Barnstable AIRPORT HYANNIS

IMMEDIATE RESPONSE ACTION PLAN
Status Report 5

Barnstable Municipal Airport
Hyannis, Massachusetts

RTN 4-26347

April 2019

Prepared for:
Barnstable Municipal Airport
480 Barnstable Road
Hyannis, MA 02840

Prepared by:
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IMMEDIATE RESPONSE ACTION PLAN STATUS REPORT 5

BARNSTABLE MUNICIPAL AIRPORT
HYANNIS, MASSACHUSETTS
RTN 4-26347

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1.0 INTRODUCTION

The Horsley Witten Group, Inc. (HW) has been retained by the Barnstable Municipal Airport (the Airport) to develop this fifth Immediate Response Action (IRA) Plan Status Report for its property at 480 Barnstable Road, Hyannis, Massachusetts (Figure 1). HW has prepared this report in accordance with the Massachusetts Contingency Plan 310 CMR 40.0000 (MCP) on behalf of:

Ms. Katie Servis, Airport Manager
Barnstable Municipal Airport
Hyannis, Massachusetts 02601
(508) 775-2020

The report describes IRA related activities conducted from October 2018 to April 2019 in the context of previous soil and groundwater sampling and analysis.

2.0 SUMMARY OF IRA PLAN

An IRA was initiated in response to a Notice of Responsibility (NOR) for Release Tracking Number (RTN) 4-26347 dated November 10, 2016, issued to the Airport by the Massachusetts Department of Environmental Protection (DEP). The NOR requested that the Airport conduct additional field investigations to evaluate sources of two types of contaminants previously detected at the Airport and on adjacent properties and to identify potential impacts to public water supply wells operated by the Hyannis Water District at the Mary Dunn and Maher wellfields.

The NOR specifically requests that the Airport investigate perfluoroalkyl substances (PFAS) including perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) previously detected in groundwater at the Airport and several adjacent properties. DEP also requested further evaluation of 1,4-dioxane, previously detected in a monitoring well downgradient of the Airport on the Maher wellfield property.

A proposed IRA plan was submitted for approval in response to the NOR. Subsequently, a meeting was held by DEP at the Airport that included other stakeholders including the Barnstable Department of Public Works, the Hyannis Water District and Barnstable County representatives (representing the Fire Training Academy). At the meeting, IRA plans were coordinated between the Airport and Fire Training Academy including sampling locations, type of analysis, groundwater modeling, goals and next steps. The IRA plan served as the guide for the soil and groundwater testing conducted since November 2016 to follow up on the results of the previous analyses.

2.1 Background

Prior to issuance of the NOR, the Airport had conducted investigations on both PFAS and 1,4-dioxane and provided results to DEP. In July 2015, HW sampled groundwater from seven wells for analysis of 1,4-dioxane. The contaminant was detected in well OW-9DD located in the Maher wellfield at a concentration of 0.93 ug/L, above the 0.30 ug/L groundwater standard for 1,4-dioxane. This well is screened from 77 to 87 feet below the ground surface. Samples taken from wells on Airport property did not contain 1,4-dioxane above laboratory reporting levels.

A potential source of 1,4-dioxane at the Airport is a historic release of 1,1,1-trichloroethane (1,1,1-TCA) from an oil/water separator associated with a floor drain in the former Provincetown Boston Airlines hangar (currently leased to Cape Air). Given the screen depth of monitoring well OW-9DD, the 1,4-dioxane may also be from an off-airport source.

On August 4, 2016, DEP issued a Request for Information (RFI) to the Airport requiring investigation of PFAS. On July 1 and 5, 2016, HW collected samples from six monitoring wells and submitted samples for laboratory analysis for the presence of PFOS and PFOA. These compounds were detected in each of the wells tested. At monitoring wells HW-3 and HW-5, the sum of PFOS and PFOA concentrations were 0.084 and 0.12 ug/L respectively, above the EPA health advisory limit and DEP standard of 0.07 ug/L. Because of the extremely low detection requirements, HW collected confirmatory samples from these two wells. Results showed 0.16 ug/L in HW-3 and 0.12 ug/L in HW-5. The concentrations detected in all the other wells were below the standard. It should be noted that these compounds were also detected above the standard in monitoring well HW-1, located at the upgradient, western boundary of the Airport.

2.2 Actions Under the IRA Plan

A summary of the groundwater and soil sampling and analyses conducted to date for both 1,4-dioxane and the PFAS compounds is provided below. This includes activities conducted between October 2018 and April 2019 which included soil and groundwater sampling for PFAS at the Airport to delineate the source and extent of the groundwater contaminants. Soil and groundwater sampling results collected during this time period including those samples that were pending review as documented in the October 2018 IRA Status Report are set forth below.

3.0 APPLICABLE MCP STANDARDS

In accordance with MCP Section 310 CMR 40.0900, the characterization of risk of harm to health, safety, public welfare, and the environment must be evaluated at each disposal site. This characterization includes the determination of site-specific soil and groundwater categories based on site location and use, and the comparison of laboratory results to these standards (310 CMR 40.0930).

Groundwater located within a Current Drinking Water Source Area is considered category GW-1. The Airport is located within several zones of contribution (Zone II) for Barnstable Fire District Water Department, the Hyannis Water District and the Town of Yarmouth. Zone IIs are considered current drinking water sources as defined in 310 CMR 40.0006; thus, category GW-1 is applicable.

Groundwater located within 30 feet of an occupied building that has an average annual depth of less than 15 feet is categorized as GW-2. This is primarily a concern because of the possibility of vapor impacts to indoor air. The average annual depth to groundwater at the site is greater than 15 feet; therefore GW-2 Standards do not apply. Also, all disposal sites shall be considered a potential source of discharge to surface water, and therefore categorized as GW-3. Based on these criteria, categories GW-1 and GW-3 are applicable to this site.

Currently, there are no DEP soil standards for PFAS compounds.

4.0 HISTORIC FIELD INVESTIGATIONS

Historic field investigations conducted since the November 2016 NOR and documented in prior status reports are summarized below:

- Groundwater monitoring wells were installed at six locations in April 2017: in the vicinity of potential sources of PFOA at the Airport Rescue and Fire Fighting (ARFF) Building, at the firefighting training deployment area adjacent to the East Ramp, and at upgradient locations to evaluate potential off-site sources of PFAS and 1,4-dioxane. Groundwater flows from the northwest to southeast across the airport, approximately parallel to Runway 15/33.

- The first round of groundwater samples for PFAS and 1,4-dioxane were collected on April 5-7 and April 11, 2017. Additional groundwater samples and one surface water sample were collected for analysis of PFAS on June 20, 2017.

- An initial round of three soil samples was taken on December 6, 2016 as reported in the first status report. One sample was taken from each location where it was determined that aircraft fire fighting foam (AFFF) had been used at the Airport, including the site of an airplane crash in 1991, the deployment area, and the drill location located along the dirt road adjacent to the deployment area.

- A second round of soil samples was taken on June 20, 2017 adjacent to the ARFF building and within the deployment area to begin to determine the extent of PFAS within the surface soils. Based on the results of these analyses, a third round of samples from these two locations was collected on September 26, 2017. The third round of sampling was designed to further delineate the extent of PFAS in soils both horizontally and vertically, with samples taken at the ground surface and at two and four feet below grade.

- In October 2017, three composite soil samples were taken from piles of sediment and topsoil associated with the redevelopment of Runway 15/33. These piles were located on Airport property at the site of the former Mildred's Restaurant and were analyzed for PFAS compounds to evaluate if sediment removed from the airport as part of this redevelopment contained PFAS. In November 2017, five additional composite samples of soils from the runway redevelopment were taken from the storage location at Cape Cod Aggregates.

- On October 26, 2017, ten PFAS samples were taken to evaluate background conditions in surficial soils on the Airport and in nearby locations in Hyannis. Ten additional background samples from locations across the Town of Barnstable were taken on December 14, 2017.

- Six PFAS soil samples were also analyzed for leaching potential using an SPLP test. The chosen samples included four samples from within the boundaries of the PFAS sites at the airport and two samples from runway reconstruction soils stockpiled at the airport. Results of these tests were provided to HW by the Laboratory in early January 2018.

5.0 FIELD INVESTIGATIONS CONDUCTED DURING THE CURRENT REPORTING PERIOD

As indicated in IRA Status Report 4, soil and groundwater investigations were completed at the end of the previous reporting period. Details regarding the results of these investigations including the results of soil and groundwater testing conducted during the current reporting period are detailed below.

- On August 14, 2018, 24 PFAS surface soil samples were collected in proximity to the ARFF building and the Deployment Area. PFAS compounds were previously detected in these areas and additional samples were collected to determine the vertical extent of PFAS impacts in soil and to refine the Disposal Site boundary at the Airport. Analytical results are set forth on Tables 1 and 2 and the location of the soil samples are indicated on Figures 2 and 3. Analytical data reports for the samples are included in Appendix A.

- In October 2018, three soil borings (DL11, DL14 and HW-F) were installed in the deployment area. One soil boring (ARFF3) was installed and one surface soil sample (HW-3) was collected near the ARFF Building in order to further delineate the extent of PFAS in soils both horizontally and vertically. All soil borings were advanced using direct push methods. Analytical results are set forth on Tables 1 and 2 and the location of the soil samples are indicated on Figures 2 and 3. Analytical data reports for the samples are included in Appendix A and soil boring logs are located in Appendix B.

- In October 2018, six (6) monitoring wells were installed at the Airport. A cluster of three wells (HW-G(s), HW-G(m), and HW-G(d)) was installed at an upgradient location to evaluate potential off-site sources of PFAS. Three (3) additional wells (HW-H, HW-I, and

HW-J) were installed southeast of the deployment area adjacent to the East Ramp. Groundwater flows from the northwest to southeast across the Airport, approximately parallel to Runway 15/33. Monitoring well construction logs are included in Appendix B.

- In November 2018, six (6) groundwater samples were collected to evaluate PFAS concentrations in the Deployment area. Four (4) groundwater samples and one surface water sample from Mary Dunn Pond were also collected for analysis of oxygen and hydrogen isotopes to determine the contribution of pond water from Mary Dunn Pond to the four downgradient wells. Analytical results are indicated on Tables 3 and 4 and the location of the monitoring wells are indicated on Figure 4. Analytical data reports for the samples are included in Appendix A.

- In December 2018, 12 groundwater samples were collected for analysis of PFAS and 13 groundwater samples were collected for analysis of oxygen and hydrogen isotopes to determine the contribution of pond water from Mary Dunn Pond to the 13 downgradient wells. Groundwater samples were also collected from four (4) monitoring wells in the Maher Wellfield for analysis of 1,4-dioxane. Analytical results are indicated on Table 5 and the location of the monitoring wells are indicated on Figure 5. Analytical data reports for the samples are included in Appendix A.

- In December 2018, two soil samples were collected from the 1991 Drill Location to determine if PFAS detected in the area are related to background conditions. Analytical results are indicated on Table 6 and the location of the borings are indicated on Figure 4. Analytical data reports for the samples are included in Appendix A.

- In February 2019, three additional surface soil samples were collected to further delineate the Disposal Site boundary around the ARFF building. Analytical results are indicated on Table 1 and the location of the soil borings are indicated on Figure 2. Analytical data reports for the samples are included in Appendix A.

Groundwater samples were collected consistent with the Massachusetts Department of Environmental Protection Guidance on Sampling and Analysis for PFAS at Disposal Sites Regulated under the MCP, dated January 2017. A submersible pump was utilized to develop each monitoring well prior to sample collection. During well purging, a properly calibrated InSitu smarTroll MP multi-parameter meter was utilized to measure temperature, pH, conductivity, DO, and oxidation reduction potential. Groundwater samples were submitted to ESS Laboratory in Cranston, Rhode Island for 1,4-dioxane analyses and to Maxim Laboratory for the PFAS compounds. Soil samples from 2019 were submitted to Con-Test Analytical Laboratory.

Surface soil samples were taken directly with the sampling bottle. If necessary, a gloved hand was used to remove any surface vegetation and to place the sample directly into the bottle. In addition, if needed, soil was loosened with a stainless-steel spade that was decontaminated

using Liquinox, and rinsed using Type II De-ionized water, followed by PFAS-free water obtained from the laboratory.

Soil samples obtained from 2 to 5 feet below grade were collected using a hand auger that was decontaminated using Liquinox, and rinsed using Type II De-ionized water, followed by PFAS-free water obtained from the laboratory. Each boring was advanced to just above the desired depth of sample then the auger was decontaminated and rinsed again prior to sample collection, in order to minimize, to the greatest extent possible, cross contamination between samples/intervals. Each step was repeated in between each interval of sampling. Samples were collected by either shaking the sample directly from the hand auger into the bottle, or, if necessary, using a gloved hand to remove the sample from bottom of the auger and placing directly into bottle. Soil samples obtained deeper than 5 feet below grade were collected using direct push methods with an AMS Power Probe. A separate set of gloves was used for each sample.

6.0 GROUND WATER MODELING AND CONTAMINANT TRANSPORT ANALYSIS

DEP requested that the Airport evaluate if potential sources on the western portion of the Airport could be upgradient of the Mary Dunn Wellfield. To answer this question, HW is using and modifying an existing U.S. Geological Survey groundwater model to evaluate groundwater flow under current and recent historical pumping conditions. This work is ongoing and will be informed by the results of the groundwater sampling and water level data collected under this IRA plan. The model will be used to document what areas of the Airport are upgradient of the Mary Dunn Wellfield. It will also be used to evaluate groundwater flow and contaminant transport from potential source areas on Airport property, as well as groundwater flow from the Fire Training Academy across the Airport to the southeast.

7.0 MANAGEMENT OF REMEDIAL WASTE

No remedial waste has been generated to date as a result of the work conducted under the IRA Plan.

8.0 UPGRADES TO AFFF TESTING PROTOCOLS AT THE AIRPORT

The Airport has purchased two Ecologic Foam Test Systems to allow the Airport to test the AFFF delivery systems on its fire trucks without having to discharge the foam into the environment. These new systems meet the Federal Aviation Administration requirements for the regular testing of AFFF usage. Therefore, it is anticipated that no further foam will be deployed at the Airport except during an emergency situation when its use is required.

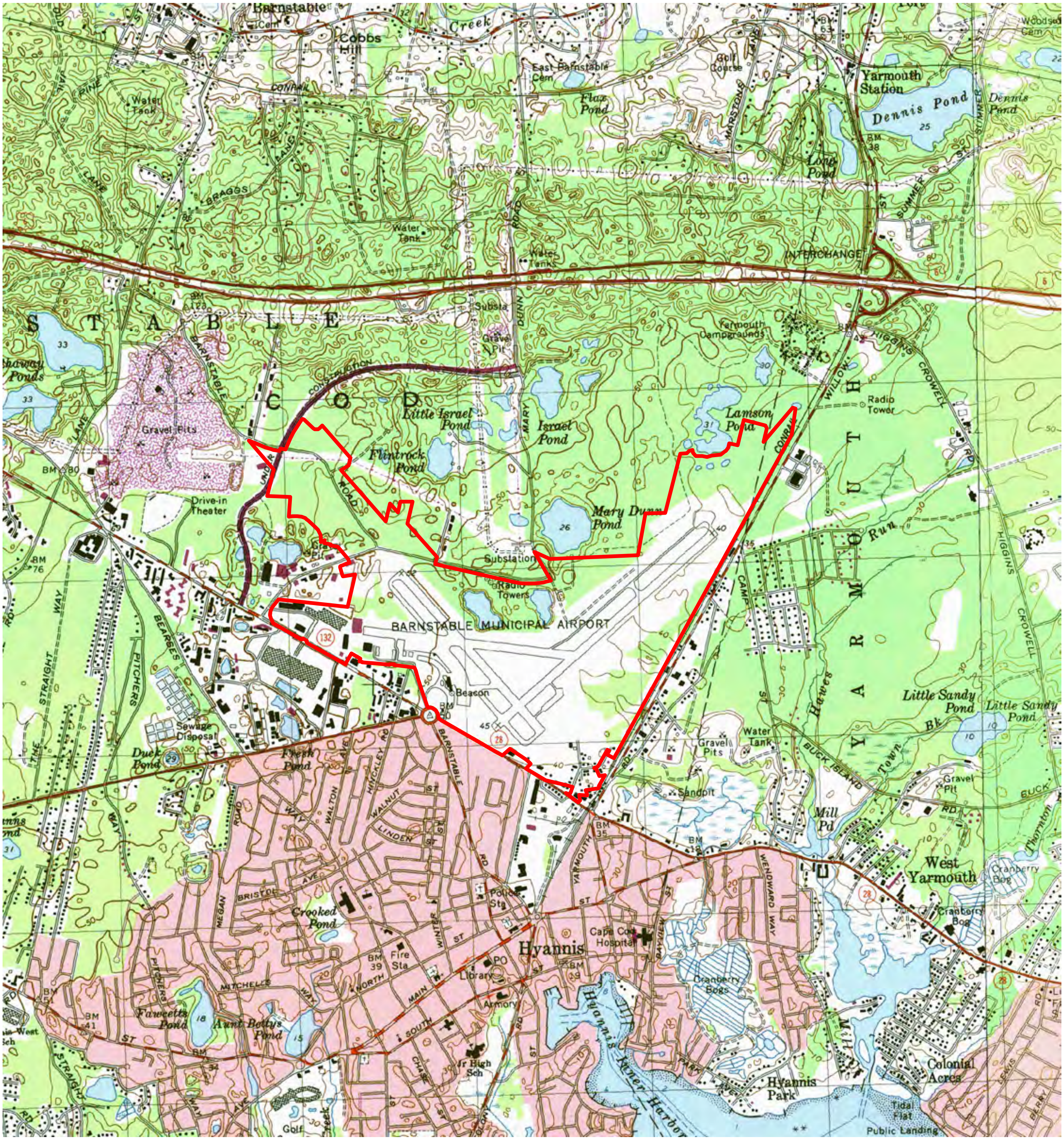
9.0 PLANS FOR NEXT REPORTING PERIOD

Further testing of soil and groundwater is planned to refine the boundaries of the PFAS soil contamination at the deployment area, and to evaluate groundwater quality in this vicinity.

DEP asked the Airport to investigate whether or not there are private wells downgradient of the Airport and potential source areas for 1,4-dioxane and PFAS compounds. In the IRA Plan, HW identified four properties in Yarmouth that, while connected to public water, also were identified as having an onsite well. Given that they are connected to public water it is likely that these wells are used for non-drinking water purposes and/or abandoned. In addition, upcoming actions include the installation of a new monitoring well for 1,4-dioxane and several new monitoring wells for PFAS. Groundwater sampling will be conducted at the new wells in 2019.

HW will continue this evaluation upon receipt of our groundwater sampling data and upon completion of our groundwater modeling analysis to determine if any additional areas need to be investigated for the presence of private wells. If any private wells are identified, further analysis will be conducted to determine if private well sampling is needed.

FIGURES



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Legend

Airport Property Line

*Hyannis Topographic Quadrangle

N

Miles

0.5

Horsley Witten Group

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USGS Locus
Barnstable Municipal Airport
Hyannis, MA

Date: 4/17/2018

Figure 1

Legend

- 2017 PFAS Soil Samples
- 2018 PFAS Soil Samples
- 2019 PFAS Soil Samples
- Barnstable Municipal Airport Property Boundary
- ## Total PFAS Soil Concentration (ug/kg)

Notes:

1. Concentration shown is Total PFAS.
2. Total PFAS = Five (5) combined PFAS compounds (PFHpA + PFHxS + PFNA + PFOS+ PFOA) Non-detect concentrations are not included in total.
3. 2018 ARFF3 sample was moved further northwest to avoid utilities.
4. Unless otherwise specified, all soil results are 0-1' samples.
5. J = estimated concentration. Laboratory result reported is above the method detection limit and below the reporting limit.
6. Concentrations shown are in ug/kg.

N

0 100 Feet

1 inch = 100 feet

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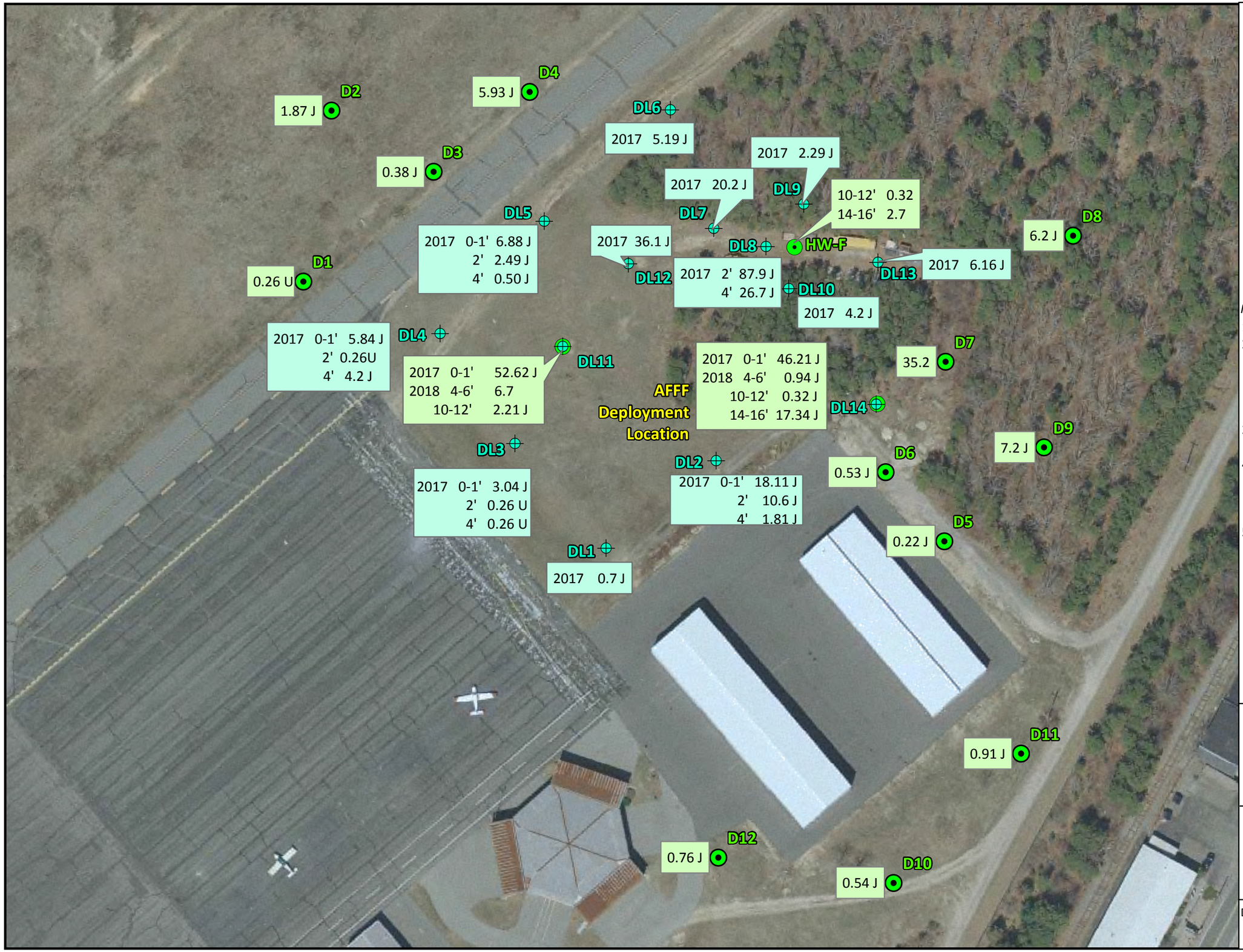
2017-2019 PFAS in Soil Results ARFF/SRE Building Barnstable Municipal Airport Hyannis, MA

Date: 3/20/2019

Figure 2

Path: H:\Projects\HYA\17027 BMA PFOS 1-4 IRA\GIS\Ma\190313_PFOS_ARFF_Results.mxd



Legend

- 2017 PFAS Soil Samples
- 2018 PFAS Soil Samples
- Barnstable Municipal Airport Property Boundary
- ## 2018 Total PFAS Soil Concentration (ug/kg)

Notes:

1. Concentration shown is Total PFAS.
2. Total PFAS = Five (5) combined PFAS compounds (PFHpA + PFHxS + PFNA + PFOS +PFOA) Non-detect concentrations are not included in total.
3. Unless otherwise specified, all soil results are 0-1' samples.
4. J = estimated concentration. Laboratory result reported is above the method detection limit and below the reporting limit.
5. Concentrations shown are in ug/kg.

N

0 150 Feet

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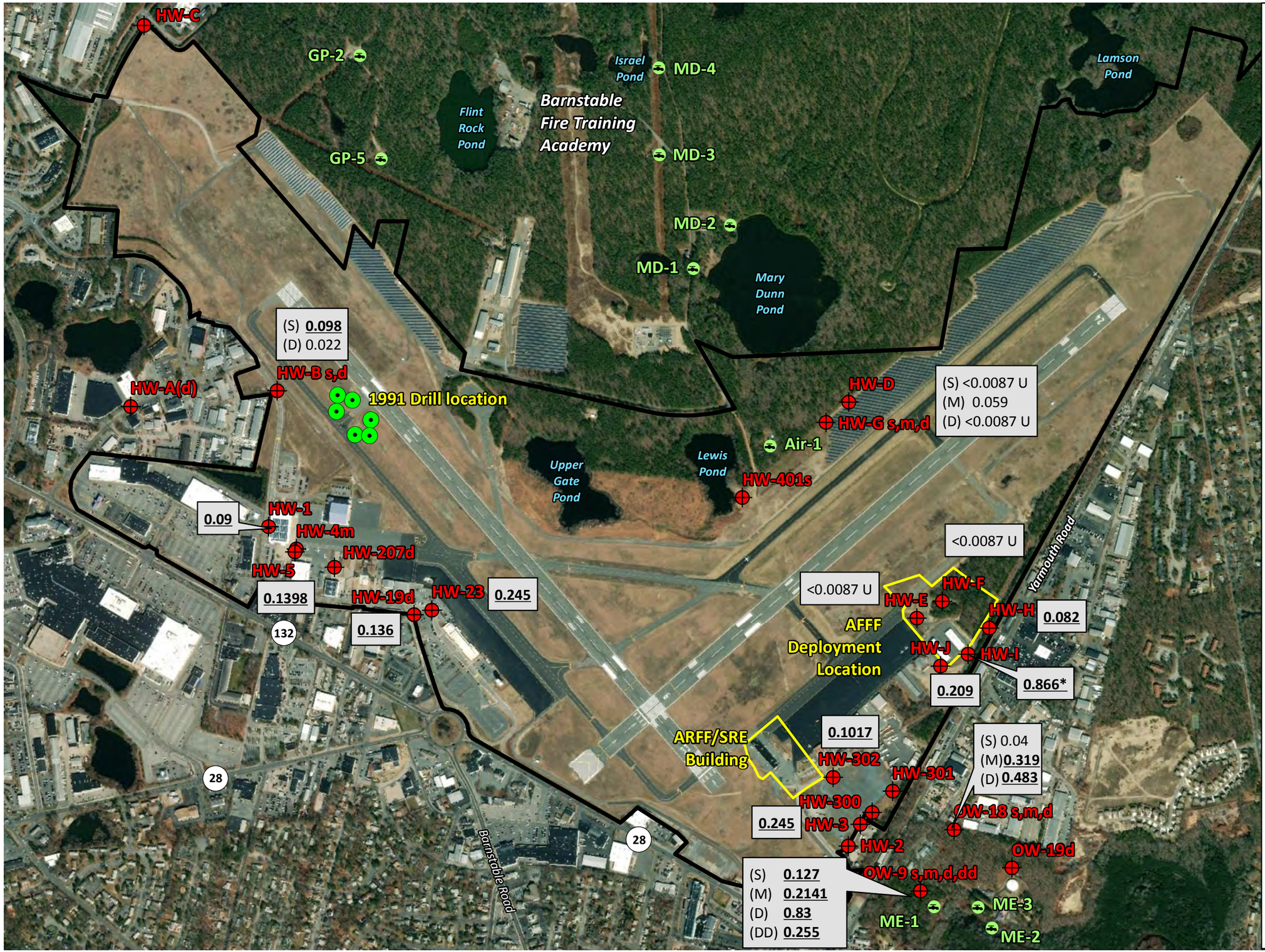
2017-2018 PFAS in Soil Results Deployment Location Barnstable Municipal Airport Hyannis, MA

Date: 11/19/2018

Figure 3

Path: H:\Projects\HYA\17027 BMA PFOS 1-4 IRA\GIS\Maps\181113_PFOS_DEPLOY_Results.mxd



Legend

- Monitoring Wells
- Soil Sample Locations
- ## 2018 Total PFAS Groundwater Concentration (ug/L)
- Drinking Water Wells
- Barnstable Municipal Airport Property Boundary

Notes:

1. Concentration shown is Total PFAS for 2018.
2. Total PFAS = Five (5) combined PFAS compounds (PFHpA + PFHxS + PFNA + PFOS +PFOA)
3. J = estimated concentration. Laboratory result reported is above the method detection limit andbelow the reporting limit.
4. Concentrations shown are in ug/L.

* Higher detection limit

N

0 750

1 in = 750 feet

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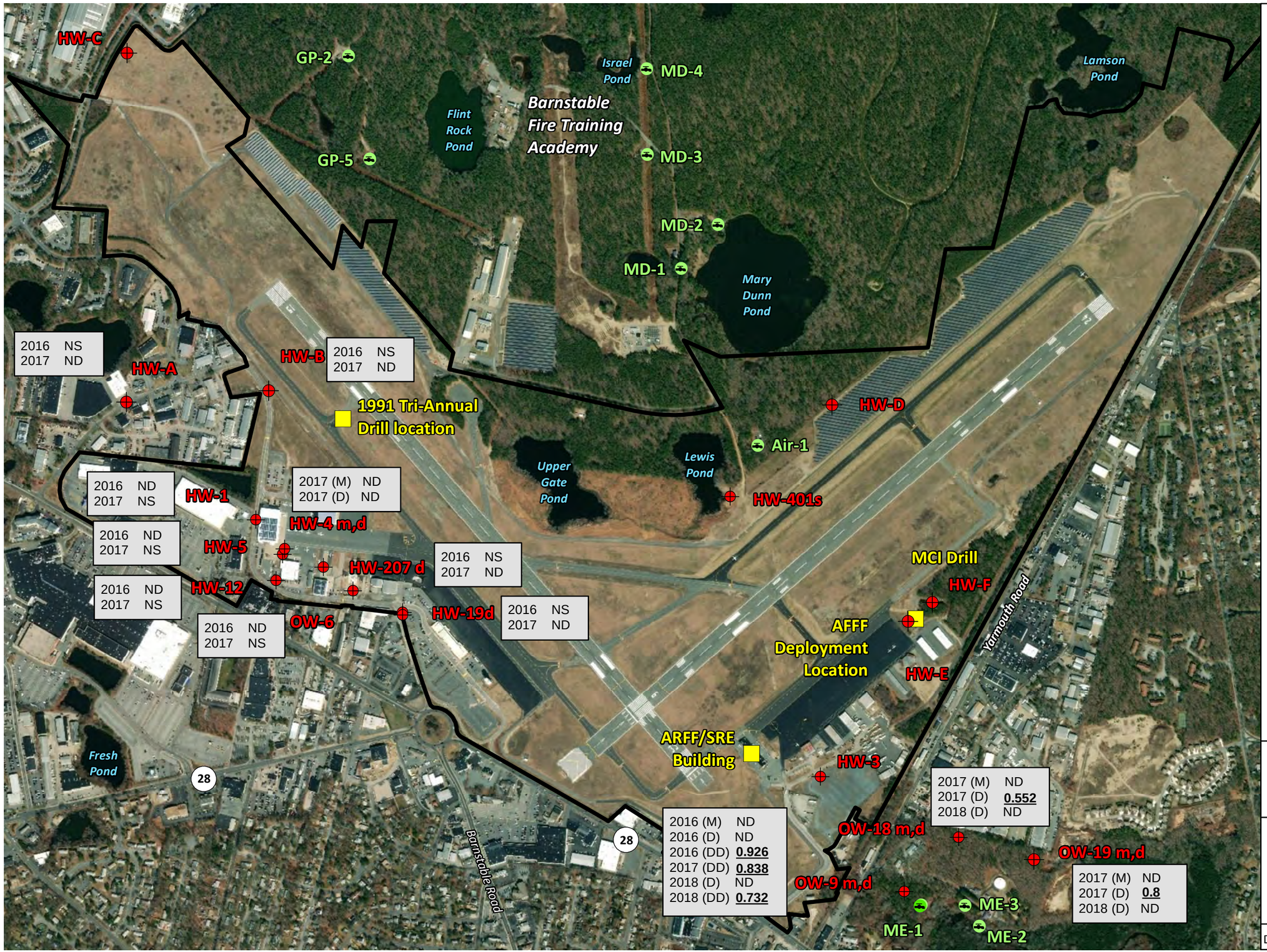
2018 PFAS Results in Groundwater Barnstable Municipal Airport Hyannis, MA

Date: 4/8/2019 Figure 4

Path: H:\Projects\HYA\17027 BMA PFOS 1-4 IRA\GIS\Maps\190108_GW Results 2018.mxd



Legend

- Monitoring Wells
- PFOS/PFOA Soil Samples
- ND — No Detect
- NS — No Sample Collected
- 0.2 — 1,4 Dioxane Below MassDEP Limit (0.3 ug/L)
- **0.8** — 1,4 Dioxane Above MassDEP Limit (0.3 ug/L)
- Drinking Water Wells
- Barnstable Municipal Airport Property Boundary

N

0 750

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1,4 Dioxane Results
Barnstable Municipal Airport
Hyannis, MA

Date: 3/13/2019

Figure 5

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TABLES

Table 1. Total PFAS in Soil at ARFF Area

	ARFF1 (0-1') 6/20/2017	ARFF1 (2') 9/26/2017	ARFF1 (4') 9/26/2017	ARFF2 (0-1') 6/20/2017	ARFF3 (0-1') 9/26/2017	ARFF3 (10-12') 10/9/2018	ARFF4 (0-1') 9/26/2017	ARFFCB (0-1) 9/26/2017
Perfluoroheptanoic acid (PFHpA)	0.82 J	1.8	0.66 J	0.17 U	0.60 J	0.32 J	0.75 J	0.60 J
Perfluorohexanesulfonic acid (PFHxS)	0.23 U	0.23 U	0.23 U	0.23 U	0.64 J	0.24 U	0.23 U	0.23 U
Perfluorooctanoic acid (PFOA)	0.75 J	2.6	0.75 J	0.26 U	0.78 J	1.9	0.97 J	0.90 J
Perfluorononanoic acid (PFNA)	2.5	5.7	1.4	0.20 J	0.91 J	3.1	2.9	0.17 U
Perfluorooctane sulfonate (PFOS)	4.5	2.7	1.1	0.29J	4.4	1.1	1.0	1.1
Total PFAS	8.57 J	12.8	3.91 J	0.49 J	7.33 J	6.42 J	5.62 J	2.6 J
	A1 (0-1') 8/14/2018	**A2 (0-1') 8/14/2018**	**A3 (0-1') 8/14/2018**	**A4 (0-1') 8/14/2018**	**A5 (0-1') 8/14/2018**	**A6 (0-1') 8/14/2018**	**A7 (0-1') 8/14/2018**	**A8 (0-1') 8/14/2018**
Perfluoroheptanoic acid (PFHpA)	0.19 U	0.19 U	0.38 J	0.19 U	1.1	0.19 U	0.19 U	0.19 U
Perfluorohexanesulfonic acid (PFHxS)	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U
Perfluorooctanoic acid (PFOA)	0.25 U	0.25 U	0.37 J	0.30 J	1.9	0.25 U	0.25 U	0.25 U
Perfluorononanoic acid (PFNA)	0.22 U	0.22 U	0.51 J	0.22 U	0.87 J	0.22 U	0.22 U	0.22 U
Perfluorooctane sulfonate (PFOS)	0.26 U	0.26 U	0.29 J	0.26 U	0.26 U	0.26 U	0.38 J	0.26 U
Total PFAS	0.26 U	0.26 U	1.55 J	0.30 J	3.87 J	0.26 U	0.38 J	0.26 U
	A9 (0-1') 8/14/2018	**A10 (0-1') 8/14/2018**	**A11 (0-1') 8/14/2018**	**A12 (0-1') 8/14/2018**	**A13 (0-1')**	**A14 (0-1')**	**A15 (0-1')**	**HW-3 (0-1') 10/9/2018**
Perfluoroheptanoic acid (PFHpA)	0.19 U	0.19 U	0.19 U	0.19 U	2.0 U	1.9 U	2.0 U	0.19 U
Perfluorohexanesulfonic acid (PFHxS)	0.24 U	0.24 U	0.24 U	0.24 U	2.0 U	1.9 U	2.0 U	0.24 U
Perfluorooctanoic acid (PFOA)	0.34 J	0.25 U	0.25 U	0.25 U	2.0 U	1.9 U	2.0 U	0.25 U
Perfluorononanoic acid (PFNA)	0.22 U	0.22 U	0.22 U	0.22 U	2.0 U	1.9 U	2.0 U	0.22 U
Perfluorooctane sulfonate (PFOS)	0.85 J	0.26 U	0.26 U	0.26 U	2.0 U	1.9 U	2.0 U	0.26 U
Total PFAS	1.19 J	0.26 U	0.26 U	0.26 U	2.0 U	1.9 U	2.0 U	0.26 U

Results in ug/kg = micrograms per kilogram

Maxxim Laboratory analysis

U - Not detected above method detection limit

J = Estimated value, result between laboratory reporting limit and method detection limit

Total = Five (5) combined PFAS compounds (PFHpA + PFHxS + PFNA + PFOS +PFOA)

Note: Totals include estimated values.

Table 2. Total PFAS in Soil at Deployment Area

	DL1(0-1') 6/20/2017	DL2 (0-1') 6/20/2017	DL2 (2') 9/26/2017	DL2 (4') 9/26/2017	DL3 (0-1') 6/20/2017	DL3 (2') 9/26/2017	DL3 (4') 9/26/2017	DL4 (0-1') 6/20/2017
Perfluoroheptanoic acid (PFHpA)	0.30 J	1.9	1.2	0.48 J	0.84 J	0.17 U	0.17 U	0.31 J
Perfluorohexanesulfonic acid (PFHxS)	0.23 U	1.8	1.3	0.59 J	0.34 J	0.23 U	0.23 U	0.23 U
Perfluorooctanoic acid (PFOA)	0.26 U	1.6	4.1	0.74 J	0.80 J	0.26 U	0.26 U	0.83 J
Perfluorononanoic acid (PFNA)	0.17 U	0.81 J	2.5	0.17 U	0.55 J	0.17 U	0.17 U	2.7
Perfluorooctane sulfonate (PFOS)	0.40 J	12	1.5	0.21 U	0.51 J	0.21 U	0.21 U	2.0
Total PFAS	0.7 J	18.11 J	10.6	1.81 J	3.04 J	0.26 U	0.26 U	5.84 J
	DL4 (2') 9/26/2017	**DL4 (4') 9/26/2017**	**DL5 (0-1') 6/20/2017**	**DL5 (2') 9/26/2017**	**DL5 (4') 9/26/2017**	**DL6 (0-1') 6/20/2017**	**DL7 (0-1') 6/20/2017**	**DL8 (2') 6/20/2017**
Perfluoroheptanoic acid (PFHpA)	0.17 U	0.17 U	2.5	0.40 J	0.50 J	5.0	2.5 J	2.9 J
Perfluorohexanesulfonic acid (PFHxS)	0.23 U	0.23 U	0.49 J	0.49 J	0.23 U	0.23 U	0.23 U	2.3 U
Perfluorooctanoic acid (PFOA)	0.26 U	0.26 U	3.7	1.6	0.26 U	0.26 U	4.2 J	25
Perfluorononanoic acid (PFNA)	0.17 U	3.7	0.19 J	0.17 U	0.17 U	0.19 J	9.6 J	46
Perfluorooctane sulfonate (PFOS)	0.21 U	0.50 J	0.21 U	0.21 U	0.21 U	0.21 U	3.9 J	14
Total PFAS	0.26 U	4.2 J	6.88 J	2.49 J	0.50 J	5.19 J	20.2 J	87.9 J
	DL8 (4') 9/26/2017	**DL9 (0-1') 6/20/2017**	**DL10 (0-1') 6/20/2017**	**DL 11 (0-1') 9/26/2017**	**DL11 (4-6') 10/4/2018**	**DL11 (10-12') 10/4/2018**	**DL11 (14-16') 10/4/2018**	**DL12 (0-1') 9/26/2017**
Perfluoroheptanoic acid (PFHpA)	4.7J	0.66 J	1.3	2.1	1.3	0.31 J	0.23 J	1.2
Perfluorohexanesulfonic acid (PFHxS)	2.3 U	0.35 J	0.94 J	0.82 J	0.24 U	0.24 U	0.24 U	0.23 U
Perfluorooctanoic acid (PFOA)	22	0.68 J	1.7	4.7	2.9	1.9	0.50 J	4.6
Perfluorononanoic acid (PFNA)	1.7 U	0.22 J	0.17 U	16	2.5	0.22 U	0.22 U	7.3
Perfluorooctane sulfonate (PFOS)	2.1 U	0.38 J	0.26 J	29	0.26 U	0.26 U	0.26 U	23
Total PFAS	26.7 J	2.29 J	4.2 J	52.62 J	6.7	2.21 J	0.73 J	36.1 J
	DL13 (0-1') 9/26/2017	**DL14 (0-1') 9/26/2017**	**DL14 (4-6') 10/4/2018**	**DL14 (10-12') 10/4/2018**	**D1 (0-1') 8/14/2018**	**D2 (0-1') 8/14/2018**	**D3 (0-1') 8/14/2018**	**D4 (0-1') 8/14/2018**
Perfluoroheptanoic acid (PFHpA)	1.6	4.9	0.36 J	0.19 U	0.19 U	0.21 J	0.19 U	0.95 J
Perfluorohexanesulfonic acid (PFHxS)	0.23 U	0.71J	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U
Perfluorooctanoic acid (PFOA)	2.4	23	0.58 J	0.32 J	0.25 U	0.33 J	0.25 U	1.1
Perfluorononanoic acid (PFNA)	1.5	10	0.22 U	0.22 U	0.22 U	0.67 J	0.22 U	0.98 J
Perfluorooctane sulfonate (PFOS)	0.66 J	7.6	0.26 U	0.26 U	0.26 U	0.66 J	0.38 J	2.9
Total PFAS	6.16 J	46.21 J	0.94 J	0.32 J	0.26 U	1.87 J	0.38 J	5.93 J
	D5 (0-1') 8/14/2018	**D6 (0-1') 8/14/2018**	**D7 (0-1') 8/14/2018**	**D8 (0-1') 8/14/2018**	**D9 (0-1') 8/14/2018**	**D10 (0-1') 8/14/2018**	**D11 (0-1') 8/14/2018**	**D12 (0-1') 8/14/2018**
Perfluoroheptanoic acid (PFHpA)	0.22 J	0.25 J	7.8	1.0	2.7	0.19 U	0.19 U	0.19 U
Perfluorohexanesulfonic acid (PFHxS)	0.24 U	0.24 U	0.24 U	0.31 J	0.24 U	0.24 U	0.24 U	0.24 U
Perfluorooctanoic acid (PFOA)	0.25 U	0.28 J	14	2.2	3	0.25 U	0.25 U	0.25 U
Perfluorononanoic acid (PFNA)	0.22 U	0.22 U	10	0.59 J	0.83 J	0.22 U	0.22 U	0.32 J
Perfluorooctane sulfonate (PFOS)	0.26 U	0.26 U	3.4	2.1	0.67 J	0.54 J	0.91 J	0.44 J
Total PFAS	0.22 J	0.53 J	35.2	6.2 J	7.2 J	0.54 J	0.91 J	0.76 J

	HW-F (10-12') 10/4/2018	**HW-F (14-16') 10/4/2018**
Perfluoroheptanoic acid (PFHpA)	0.32 J	1.3
Perfluorohexanesulfonic acid (PFHxS)	0.24 U	0.24 U
Perfluorooctanoic acid (PFOA)	0.25 U	1.4
Perfluorononanoic acid (PFNA)	0.22 U	0.22 U
Perfluorooctane sulfonate (PFOS)	0.26 U	0.26 U
Total PFAS	0.32 J	2.7

Results in ug/kg = micrograms per kilogram

Maxxim Laboratory analysis

U - Not detected above method detection limit

J = Estimated value, result between laboratory reporting limit and method detection limit

Total = Five (5) combined PFAS compounds (PFHpA + PFHxS + PFNA + PFOS +PFOA)

Note: Totals include estimated values.

Table 3. Groundwater Results for PFAS Compounds 2018

	North Ramp				Airport Road		Steamship Parking Lot	
Sample ID	HW-1	HW-5	HW-23	HW-19D	HW-B(S)	HW-B(D)	HW-3	HW-302
Sample Date	10/26/2018	10/26/2018	10/26/2018	11/7/2018	10/26/2018	10/26/2018	10/26/2018	12/3/2018
Perfluorobutanesulfonic acid (PFBS)	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U
Perfluoroheptanoic acid (PFHpA)	0.013 J	0.0074 U	0.0098 J	0.0080 J	0.012 J	0.0074 U	**0.10**	0.015 J
Perfluorohexanesulfonic acid (PFHxS)	0.018 J	0.0056 U	0.023	0.045	0.047	0.0056 U	0.012 J	0.016 J
Perfluorononanoic acid (PFNA)	0.0087 U	0.0088 J	0.0087 U	0.0087 U	0.0087 U	0.0087 U	0.023	0.0097 J
Perfluorooctanoic acid (PFOA)	0.031	0.011 J	0.011 J	0.014 J	0.020 J	0.012 J	0.057	0.03
Perfluorooctane sulfonate (PFOS)	0.028	**0.12**	0.015 J	0.069	0.019 J	0.010 J	0.053	0.031
Total	**0.09**	**0.1398**	0.0588	**0.136**	**0.098**	0.022	**0.245**	**0.1017**

	Solar Field			Deployment Area				
Sample ID	HW-G(S)	HW-G(M)	HW-G(D)	HW-H	HW-I *	HW-J	HW-E	HW-F
Sample Date	12/3/2018	12/3/2018	12/3/2018	11/7/2018	11/7/2018	11/7/2018	11/7/2018	11/7/2018
Perfluorobutanesulfonic acid (PFBS)	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.011 U	0.0054 U	0.0054 U	0.0054 U
Perfluoroheptanoic acid (PFHpA)	0.0074 U	0.0074 U	0.0074 U	**0.077**	**0.2**	0.025	0.0074 U	0.0074 U
Perfluorohexanesulfonic acid (PFHxS)	0.0056 U	0.012 J	0.0056 U	0.0056 U	**0.18**	0.0056 U	0.0056 U	0.0056 U
Perfluorononanoic acid (PFNA)	0.0087 U	0.011 J	0.0087 U	0.0087 U	**0.16**	0.028	0.0087 U	0.0087 U
Perfluorooctanoic acid (PFOA)	0.0033 U	0.0033 U	0.0033 U	0.0050 J	**0.26**	0.026	0.0033 U	0.0033 U
Perfluorooctane sulfonate (PFOS)	0.0060 U	0.036	0.0060 U	0.0060 U	0.066	**0.13**	0.0060 U	0.0060 U
Total	0.0087 U	0.059	0.0087 U	**0.082**	**0.866**	**0.209**	0.0087 U	0.0087 U

	Maher Wells							
Sample ID	OW-9S	OW-9M	OW-9D	OW-9DD	OW-18S	OW-18M	OW-18D	OW-19D
Sample Date	12/3/2018	12/3/2018	12/3/2018	12/3/2018	12/7/2018	12/7/2018	12/7/2018	12/7/2018
Perfluorobutanesulfonic acid (PFBS)	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U	NS
Perfluoroheptanoic acid (PFHpA)	0.048	**0.11**	0.033	0.015 J	0.0074 U	0.0074 U	0.014 J	NS
Perfluorohexanesulfonic acid (PFHxS)	0.023	0.0056 U	**0.12**	0.042	0.0056 U	**0.073**	**0.13**	NS
Perfluorononanoic acid (PFNA)	0.0087 U	0.044	**0.1**	0.038	0.0087 U	0.0087 U	0.0087 U	NS
Perfluorooctanoic acid (PFOA)	0.032	0.052	0.057	0.020 J	0.012 J	0.0060 J	0.019 J	NS
Perfluorooctane sulfonate (PFOS)	0.024	0.0081 J	**0.52**	**0.14**	0.028	**0.24**	**0.32**	NS
Total	**0.127**	**0.2141**	**0.83**	**0.255**	0.04	**0.319**	**0.483**	NS

J = Estimated concentration between the EDL and RDL.

Results in ug/kg, micrograms per kilogram

U= Undetected at the limit of quantitation.

EDL = Estimated Detection Limit

RDL = Reportable Detection Limit

MDL= Method Detection Limit

NS = Not Sampled

Shaded/ Bold results above DEP GW-1 standard (0.07 ug/L)

Total PFAS = Five (5) combined PFAS compounds (PFHpA + PFHxS + PFNA + PFOA +PFOS)

Note: Totals include estimated values. Totals do not include PFBS.

* HIGHER DETECTION LIMIT

Table 4: Ratio of Stable Isotopes Oxygen-18 and Hydrogen-2 Laboratory Results

Sample Date	Lab Sample ID	HW Sample ID	Stable Isotope Oxygen-18			Stable Isotope Hydrogen-2		
			δ18O (V-SMOW)	Atm %	Expected Values	δ18O (V-SMOW)	Atm %	Expected Values
11/7/2018	1811299-2	HW-I	-6.92	0.20	-	-40.41	0.01494	-
			-6.77	0.20	-	-40.17	0.01495	-
	1811299-4	HW-E	-6.79	0.20	-	-38.56	0.01497	-
			-6.85	0.20	-	-38.87	0.01497	-
	1811299-5	HW-F	-6.9	0.20	-	-38.28	0.01498	-
			-6.88	0.20	-	-38.15	0.01498	-
	1811299-7	SW-2	-2.67	0.20	-	-18.65	0.01528	-
			-2.61	0.20	-	-20.42	0.01526	-
						-23.04	0.01521	-
12/3/2018	1812198-1	HW-G(S)	-6.74	0.20	-	-38.19	0.01498	-
			-6.93	0.20	-	-37.87	0.01498	-
	1812198-2	HW-G(M)	-7.53	0.20	-	-44.34	0.01498	-
			-7.57	0.20	-	-44.39	0.01498	-
	1812198-3	HW-G(D)	-7.18	0.20	-	-44.15	0.01489	-
			-7.45	0.20	-	-44.56	0.01488	-
	1812198-4	OW-9S	-7.29	0.20	-	-41.86	0.01492	-
			-7.41	0.20	-	-42.94	0.0149	-
	1812198-5	OW-9D	-7.76	0.20	-	-47.91	0.01483	-
			-7.71	0.20	-	-46.82	0.01484	-
					-	-47.20	0.01484	-
	1812198-6	OW-9DD	-7.52	0.20	-	-45.58	0.01486	-
			-7.57	0.20	-	-45.48	0.01487	-
	1812198-7	OW-9M	-7.13	0.20	-	-41.44	0.01493	-
			-7.24	0.20	-	-43.40	0.0149	-
12/7/2018	1812232-1	OW-18S	-7.58	0.20	-	-49.29	0.01481	-
			-7.54	0.20	-	-49.66	0.0148	-
	1812232-2	OW-18M	-6.95	0.20	-	-42.64	0.01491	-
			-6.89	0.20	-	-42.57	0.01491	-
	1812232-3	OW-18D	-7.28	0.20	-	-44.76	0.01488	*
			-7.36	0.20	-	-41.61	0.01493	*
QA/QC	IAEA OH-14	-	-5.64	0.20	-5.6	-37.45	0.01499	-37.70
	IAEA OH-15	-	-9.59	0.20	-9.41	-77.89	0.01436	-78
	IAEA OH-16	-	-15.72	0.20	-15.41	-	-	-113.8
	Antarc IC	-	-29.83	0.19	-30	-	-	-239.69

Table 5. 1,4 Dioxane Groundwater Results 2018

Sample ID		GW-1	OW-9D	OW-9DD	OW-18D	OW-19D
Sample Date			12/3/2018	12/3/2018	12/17/2018	12/17/2018
1,4-Dioxane	ug/L	**0.3**	<0.25	**0.732**	<0.25	<0.25

Results in ug/L, micrograms per liter

Laboratory Reporting Limit = 0.25 ug/L

Shaded/ Bold results above DEP GW-1 standard (0.3 ug/L)

Table 6. Total PFAS in Soil at 1991 Drill Location

	1991A (0-1') 8/14/2018	1991B (0-1') 8/14/2018	1991C (0-1') 8/14/2018	1991D (0-1') 8/14/2018	1991A-B (3-4') 12/14/2018	1991C-D (2-3') 12/14/2018
Perfluoroheptanoic acid (PFHpA)	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Perfluorohexanesulfonic acid (PFHxS)	0.24 U	0.66 J	0.24 U	0.24 U	0.24 U	0.24 U
Perfluorooctanoic acid (PFOA)	0.25 U	0.26 J	0.25 U	0.25 U	0.25 U	0.25 U
Perfluorononanoic acid (PFNA)	0.22 U	0.22 U	0.22 U	0.30 J	0.22 U	0.22 U
Perfluorooctane sulfonate (PFOS)	0.49 J	1.1	0.55 J	0.36 J	0.30 J	0.42 J
Total PFAS	0.49 J	2.02	0.55 J	0.66	0.30 J	0.42 J

Results in ug/kg = micrograms per kilogram

Maxxim Laboratory analysis

U - Not detected above method detection limit

J = Estimated value, result between laboratory reporting limit and method detection limit

Total = Five (5) combined PFAS compounds (PFHpA + PFHxS + PFNA + PFOS +PFOA)

Note: Totals include estimated values.

APPENDIX A

CERTIFICATE OF ANALYSIS

Josphine Ibanez
Horsley & Witten
90 Route 6A
Sandwich, MA 02563

RE: Barn. On-Call No. 4 (17027)
ESS Laboratory Work Order Number: 1808548

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 11:42 am, Sep 10, 2018

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses
Maxxam Analytics - Cheektowaga, NY PFOA

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808548

SAMPLE RECEIPT

The following samples were received on August 21, 2018 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
1808548-01	A1	Soil	SUB
1808548-02	A2	Soil	SUB
1808548-03	A3	Soil	SUB
1808548-04	A4	Soil	SUB
1808548-05	A5	Soil	SUB
1808548-06	A6	Soil	SUB
1808548-07	A7	Soil	SUB
1808548-08	A8	Soil	SUB
1808548-09	A9	Soil	SUB
1808548-10	A10	Soil	SUB
1808548-11	A11	Soil	SUB
1808548-12	A12	Soil	SUB
1808548-13	D1	Soil	SUB
1808548-14	D2	Soil	SUB
1808548-15	D3	Soil	SUB
1808548-16	D4	Soil	SUB
1808548-17	D5	Soil	SUB
1808548-18	D6	Soil	SUB
1808548-19	D7	Soil	SUB
1808548-20	D8	Soil	SUB

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4 ESS Laboratory Work Order: 1808548

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808548

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035 - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808548

Subcontracted Analysis

Client Sample ID: A1
Date Sampled: 08/14/18 13:54

ESS Laboratory Sample ID: 1808548-01
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: A2
Date Sampled: 08/14/18 14:56

ESS Laboratory Sample ID: 1808548-02
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: A3
Date Sampled: 08/14/18 13:32

ESS Laboratory Sample ID: 1808548-03
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: A4
Date Sampled: 08/14/18 13:37

ESS Laboratory Sample ID: 1808548-04
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: A5
Date Sampled: 08/14/18 13:32

ESS Laboratory Sample ID: 1808548-05
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808548

Subcontracted Analysis

Client Sample ID: A6
Date Sampled: 08/14/18 13:27

ESS Laboratory Sample ID: 1808548-06
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: A7
Date Sampled: 08/14/18 13:20

ESS Laboratory Sample ID: 1808548-07
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: A8
Date Sampled: 08/14/18 13:20

ESS Laboratory Sample ID: 1808548-08
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: A9
Date Sampled: 08/14/18 16:06

ESS Laboratory Sample ID: 1808548-09
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: A10
Date Sampled: 08/14/18 16:22

ESS Laboratory Sample ID: 1808548-10
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808548

Subcontracted Analysis

Client Sample ID: A11
Date Sampled: 08/14/18 16:06

ESS Laboratory Sample ID: 1808548-11
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: A12
Date Sampled: 08/14/18 16:30

ESS Laboratory Sample ID: 1808548-12
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: D1
Date Sampled: 08/14/18 15:05

ESS Laboratory Sample ID: 1808548-13
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: D2
Date Sampled: 08/14/18 15:10

ESS Laboratory Sample ID: 1808548-14
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: D3
Date Sampled: 08/14/18 15:07

ESS Laboratory Sample ID: 1808548-15
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808548

Subcontracted Analysis

Client Sample ID: D4
Date Sampled: 08/14/18 15:12

ESS Laboratory Sample ID: 1808548-16
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: D5
Date Sampled: 08/14/18 14:20

ESS Laboratory Sample ID: 1808548-17
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: D6
Date Sampled: 08/14/18 14:18

ESS Laboratory Sample ID: 1808548-18
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: D7
Date Sampled: 08/14/18 14:30

ESS Laboratory Sample ID: 1808548-19
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: D8
Date Sampled: 08/14/18 14:35

ESS Laboratory Sample ID: 1808548-20
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4 ESS Laboratory Work Order: 1808548

Notes and Definitions

Z-08	See Attached
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808548

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

Maxxam
A Bureau Veritas Group Company

Your P.O. #: B02815
Your Project #: 1808548
Your C.O.C. #: N/A

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/09/09
Report #: R5391900
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8L6091
Received: 2018/08/22, 13:25

Sample Matrix: Soil
Samples Received: 20

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	20	N/A	2018/08/24	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	20	2018/09/05	2018/09/06	CAM SOP-00894	EPA537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

U = Undetected at the limit of quantitation.
J = Estimated concentration between the EDL & RDL.
B = Blank Contamination.
Q = One or more quality control criteria failed.
E = Analyte concentration exceeds the maximum concentration level.
K = Estimated maximum possible concentration due to ion abundance ratio failure.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your P.O. #: B02815
Your Project #: 1808548
Your C.O.C. #: N/A

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/09/09
Report #: R5391900
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8L6091
Received: 2018/08/22, 13:25

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B8L6091
Report Date: 2018/09/09

ESS Laboratory
Client Project #: 1808548
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HNT805	HNT805	HNT806	HNT807	HNT808			
Sampling Date		2018/08/14 13:54	2018/08/14 13:54	2018/08/14 14:56	2018/08/14 13:32	2018/08/14 13:37			
	UNITS	1808548-01	1808548-01 Lab-Dup	1808548-02	1808548-03	1808548-04	RDL	MDL	QC Batch
Inorganics									
Moisture	%	12	13	11	8.6	17	1.0	0.50	5698089
Miscellaneous Parameters									
6:2 Fluorotelomer sulfonate	ug/kg	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	1.0	0.26	5714358
8:2 Fluorotelomer sulfonate	ug/kg	0.33 U	0.33 U	0.33 U	0.34 J	0.33 U	1.0	0.33	5714358
Perfluorobutane Sulfonate (PFBS)	ug/kg	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	1.0	0.17	5714358
Perfluorobutanoic acid	ug/kg	0.23 U	0.23 U	0.23 U	0.49 J	0.23 U	1.0	0.23	5714358
Perfluorodecane Sulfonate	ug/kg	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	1.0	0.39	5714358
Perfluorodecanoic Acid (PFDA)	ug/kg	0.28 U	0.28 U	0.28 U	0.42 J	0.28 U	1.0	0.28	5714358
Perfluorododecanoic Acid (PFDoA)	ug/kg	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	1.0	0.28	5714358
Perfluoroheptanoic Acid (PFHpA)	ug/kg	0.19 U	0.19 U	0.19 U	0.38 J	0.19 U	1.0	0.19	5714358
Perfluorohexane Sulfonate (PFHxS)	ug/kg	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	1.0	0.24	5714358
Perfluorohexanoic Acid (PFHxA)	ug/kg	0.14 U	0.14 U	0.14 U	0.60 J	0.14 U	1.0	0.14	5714358
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	0.25 U	0.25 U	0.25 U	0.37 J	0.30 J	1.0	0.25	5714358
Perfluorononanoic Acid (PFNA)	ug/kg	0.22 U	0.22 U	0.22 U	0.51 J	0.22 U	1.0	0.22	5714358
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	1.0	0.14	5714358
Perfluorooctane Sulfonate (PFOS)	ug/kg	0.26 U	0.26 U	0.26 U	0.29 J	0.26 U	1.0	0.26	5714358
Perfluoropentanoic Acid (PFPeA)	ug/kg	0.25 U	0.25 U	0.25 U	1.6	0.37 J	1.0	0.25	5714358
Perfluorotetradecanoic Acid	ug/kg	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	1.0	0.31	5714358
Perfluorotridecanoic Acid	ug/kg	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	1.0	0.33	5714358
Perfluoroundecanoic Acid (PFUnA)	ug/kg	0.34 U	0.34 U	0.34 U	1.2	0.47 J	1.0	0.34	5714358
Surrogate Recovery (%)									
13C2-6:2 Fluorotelomer sulfonate	%	92	82	99	94	90	N/A	N/A	5714358
13C2-8:2 Fluorotelomer sulfonate	%	80	78	86	77	81	N/A	N/A	5714358
13C2-Perfluorodecanoic acid	%	85	81	80	80	88	N/A	N/A	5714358
13C2-Perfluorododecanoic acid	%	83	78	79	77	80	N/A	N/A	5714358
13C2-Perfluorohexanoic acid	%	93	84	93	87	90	N/A	N/A	5714358
13C2-perfluorotetradecanoic acid	%	75	73	73	73	67	N/A	N/A	5714358
13C2-Perfluoroundecanoic acid	%	82	75	87	86	84	N/A	N/A	5714358
13C4-Perfluorobutanoic acid	%	90	85	95	88	90	N/A	N/A	5714358
13C4-Perfluoroheptanoic acid	%	90	86	96	92	90	N/A	N/A	5714358
13C4-Perfluorooctanesulfonate	%	96	78	91	80	86	N/A	N/A	5714358
13C4-Perfluorooctanoic acid	%	90	83	92	83	90	N/A	N/A	5714358
13C5-Perfluorononanoic acid	%	90	79	95	90	86	N/A	N/A	5714358
13C5-Perfluoropentanoic acid	%	91	85	95	88	89	N/A	N/A	5714358

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8L6091
Report Date: 2018/09/09

ESS Laboratory
Client Project #: 1808548
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HNT805	HNT805	HNT806	HNT807	HNT808			
Sampling Date		2018/08/14 13:54	2018/08/14 13:54	2018/08/14 14:56	2018/08/14 13:32	2018/08/14 13:37			
	UNITS	**1808548-01**	**1808548-01 Lab-Dup**	**1808548-02**	**1808548-03**	**1808548-04**	**RDL**	**MDL**	**QC Batch**
13C8-Perfluorooctane Sulfonamide	%	75	72	82	73	77	N/A	N/A	5714358
18O2-Perfluorohexanesulfonate	%	87	86	93	87	87	N/A	N/A	5714358

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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RESULTS OF ANALYSES OF SOIL

Maxxam ID		HNT809			HNT810	HNT811	HNT812	HNT813			
Sampling Date		2018/08/14 13:32			2018/08/14 13:27	2018/08/14 13:20	2018/08/14 13:20	2018/08/14 16:06			
	UNITS	1808548-05	RDL	MDL	1808548-06	1808548-07	1808548-08	1808548-09	RDL	MDL	QC Batch
Inorganics											
Moisture	%	8.6	1.0	0.50	6.2	12	10	19	1.0	0.50	5698089
Miscellaneous Parameters											
6:2 Fluorotelomer sulfonate	ug/kg	18	1.0	0.26	0.26 U	0.26 U	0.26 U	0.26 U	1.0	0.26	5714358
8:2 Fluorotelomer sulfonate	ug/kg	21	1.0	0.33	0.33 U	0.33 U	0.33 U	0.33 U	1.0	0.33	5714358
Perfluorobutane Sulfonate (PFBS)	ug/kg	0.17 U	1.0	0.17	0.17 U	0.17 U	0.17 U	0.17 U	1.0	0.17	5714358
Perfluorobutanoic acid	ug/kg	1.5	1.0	0.23	0.23 U	0.23 U	0.23 U	0.23 U	1.0	0.23	5714358
Perfluorodecane Sulfonate	ug/kg	0.39 U	1.0	0.39	0.39 U	0.39 U	0.39 U	0.39 U	1.0	0.39	5714358
Perfluorodecanoic Acid (PFDA)	ug/kg	1.4	1.0	0.28	0.28 U	0.28 U	0.28 U	0.28 U	1.0	0.28	5714358
Perfluorododecanoic Acid (PFDoA)	ug/kg	2.5	1.0	0.28	0.28 U	0.28 U	0.28 U	0.28 U	1.0	0.28	5714358
Perfluoroheptanoic Acid (PFHpA)	ug/kg	1.1	1.0	0.19	0.19 U	0.19 U	0.19 U	0.19 U	1.0	0.19	5714358
Perfluorohexane Sulfonate (PFHxS)	ug/kg	0.24 U	1.0	0.24	0.24 U	0.24 U	0.24 U	0.24 U	1.0	0.24	5714358
Perfluorohexanoic Acid (PFHxA)	ug/kg	2.1	1.0	0.14	0.14 U	0.14 U	0.14 U	0.14 U	1.0	0.14	5714358
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	1.9	1.0	0.25	0.25 U	0.25 U	0.25 U	0.34 J	1.0	0.25	5714358
Perfluorononanoic Acid (PFNA)	ug/kg	0.87 J	1.0	0.22	0.22 U	0.22 U	0.22 U	0.22 U	1.0	0.22	5714358
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	0.14 U	1.0	0.14	0.14 U	0.14 U	0.14 U	0.14 U	1.0	0.14	5714358
Perfluorooctane Sulfonate (PFOS)	ug/kg	0.26 U	1.0	0.26	0.26 U	0.38 J	0.26 U	0.85 J	1.0	0.26	5714358
Perfluoropentanoic Acid (PFPeA)	ug/kg	5.6	1.0	0.25	0.25 U	0.25 U	0.25 U	0.25 U	1.0	0.25	5714358
Perfluorotetradecanoic Acid	ug/kg	1.1	1.0	0.31	0.31 U	0.31 U	0.31 U	0.31 U	1.0	0.31	5714358
Perfluorotridecanoic Acid	ug/kg	60 (1)	10	3.3	0.77 J	0.33 U	0.33 U	0.33 U	1.0	0.33	5714358
Perfluoroundecanoic Acid (PFUnA)	ug/kg	44	1.0	0.34	0.73 J	0.97 J	0.48 J	0.73 J	1.0	0.34	5714358
Surrogate Recovery (%)											
13C2-6:2 Fluorotelomer sulfonate	%	81	N/A	N/A	91	95	86	88	N/A	N/A	5714358
13C2-8:2 Fluorotelomer sulfonate	%	77	N/A	N/A	84	89	72	77	N/A	N/A	5714358
13C2-Perfluorodecanoic acid	%	74	N/A	N/A	82	88	75	81	N/A	N/A	5714358
13C2-Perfluorododecanoic acid	%	69	N/A	N/A	75	86	70	71	N/A	N/A	5714358
13C2-Perfluorohexanoic acid	%	86	N/A	N/A	90	95	82	85	N/A	N/A	5714358
13C2-perfluorotetradecanoic acid	%	105	N/A	N/A	75	81	64	53	N/A	N/A	5714358
13C2-Perfluoroundecanoic acid	%	75	N/A	N/A	87	90	76	81	N/A	N/A	5714358
13C4-Perfluorobutanoic acid	%	84	N/A	N/A	92	97	82	87	N/A	N/A	5714358
13C4-Perfluoroheptanoic acid	%	81	N/A	N/A	93	95	81	88	N/A	N/A	5714358
13C4-Perfluorooctanesulfonate	%	78	N/A	N/A	95	93	77	84	N/A	N/A	5714358
13C4-Perfluorooctanoic acid	%	79	N/A	N/A	91	94	80	88	N/A	N/A	5714358
13C5-Perfluorononanoic acid	%	79	N/A	N/A	88	98	84	85	N/A	N/A	5714358
13C5-Perfluoropentanoic acid	%	84	N/A	N/A	90	96	81	84	N/A	N/A	5714358

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Due to high concentration of the target analyte, sample required dilution. Detection limit was adjusted accordingly.

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Maxxam Job #: B8L6091
Report Date: 2018/09/09

ESS Laboratory
Client Project #: 1808548
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HNT809			HNT810	HNT811	HNT812	HNT813			
Sampling Date		2018/08/14 13:32			2018/08/14 13:27	2018/08/14 13:20	2018/08/14 13:20	2018/08/14 16:06			
	UNITS	**1808548-05**	**RDL**	**MDL**	**1808548-06**	**1808548-07**	**1808548-08**	**1808548-09**	**RDL**	**MDL**	**QC Batch**
13C8-Perfluorooctane Sulfonamide	%	73	N/A	N/A	71	82	65	66	N/A	N/A	5714358
18O2-Perfluorohexanesulfonate	%	75	N/A	N/A	91	96	77	85	N/A	N/A	5714358

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8L6091
Report Date: 2018/09/09

ESS Laboratory
Client Project #: 1808548
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HNT814	HNT815	HNT816	HNT817	HNT818	HNT819			
Sampling Date		2018/08/14 16:22	2018/08/14 16:06	2018/08/14 16:30	2018/08/14 15:05	2018/08/14 15:10	2018/08/14 15:07			
	UNITS	1808548-10	1808548-11	1808548-12	1808548-13	1808548-14	1808548-15	RDL	MDL	QC Batch
Inorganics										
Moisture	%	18	10	5.0	18	9.1	15	1.0	0.50	5698089
Miscellaneous Parameters										
6:2 Fluorotelomer sulfonate	ug/kg	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	1.0	0.26	5714358
8:2 Fluorotelomer sulfonate	ug/kg	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	1.0	0.33	5714358
Perfluorobutane Sulfonate (PFBS)	ug/kg	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	1.0	0.17	5714358
Perfluorobutanoic acid	ug/kg	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	1.0	0.23	5714358
Perfluorodecane Sulfonate	ug/kg	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	1.0	0.39	5714358
Perfluorodecanoic Acid (PFDA)	ug/kg	0.33 J	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	1.0	0.28	5714358
Perfluorododecanoic Acid (PFDoA)	ug/kg	0.35 J	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	1.0	0.28	5714358
Perfluoroheptanoic Acid (PFHpA)	ug/kg	0.19 U	0.19 U	0.19 U	0.19 U	0.21 J	0.19 U	1.0	0.19	5714358
Perfluorohexane Sulfonate (PFHxS)	ug/kg	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	1.0	0.24	5714358
Perfluorohexanoic Acid (PFHxA)	ug/kg	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	1.0	0.14	5714358
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	0.25 U	0.25 U	0.25 U	0.25 U	0.33 J	0.25 U	1.0	0.25	5714358
Perfluorononanoic Acid (PFNA)	ug/kg	0.22 U	0.22 U	0.22 U	0.22 U	0.67 J	0.22 U	1.0	0.22	5714358
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	1.0	0.14	5714358
Perfluorooctane Sulfonate (PFOS)	ug/kg	0.26 U	0.26 U	0.26 U	0.26 U	0.66 J	0.38 J	1.0	0.26	5714358
Perfluoropentanoic Acid (PFPeA)	ug/kg	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	1.0	0.25	5714358
Perfluorotetradecanoic Acid	ug/kg	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	1.0	0.31	5714358
Perfluorotridecanoic Acid	ug/kg	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	1.0	0.33	5714358
Perfluoroundecanoic Acid (PFUnA)	ug/kg	0.42 J	0.43 J	0.34 U	0.74 J	0.34 U	0.56 J	1.0	0.34	5714358
Surrogate Recovery (%)										
13C2-6:2 Fluorotelomer sulfonate	%	90	90	97	84	97	92	N/A	N/A	5714358
13C2-8:2 Fluorotelomer sulfonate	%	85	84	90	77	71	87	N/A	N/A	5714358
13C2-Perfluorodecanoic acid	%	82	89	93	76	85	85	N/A	N/A	5714358
13C2-Perfluorododecanoic acid	%	78	81	85	67	80	82	N/A	N/A	5714358
13C2-Perfluorohexanoic acid	%	89	89	92	84	89	85	N/A	N/A	5714358
13C2-perfluorotetradecanoic acid	%	75	66	80	62	73	67	N/A	N/A	5714358
13C2-Perfluoroundecanoic acid	%	84	87	93	73	89	85	N/A	N/A	5714358
13C4-Perfluorobutanoic acid	%	89	92	94	84	90	90	N/A	N/A	5714358
13C4-Perfluoroheptanoic acid	%	90	93	93	85	88	87	N/A	N/A	5714358
13C4-Perfluorooctanesulfonate	%	92	85	88	84	87	80	N/A	N/A	5714358
13C4-Perfluorooctanoic acid	%	85	92	93	77	86	87	N/A	N/A	5714358
13C5-Perfluorononanoic acid	%	86	91	97	89	86	91	N/A	N/A	5714358
13C5-Perfluoropentanoic acid	%	86	93	93	81	88	89	N/A	N/A	5714358
13C8-Perfluorooctane Sulfonamide	%	72	77	82	61	75	75	N/A	N/A	5714358

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8L6091
Report Date: 2018/09/09

ESS Laboratory
Client Project #: 1808548
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HNT814	HNT815	HNT816	HNT817	HNT818	HNT819			
Sampling Date		2018/08/14 16:22	2018/08/14 16:06	2018/08/14 16:30	2018/08/14 15:05	2018/08/14 15:10	2018/08/14 15:07			
	UNITS	**1808548-10**	**1808548-11**	**1808548-12**	**1808548-13**	**1808548-14**	**1808548-15**	**RDL**	**MDL**	**QC Batch**
18O2-Perfluorohexanesulfonate	%	84	93	87	84	87	83	N/A	N/A	5714358

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8L6091
Report Date: 2018/09/09

ESS Laboratory
Client Project #: 1808548
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HNT820	HNT821	HNT822	HNT823	HNT824			
Sampling Date		2018/08/14 15:12	2018/08/14 14:20	2018/08/14 14:18	2018/08/14 14:30	2018/08/14 14:35			
	UNITS	1808548-16	1808548-17	1808548-18	1808548-19	1808548-20	RDL	MDL	QC Batch
Inorganics									
Moisture	%	13	3.0	4.4	21	29	1.0	0.50	5698089
Miscellaneous Parameters									
6:2 Fluorotelomer sulfonate	ug/kg	0.26 U	0.78 J	1.2	12	0.26 U	1.0	0.26	5714358
8:2 Fluorotelomer sulfonate	ug/kg	0.33 U	0.51 J	2.9	15	0.43 J	1.0	0.33	5714358
Perfluorobutane Sulfonate (PFBS)	ug/kg	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	1.0	0.17	5714358
Perfluorobutanoic acid	ug/kg	1.2	0.23 U	0.31 J	16	4.1	1.0	0.23	5714358
Perfluorodecane Sulfonate	ug/kg	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	1.0	0.39	5714358
Perfluorodecanoic Acid (PFDA)	ug/kg	0.40 J	0.28 U	0.66 J	8.6	1.3	1.0	0.28	5714358
Perfluorododecanoic Acid (PFDoA)	ug/kg	0.28 U	0.28 U	1.3	1.9	0.50 J	1.0	0.28	5714358
Perfluoroheptanoic Acid (PFHpA)	ug/kg	0.95 J	0.22 J	0.25 J	7.8	1.0	1.0	0.19	5714358
Perfluorohexane Sulfonate (PFHxS)	ug/kg	0.24 U	0.24 U	0.24 U	0.24 U	0.31 J	1.0	0.24	5714358
Perfluorohexanoic Acid (PFHxA)	ug/kg	1.4	0.50 J	0.40 J	11	2.9	1.0	0.14	5714358
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	1.1	0.25 U	0.28 J	14	2.2	1.0	0.25	5714358
Perfluorononanoic Acid (PFNA)	ug/kg	0.98 J	0.22 U	0.22 U	10	0.59 J	1.0	0.22	5714358
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	1.0	0.14	5714358
Perfluorooctane Sulfonate (PFOS)	ug/kg	2.9	0.26 U	0.26 U	3.4	2.1	1.0	0.26	5714358
Perfluoropentanoic Acid (PFPeA)	ug/kg	2.1	1.0	0.83 J	33	8.3	1.0	0.25	5714358
Perfluorotetradecanoic Acid	ug/kg	0.31 U	0.31 U	0.31 U	0.34 J	0.31 U	1.0	0.31	5714358
Perfluorotridecanoic Acid	ug/kg	0.33 U	0.33 U	0.56 J	5.2	0.33 U	1.0	0.33	5714358
Perfluoroundecanoic Acid (PFUnA)	ug/kg	0.39 J	0.34 U	0.37 J	13	0.88 J	1.0	0.34	5714358
Surrogate Recovery (%)									
13C2-6:2 Fluorotelomer sulfonate	%	85	96	96	76	88	N/A	N/A	5714358
13C2-8:2 Fluorotelomer sulfonate	%	75	83	85	73	83	N/A	N/A	5714358
13C2-Perfluorodecanoic acid	%	81	81	81	79	77	N/A	N/A	5714358
13C2-Perfluorododecanoic acid	%	83	76	80	71	71	N/A	N/A	5714358
13C2-Perfluorohexanoic acid	%	81	87	88	80	85	N/A	N/A	5714358
13C2-perfluorotetradecanoic acid	%	76	77	71	55	45 (1)	N/A	N/A	5714358
13C2-Perfluoroundecanoic acid	%	85	87	84	82	78	N/A	N/A	5714358
13C4-Perfluorobutanoic acid	%	86	85	89	85	88	N/A	N/A	5714358

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

N/A = Not Applicable

(1) Extracted internal standard analyte recovery was below the defined lower control limit (LCL). Laboratory spiked soil resulted in satisfactory recovery of the extracted internal standard analyte. When considered together, these QC data suggest that matrix interferences may be biasing the data low. Because quantitation is performed using isotope dilution techniques, any losses of the native compound that may occur during any of the sample preparation, extraction, cleanup or determinative steps will be mirrored by a similar loss of the labeled standard, and as such can be accounted for and corrected. Therefore, the quantification of these target compounds is not affected by the low extracted internal standard analyte recovery.

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Maxxam Job #: B8L6091
Report Date: 2018/09/09

ESS Laboratory
Client Project #: 1808548
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HNT820	HNT821	HNT822	HNT823	HNT824			
Sampling Date		2018/08/14 15:12	2018/08/14 14:20	2018/08/14 14:18	2018/08/14 14:30	2018/08/14 14:35			
	UNITS	1808548-16	1808548-17	1808548-18	1808548-19	1808548-20	RDL	MDL	QC Batch
13C4-Perfluoroheptanoic acid	%	87	88	89	81	88	N/A	N/A	5714358
13C4-Perfluorooctanesulfonate	%	86	84	85	72	78	N/A	N/A	5714358
13C4-Perfluorooctanoic acid	%	81	90	88	79	85	N/A	N/A	5714358
13C5-Perfluorononanoic acid	%	82	83	86	82	89	N/A	N/A	5714358
13C5-Perfluoropentanoic acid	%	87	90	87	81	86	N/A	N/A	5714358
13C8-Perfluorooctane Sulfonamide	%	76	75	77	55	56	N/A	N/A	5714358
18O2-Perfluorohexanesulfonate	%	83	80	81	82	90	N/A	N/A	5714358

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8L6091
Report Date: 2018/09/09

ESS Laboratory
Client Project #: 1808548
Your P.O. #: B02815

TEST SUMMARY

Maxxam ID: HNT805
Sample ID: 1808548-01
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT805 Dup
Sample ID: 1808548-01
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT806
Sample ID: 1808548-02
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT807
Sample ID: 1808548-03
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT808
Sample ID: 1808548-04
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT809
Sample ID: 1808548-05
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

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TEST SUMMARY

Maxxam ID: HNT810 **Collected:** 2018/08/14
Sample ID: 1808548-06 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT811 **Collected:** 2018/08/14
Sample ID: 1808548-07 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT812 **Collected:** 2018/08/14
Sample ID: 1808548-08 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT813 **Collected:** 2018/08/14
Sample ID: 1808548-09 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT814 **Collected:** 2018/08/14
Sample ID: 1808548-10 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT815 **Collected:** 2018/08/14
Sample ID: 1808548-11 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

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TEST SUMMARY

Maxxam ID: HNT816 **Collected:** 2018/08/14
Sample ID: 1808548-12 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT817 **Collected:** 2018/08/14
Sample ID: 1808548-13 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT818 **Collected:** 2018/08/14
Sample ID: 1808548-14 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT819 **Collected:** 2018/08/14
Sample ID: 1808548-15 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT820 **Collected:** 2018/08/14
Sample ID: 1808548-16 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT821 **Collected:** 2018/08/14
Sample ID: 1808548-17 **Shipped:**
Matrix: Soil **Received:** 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

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Maxxam Job #: B8L6091
Report Date: 2018/09/09

ESS Laboratory
Client Project #: 1808548
Your P.O. #: B02815

TEST SUMMARY

Maxxam ID: HNT822
Sample ID: 1808548-18
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT823
Sample ID: 1808548-19
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

Maxxam ID: HNT824
Sample ID: 1808548-20
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5698089	N/A	2018/08/24	Nilam Borole
PFOS and PFOA in soil by SPE/LCMS	LCMS	5714358	2018/09/05	2018/09/06	Marian Godax

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GENERAL COMMENTS

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
5698089	GYA	RPD - Sample/Sample Dup	Moisture	2018/08/24	0.80		%	20
5714358	M_G	Matrix Spike(HNT805)	13C2-6:2 Fluorotelomer sulfonate	2018/09/06		87	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/09/06		80	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/09/06		76	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/09/06		75	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/09/06		85	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/09/06		72	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/09/06		84	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/09/06		87	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/09/06		85	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/09/06		82	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/09/06		86	%	50 - 150
			13C5-Perfluorononanoic acid	2018/09/06		87	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/09/06		83	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/09/06		70	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/09/06		83	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/09/06		101	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/09/06		104	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/09/06		118	%	70 - 130
			Perfluorobutanoic acid	2018/09/06		110	%	70 - 130
			Perfluorodecane Sulfonate	2018/09/06		111	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/09/06		119	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/09/06		114	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/09/06		111	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/09/06		110	%	70 - 130
			Perfluorotetradecanoic Acid	2018/09/06		112	%	70 - 130
			Perfluorotridecanoic Acid	2018/09/06		118	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/09/06		100	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/09/06		108	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/09/06		107	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/09/06		113	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/09/06		107	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/09/06		112	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/09/06		113	%	70 - 130
5714358	M_G	Spiked Blank	13C2-6:2 Fluorotelomer sulfonate	2018/09/06		92	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/09/06		83	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/09/06		87	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/09/06		83	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/09/06		90	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/09/06		83	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/09/06		83	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/09/06		87	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/09/06		88	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/09/06		88	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/09/06		89	%	50 - 150
			13C5-Perfluorononanoic acid	2018/09/06		88	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/09/06		87	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/09/06		77	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/09/06		79	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/09/06		101	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/09/06		110	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/09/06		130	%	70 - 130
			Perfluorobutanoic acid	2018/09/06		112	%	70 - 130
			Perfluorodecane Sulfonate	2018/09/06		107	%	70 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorodecanoic Acid (PFDA)	2018/09/06		110	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/09/06		111	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/09/06		110	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/09/06		110	%	70 - 130
			Perfluorotetradecanoic Acid	2018/09/06		110	%	70 - 130
			Perfluorotridecanoic Acid	2018/09/06		113	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/09/06		113	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/09/06		109	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/09/06		120	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/09/06		108	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/09/06		107	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/09/06		109	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/09/06		108	%	70 - 130
5714358	M_G	Method Blank	13C2-6:2 Fluorotelomer sulfonate	2018/09/06		83	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/09/06		79	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/09/06		77	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/09/06		79	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/09/06		84	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/09/06		74	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/09/06		81	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/09/06		86	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/09/06		86	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/09/06		81	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/09/06		82	%	50 - 150
			13C5-Perfluorononanoic acid	2018/09/06		82	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/09/06		86	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/09/06		76	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/09/06		82	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/09/06	0.26 U, MDL=0.26		ug/kg	
			8:2 Fluorotelomer sulfonate	2018/09/06	0.33 U, MDL=0.33		ug/kg	
			Perfluorobutane Sulfonate (PFBS)	2018/09/06	0.17 U, MDL=0.17		ug/kg	
			Perfluorobutanoic acid	2018/09/06	0.23 U, MDL=0.23		ug/kg	
			Perfluorodecane Sulfonate	2018/09/06	0.39 U, MDL=0.39		ug/kg	
			Perfluorodecanoic Acid (PFDA)	2018/09/06	0.28 U, MDL=0.28		ug/kg	
			Perfluorododecanoic Acid (PFDoA)	2018/09/06	0.28 U, MDL=0.28		ug/kg	
			Perfluorononanoic Acid (PFNA)	2018/09/06	0.22 U, MDL=0.22		ug/kg	
			Perfluorooctane Sulfonamide (PFOSA)	2018/09/06	0.14 U, MDL=0.14		ug/kg	
			Perfluorotetradecanoic Acid	2018/09/06	0.31 U, MDL=0.31		ug/kg	
			Perfluorotridecanoic Acid	2018/09/06	0.33 U, MDL=0.33		ug/kg	
			Perfluoroundecanoic Acid (PFUnA)	2018/09/06	0.34 U, MDL=0.34		ug/kg	
			Perfluoroheptanoic Acid (PFHpA)	2018/09/06	0.19 U, MDL=0.19		ug/kg	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorohexane Sulfonate (PFHxS)	2018/09/06	0.24 U, MDL=0.24		ug/kg	
			Perfluorohexanoic Acid (PFHxA)	2018/09/06	0.14 U, MDL=0.14		ug/kg	
			Perfluoro-n-Octanoic Acid (PFOA)	2018/09/06	0.25 U, MDL=0.25		ug/kg	
			Perfluorooctane Sulfonate (PFOS)	2018/09/06	0.26 U, MDL=0.26		ug/kg	
			Perfluoropentanoic Acid (PFPeA)	2018/09/06	0.25 U, MDL=0.25		ug/kg	
5714358	M_G	RPD - Sample/Sample Dup	6:2 Fluorotelomer sulfonate	2018/09/06	NC		%	30
			8:2 Fluorotelomer sulfonate	2018/09/06	NC		%	30
			Perfluorobutane Sulfonate (PFBS)	2018/09/06	NC		%	30
			Perfluorobutanoic acid	2018/09/06	NC		%	30
			Perfluorodecane Sulfonate	2018/09/06	NC		%	30
			Perfluorodecanoic Acid (PFDA)	2018/09/06	NC		%	30
			Perfluorododecanoic Acid (PFDoA)	2018/09/06	NC		%	30
			Perfluorononanoic Acid (PFNA)	2018/09/06	NC		%	30
			Perfluorooctane Sulfonamide (PFOSA)	2018/09/06	NC		%	25
			Perfluorotetradecanoic Acid	2018/09/06	NC		%	30
			Perfluorotridecanoic Acid	2018/09/06	NC		%	30
			Perfluoroundecanoic Acid (PFUnA)	2018/09/06	NC		%	30
			Perfluoroheptanoic Acid (PFHpA)	2018/09/06	NC		%	30
			Perfluorohexane Sulfonate (PFHxS)	2018/09/06	NC		%	30
			Perfluorohexanoic Acid (PFHxA)	2018/09/06	NC		%	30
			Perfluoro-n-Octanoic Acid (PFOA)	2018/09/06	NC		%	30
			Perfluorooctane Sulfonate (PFOS)	2018/09/06	NC		%	30
			Perfluoropentanoic Acid (PFPeA)	2018/09/06	NC		%	30

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B8L6091
Report Date: 2018/09/09

ESS Laboratory
Client Project #: 1808548
Your P.O. #: B02815

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Colm McNamara, Senior Analyst, Liquid Chromatography

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 180548

Turn Time STANDARD Rush
Regulatory State MA
Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP
Reporting Limits S-1 / GW-1
Electonic Deliverables ☑Limit Checker ☐Standard Excel ☑Other (Please Specify →) PDF

Company Name	Project #	Project Name
HORSLEY WITTEN GROUP	17027	BARN. ON-CALL #4
Contact Person	**Address**	
JOSEPHINE IBANEZ	90 ROUTE 6A, UNIT 1	
City	**State**	**Zip Code** / **PO #**
SANDWICH	MA	02563
Telephone Number	**FAX Number**	**Email Address**
508-833-6600	508-833-3150	jibanez@horsleywitten.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: PFAS-FULL LIST
1	8/14/18	1354	Grab	Soil	A1	X
2		1450			A2	
3		1332			A3	
4		1337			A4	
5		1332			A5	
6		1327			A6	
7		1320			A7	
8		1320			A8	
9		1606			A9	
10		1622			A10	X

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer G - Glass O-Other (P-Poly) S-Sterile V-Vial
Container Volume: 1-100 mL 2-2.5 gal (3-250 mL) 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*
Preservation Code: (1-Non Preserved) 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Ascorbic Acid 12-Other*
Number of Containers per Sample: 1

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 2.2 °C ICE RC

Sampled by : HW, BM
Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
8/14/18 1715	HW FRIDGE 8/14/18 1715	HW FRIDGE	R. Cuba 8/21/18 1215
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
R. Cuba 8/21/18 1546	8/21/18 1649	~~8/21/18 1606~~	

ESS Laboratory

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CHAIN OF CUSTODY

ESS Lab # 1180548
Turn Time STANDARD Rush
Regulatory State MA
Is this project for any of the following?: OCT RCP OMA MCP ORGP
Reporting Limits S-1 / GW-1
Electonic Deliverables ☑ Limit Checker ☐ Standard Excel ☑ Other (Please Specify →) PDF

Company Name	Project #	Project Name
HORSLEY WITTEN GROUP	17027	BARN. ON-CALL #4

Contact Person	Address
JOSEPHINE IBANEZ	90 ROUTE 6A, UNIT 1

City	State	Zip Code	PO #
SANDWICH	MA	02563	

Telephone Number	FAX Number	Email Address
508-833-6600	508-833-3150	jibanez@horsleywitten.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: PFAS - FULL LIST
11	8/14/18	1606	Grab	Soil	A11	X
12		1630			A12	
13		1505			D1	
14		1510			D2	
15		1507			D3	
16		1512			D4	
17		1420			D5	
18		1418			D6	
19		1430			D7	
20	↓	1435	↓	↓	D8	↓

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer G - Glass O-Other (P-Poly) S-Sterile V-Vial
Container Volume: 1-100 mL 2-2.5 gal (3-250 mL) 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*
Preservation Code: (1-Non Preserved) 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Ascorbic Acid 12-Other*
Number of Containers per Sample: 1

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 2.2 °C ICE RC

Sampled by: HW, BM
Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
8/14/18 1715	HW FRIDGE 8/14/18 1715	HW FRIDGE	8/21/18 1215
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
8/21/18 1546	8/21/18 1549	8/21/18 1607	

CERTIFICATE OF ANALYSIS

Josphine Ibanez
Horsley & Witten
90 Route 6A
Sandwich, MA 02563

RE: Barn. On-Call No. 4 (17027)
ESS Laboratory Work Order Number: 1808549

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 11:45 am, Sep 10, 2018

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses
Maxxam Analytics - Cheektowaga, NY PFOA

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808549

SAMPLE RECEIPT

The following samples were received on August 21, 2018 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
1808549-01	D9	Soil	SUB
1808549-02	D10	Soil	SUB
1808549-03	D11	Soil	SUB
1808549-04	D12	Soil	SUB
1808549-05	1991A	Soil	SUB
1808549-06	1991B	Soil	SUB
1808549-07	1991C	Soil	SUB
1808549-08	1991D	Soil	SUB

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4 ESS Laboratory Work Order: 1808549

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808549

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035 - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808549

Subcontracted Analysis

Client Sample ID: D9
Date Sampled: 08/14/18 14:25

ESS Laboratory Sample ID: 1808549-01
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: D10
Date Sampled: 08/14/18 14:02

ESS Laboratory Sample ID: 1808549-02
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: D11
Date Sampled: 08/14/18 14:10

ESS Laboratory Sample ID: 1808549-03
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: D12
Date Sampled: 08/14/18 14:03

ESS Laboratory Sample ID: 1808549-04
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: 1991A
Date Sampled: 08/14/18 15:33

ESS Laboratory Sample ID: 1808549-05
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808549

Subcontracted Analysis

Client Sample ID: 1991B
Date Sampled: 08/14/18 15:33

ESS Laboratory Sample ID: 1808549-06
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: 1991C
Date Sampled: 08/14/18 15:38

ESS Laboratory Sample ID: 1808549-07
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

Client Sample ID: 1991D
Date Sampled: 08/14/18 15:30

ESS Laboratory Sample ID: 1808549-08
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOA	See Attached								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4 ESS Laboratory Work Order: 1808549

Notes and Definitions

Z-08	See Attached
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1808549

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

Maxxam
A Bureau Veritas Group Company

Your P.O. #: B02815
Your Project #: 1808549
Your C.O.C. #: N/A

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/09/06
Report #: R5387720
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8L7823
Received: 2018/08/22, 13:25

Sample Matrix: Soil
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	8	N/A	2018/08/24	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	8	2018/08/31	2018/09/05	CAM SOP-00894	EPA537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

U = Undetected at the limit of quantitation.
J = Estimated concentration between the EDL & RDL.
B = Blank Contamination.
Q = One or more quality control criteria failed.
E = Analyte concentration exceeds the maximum concentration level.
K = Estimated maximum possible concentration due to ion abundance ratio failure.

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Your P.O. #: B02815
Your Project #: 1808549
Your C.O.C. #: N/A

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/09/06
Report #: R5387720
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8L7823
Received: 2018/08/22, 13:25

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B8L7823
Report Date: 2018/09/06

ESS Laboratory
Client Project #: 1808549
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HOC751	HOC752	HOC753	HOC754	HOC755	HOC755			
Sampling Date		2018/08/14 14:25	2018/08/14 14:02	2018/08/14 14:10	2018/08/14 14:03	2018/08/14 15:33	2018/08/14 15:33			
	UNITS	1808549-01	1808549-02	1808549-03	1808549-04	1808549-05	1808549-05 Lab-Dup	RDL	MDL	QC Batch
Inorganics										
Moisture	%	12	8.0	10	8.3	8.9	N/A	1.0	0.50	5697821
Miscellaneous Parameters										
6:2 Fluorotelomer sulfonate	ug/kg	6.6	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	1.0	0.26	5709099
8:2 Fluorotelomer sulfonate	ug/kg	3.9	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	1.0	0.33	5709099
Perfluorobutane Sulfonate (PFBS)	ug/kg	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	1.0	0.17	5709099
Perfluorobutanoic acid	ug/kg	4.9	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	1.0	0.23	5709099
Perfluorodecane Sulfonate	ug/kg	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	1.0	0.39	5709099
Perfluorodecanoic Acid (PFDA)	ug/kg	1.6	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	1.0	0.28	5709099
Perfluorododecanoic Acid (PFDoA)	ug/kg	0.45 J	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	1.0	0.28	5709099
Perfluoroheptanoic Acid (PFHpA)	ug/kg	2.7	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	1.0	0.19	5709099
Perfluorohexane Sulfonate (PFHxS)	ug/kg	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	1.0	0.24	5709099
Perfluorohexanoic Acid (PFHxA)	ug/kg	6.2	0.14 U	0.14 U	0.26 J	0.14 U	0.14 U	1.0	0.14	5709099
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	3.0	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	1.0	0.25	5709099
Perfluorononanoic Acid (PFNA)	ug/kg	0.83 J	0.22 U	0.22 U	0.32 J	0.22 U	0.22 U	1.0	0.22	5709099
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	1.0	0.14	5709099
Perfluorooctane Sulfonate (PFOS)	ug/kg	0.67 J	0.54 J	0.91 J	0.44 J	0.49 J	0.40 J	1.0	0.26	5709099
Perfluoropentanoic Acid (PFPeA)	ug/kg	12	0.29 J	0.33 J	0.25 U	0.25 U	0.25 U	1.0	0.25	5709099
Perfluorotetradecanoic Acid	ug/kg	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	1.0	0.31	5709099
Perfluorotridecanoic Acid	ug/kg	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	1.0	0.33	5709099
Perfluoroundecanoic Acid (PFUnA)	ug/kg	0.56 J	0.34 U	0.38 J	0.45 J	0.34 U	0.34 U	1.0	0.34	5709099
Surrogate Recovery (%)										
13C2-6:2 Fluorotelomer sulfonate	%	108	115	104	93	102	98	N/A	N/A	5709099
13C2-8:2 Fluorotelomer sulfonate	%	99	104	104	98	97	94	N/A	N/A	5709099
13C2-Perfluorodecanoic acid	%	106	106	103	96	99	91	N/A	N/A	5709099
13C2-Perfluorododecanoic acid	%	101	106	99	97	96	93	N/A	N/A	5709099
13C2-Perfluorohexanoic acid	%	109	114	107	96	97	96	N/A	N/A	5709099
13C2-perfluorotetradecanoic acid	%	83	80	86	74	77	73	N/A	N/A	5709099
13C2-Perfluoroundecanoic acid	%	101	109	100	93	94	90	N/A	N/A	5709099
13C4-Perfluorobutanoic acid	%	113	113	105	98	97	96	N/A	N/A	5709099
13C4-Perfluoroheptanoic acid	%	109	116	105	97	101	96	N/A	N/A	5709099
13C4-Perfluorooctanesulfonate	%	108	110	105	93	99	91	N/A	N/A	5709099
13C4-Perfluorooctanoic acid	%	104	110	103	95	97	91	N/A	N/A	5709099
13C5-Perfluorononanoic acid	%	105	111	99	95	97	95	N/A	N/A	5709099
13C5-Perfluoropentanoic acid	%	113	112	104	99	97	97	N/A	N/A	5709099

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B8L7823
Report Date: 2018/09/06

ESS Laboratory
Client Project #: 1808549
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HOC751	HOC752	HOC753	HOC754	HOC755	HOC755			
Sampling Date		2018/08/14 14:25	2018/08/14 14:02	2018/08/14 14:10	2018/08/14 14:03	2018/08/14 15:33	2018/08/14 15:33			
	UNITS	**1808549-01**	**1808549-02**	**1808549-03**	**1808549-04**	**1808549-05**	**1808549-05 Lab-Dup**	**RDL**	**MDL**	**QC Batch**
13C8-Perfluorooctane Sulfonamide	%	99	97	97	94	92	93	N/A	N/A	5709099
18O2-Perfluorohexanesulfonate	%	108	106	100	91	92	84	N/A	N/A	5709099

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B8L7823
Report Date: 2018/09/06

ESS Laboratory
Client Project #: 1808549
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HOC756	HOC757	HOC758			
Sampling Date		2018/08/14 15:33	2018/08/14 15:38	2018/08/14 15:30			
	UNITS	1808549-06	1808549-07	1808549-08	RDL	MDL	QC Batch
Inorganics							
Moisture	%	9.7	12	13	1.0	0.50	5697821
Miscellaneous Parameters							
6:2 Fluorotelomer sulfonate	ug/kg	0.26 U	0.26 U	0.26 U	1.0	0.26	5709099
8:2 Fluorotelomer sulfonate	ug/kg	0.33 U	0.33 U	0.33 U	1.0	0.33	5709099
Perfluorobutane Sulfonate (PFBS)	ug/kg	0.17 U	0.17 U	0.17 U	1.0	0.17	5709099
Perfluorobutanoic acid	ug/kg	0.23 U	0.23 U	0.23 U	1.0	0.23	5709099
Perfluorodecane Sulfonate	ug/kg	0.39 U	0.39 U	0.39 U	1.0	0.39	5709099
Perfluorodecanoic Acid (PFDA)	ug/kg	0.28 U	0.28 U	0.28 U	1.0	0.28	5709099
Perfluorododecanoic Acid (PFDoA)	ug/kg	0.28 U	0.28 U	0.28 U	1.0	0.28	5709099
Perfluoroheptanoic Acid (PFHpA)	ug/kg	0.19 U	0.19 U	0.19 U	1.0	0.19	5709099
Perfluorohexane Sulfonate (PFHxS)	ug/kg	0.66 J	0.24 U	0.24 U	1.0	0.24	5709099
Perfluorohexanoic Acid (PFHxA)	ug/kg	0.27 J	0.14 U	0.14 U	1.0	0.14	5709099
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	0.26 J	0.25 U	0.25 U	1.0	0.25	5709099
Perfluorononanoic Acid (PFNA)	ug/kg	0.22 U	0.22 U	0.30 J	1.0	0.22	5709099
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	0.89 J	0.14 U	0.14 U	1.0	0.14	5709099
Perfluorooctane Sulfonate (PFOS)	ug/kg	1.1	0.55 J	0.36 J	1.0	0.26	5709099
Perfluoropentanoic Acid (PFPeA)	ug/kg	0.25 U	0.25 U	0.25 U	1.0	0.25	5709099
Perfluorotetradecanoic Acid	ug/kg	0.31 U	0.31 U	0.31 U	1.0	0.31	5709099
Perfluorotridecanoic Acid	ug/kg	0.33 U	0.33 U	0.33 U	1.0	0.33	5709099
Perfluoroundecanoic Acid (PFUnA)	ug/kg	0.34 U	0.34 U	0.34 U	1.0	0.34	5709099
Surrogate Recovery (%)							
13C2-6:2 Fluorotelomer sulfonate	%	100	109	112	N/A	N/A	5709099
13C2-8:2 Fluorotelomer sulfonate	%	86	109	106	N/A	N/A	5709099
13C2-Perfluorodecanoic acid	%	95	111	104	N/A	N/A	5709099
13C2-Perfluorododecanoic acid	%	94	103	101	N/A	N/A	5709099
13C2-Perfluorohexanoic acid	%	97	112	108	N/A	N/A	5709099
13C2-perfluorotetradecanoic acid	%	83	85	78	N/A	N/A	5709099
13C2-Perfluoroundecanoic acid	%	92	108	100	N/A	N/A	5709099
13C4-Perfluorobutanoic acid	%	98	112	110	N/A	N/A	5709099
13C4-Perfluoroheptanoic acid	%	97	107	108	N/A	N/A	5709099
13C4-Perfluorooctanesulfonate	%	91	113	103	N/A	N/A	5709099
13C4-Perfluorooctanoic acid	%	91	110	98	N/A	N/A	5709099
13C5-Perfluorononanoic acid	%	87	105	103	N/A	N/A	5709099
13C5-Perfluoropentanoic acid	%	98	113	108	N/A	N/A	5709099
13C8-Perfluorooctane Sulfonamide	%	94	101	104	N/A	N/A	5709099

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8L7823
Report Date: 2018/09/06

ESS Laboratory
Client Project #: 1808549
Your P.O. #: B02815

RESULTS OF ANALYSES OF SOIL

Maxxam ID		HOC756	HOC757	HOC758			
Sampling Date		2018/08/14 15:33	2018/08/14 15:38	2018/08/14 15:30			
	UNITS	**1808549-06**	**1808549-07**	**1808549-08**	**RDL**	**MDL**	**QC Batch**
18O2-Perfluorohexanesulfonate	%	92	105	102	N/A	N/A	5709099

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8L7823
Report Date: 2018/09/06

ESS Laboratory
Client Project #: 1808549
Your P.O. #: B02815

TEST SUMMARY

Maxxam ID: HOC751
Sample ID: 1808549-01
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5697821	N/A	2018/08/24	Chun Yan
PFOS and PFOA in soil by SPE/LCMS	LCMS	5709099	2018/08/31	2018/09/05	Marian Godax

Maxxam ID: HOC752
Sample ID: 1808549-02
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5697821	N/A	2018/08/24	Chun Yan
PFOS and PFOA in soil by SPE/LCMS	LCMS	5709099	2018/08/31	2018/09/05	Marian Godax

Maxxam ID: HOC753
Sample ID: 1808549-03
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5697821	N/A	2018/08/24	Chun Yan
PFOS and PFOA in soil by SPE/LCMS	LCMS	5709099	2018/08/31	2018/09/05	Marian Godax

Maxxam ID: HOC754
Sample ID: 1808549-04
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5697821	N/A	2018/08/24	Chun Yan
PFOS and PFOA in soil by SPE/LCMS	LCMS	5709099	2018/08/31	2018/09/05	Marian Godax

Maxxam ID: HOC755
Sample ID: 1808549-05
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5697821	N/A	2018/08/24	Chun Yan
PFOS and PFOA in soil by SPE/LCMS	LCMS	5709099	2018/08/31	2018/09/05	Marian Godax

Maxxam ID: HOC755 Dup
Sample ID: 1808549-05
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in soil by SPE/LCMS	LCMS	5709099	2018/08/31	2018/09/05	Marian Godax

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Maxxam Job #: B8L7823
Report Date: 2018/09/06

ESS Laboratory
Client Project #: 1808549
Your P.O. #: B02815

TEST SUMMARY

Maxxam ID: HOC756
Sample ID: 1808549-06
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5697821	N/A	2018/08/24	Chun Yan
PFOS and PFOA in soil by SPE/LCMS	LCMS	5709099	2018/08/31	2018/09/05	Marian Godax

Maxxam ID: HOC757
Sample ID: 1808549-07
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5697821	N/A	2018/08/24	Chun Yan
PFOS and PFOA in soil by SPE/LCMS	LCMS	5709099	2018/08/31	2018/09/05	Marian Godax

Maxxam ID: HOC758
Sample ID: 1808549-08
Matrix: Soil

Collected: 2018/08/14
Shipped:
Received: 2018/08/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5697821	N/A	2018/08/24	Chun Yan
PFOS and PFOA in soil by SPE/LCMS	LCMS	5709099	2018/08/31	2018/09/05	Marian Godax

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GENERAL COMMENTS

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
5697821	NKG	RPD - Sample/Sample Dup	Moisture	2018/08/24	3.6		%	20
5709099	M_G	Matrix Spike(HOC755)	13C2-6:2 Fluorotelomer sulfonate	2018/09/05		111	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/09/05		111	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/09/05		111	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/09/05		106	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/09/05		113	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/09/05		90	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/09/05		106	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/09/05		114	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/09/05		110	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/09/05		109	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/09/05		106	%	50 - 150
			13C5-Perfluorononanoic acid	2018/09/05		112	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/09/05		110	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/09/05		102	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/09/05		109	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/09/05		87	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/09/05		89	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/09/05		94	%	70 - 130
			Perfluorobutanoic acid	2018/09/05		83	%	70 - 130
			Perfluorodecane Sulfonate	2018/09/05		85	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/09/05		81	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/09/05		83	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/09/05		83	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/09/05		86	%	70 - 130
			Perfluorotetradecanoic Acid	2018/09/05		87	%	70 - 130
			Perfluorotridecanoic Acid	2018/09/05		99	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/09/05		97	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/09/05		86	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/09/05		84	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/09/05		88	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/09/05		90	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/09/05		91	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/09/05		86	%	70 - 130
5709099	M_G	Spiked Blank	13C2-6:2 Fluorotelomer sulfonate	2018/09/05		117	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/09/05		117	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/09/05		117	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/09/05		116	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/09/05		116	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/09/05		109	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/09/05		113	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/09/05		120	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/09/05		118	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/09/05		115	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/09/05		115	%	50 - 150
			13C5-Perfluorononanoic acid	2018/09/05		114	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/09/05		116	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/09/05		109	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/09/05		117	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/09/05		84	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/09/05		85	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/09/05		88	%	70 - 130
			Perfluorobutanoic acid	2018/09/05		80	%	70 - 130
			Perfluorodecane Sulfonate	2018/09/05		81	%	70 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorodecanoic Acid (PFDA)	2018/09/05		78	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/09/05		80	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/09/05		83	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/09/05		84	%	70 - 130
			Perfluorotetradecanoic Acid	2018/09/05		82	%	70 - 130
			Perfluorotridecanoic Acid	2018/09/05		88	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/09/05		92	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/09/05		81	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/09/05		81	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/09/05		86	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/09/05		85	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/09/05		90	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/09/05		83	%	70 - 130
5709099	M_G	Method Blank	13C2-6:2 Fluorotelomer sulfonate	2018/09/05		115	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/09/05		112	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/09/05		106	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/09/05		100	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/09/05		114	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/09/05		95	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/09/05		104	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/09/05		111	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/09/05		110	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/09/05		109	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/09/05		116	%	50 - 150
			13C5-Perfluorononanoic acid	2018/09/05		112	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/09/05		111	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/09/05		94	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/09/05		114	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/09/05	0.26 U, MDL=0.26		ug/kg	
			8:2 Fluorotelomer sulfonate	2018/09/05	0.33 U, MDL=0.33		ug/kg	
			Perfluorobutane Sulfonate (PFBS)	2018/09/05	0.17 U, MDL=0.17		ug/kg	
			Perfluorobutanoic acid	2018/09/05	0.23 U, MDL=0.23		ug/kg	
			Perfluorodecane Sulfonate	2018/09/05	0.39 U, MDL=0.39		ug/kg	
			Perfluorodecanoic Acid (PFDA)	2018/09/05	0.28 U, MDL=0.28		ug/kg	
			Perfluorododecanoic Acid (PFDoA)	2018/09/05	0.28 U, MDL=0.28		ug/kg	
			Perfluorononanoic Acid (PFNA)	2018/09/05	0.22 U, MDL=0.22		ug/kg	
			Perfluorooctane Sulfonamide (PFOSA)	2018/09/05	0.14 U, MDL=0.14		ug/kg	
			Perfluorotetradecanoic Acid	2018/09/05	0.31 U, MDL=0.31		ug/kg	
			Perfluorotridecanoic Acid	2018/09/05	0.33 U, MDL=0.33		ug/kg	
			Perfluoroundecanoic Acid (PFUnA)	2018/09/05	0.34 U, MDL=0.34		ug/kg	
			Perfluoroheptanoic Acid (PFHpA)	2018/09/05	0.19 U, MDL=0.19		ug/kg	

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorohexane Sulfonate (PFHxS)	2018/09/05	0.24 U, MDL=0.24		ug/kg	
			Perfluorohexanoic Acid (PFHxA)	2018/09/05	0.14 U, MDL=0.14		ug/kg	
			Perfluoro-n-Octanoic Acid (PFOA)	2018/09/05	0.25 U, MDL=0.25		ug/kg	
			Perfluorooctane Sulfonate (PFOS)	2018/09/05	0.26 U, MDL=0.26		ug/kg	
			Perfluoropentanoic Acid (PFPeA)	2018/09/05	0.25 U, MDL=0.25		ug/kg	
5709099	M_G	RPD - Sample/Sample Dup	6:2 Fluorotelomer sulfonate	2018/09/05	NC		%	30
			8:2 Fluorotelomer sulfonate	2018/09/05	NC		%	30
			Perfluorobutane Sulfonate (PFBS)	2018/09/05	NC		%	30
			Perfluorobutanoic acid	2018/09/05	NC		%	30
			Perfluorodecane Sulfonate	2018/09/05	NC		%	30
			Perfluorodecanoic Acid (PFDA)	2018/09/05	NC		%	30
			Perfluorododecanoic Acid (PFDoA)	2018/09/05	NC		%	30
			Perfluorononanoic Acid (PFNA)	2018/09/05	NC		%	30
			Perfluorooctane Sulfonamide (PFOSA)	2018/09/05	NC		%	25
			Perfluorotetradecanoic Acid	2018/09/05	NC		%	30
			Perfluorotridecanoic Acid	2018/09/05	NC		%	30
			Perfluoroundecanoic Acid (PFUnA)	2018/09/05	NC		%	30
			Perfluoroheptanoic Acid (PFHpA)	2018/09/05	NC		%	30
			Perfluorohexane Sulfonate (PFHxS)	2018/09/05	NC		%	30
			Perfluorohexanoic Acid (PFHxA)	2018/09/05	NC		%	30
			Perfluoro-n-Octanoic Acid (PFOA)	2018/09/05	NC		%	30
			Perfluorooctane Sulfonate (PFOS)	2018/09/05	NC		%	30
			Perfluoropentanoic Acid (PFPeA)	2018/09/05	NC		%	30

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8L7823
Report Date: 2018/09/06

ESS Laboratory
Client Project #: 1808549
Your P.O. #: B02815

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Adam Robinson, Supervisor, LC/MS/MS

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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*updated sample times per client 8/23/18 LLB

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1808549
Turn Time STANDARD Rush
Reporting Limits S-1/GW-1
Regulatory State MA
Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP
Electonic Deliverables ☑Limit Checker ☐Standard Excel ☑Other (Please Specify →) PDF

Company Name	Project #	Project Name
HORSLEY WITTEN GROUP	17027	BARN. ONCALL #4
Contact Person	**Address**	
JOSEPHINE IBANEZ	90 ROUTE 6A, UNIT 1	
City	**State**	**Zip Code** / **PO #**
SANDWICH	MA	02563
Telephone Number	**FAX Number**	**Email Address**
508-833-6600	508-833-3150	jibanez@horsleywitten.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: PFAS - FULL LIST
1	8/14/18	1425	Grab	Soil	D9	X
2		1402			D10	
3		1410			D11	
4		1403			D12	
5		1533			1991A	
6		~~1530~~	15:33*		1991B	
7		1538			1991C	
8	X	~~1533~~	15:30*		1991D	X

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer G-Glass O-Other (P-Poly) S-Sterile V-Vial
Container Volume: 1-100 mL 2-2.5 gal (3-250 mL) 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*
Preservation Code: (1-Non Preserved) 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Ascorbic Acid 12-Other*
Number of Containers per Sample: 1

Laboratory Use Only
Cooler Present: ✓
Seals Intact: ____
Cooler Temperature: 2.2 °C ICE RC

Sampled by : HW, BM
Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
8/14/18 1715	HW FRIDGE 8/14/18 1715	HW FRIDGE	8/21/18 1215
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
8/21/18 1546	8/21/18 16:00	8/21/18 16:10	

ESS Laboratory
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CHAIN OF CUSTODY

ESS Lab # 1808549
Turn Time STANDARD Rush
Reporting Limits S-1/GW-1
Regulatory State MA
Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP
Electonic Deliverables ☑Limit Checker ☐Standard Excel ☑Other (Please Specify →) PDF

Company Name	Project #	Project Name
HORSLEY WITTEN GROUP	17027	BARN. ONCALL #4
Contact Person	**Address**	
JOSEPHINE IBANEZ	90 ROUTE 6A, UNIT 1	
City	**State**	**Zip Code** / **PO #**
SANDWICH	MA	02563
Telephone Number	**FAX Number**	**Email Address**
508-833-6600	508-833-3150	jibanez@horsleywitten.com

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5		1533			1991A	
6		1530			1991B	
7		1538			1991C	
8		1533			1991D	

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer G - Glass O-Other (P-Poly) S-Sterile V-Vial
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Preservation Code: (1-Non Preserved) 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Ascorbic Acid 12-Other*
Number of Containers per Sample: 1

Laboratory Use Only
Cooler Present: ✓
Seals Intact: ____
Cooler Temperature: 2.2 °C ICE RC

Sampled by : HW, BM
Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
8/14/18 1715	HW FRIDGE 8/14/18 1715	HW FRIDGE	8/21/18 1215
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
8/21/18 1546	8/21/18 16:00	8/21/18 16:10	

CERTIFICATE OF ANALYSIS

Josphine Ibanez
Horsley & Witten
90 Route 6A
Sandwich, MA 02563

RE: Barn. On-Call No. 4 (17027)
ESS Laboratory Work Order Number: 1810330

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 5:24 pm, Nov 09, 2018

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses
Maxxam Analytics - Cheektowaga, NY PFOS

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1810330

SAMPLE RECEIPT

The following samples were received on October 11, 2018 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
1810330-01	DL 11-5ft	Soil	SUB
1810330-02	DL 11-10ft	Soil	SUB
1810330-03	DL 11-15ft	Soil	SUB
1810330-04	HW-F-10ft	Soil	SUB
1810330-05	HW-F-15ft	Soil	SUB
1810330-06	DL 14-5ft	Soil	SUB
1810330-07	DL 14-10ft	Soil	SUB
1810330-08	DL 14-15ft	Soil	SUB
1810330-09	ARFF3-10ft	Soil	SUB
1810330-10	HW-3	Soil	SUB

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4 ESS Laboratory Work Order: 1810330

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1810330

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035 - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1810330

Subcontracted Analysis

Client Sample ID: DL 11-5ft
Date Sampled: 10/04/18 08:22

ESS Laboratory Sample ID: 1810330-01
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: DL 11-10ft
Date Sampled: 10/04/18 08:28

ESS Laboratory Sample ID: 1810330-02
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: DL 11-15ft
Date Sampled: 10/04/18 08:33

ESS Laboratory Sample ID: 1810330-03
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: HW-F-10ft
Date Sampled: 10/04/18 10:19

ESS Laboratory Sample ID: 1810330-04
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: HW-F-15ft
Date Sampled: 10/04/18 10:23

ESS Laboratory Sample ID: 1810330-05
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1810330

Subcontracted Analysis

Client Sample ID: DL 14-5ft
Date Sampled: 10/04/18 11:22

ESS Laboratory Sample ID: 1810330-06
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: DL 14-10ft
Date Sampled: 10/04/18 11:26

ESS Laboratory Sample ID: 1810330-07
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: DL 14-15ft
Date Sampled: 10/04/18 11:30

ESS Laboratory Sample ID: 1810330-08
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: ARFF3-10ft
Date Sampled: 10/09/18 00:00

ESS Laboratory Sample ID: 1810330-09
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: HW-3
Date Sampled: 10/09/18 12:30

ESS Laboratory Sample ID: 1810330-10
Sample Matrix: Soil

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4 ESS Laboratory Work Order: 1810330

Notes and Definitions

Z-08	See Attached
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn. On-Call No. 4

ESS Laboratory Work Order: 1810330

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

Your P.O. #: B02623
Your Project #: 1810330
Your C.O.C. #: n\a

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/11/09
Report #: R5478247
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8R0991
Received: 2018/10/13, 11:57

Sample Matrix: Soil
Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	10	N/A	2018/10/16	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	8	2018/11/07	2018/11/08	CAM SOP-00894	EPA537 m
PFOS and PFOA in soil by SPE/LCMS (1)	2	2018/11/07	2018/11/09	CAM SOP-00894	EPA537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

U = Undetected at the limit of quantitation.
J = Estimated concentration between the EDL & RDL.
B = Blank Contamination.
Q = One or more quality control criteria failed.
E = Analyte concentration exceeds the maximum concentration level.
K = Estimated maximum possible concentration due to ion abundance ratio failure.

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Your P.O. #: B02623
Your Project #: 1810330
Your C.O.C. #: n\a

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/11/09
Report #: R5478247
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8R0991
Received: 2018/10/13, 11:57

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B8R0991
Report Date: 2018/11/09

ESS Laboratory
Client Project #: 1810330
Your P.O. #: B02623

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IAA272	IAA273	IAA273	IAA274	IAA275			
Sampling Date		2018/10/04 08:22	2018/10/04 08:28	2018/10/04 08:28	2018/10/04 08:33	2018/10/04 10:19			
COC Number		n\a	n\a	n\a	n\a	n\a			
	UNITS	1810330-01	1810330-02	1810330-02 Lab-Dup	1810330-03	1810330-04	RDL	MDL	QC Batch
Inorganics									
Moisture	%	2.1	2.2	N/A	3.0	2.2	1.0	0.50	5785837
Miscellaneous Parameters									
6:2 Fluorotelomer sulfonate	ug/kg	4.1	4.4	4.1	6.7	24	1.0	0.26	5824609
8:2 Fluorotelomer sulfonate	ug/kg	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	1.0	0.33	5824609
Perfluorobutane Sulfonate (PFBS)	ug/kg	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	1.0	0.17	5824609
Perfluorobutanoic acid	ug/kg	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	1.0	0.23	5824609
Perfluorodecane Sulfonate	ug/kg	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	1.0	0.39	5824609
Perfluorodecanoic Acid (PFDA)	ug/kg	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	1.0	0.28	5824609
Perfluorododecanoic Acid (PFDoA)	ug/kg	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	1.0	0.28	5824609
Perfluoroheptanoic Acid (PFHpA)	ug/kg	1.3	0.31 J	0.32 J	0.23 J	0.32 J	1.0	0.19	5824609
Perfluorohexane Sulfonate (PFHxS)	ug/kg	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	1.0	0.24	5824609
Perfluorohexanoic Acid (PFHxA)	ug/kg	0.27 J	0.21 J	0.20 J	0.20 J	0.39 J	1.0	0.14	5824609
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	2.9	1.9	1.7	0.50 J	0.25 U	1.0	0.25	5824609
Perfluorononanoic Acid (PFNA)	ug/kg	2.5	0.22 U	0.22 U	0.22 U	0.22 U	1.0	0.22	5824609
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	1.0	0.14	5824609
Perfluorooctane Sulfonate (PFOS)	ug/kg	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	1.0	0.26	5824609
Perfluoropentanoic Acid (PFPeA)	ug/kg	0.25 U	0.25 U	0.25 U	0.25 U	0.56 J	1.0	0.25	5824609
Perfluorotetradecanoic Acid	ug/kg	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	1.0	0.31	5824609
Perfluorotridecanoic Acid	ug/kg	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	1.0	0.33	5824609
Perfluoroundecanoic Acid (PFUnA)	ug/kg	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	1.0	0.34	5824609
Surrogate Recovery (%)									
13C2-6:2 Fluorotelomer sulfonate	%	88	86	90	92	94	N/A	N/A	5824609
13C2-8:2 Fluorotelomer sulfonate	%	82	86	87	86	91	N/A	N/A	5824609
13C2-Perfluorodecanoic acid	%	79	85	86	86	90	N/A	N/A	5824609
13C2-Perfluorododecanoic acid	%	71	82	78	79	88	N/A	N/A	5824609
13C2-Perfluorohexanoic acid	%	88	87	90	88	103	N/A	N/A	5824609
13C2-perfluorotetradecanoic acid	%	61	83	83	86	88	N/A	N/A	5824609
13C2-Perfluoroundecanoic acid	%	76	82	77	80	90	N/A	N/A	5824609
13C4-Perfluorobutanoic acid	%	89	89	88	90	102	N/A	N/A	5824609
13C4-Perfluoroheptanoic acid	%	88	88	91	88	99	N/A	N/A	5824609
13C4-Perfluorooctanesulfonate	%	83	82	93	90	99	N/A	N/A	5824609
13C4-Perfluorooctanoic acid	%	88	86	89	90	102	N/A	N/A	5824609
13C5-Perfluorononanoic acid	%	88	88	86	89	97	N/A	N/A	5824609

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B8R0991
Report Date: 2018/11/09

ESS Laboratory
Client Project #: 1810330
Your P.O. #: B02623

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IAA272	IAA273	IAA273	IAA274	IAA275			
Sampling Date		2018/10/04 08:22	2018/10/04 08:28	2018/10/04 08:28	2018/10/04 08:33	2018/10/04 10:19			
COC Number		n\a	n\a	n\a	n\a	n\a			
	UNITS	**1810330-01**	**1810330-02**	**1810330-02 Lab-Dup**	**1810330-03**	**1810330-04**	**RDL**	**MDL**	**QC Batch**
13C5-Perfluoropentanoic acid	%	89	88	88	92	104	N/A	N/A	5824609
13C8-Perfluorooctane Sulfonamide	%	78	81	80	77	85	N/A	N/A	5824609
18O2-Perfluorohexanesulfonate	%	79	86	86	81	93	N/A	N/A	5824609

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B8R0991
Report Date: 2018/11/09

ESS Laboratory
Client Project #: 1810330
Your P.O. #: B02623

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IAA276			IAA277	IAA278			IAA279			
Sampling Date		2018/10/04 10:23			2018/10/04 11:22	2018/10/04 11:26			2018/10/04 11:30			
COC Number		n\a			n\a	n\a			n\a			
	UNITS	1810330-05	RDL	MDL	1810330-06	1810330-07	RDL	MDL	1810330-08	RDL	MDL	QC Batch
Inorganics												
Moisture	%	2.3	1.0	0.50	2.3	2.1	1.0	0.50	6.7	1.0	0.50	5785837
Miscellaneous Parameters												
6:2 Fluorotelomer sulfonate	ug/kg	140 (1)	10	2.6	0.67 J	0.30 J	1.0	0.26	64 (1)	10	2.6	5824609
8:2 Fluorotelomer sulfonate	ug/kg	0.33 U	1.0	0.33	0.33 U	0.33 U	1.0	0.33	0.33 U	1.0	0.33	5824609
Perfluorobutane Sulfonate (PFBS)	ug/kg	0.17 U	1.0	0.17	0.17 U	0.17 U	1.0	0.17	0.17 U	1.0	0.17	5824609
Perfluorobutanoic acid	ug/kg	0.40 J	1.0	0.23	2.5	1.4	1.0	0.23	3.9	1.0	0.23	5824609
Perfluorodecane Sulfonate	ug/kg	0.39 U	1.0	0.39	0.39 U	0.39 U	1.0	0.39	0.39 U	1.0	0.39	5824609
Perfluorodecanoic Acid (PFDA)	ug/kg	0.28 U	1.0	0.28	0.28 U	0.28 U	1.0	0.28	0.28 U	1.0	0.28	5824609
Perfluorododecanoic Acid (PFDoA)	ug/kg	0.28 U	1.0	0.28	0.28 U	0.28 U	1.0	0.28	0.28 U	1.0	0.28	5824609
Perfluoroheptanoic Acid (PFHpA)	ug/kg	1.3	1.0	0.19	0.36 J	0.19 U	1.0	0.19	1.4	1.0	0.19	5824609
Perfluorohexane Sulfonate (PFHxS)	ug/kg	0.24 U	1.0	0.24	0.24 U	0.24 U	1.0	0.24	0.74 J	1.0	0.24	5824609
Perfluorohexanoic Acid (PFHxA)	ug/kg	1.4	1.0	0.14	24	5.2	1.0	0.14	7.4	1.0	0.14	5824609
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	1.4	1.0	0.25	0.58 J	0.32 J	1.0	0.25	2.9	1.0	0.25	5824609
Perfluorononanoic Acid (PFNA)	ug/kg	0.22 U	1.0	0.22	0.22 U	0.22 U	1.0	0.22	10	1.0	0.22	5824609
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	0.14 U	1.0	0.14	0.14 U	0.14 U	1.0	0.14	0.14 U	1.0	0.14	5824609
Perfluorooctane Sulfonate (PFOS)	ug/kg	0.26 U	1.0	0.26	0.26 U	0.26 U	1.0	0.26	2.3	1.0	0.26	5824609
Perfluoropentanoic Acid (PFPeA)	ug/kg	2.0	1.0	0.25	22	14	1.0	0.25	24	1.0	0.25	5824609
Perfluorotetradecanoic Acid	ug/kg	0.31 U	1.0	0.31	0.31 U	0.31 U	1.0	0.31	0.31 U	1.0	0.31	5824609
Perfluorotridecanoic Acid	ug/kg	0.33 U	1.0	0.33	0.33 U	0.33 U	1.0	0.33	0.33 U	1.0	0.33	5824609
Perfluoroundecanoic Acid (PFUnA)	ug/kg	0.34 U	1.0	0.34	0.34 U	0.34 U	1.0	0.34	0.34 U	1.0	0.34	5824609
Surrogate Recovery (%)												
13C2-6:2 Fluorotelomer sulfonate	%	83	N/A	N/A	88	86	N/A	N/A	84	N/A	N/A	5824609
13C2-8:2 Fluorotelomer sulfonate	%	83	N/A	N/A	85	79	N/A	N/A	75	N/A	N/A	5824609
13C2-Perfluorodecanoic acid	%	82	N/A	N/A	80	79	N/A	N/A	79	N/A	N/A	5824609
13C2-Perfluorododecanoic acid	%	80	N/A	N/A	75	80	N/A	N/A	75	N/A	N/A	5824609
13C2-Perfluorohexanoic acid	%	89	N/A	N/A	86	84	N/A	N/A	82	N/A	N/A	5824609
13C2-perfluorotetradecanoic acid	%	84	N/A	N/A	76	80	N/A	N/A	71	N/A	N/A	5824609
13C2-Perfluoroundecanoic acid	%	82	N/A	N/A	79	79	N/A	N/A	76	N/A	N/A	5824609
13C4-Perfluorobutanoic acid	%	88	N/A	N/A	87	87	N/A	N/A	81	N/A	N/A	5824609
13C4-Perfluoroheptanoic acid	%	89	N/A	N/A	87	86	N/A	N/A	83	N/A	N/A	5824609
13C4-Perfluorooctanesulfonate	%	85	N/A	N/A	88	79	N/A	N/A	79	N/A	N/A	5824609
13C4-Perfluorooctanoic acid	%	88	N/A	N/A	86	83	N/A	N/A	83	N/A	N/A	5824609
13C5-Perfluorononanoic acid	%	85	N/A	N/A	84	86	N/A	N/A	78	N/A	N/A	5824609

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Due to high concentration of the target analyte, sample required dilution. Detection limit was adjusted accordingly (10x).

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8R0991
Report Date: 2018/11/09

ESS Laboratory
Client Project #: 1810330
Your P.O. #: B02623

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IAA276			IAA277	IAA278			IAA279			
Sampling Date		2018/10/04 10:23			2018/10/04 11:22	2018/10/04 11:26			2018/10/04 11:30			
COC Number		n\a			n\a	n\a			n\a			
	UNITS	**1810330-05**	**RDL**	**MDL**	**1810330-06**	**1810330-07**	**RDL**	**MDL**	**1810330-08**	**RDL**	**MDL**	**QC Batch**
13C5-Perfluoropentanoic acid	%	89	N/A	N/A	84	86	N/A	N/A	83	N/A	N/A	5824609
13C8-Perfluorooctane Sulfonamide	%	79	N/A	N/A	76	75	N/A	N/A	74	N/A	N/A	5824609
18O2-Perfluorohexanesulfonate	%	81	N/A	N/A	89	80	N/A	N/A	79	N/A	N/A	5824609

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8R0991
Report Date: 2018/11/09

ESS Laboratory
Client Project #: 1810330
Your P.O. #: B02623

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IAA280	IAA281			
Sampling Date		2018/10/09 10:46	2018/10/09 12:30			
COC Number		n\a	n\a			
	UNITS	1810330-09	1810330-10	RDL	MDL	QC Batch
Inorganics						
Moisture	%	2.5	3.9	1.0	0.50	5785837
Miscellaneous Parameters						
6:2 Fluorotelomer sulfonate	ug/kg	4.2	0.26 U	1.0	0.26	5824609
8:2 Fluorotelomer sulfonate	ug/kg	0.33 U	0.33 U	1.0	0.33	5824609
Perfluorobutane Sulfonate (PFBS)	ug/kg	0.17 U	0.17 U	1.0	0.17	5824609
Perfluorobutanoic acid	ug/kg	0.23 U	0.23 U	1.0	0.23	5824609
Perfluorodecane Sulfonate	ug/kg	0.39 U	0.39 U	1.0	0.39	5824609
Perfluorodecanoic Acid (PFDA)	ug/kg	0.28 U	0.28 U	1.0	0.28	5824609
Perfluorododecanoic Acid (PFDoA)	ug/kg	0.28 U	0.28 U	1.0	0.28	5824609
Perfluoroheptanoic Acid (PFHpA)	ug/kg	0.32 J	0.19 U	1.0	0.19	5824609
Perfluorohexane Sulfonate (PFHxS)	ug/kg	0.24 U	0.24 U	1.0	0.24	5824609
Perfluorohexanoic Acid (PFHxA)	ug/kg	0.14 U	0.14 U	1.0	0.14	5824609
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	1.9	0.25 U	1.0	0.25	5824609
Perfluorononanoic Acid (PFNA)	ug/kg	3.1	0.22 U	1.0	0.22	5824609
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	0.14 U	0.14 U	1.0	0.14	5824609
Perfluorooctane Sulfonate (PFOS)	ug/kg	1.1	0.26 U	1.0	0.26	5824609
Perfluoropentanoic Acid (PFPeA)	ug/kg	0.25 U	0.25 U	1.0	0.25	5824609
Perfluorotetradecanoic Acid	ug/kg	0.31 U	0.31 U	1.0	0.31	5824609
Perfluorotridecanoic Acid	ug/kg	0.33 U	0.33 U	1.0	0.33	5824609
Perfluoroundecanoic Acid (PFUnA)	ug/kg	0.41 J	0.34 U	1.0	0.34	5824609
Surrogate Recovery (%)						
13C2-6:2 Fluorotelomer sulfonate	%	87	83	N/A	N/A	5824609
13C2-8:2 Fluorotelomer sulfonate	%	82	81	N/A	N/A	5824609
13C2-Perfluorodecanoic acid	%	84	82	N/A	N/A	5824609
13C2-Perfluorododecanoic acid	%	79	77	N/A	N/A	5824609
13C2-Perfluorohexanoic acid	%	84	87	N/A	N/A	5824609
13C2-perfluorotetradecanoic acid	%	83	51	N/A	N/A	5824609
13C2-Perfluoroundecanoic acid	%	78	80	N/A	N/A	5824609
13C4-Perfluorobutanoic acid	%	83	88	N/A	N/A	5824609
13C4-Perfluoroheptanoic acid	%	85	86	N/A	N/A	5824609
13C4-Perfluorooctanesulfonate	%	85	83	N/A	N/A	5824609
13C4-Perfluorooctanoic acid	%	78	83	N/A	N/A	5824609
13C5-Perfluorononanoic acid	%	81	83	N/A	N/A	5824609
13C5-Perfluoropentanoic acid	%	83	87	N/A	N/A	5824609

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8R0991
Report Date: 2018/11/09

ESS Laboratory
Client Project #: 1810330
Your P.O. #: B02623

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IAA280	IAA281			
Sampling Date		2018/10/09 10:46	2018/10/09 12:30			
COC Number		n\a	n\a			
	UNITS	**1810330-09**	**1810330-10**	**RDL**	**MDL**	**QC Batch**
13C8-Perfluorooctane Sulfonamide	%	76	77	N/A	N/A	5824609
18O2-Perfluorohexanesulfonate	%	79	84	N/A	N/A	5824609

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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TEST SUMMARY

Maxxam ID: IAA272 **Collected:** 2018/10/04
Sample ID: 1810330-01 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5785837	N/A	2018/10/16	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/08	Anjan Desai

Maxxam ID: IAA273 **Collected:** 2018/10/04
Sample ID: 1810330-02 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5785837	N/A	2018/10/16	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/08	Anjan Desai

Maxxam ID: IAA273 Dup **Collected:** 2018/10/04
Sample ID: 1810330-02 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/08	Anjan Desai

Maxxam ID: IAA274 **Collected:** 2018/10/04
Sample ID: 1810330-03 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5785837	N/A	2018/10/16	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/08	Anjan Desai

Maxxam ID: IAA275 **Collected:** 2018/10/04
Sample ID: 1810330-04 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5785837	N/A	2018/10/16	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/08	Anjan Desai

Maxxam ID: IAA276 **Collected:** 2018/10/04
Sample ID: 1810330-05 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5785837	N/A	2018/10/16	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/08	Anjan Desai

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TEST SUMMARY

Maxxam ID: IAA277 **Collected:** 2018/10/04
Sample ID: 1810330-06 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5785837	N/A	2018/10/16	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/08	Anjan Desai

Maxxam ID: IAA278 **Collected:** 2018/10/04
Sample ID: 1810330-07 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5785837	N/A	2018/10/16	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/08	Anjan Desai

Maxxam ID: IAA279 **Collected:** 2018/10/04
Sample ID: 1810330-08 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5785837	N/A	2018/10/16	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/08	Anjan Desai

Maxxam ID: IAA280 **Collected:** 2018/10/09
Sample ID: 1810330-09 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5785837	N/A	2018/10/16	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/09	Anjan Desai

Maxxam ID: IAA281 **Collected:** 2018/10/09
Sample ID: 1810330-10 **Shipped:**
Matrix: Soil **Received:** 2018/10/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5785837	N/A	2018/10/16	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5824609	2018/11/07	2018/11/09	Anjan Desai

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GENERAL COMMENTS

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
5785837	GYA	RPD - Sample/Sample Dup	Moisture	2018/10/16	0		%	20
5824609	AD9	Matrix Spike(IAA273)	13C2-6:2 Fluorotelomer sulfonate	2018/11/08		83	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/11/08		85	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/11/08		81	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/11/08		81	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/11/08		88	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/11/08		87	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/11/08		79	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/11/08		91	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/11/08		87	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/11/08		87	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/11/08		88	%	50 - 150
			13C5-Perfluorononanoic acid	2018/11/08		88	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/11/08		91	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/11/08		78	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/11/08		89	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/11/08		106	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/11/08		105	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/11/08		107	%	70 - 130
			Perfluorobutanoic acid	2018/11/08		110	%	70 - 130
			Perfluorodecane Sulfonate	2018/11/08		110	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/11/08		116	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/11/08		109	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/11/08		112	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/08		109	%	70 - 130
			Perfluorotetradecanoic Acid	2018/11/08		110	%	70 - 130
			Perfluorotridecanoic Acid	2018/11/08		109	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/11/08		113	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/11/08		112	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/11/08		109	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/11/08		114	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/08		109	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/11/08		105	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/11/08		111	%	70 - 130
5824609	AD9	Spiked Blank	13C2-6:2 Fluorotelomer sulfonate	2018/11/08		92	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/11/08		99	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/11/08		90	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/11/08		83	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/11/08		98	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/11/08		82	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/11/08		87	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/11/08		94	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/11/08		96	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/11/08		95	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/11/08		93	%	50 - 150
			13C5-Perfluorononanoic acid	2018/11/08		97	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/11/08		96	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/11/08		81	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/11/08		94	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/11/08		100	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/11/08		95	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/11/08		104	%	70 - 130
			Perfluorobutanoic acid	2018/11/08		108	%	70 - 130
			Perfluorodecane Sulfonate	2018/11/08		101	%	70 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorodecanoic Acid (PFDA)	2018/11/08		108	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/11/08		110	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/11/08		103	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/08		108	%	70 - 130
			Perfluorotetradecanoic Acid	2018/11/08		105	%	70 - 130
			Perfluorotridecanoic Acid	2018/11/08		110	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/11/08		104	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/11/08		107	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/11/08		110	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/11/08		105	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/08		108	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/11/08		105	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/11/08		106	%	70 - 130
5824609	AD9	Method Blank	13C2-6:2 Fluorotelomer sulfonate	2018/11/08		95	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/11/08		87	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/11/08		85	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/11/08		73	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/11/08		93	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/11/08		75	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/11/08		77	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/11/08		95	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/11/08		93	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/11/08		94	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/11/08		94	%	50 - 150
			13C5-Perfluorononanoic acid	2018/11/08		91	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/11/08		92	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/11/08		80	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/11/08		92	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/11/08	0.26 U, MDL=0.26		ug/kg	
			8:2 Fluorotelomer sulfonate	2018/11/08	0.33 U, MDL=0.33		ug/kg	
			Perfluorobutane Sulfonate (PFBS)	2018/11/08	0.17 U, MDL=0.17		ug/kg	
			Perfluorobutanoic acid	2018/11/08	0.23 U, MDL=0.23		ug/kg	
			Perfluorodecane Sulfonate	2018/11/08	0.39 U, MDL=0.39		ug/kg	
			Perfluorodecanoic Acid (PFDA)	2018/11/08	0.28 U, MDL=0.28		ug/kg	
			Perfluorododecanoic Acid (PFDoA)	2018/11/08	0.28 U, MDL=0.28		ug/kg	
			Perfluorononanoic Acid (PFNA)	2018/11/08	0.22 U, MDL=0.22		ug/kg	
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/08	0.14 U, MDL=0.14		ug/kg	
			Perfluorotetradecanoic Acid	2018/11/08	0.31 U, MDL=0.31		ug/kg	
			Perfluorotridecanoic Acid	2018/11/08	0.33 U, MDL=0.33		ug/kg	
			Perfluoroundecanoic Acid (PFUnA)	2018/11/08	0.34 U, MDL=0.34		ug/kg	
			Perfluoroheptanoic Acid (PFHpA)	2018/11/08	0.19 U, MDL=0.19		ug/kg	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorohexane Sulfonate (PFHxS)	2018/11/08	0.24 U, MDL=0.24		ug/kg	
			Perfluorohexanoic Acid (PFHxA)	2018/11/08	0.14 U, MDL=0.14		ug/kg	
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/08	0.25 U, MDL=0.25		ug/kg	
			Perfluorooctane Sulfonate (PFOS)	2018/11/08	0.26 U, MDL=0.26		ug/kg	
			Perfluoropentanoic Acid (PFPeA)	2018/11/08	0.25 U, MDL=0.25		ug/kg	
5824609	AD9	RPD - Sample/Sample Dup	6:2 Fluorotelomer sulfonate	2018/11/08	8.3		%	30
			8:2 Fluorotelomer sulfonate	2018/11/08	NC		%	30
			Perfluorobutane Sulfonate (PFBS)	2018/11/08	NC		%	30
			Perfluorobutanoic acid	2018/11/08	NC		%	30
			Perfluorodecane Sulfonate	2018/11/08	NC		%	30
			Perfluorodecanoic Acid (PFDA)	2018/11/08	NC		%	30
			Perfluorododecanoic Acid (PFDoA)	2018/11/08	NC		%	30
			Perfluorononanoic Acid (PFNA)	2018/11/08	NC		%	30
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/08	NC		%	25
			Perfluorotetradecanoic Acid	2018/11/08	NC		%	30
			Perfluorotridecanoic Acid	2018/11/08	NC		%	30
			Perfluoroundecanoic Acid (PFUnA)	2018/11/08	NC		%	30
			Perfluoroheptanoic Acid (PFHpA)	2018/11/08	NC		%	30
			Perfluorohexane Sulfonate (PFHxS)	2018/11/08	NC		%	30
			Perfluorohexanoic Acid (PFHxA)	2018/11/08	NC		%	30
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/08	11		%	30
			Perfluorooctane Sulfonate (PFOS)	2018/11/08	NC		%	30
			Perfluoropentanoic Acid (PFPeA)	2018/11/08	NC		%	30

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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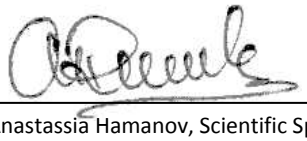
Maxxam Job #: B8R0991
Report Date: 2018/11/09

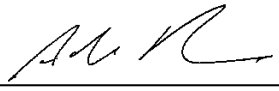
ESS Laboratory
Client Project #: 1810330
Your P.O. #: B02623

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist



Adam Robinson, Supervisor, LC/MS/MS

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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ESS Laboratory — MAXXAM — CHAIN OF CUSTODY

Division of Thielsch Engineering, Inc.

185 Frances Avenue, Cranston RI 02910-2211
Tel. (401)461-7181 Fax (401)461-4486
www.esslaboratory.com

ESS Lab # 1810330

Turn Time __X__Standard Other_____

Regulatory State: **MA** RI CT NH NJ NY ME Other_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Reporting Limits - _____S-1_____

Electonic Deliverables Excel Access PDF

Co. Name: ESS Laboratory	Project #:	Project Name: 1810330	
Contact Person: Shawn Morrell	Proj. Location:		
Address:	City, State:	Zip:	PO #: B02623
Tel.: ext 3083	email: smorrell@thielsch.com		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis	PFAS - full list:
	10/4/18	8:22	G	S	1810330-01	1	1	AG			X
	10/4/18	8:28	G	S	1810330-02	1	1	AG			X
	10/4/18	8:33	G	S	1810330-03	1	1	AG			X
	10/4/18	10:19	G	S	1810330-04	1	1	AG			X
	10/4/18	10:23	G	S	1810330-05	1	1	AG			X
	10/4/18	11:22	G	S	1810330-06	1	1	AG			X
	10/4/18	11:26	G	S	1810330-07	1	1	AG			X
	10/4/18	11:30	G	S	1810330-08	1	1	AG			X
	10/9/18	10:46	G	S	1810330-09	1	1	AG			X
	10/9/18	12:30	G	S	1810330-10	1	1	AG			X

13-Oct-18 11:57
Stephanie Pollen
B8R0991
GUS ENV-623

International Solid Sample
Heat Treat Required
High Risk material
Controlled Storage and Disposal

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present _____Yes ____No

Seals Intact ____ Yes ____No NA:____

Cooler Temperature:

Internal Use Only
[ ] Pickup
[ ] Technician

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_____

Sampled by :

Comments:

Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
10/12/18 8:16	Roger Paseenkrieg 2018/10/13 11:57		
Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)

collected in accordance with MADEP CAM VIIA

Report Method Blank & Laboratory Control Sample Results

32/4.0/2.2

Ship To: 299 Cayuga Rd
Cheektowaga, NY 14225

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1810330
Turn Time STANDARD Rush
Reporting Limits S-1
Regulatory State MA
Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP
Electonic Deliverables ☐Limit Checker ☑Standard Excel ☑Other (Please Specify →) PDF

Company Name: HORSLEY WITTEN GROUP
Project #: 17027
Project Name: BARN ON CALL #4
Contact Person: JOSEPHINE IBANEZ
Address: 90 ROUTE 6A, UNIT 1
City: SANDWICH
State: MA
Zip Code: 02563
PO #:
Telephone Number: 508-833-6600
FAX Number: 508-833-3150
Email Address: jibanez@horsleywitten.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: PFAS-Full List
1	10/4/18	0822	GRAB	SOIL	DL 11-5ft	X
2		0828			DL 11-10ft	
3		0833			DL 11-15ft	
4		1019			HW-F-10ft	
5		1023			HW-F-15ft	
6		1122			DLH-5ft	
7		1120			DL 14-10ft	
8	X	1130			DL 14-15ft	X
9	10/9/18				ARFF 3 - 10ft	
10	10/9/18	1230	↓	↓	HW-3	

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer G-Glass O-Other (P-Poly) S-Sterile V-Vial — P
Container Volume: 1-100 mL 2-2.5 gal (3-250 mL) 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other* — 3
Preservation Code: (1-Non Preserved) 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Ascorbic Acid 12-Other* — 1
Number of Containers per Sample: 1

Laboratory Use Only
Cooler Present: ✓
Seals Intact: ____
Cooler Temperature: 2.5 °C ICE RC

Sampled by: HW
Comments: PFAS Full List
Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
10/9/18 1310	HW FRIDGE 10/9/18 1310	HW FRIDGE	10/11/18 1040
10/11/18 1821	10/11/18 2032		

CERTIFICATE OF ANALYSIS

Josphine Ibanez
Horsley & Witten
90 Route 6A
Sandwich, MA 02563

RE: Barn On-Call No. 4 (17027)
ESS Laboratory Work Order Number: 1811141

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 1:35 pm, Nov 26, 2018

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses
Maxxam Analytics - Cheektowaga, NY PFOS

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1811141

SAMPLE RECEIPT

The following samples were received on November 06, 2018 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
1811141-01	HW-3	Ground Water	SUB
1811141-02	HW-B S	Ground Water	SUB
1811141-03	HW-B D	Ground Water	SUB
1811141-04	HW-23	Ground Water	SUB
1811141-05	HW-5	Ground Water	SUB
1811141-06	HW-1	Ground Water	SUB

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1811141

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1811141

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1811141

Subcontracted Analysis

Client Sample ID: HW-3
Date Sampled: 10/26/18 12:45

ESS Laboratory Sample ID: 1811141-01
Sample Matrix: Ground Water

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: HW-B S
Date Sampled: 10/26/18 14:23

ESS Laboratory Sample ID: 1811141-02
Sample Matrix: Ground Water

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: HW-B D
Date Sampled: 10/26/18 14:49

ESS Laboratory Sample ID: 1811141-03
Sample Matrix: Ground Water

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: HW-23
Date Sampled: 11/01/18 10:33

ESS Laboratory Sample ID: 1811141-04
Sample Matrix: Ground Water

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

Client Sample ID: HW-5
Date Sampled: 11/01/18 11:21

ESS Laboratory Sample ID: 1811141-05
Sample Matrix: Ground Water

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	See Attached								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1811141

Subcontracted Analysis

Client Sample ID: HW-1
Date Sampled: 11/01/18 12:14

ESS Laboratory Sample ID: 1811141-06
Sample Matrix: Ground Water

Analyte	Results	Units	MRL	Method	DF	Analyst	Analyzed	I/V	F/V
PFOS	**See Attached**								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1811141

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1811141

Notes and Definitions

Z-08	See Attached
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1811141

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

Maxxam
A Bureau Veritas Group Company

Your P.O. #: B02815
Your Project #: 1811141
Your C.O.C. #: na

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/11/22
Report #: R5494758
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8T8425
Received: 2018/11/08, 13:35

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	6	2018/11/09	2018/11/12	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

U = Undetected at the limit of quantitation.
J = Estimated concentration between the EDL & RDL.
B = Blank Contamination.
Q = One or more quality control criteria failed.
E = Analyte concentration exceeds the maximum concentration level.
K = Estimated maximum possible concentration due to ion abundance ratio failure.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your P.O. #: B02815
Your Project #: 1811141
Your C.O.C. #: na

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/11/22
Report #: R5494758
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8T8425
Received: 2018/11/08, 13:35

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B8T8425
Report Date: 2018/11/22

ESS Laboratory
Client Project #: 1811141
Your P.O. #: B02815
Sampler Initials: SM

RESULTS OF ANALYSES OF WATER

Maxxam ID		IGA042	IGA043	IGA044	IGA045	IGA046			
Sampling Date		2018/10/26 12:45	2018/10/26 14:23	2018/10/26 14:49	2018/10/26 10:33	2018/10/26 11:21			
COC Number		na	na	na	na	na			
	UNITS	1811141-01	1811141-02	1811141-03	1811141-04	1811141-05	RDL	MDL	QC Batch
Miscellaneous Parameters									
6:2 Fluorotelomer sulfonate	ug/L	0.12	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.020	0.0066	5829083
8:2 Fluorotelomer sulfonate	ug/L	0.017 J	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.020	0.0066	5829083
Perfluorobutanoic acid	ug/L	0.10	0.016 J	0.0058 J	0.0055 U	0.0067 J	0.020	0.0055	5829083
Perfluorobutane Sulfonate (PFBS)	ug/L	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.020	0.0054	5829083
Perfluorodecane Sulfonate	ug/L	0.0060 U	0.0060 U	0.0060 U	0.0060 U	0.0060 U	0.020	0.0060	5829083
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.10	0.012 J	0.0074 U	0.0098 J	0.0074 U	0.020	0.0074	5829083
Perfluorohexanoic Acid (PFHxA)	ug/L	0.15	0.032	0.0077 J	0.010 J	0.0042 J	0.020	0.0035	5829083
Perfluorohexane Sulfonate (PFHxS)	ug/L	0.012 J	0.047	0.0056 U	0.023	0.0056 U	0.020	0.0056	5829083
Perfluorononanoic Acid (PFNA)	ug/L	0.023	0.0087 U	0.0087 U	0.0087 U	0.0088 J	0.020	0.0087	5829083
Perfluorooctane Sulfonamide (PFOSA)	ug/L	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.020	0.0034	5829083
Perfluoropentanoic Acid (PFPeA)	ug/L	0.32	0.040	0.011 J	0.017 J	0.0075 U	0.020	0.0075	5829083
Perfluorotetradecanoic Acid	ug/L	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.020	0.0027	5829083
Perfluorotridecanoic Acid	ug/L	0.0038 U	0.0038 U	0.0038 U	0.0038 U	0.0038 U	0.020	0.0038	5829083
Perfluoroundecanoic Acid (PFUnA)	ug/L	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.020	0.0025	5829083
Perfluorodecanoic Acid (PFDA)	ug/L	0.0061 U	0.0061 U	0.0061 U	0.0061 U	0.0061 U	0.020	0.0061	5829083
Perfluorododecanoic Acid (PFDoA)	ug/L	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.020	0.0050	5829083
Perfluoro-n-Octanoic Acid (PFOA)	ug/L	0.057	0.020 J	0.012 J	0.011 J	0.011 J	0.020	0.0033	5829083
Perfluorooctane Sulfonate (PFOS)	ug/L	0.053	0.019 J	0.010 J	0.015 J	0.12	0.020	0.0060	5829083
Surrogate Recovery (%)									
13C2-6:2 Fluorotelomer sulfonate	%	95	104	91	92	81	N/A	N/A	5829083
13C2-8:2 Fluorotelomer sulfonate	%	91	102	82	87	88	N/A	N/A	5829083
13C2-Perfluorodecanoic acid	%	88	87	87	86	84	N/A	N/A	5829083
13C2-Perfluorododecanoic acid	%	81	81	83	62	72	N/A	N/A	5829083
13C2-Perfluorohexanoic acid	%	93	92	87	92	89	N/A	N/A	5829083
13C2-perfluorotetradecanoic acid	%	66	71	64	42 (1)	61	N/A	N/A	5829083
13C2-Perfluoroundecanoic acid	%	87	86	78	81	81	N/A	N/A	5829083
13C4-Perfluorobutanoic acid	%	91	87	87	90	85	N/A	N/A	5829083
13C4-Perfluoroheptanoic acid	%	93	92	89	92	89	N/A	N/A	5829083

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Extracted internal standard analyte recovery was below the defined lower control limit (LCL). Because quantitation is performed using isotope dilution techniques, any losses of the native compound that may occur during any of the sample preparation, extraction, cleanup or determinative steps will be mirrored by a similar loss of the labeled standard, and as such can be accounted for and corrected. Therefore, the quantification of these target compounds is not affected by the low extracted internal standard analyte recovery.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8T8425
Report Date: 2018/11/22

ESS Laboratory
Client Project #: 1811141
Your P.O. #: B02815
Sampler Initials: SM

RESULTS OF ANALYSES OF WATER

Maxxam ID		IGA042	IGA043	IGA044	IGA045	IGA046			
Sampling Date		2018/10/26 12:45	2018/10/26 14:23	2018/10/26 14:49	2018/10/26 10:33	2018/10/26 11:21			
COC Number		na	na	na	na	na			
	UNITS	1811141-01	1811141-02	1811141-03	1811141-04	1811141-05	RDL	MDL	QC Batch
13C4-Perfluorooctanesulfonate	%	96	99	93	100	92	N/A	N/A	5829083
13C4-Perfluorooctanoic acid	%	92	92	93	92	92	N/A	N/A	5829083
13C5-Perfluorononanoic acid	%	96	93	85	96	86	N/A	N/A	5829083
13C5-Perfluoropentanoic acid	%	91	92	89	95	90	N/A	N/A	5829083
13C8-Perfluorooctane Sulfonamide	%	87	81	83	88	82	N/A	N/A	5829083
18O2-Perfluorohexanesulfonate	%	99	100	90	97	90	N/A	N/A	5829083

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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RESULTS OF ANALYSES OF WATER

Maxxam ID		IGA047			
Sampling Date		2018/10/26 12:14			
COC Number		na			
	UNITS	1811141-06	RDL	MDL	QC Batch
Miscellaneous Parameters					
6:2 Fluorotelomer sulfonate	ug/L	0.0066 U	0.020	0.0066	5829083
8:2 Fluorotelomer sulfonate	ug/L	0.0066 U	0.020	0.0066	5829083
Perfluorobutanoic acid	ug/L	0.010 J	0.020	0.0055	5829083
Perfluorobutane Sulfonate (PFBS)	ug/L	0.0054 U	0.020	0.0054	5829083
Perfluorodecane Sulfonate	ug/L	0.0060 U	0.020	0.0060	5829083
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.013 J	0.020	0.0074	5829083
Perfluorohexanoic Acid (PFHxA)	ug/L	0.025	0.020	0.0035	5829083
Perfluorohexane Sulfonate (PFHxS)	ug/L	0.018 J	0.020	0.0056	5829083
Perfluorononanoic Acid (PFNA)	ug/L	0.0087 U	0.020	0.0087	5829083
Perfluorooctane Sulfonamide (PFOSA)	ug/L	0.0034 U	0.020	0.0034	5829083
Perfluoropentanoic Acid (PFPeA)	ug/L	0.025	0.020	0.0075	5829083
Perfluorotetradecanoic Acid	ug/L	0.0027 U	0.020	0.0027	5829083
Perfluorotridecanoic Acid	ug/L	0.0038 U	0.020	0.0038	5829083
Perfluoroundecanoic Acid (PFUnA)	ug/L	0.0025 U	0.020	0.0025	5829083
Perfluorodecanoic Acid (PFDA)	ug/L	0.0061 U	0.020	0.0061	5829083
Perfluorododecanoic Acid (PFDoA)	ug/L	0.0050 U	0.020	0.0050	5829083
Perfluoro-n-Octanoic Acid (PFOA)	ug/L	0.031	0.020	0.0033	5829083
Perfluorooctane Sulfonate (PFOS)	ug/L	0.028	0.020	0.0060	5829083
Surrogate Recovery (%)					
13C2-6:2 Fluorotelomer sulfonate	%	91	N/A	N/A	5829083
13C2-8:2 Fluorotelomer sulfonate	%	84	N/A	N/A	5829083
13C2-Perfluorodecanoic acid	%	80	N/A	N/A	5829083
13C2-Perfluorododecanoic acid	%	74	N/A	N/A	5829083
13C2-Perfluorohexanoic acid	%	86	N/A	N/A	5829083
13C2-perfluorotetradecanoic acid	%	67	N/A	N/A	5829083
13C2-Perfluoroundecanoic acid	%	85	N/A	N/A	5829083
13C4-Perfluorobutanoic acid	%	86	N/A	N/A	5829083
13C4-Perfluoroheptanoic acid	%	90	N/A	N/A	5829083
13C4-Perfluorooctanesulfonate	%	97	N/A	N/A	5829083
13C4-Perfluorooctanoic acid	%	93	N/A	N/A	5829083
13C5-Perfluorononanoic acid	%	91	N/A	N/A	5829083
13C5-Perfluoropentanoic acid	%	89	N/A	N/A	5829083
13C8-Perfluorooctane Sulfonamide	%	84	N/A	N/A	5829083

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8T8425
Report Date: 2018/11/22

ESS Laboratory
Client Project #: 1811141
Your P.O. #: B02815
Sampler Initials: SM

RESULTS OF ANALYSES OF WATER

Maxxam ID		IGA047			
Sampling Date		2018/10/26 12:14			
COC Number		na			
	UNITS	**1811141-06**	**RDL**	**MDL**	**QC Batch**
18O2-Perfluorohexanesulfonate	%	93	N/A	N/A	5829083

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8T8425
Report Date: 2018/11/22

ESS Laboratory
Client Project #: 1811141
Your P.O. #: B02815
Sampler Initials: SM

TEST SUMMARY

Maxxam ID: IGA042 **Collected:** 2018/10/26
Sample ID: 1811141-01 **Shipped:**
Matrix: Water **Received:** 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5829083	2018/11/09	2018/11/12	Adnan Khan

Maxxam ID: IGA043 **Collected:** 2018/10/26
Sample ID: 1811141-02 **Shipped:**
Matrix: Water **Received:** 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5829083	2018/11/09	2018/11/12	Adnan Khan

Maxxam ID: IGA044 **Collected:** 2018/10/26
Sample ID: 1811141-03 **Shipped:**
Matrix: Water **Received:** 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5829083	2018/11/09	2018/11/12	Adnan Khan

Maxxam ID: IGA045 **Collected:** 2018/10/26
Sample ID: 1811141-04 **Shipped:**
Matrix: Water **Received:** 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5829083	2018/11/09	2018/11/12	Adnan Khan

Maxxam ID: IGA046 **Collected:** 2018/10/26
Sample ID: 1811141-05 **Shipped:**
Matrix: Water **Received:** 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5829083	2018/11/09	2018/11/12	Adnan Khan

Maxxam ID: IGA047 **Collected:** 2018/10/26
Sample ID: 1811141-06 **Shipped:**
Matrix: Water **Received:** 2018/11/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5829083	2018/11/09	2018/11/12	Adnan Khan

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Maxxam Job #: B8T8425
Report Date: 2018/11/22

ESS Laboratory
Client Project #: 1811141
Your P.O. #: B02815
Sampler Initials: SM

GENERAL COMMENTS

Results relate only to the items tested.

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Maxxam Job #: B8T8425
Report Date: 2018/11/22

ESS Laboratory
Client Project #: 1811141
Your P.O. #: B02815
Sampler Initials: SM

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
5829083	AKH	Spiked Blank	13C2-6:2 Fluorotelomer sulfonate	2018/11/12		92	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/11/12		87	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/11/12		92	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/11/12		82	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/11/12		88	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/11/12		75	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/11/12		85	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/11/12		90	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/11/12		90	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/11/12		82	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/11/12		92	%	50 - 150
			13C5-Perfluorononanoic acid	2018/11/12		85	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/11/12		88	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/11/12		83	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/11/12		90	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/11/12		89	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/11/12		84	%	70 - 130
			Perfluorobutanoic acid	2018/11/12		96	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/11/12		95	%	70 - 130
			Perfluorodecane Sulfonate	2018/11/12		90	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/11/12		95	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/11/12		99	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/11/12		96	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/11/12		102	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/12		89	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/11/12		97	%	70 - 130
			Perfluorotetradecanoic Acid	2018/11/12		102	%	70 - 130
			Perfluorotridecanoic Acid	2018/11/12		103	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/11/12		98	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/11/12		93	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/11/12		95	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/12		92	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/11/12		103	%	70 - 130
5829083	AKH	Spiked Blank DUP	13C2-6:2 Fluorotelomer sulfonate	2018/11/12		95	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/11/12		80	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/11/12		82	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/11/12		80	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/11/12		92	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/11/12		77	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/11/12		90	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/11/12		89	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/11/12		87	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/11/12		93	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/11/12		86	%	50 - 150
			13C5-Perfluorononanoic acid	2018/11/12		88	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/11/12		90	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/11/12		77	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/11/12		92	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/11/12		92	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/11/12		101	%	70 - 130
			Perfluorobutanoic acid	2018/11/12		98	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/11/12		94	%	70 - 130
			Perfluorodecane Sulfonate	2018/11/12		95	%	70 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluoroheptanoic Acid (PFHpA)	2018/11/12		101	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/11/12		98	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/11/12		96	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/11/12		99	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/12		99	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/11/12		95	%	70 - 130
			Perfluorotetradecanoic Acid	2018/11/12		100	%	70 - 130
			Perfluorotridecanoic Acid	2018/11/12		97	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/11/12		90	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/11/12		104	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/11/12		96	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/12		101	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/11/12		92	%	70 - 130
5829083	AKH	RPD	6:2 Fluorotelomer sulfonate	2018/11/12	3.7		%	30
			8:2 Fluorotelomer sulfonate	2018/11/12	18		%	30
			Perfluorobutanoic acid	2018/11/12	1.9		%	30
			Perfluorobutane Sulfonate (PFBS)	2018/11/12	0.97		%	30
			Perfluorodecane Sulfonate	2018/11/12	6.1		%	30
			Perfluoroheptanoic Acid (PFHpA)	2018/11/12	6.8		%	30
			Perfluorohexanoic Acid (PFHxA)	2018/11/12	1.8		%	30
			Perfluorohexane Sulfonate (PFHxS)	2018/11/12	0.13		%	30
			Perfluorononanoic Acid (PFNA)	2018/11/12	2.9		%	30
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/12	11		%	30
			Perfluoropentanoic Acid (PFPeA)	2018/11/12	1.7		%	30
			Perfluorotetradecanoic Acid	2018/11/12	2.0		%	30
			Perfluorotridecanoic Acid	2018/11/12	6.5		%	30
			Perfluoroundecanoic Acid (PFUnA)	2018/11/12	8.4		%	30
			Perfluorodecanoic Acid (PFDA)	2018/11/12	10		%	30
			Perfluorododecanoic Acid (PFDoA)	2018/11/12	1.4		%	30
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/12	9.3		%	30
			Perfluorooctane Sulfonate (PFOS)	2018/11/12	10		%	30
5829083	AKH	Method Blank	13C2-6:2 Fluorotelomer sulfonate	2018/11/12		102	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/11/12		85	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/11/12		88	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/11/12		78	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/11/12		92	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/11/12		77	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/11/12		85	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/11/12		92	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/11/12		90	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/11/12		99	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/11/12		95	%	50 - 150
			13C5-Perfluorononanoic acid	2018/11/12		86	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/11/12		91	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/11/12		78	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/11/12		94	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/11/12	0.0066 U, MDL=0.0066		ug/L	
			8:2 Fluorotelomer sulfonate	2018/11/12	0.0066 U, MDL=0.0066		ug/L	
			Perfluorobutanoic acid	2018/11/12	0.0055 U, MDL=0.0055		ug/L	

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Maxxam Job #: B8T8425
Report Date: 2018/11/22

ESS Laboratory
Client Project #: 1811141
Your P.O. #: B02815
Sampler Initials: SM

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorobutane Sulfonate (PFBS)	2018/11/12	0.0054 U, MDL=0.0054		ug/L	
			Perfluorodecane Sulfonate	2018/11/12	0.0060 U, MDL=0.0060		ug/L	
			Perfluoroheptanoic Acid (PFHpA)	2018/11/12	0.0074 U, MDL=0.0074		ug/L	
			Perfluorohexanoic Acid (PFHxA)	2018/11/12	0.0035 U, MDL=0.0035		ug/L	
			Perfluorohexane Sulfonate (PFHxS)	2018/11/12	0.0056 U, MDL=0.0056		ug/L	
			Perfluorononanoic Acid (PFNA)	2018/11/12	0.0087 U, MDL=0.0087		ug/L	
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/12	0.0034 U, MDL=0.0034		ug/L	
			Perfluoropentanoic Acid (PFPeA)	2018/11/12	0.0075 U, MDL=0.0075		ug/L	
			Perfluorotetradecanoic Acid	2018/11/12	0.0027 U, MDL=0.0027		ug/L	
			Perfluorotridecanoic Acid	2018/11/12	0.0038 U, MDL=0.0038		ug/L	
			Perfluoroundecanoic Acid (PFUnA)	2018/11/12	0.0025 U, MDL=0.0025		ug/L	
			Perfluorodecanoic Acid (PFDA)	2018/11/12	0.0061 U, MDL=0.0061		ug/L	
			Perfluorododecanoic Acid (PFDoA)	2018/11/12	0.0050 U, MDL=0.0050		ug/L	
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/12	0.0033 U, MDL=0.0033		ug/L	
			Perfluorooctane Sulfonate (PFOS)	2018/11/12	0.0060 U, MDL=0.0060		ug/L	

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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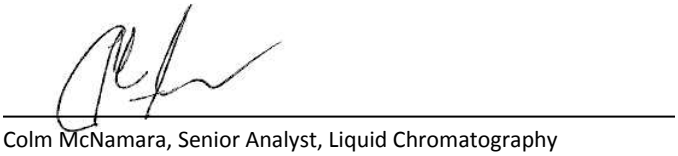
Maxxam Job #: B8T8425
Report Date: 2018/11/22

ESS Laboratory
Client Project #: 1811141
Your P.O. #: B02815
Sampler Initials: SM

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Colm McNamara, Senior Analyst, Liquid Chromatography

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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ESS Laboratory

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CHAIN OF CUSTODY

ESS Lab # ~~181140~~ 181141

Turn Time ✓ Standard Other_____

Regulatory State (MA) RI CT NH NJ NY ME Other_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Reporting Limits - GW-1

Electonic Deliverables (*Excel) Access (PDF)

Co. Name	Project #	Project Name
HORSLEY WITTEN GROUP	17027	Barn. On call #4

Contact Person	Proj. Location
JOSEPHINE IBANEZ	BARNSTABLE AIRPORT

Address	City, State	Zip	PO #
90 ROUTE 6A, UNIT 1	SANDWICH, MA	02563	

Tel. 508-833-6600 email: jibanez@horsleywitten.com

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis: PFAS- Full List
1	10/26/18	1245	G	GW	HW-3	1	1	P	125mL	X
2	10/26/18	1423	G		HW-B(S)					
3	10/26/18	1449	G		HW-B(D)					
4	11/1/18	1033			HW-23					
5	11/1/18	1121			HW-5					
6	11/1/18	1214	X	X	HW-1	X	X	X	X	X

Cooler Present ✓ Yes ____ No

Seals Intact ____ Yes ____ No NA: ____

Cooler Temperature: 3.4 ICE RC

Internal Use Only
[✓] Pickup
[ ] Technician____

Sampled by : HW

Comments:

Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
11/1/18 1340	HW FRIDGE 11/1/18 1340	HW FRIDGE 11/6/18 1205 DM	11/6/18 1205
11/6/18 1525	11/6/18 1741		

* By circling MA-MCP, client acknowledges samples were collected in accordance with MADEP CAM VIIA

Please fax to the laboratory all changes to Chain of Custody

Report Method Blank & Laboratory Control Sample Results

CERTIFICATE OF ANALYSIS

Josphine Ibanez
Horsley & Witten
90 Route 6A
Sandwich, MA 02563

RE: Barn On-Call No. 4 (17027)
ESS Laboratory Work Order Number: 1811299

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 2:45 pm, Jan 28, 2019

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses

Boston University Stable Isotipe Lboratory - Boston, MA	Isotopic - Compound Specific
Maxxam Analytics - Cheektowaga, NY	PFOS

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1811299

SAMPLE RECEIPT

The following samples were received on November 12, 2018 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
1811299-01	HW-H	Ground Water	SUB
1811299-02	HW-I	Ground Water	SUB
1811299-03	HW-J	Ground Water	SUB
1811299-04	HW-E	Ground Water	SUB
1811299-05	HW-F	Ground Water	SUB
1811299-06	HW-19D	Ground Water	SUB
1811299-07	SW-2	Surface Water	SUB

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1811299

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1811299

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-H
Date Sampled: 11/07/18 10:38

ESS Laboratory Work Order: 1811299
ESS Laboratory Sample ID: 1811299-01
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-I
Date Sampled: 11/07/18 11:41

ESS Laboratory Work Order: 1811299
ESS Laboratory Sample ID: 1811299-02
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-J
Date Sampled: 11/07/18 11:47

ESS Laboratory Work Order: 1811299
ESS Laboratory Sample ID: 1811299-03
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-E
Date Sampled: 11/07/18 12:51

ESS Laboratory Work Order: 1811299
ESS Laboratory Sample ID: 1811299-04
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-F
Date Sampled: 11/07/18 12:18

ESS Laboratory Work Order: 1811299
ESS Laboratory Sample ID: 1811299-05
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-19D
Date Sampled: 11/07/18 14:37

ESS Laboratory Work Order: 1811299
ESS Laboratory Sample ID: 1811299-06
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: SW-2
Date Sampled: 11/07/18 15:15

ESS Laboratory Work Order: 1811299
ESS Laboratory Sample ID: 1811299-07
Sample Matrix: Surface Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1811299

Notes and Definitions

Z-08	See Attached
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1811299

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

BOSTON UNIVERSITY STABLE ISOTOPE LABORATORY

Data Sheet ^{18}O Water

Date: 28 January 2019
Client: Kevin Braga
Project: ESS Laboratory
Data emailed: 1/28/19
Samples Returned/Archived:
Data Location: MF 79-79a

Samples arrived: 11/14/18; 12/10/18
Job Number: 18OH 65; 18OH 74
Comments: combined 2 jobs
File name: br18OH65 18OH74.xls

Data normalized to V-SMOW/SLAP scale

Volume Water used: 100 ul per sample

IMPORTANT DISCLAIMER: Due to a quirk in Excel, numbers are shown to 9 decimal places.
Values MUST be rounded to 2 decimal places. The accuracy of the data are reliable to 2 decimal places ONLY.

Sample ID	δ^{18}O (V-SMOW)	Atm %	Comments
IAEA OH-14	-5.64	0.19899	
IAEA OH-15	-9.59	0.19820	
1811299-2	-6.92	0.19874	
1811299-2	-6.77	0.19877	
1811299-4	-6.79	0.19876	
1811299-4	-6.85	0.19875	
1811299-5	-6.90	0.19874	
1811299-5	-6.88	0.19875	
1811299-7	-2.67	0.19959	
1811299-7	-2.61	0.19960	
1812198-1	-6.74	0.19877	
1812198-1	-6.93	0.19874	
1812198-2	-7.53	0.19861	
1812198-2	-7.57	0.19861	
1812198-3	-7.18	0.19868	
1812198-3	-7.45	0.19863	
1812198-4	-7.29	0.19866	
1812198-4	-7.41	0.19864	
1812198-5	-7.76	0.19857	
1812198-5	-7.71	0.19858	
Antarc IC	-29.83	0.19416	
1812198-6	-7.52	0.19862	
1812198-6	-7.57	0.19861	
1812198-7	-7.13	0.19870	
1812198-7	-7.24	0.19867	
1812232-1	-7.58	0.19860	
1812232-1	-7.54	0.19861	
1812232-2	-6.95	0.19873	
1812232-2	-6.89	0.19874	
1812232-3	-7.28	0.19867	
1812232-3	-7.36	0.19865	
IAEA OH-16	-15.72	0.19698	

Expected Values:	
IAEA OH-14	**-5.60**
IAEA OH-15	**-9.41**
IAEA OH-16	**-15.41**
Ant. IC	**-30.00**

BOSTON UNIVERSITY STABLE ISOTOPE LABORATORY

Client Data Sheet ^{2}H Water

Date: 22 January 2019
Client: Kevin Braga
Project: ESS Laboratory
Data emailed: 1/28/19
Samples Returned/Archived:
Data Location: MF 79-79a
Volume Water used: 100 ul per sample

Samples arrived: 11/14/18; 12/10/18
Job Number: 18OH 65; 18OH 74
Comments: combined 2 jobs
File name: br18OH65 18OH74.xls

Data normalized to VSMOW/SLAP scale

IMPORTANT DISCLAIMER: Due to a quirk in Excel, numbers are shown to 9 decimal places.
Values MUST be rounded to 2 decimal places. The accuracy of the data are reliable to 2 decimal places ONLY.

Sample ID	δD (V-SMOW)	Atm %	Comments
IAEA OH-14	-37.45	0.01499	
IAEA OH-15	-77.89	0.01436	
1811299-2	-40.41	0.01494	
1811299-2	-40.17	0.01495	
1811299-4	-38.56	0.01497	
1811299-4	-38.87	0.01497	
1811299-5	-38.28	0.01498	
1811299-5	-38.15	0.01498	
1811299-7	-18.65	0.01528	
1811299-7	-20.42	0.01526	
1811299-7	-23.04	0.01521	
1812198-1	-38.19	0.01498	
1812198-1	-37.87	0.01498	
1812198-2	-44.34	0.01488	
1812198-2	-44.39	0.01488	
1812198-3	-44.15	0.01489	
1812198-3	-44.56	0.01488	
1812198-4	-41.86	0.01492	
1812198-4	-42.94	0.01490	
1812198-5	-47.91	0.01483	
1812198-5	-46.82	0.01484	
1812198-5	-47.20	0.01484	
1812198-6	-45.58	0.01486	
1812198-6	-45.48	0.01487	
1812198-7	-41.44	0.01493	
1812198-7	-43.40	0.01490	
1812232-1	-49.29	0.01481	
1812232-1	-49.66	0.01480	
1812232-2	-42.64	0.01491	
1812232-2	-42.57	0.01491	
1812232-3	-44.76	0.01488	*
1812232-3	-41.61	0.01493	*

Expected Values:	
IAEA OH-1	**-37.70**
IAEA OH-1	**-78.00**
IAEA OH-1	**-113.80**
Ant. IC	**-239.69**

ESS Laboratory **BU**

Division of Thielsch Engineering, Inc.

185 Frances Avenue,Cranston RI 02910-2211
Tel. (401)461-7181 Fax (401)461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1811299

Turn Time ___X__Standard Other_____

Regulatory State: **MA** RI CT NH NJ NY ME Other_____

Reporting Limits - ___**GW-1**_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Electonic Deliverables Excel Access PDF

Co. Name: **ESS Laboratory**	Project #:	Project Name: **1811299**	
Contact Person: **Shawn Morrell**	Proj. Location:		
Address:	City , State:	Zip:	PO #:
Tel. ext 3083	email: smorrell@thielsch.com		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis		Stable Isotope for	Hydrogen and Oxygen							
	11/7/18	**1141**	**G**	**GW**	**1811299-02**	**1**	**1**	**P**				**X**								
	11/7/18	**1251**	**G**	**GW**	**1811299-04**	**1**	**1**	**P**				**X**								
	11/7/18	**1218**	**G**	**GW**	**1811299-05**	**1**	**1**	**P**				**X**								
	11/7/18	**1515**	**G**	**GW**	**1811299-07**	**1**	**1**	**P**				**X**								

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present _____Yes _____No

Seals Intact ____ Yes _____No NA:____

Cooler Temperature:

Internal Use Only
[ ] Pickup
[ ] Technician

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_____

Sampled by :

Comments:

Relinquished by: (Signature, Date & Time) 11/14/18 11:12	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
Relinquished by: (Signature, Date & Time) 11/14/18 11:12	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)

collected in accordance with MADEP CAM VIIA

Report Method Blank & Laboratory Control Sample Results

5 Cummington Mall
Boston MA 02215

Maxxam
A Bureau Veritas Group Company

Your P.O. #: B02815
Your Project #: 1811299
Your C.O.C. #: na

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/11/28
Report #: R5502487
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8U4293
Received: 2018/11/14, 13:51

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	6	2018/11/20	2018/11/23	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

U = Undetected at the limit of quantitation.
J = Estimated concentration between the EDL & RDL.
B = Blank Contamination.
Q = One or more quality control criteria failed.
E = Analyte concentration exceeds the maximum concentration level.
K = Estimated maximum possible concentration due to ion abundance ratio failure.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your P.O. #: B02815
Your Project #: 1811299
Your C.O.C. #: na

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/11/28
Report #: R5502487
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8U4293
Received: 2018/11/14, 13:51

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B8U4293
Report Date: 2018/11/28

ESS Laboratory
Client Project #: 1811299
Your P.O. #: B02815

RESULTS OF ANALYSES OF WATER

Maxxam ID		IHI501			IHI502			IHI503			
Sampling Date		2018/11/07 10:38			2018/11/07 11:41			2018/11/07 11:17			
COC Number		na			na			na			
	UNITS	1811299-01	RDL	MDL	1811299-02	RDL	MDL	1811299-03	RDL	MDL	QC Batch
Miscellaneous Parameters											
6:2 Fluorotelomer sulfonate	ug/L	1.5	0.20	0.066	11	0.40	0.13	0.68	0.020	0.0066	5846951
8:2 Fluorotelomer sulfonate	ug/L	0.0066 U	0.020	0.0066	0.013 U	0.040	0.013	0.024	0.020	0.0066	5846951
Perfluorobutanoic acid	ug/L	0.35	0.020	0.0055	0.18	0.040	0.011	0.023	0.020	0.0055	5846951
Perfluorobutane Sulfonate (PFBS)	ug/L	0.0054 U	0.020	0.0054	0.011 U	0.040	0.011	0.0054 U	0.020	0.0054	5846951
Perfluorodecane Sulfonate	ug/L	0.0060 U	0.020	0.0060	0.012 U	0.040	0.012	0.0060 U	0.020	0.0060	5846951
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.077	0.020	0.0074	0.20	0.040	0.015	0.025	0.020	0.0074	5846951
Perfluorohexanoic Acid (PFHxA)	ug/L	0.92	0.020	0.0035	0.49	0.040	0.0070	0.046	0.020	0.0035	5846951
Perfluorohexane Sulfonate (PFHxS)	ug/L	0.0056 U	0.020	0.0056	0.18	0.040	0.011	0.0056 U	0.020	0.0056	5846951
Perfluorononanoic Acid (PFNA)	ug/L	0.0087 U	0.020	0.0087	0.16	0.040	0.017	0.028	0.020	0.0087	5846951
Perfluorooctane Sulfonamide (PFOSA)	ug/L	0.0034 U	0.020	0.0034	0.0068 U	0.040	0.0068	0.0034 U	0.020	0.0034	5846951
Perfluoropentanoic Acid (PFPeA)	ug/L	1.6	0.20	0.075	0.81	0.040	0.015	0.092	0.020	0.0075	5846951
Perfluorotetradecanoic Acid	ug/L	0.0027 U	0.020	0.0027	0.0054 U	0.040	0.0054	0.0027 U	0.020	0.0027	5846951
Perfluorotridecanoic Acid	ug/L	0.0038 U	0.020	0.0038	0.0076 U	0.040	0.0076	0.0038 U	0.020	0.0038	5846951
Perfluoroundecanoic Acid (PFUnA)	ug/L	0.0025 U	0.020	0.0025	0.0050 U	0.040	0.0050	0.0025 U	0.020	0.0025	5846951
Perfluorodecanoic Acid (PFDA)	ug/L	0.0061 U	0.020	0.0061	0.012 U	0.040	0.012	0.0061 U	0.020	0.0061	5846951
Perfluorododecanoic Acid (PFDoA)	ug/L	0.0050 U	0.020	0.0050	0.010 U	0.040	0.010	0.0050 U	0.020	0.0050	5846951
Perfluoro-n-Octanoic Acid (PFOA)	ug/L	0.0050 J	0.020	0.0033	0.26	0.040	0.0066	0.026	0.020	0.0033	5846951
Perfluorooctane Sulfonate (PFOS)	ug/L	0.0060 U	0.020	0.0060	0.066	0.040	0.012	0.13	0.020	0.0060	5846951
Surrogate Recovery (%)											
13C2-6:2 Fluorotelomer sulfonate	%	87	N/A	N/A	92	N/A	N/A	88	N/A	N/A	5846951
13C2-8:2 Fluorotelomer sulfonate	%	93	N/A	N/A	87	N/A	N/A	87	N/A	N/A	5846951
13C2-Perfluorodecanoic acid	%	83	N/A	N/A	80	N/A	N/A	80	N/A	N/A	5846951
13C2-Perfluorododecanoic acid	%	78	N/A	N/A	73	N/A	N/A	81	N/A	N/A	5846951
13C2-Perfluorohexanoic acid	%	91	N/A	N/A	85	N/A	N/A	88	N/A	N/A	5846951
13C2-perfluorotetradecanoic acid	%	59	N/A	N/A	40 (1)	N/A	N/A	68	N/A	N/A	5846951
13C2-Perfluoroundecanoic acid	%	83	N/A	N/A	78	N/A	N/A	76	N/A	N/A	5846951
13C4-Perfluorobutanoic acid	%	88	N/A	N/A	87	N/A	N/A	88	N/A	N/A	5846951
13C4-Perfluoroheptanoic acid	%	95	N/A	N/A	88	N/A	N/A	89	N/A	N/A	5846951
13C4-Perfluorooctanesulfonate	%	90	N/A	N/A	77	N/A	N/A	88	N/A	N/A	5846951

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

N/A = Not Applicable

(1) Extracted internal standard analyte recovery was below the defined lower control limit (LCL). Because quantitation is performed using isotope dilution techniques, any losses of the native compound that may occur during any of the sample preparation, extraction, cleanup or determinative steps will be mirrored by a similar loss of the labeled standard, and as such can be accounted for and corrected. Therefore, the quantification of these target compounds is not affected by the low extracted internal standard analyte recovery.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8U4293
Report Date: 2018/11/28

ESS Laboratory
Client Project #: 1811299
Your P.O. #: B02815

RESULTS OF ANALYSES OF WATER

Maxxam ID		IHI501			IHI502			IHI503			
Sampling Date		2018/11/07 10:38			2018/11/07 11:41			2018/11/07 11:17			
COC Number		na			na			na			
	UNITS	**1811299-01**	**RDL**	**MDL**	**1811299-02**	**RDL**	**MDL**	**1811299-03**	**RDL**	**MDL**	**QC Batch**
13C4-Perfluorooctanoic acid	%	90	N/A	N/A	88	N/A	N/A	87	N/A	N/A	5846951
13C5-Perfluorononanoic acid	%	91	N/A	N/A	86	N/A	N/A	85	N/A	N/A	5846951
13C5-Perfluoropentanoic acid	%	87	N/A	N/A	86	N/A	N/A	90	N/A	N/A	5846951
13C8-Perfluorooctane Sulfonamide	%	87	N/A	N/A	80	N/A	N/A	82	N/A	N/A	5846951
18O2-Perfluorohexanesulfonate	%	92	N/A	N/A	84	N/A	N/A	86	N/A	N/A	5846951

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8U4293
Report Date: 2018/11/28

ESS Laboratory
Client Project #: 1811299
Your P.O. #: B02815

RESULTS OF ANALYSES OF WATER

Maxxam ID		IHI504	IHI505	IHI506			
Sampling Date		2018/11/07 12:51	2018/11/07 12:18	2018/11/07 14:37			
COC Number		na	na	na			
	UNITS	1811299-04	1811299-05	1811299-06	RDL	MDL	QC Batch
Miscellaneous Parameters							
6:2 Fluorotelomer sulfonate	ug/L	0.0066 U	0.0066 U	0.0066 U	0.020	0.0066	5846951
8:2 Fluorotelomer sulfonate	ug/L	0.0066 U	0.0066 U	0.0066 U	0.020	0.0066	5846951
Perfluorobutanoic acid	ug/L	0.0055 U	0.015 J	0.0055 U	0.020	0.0055	5846951
Perfluorobutane Sulfonate (PFBS)	ug/L	0.0054 U	0.0054 U	0.0054 U	0.020	0.0054	5846951
Perfluorodecane Sulfonate	ug/L	0.0060 U	0.0060 U	0.0060 U	0.020	0.0060	5846951
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.0074 U	0.0074 U	0.0080 J	0.020	0.0074	5846951
Perfluorohexanoic Acid (PFHxA)	ug/L	0.0035 U	0.017 J	0.012 J	0.020	0.0035	5846951
Perfluorohexane Sulfonate (PFHxS)	ug/L	0.0056 U	0.0056 U	0.045	0.020	0.0056	5846951
Perfluorononanoic Acid (PFNA)	ug/L	0.0087 U	0.0087 U	0.0087 U	0.020	0.0087	5846951
Perfluorooctane Sulfonamide (PFOSA)	ug/L	0.0034 U	0.0034 U	0.0034 U	0.020	0.0034	5846951
Perfluoropentanoic Acid (PFPeA)	ug/L	0.0075 U	0.052	0.012 J	0.020	0.0075	5846951
Perfluorotetradecanoic Acid	ug/L	0.0027 U	0.0027 U	0.0027 U	0.020	0.0027	5846951
Perfluorotridecanoic Acid	ug/L	0.0038 U	0.0038 U	0.0038 U	0.020	0.0038	5846951
Perfluoroundecanoic Acid (PFUnA)	ug/L	0.0025 U	0.0025 U	0.0025 U	0.020	0.0025	5846951
Perfluorodecanoic Acid (PFDA)	ug/L	0.0061 U	0.0061 U	0.0061 U	0.020	0.0061	5846951
Perfluorododecanoic Acid (PFDoA)	ug/L	0.0050 U	0.0050 U	0.0050 U	0.020	0.0050	5846951
Perfluoro-n-Octanoic Acid (PFOA)	ug/L	0.0033 U	0.0033 U	0.014 J	0.020	0.0033	5846951
Perfluorooctane Sulfonate (PFOS)	ug/L	0.0060 U	0.0060 U	0.069	0.020	0.0060	5846951
Surrogate Recovery (%)							
13C2-6:2 Fluorotelomer sulfonate	%	89	99	91	N/A	N/A	5846951
13C2-8:2 Fluorotelomer sulfonate	%	90	95	87	N/A	N/A	5846951
13C2-Perfluorodecanoic acid	%	85	87	86	N/A	N/A	5846951
13C2-Perfluorododecanoic acid	%	79	81	84	N/A	N/A	5846951
13C2-Perfluorohexanoic acid	%	89	91	89	N/A	N/A	5846951
13C2-perfluorotetradecanoic acid	%	61	69	70	N/A	N/A	5846951
13C2-Perfluoroundecanoic acid	%	78	85	88	N/A	N/A	5846951
13C4-Perfluorobutanoic acid	%	85	88	86	N/A	N/A	5846951
13C4-Perfluoroheptanoic acid	%	89	89	91	N/A	N/A	5846951
13C4-Perfluorooctanesulfonate	%	81	93	93	N/A	N/A	5846951
13C4-Perfluorooctanoic acid	%	85	88	91	N/A	N/A	5846951
13C5-Perfluorononanoic acid	%	90	95	91	N/A	N/A	5846951
13C5-Perfluoropentanoic acid	%	86	90	88	N/A	N/A	5846951
13C8-Perfluorooctane Sulfonamide	%	83	87	85	N/A	N/A	5846951
18O2-Perfluorohexanesulfonate	%	86	91	92	N/A	N/A	5846951

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8U4293
Report Date: 2018/11/28

ESS Laboratory
Client Project #: 1811299
Your P.O. #: B02815

TEST SUMMARY

Maxxam ID: IHI501 **Collected:** 2018/11/07
Sample ID: 1811299-01 **Shipped:**
Matrix: Water **Received:** 2018/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5846951	2018/11/20	2018/11/23	Adnan Khan

Maxxam ID: IHI502 **Collected:** 2018/11/07
Sample ID: 1811299-02 **Shipped:**
Matrix: Water **Received:** 2018/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5846951	2018/11/20	2018/11/23	Adnan Khan

Maxxam ID: IHI503 **Collected:** 2018/11/07
Sample ID: 1811299-03 **Shipped:**
Matrix: Water **Received:** 2018/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5846951	2018/11/20	2018/11/23	Adnan Khan

Maxxam ID: IHI504 **Collected:** 2018/11/07
Sample ID: 1811299-04 **Shipped:**
Matrix: Water **Received:** 2018/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5846951	2018/11/20	2018/11/23	Adnan Khan

Maxxam ID: IHI505 **Collected:** 2018/11/07
Sample ID: 1811299-05 **Shipped:**
Matrix: Water **Received:** 2018/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5846951	2018/11/20	2018/11/23	Adnan Khan

Maxxam ID: IHI506 **Collected:** 2018/11/07
Sample ID: 1811299-06 **Shipped:**
Matrix: Water **Received:** 2018/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5846951	2018/11/20	2018/11/23	Adnan Khan

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GENERAL COMMENTS

Sample IHI501 [1811299-01] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample IHI502 [1811299-02] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
5846951	AKH	Spiked Blank	13C2-6:2 Fluorotelomer sulfonate	2018/11/23		90	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/11/23		89	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/11/23		85	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/11/23		83	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/11/23		91	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/11/23		82	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/11/23		83	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/11/23		91	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/11/23		90	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/11/23		89	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/11/23		85	%	50 - 150
			13C5-Perfluorononanoic acid	2018/11/23		91	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/11/23		91	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/11/23		82	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/11/23		88	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/11/23		105	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/11/23		105	%	70 - 130
			Perfluorobutanoic acid	2018/11/23		105	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/11/23		107	%	70 - 130
			Perfluorodecane Sulfonate	2018/11/23		102	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/11/23		107	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/11/23		110	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/11/23		113	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/11/23		101	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/23		107	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/11/23		108	%	70 - 130
			Perfluorotetradecanoic Acid	2018/11/23		109	%	70 - 130
			Perfluorotridecanoic Acid	2018/11/23		108	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/11/23		110	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/11/23		109	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/11/23		107	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/23		112	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/11/23		106	%	70 - 130
5846951	AKH	Spiked Blank DUP	13C2-6:2 Fluorotelomer sulfonate	2018/11/23		88	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/11/23		86	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/11/23		91	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/11/23		86	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/11/23		93	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/11/23		85	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/11/23		88	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/11/23		91	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/11/23		90	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/11/23		86	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/11/23		90	%	50 - 150
			13C5-Perfluorononanoic acid	2018/11/23		88	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/11/23		91	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/11/23		86	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/11/23		85	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/11/23		107	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/11/23		108	%	70 - 130
			Perfluorobutanoic acid	2018/11/23		104	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/11/23		107	%	70 - 130
			Perfluorodecane Sulfonate	2018/11/23		99	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/11/23		101	%	70 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorohexanoic Acid (PFHxA)	2018/11/23		103	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/11/23		114	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/11/23		105	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/23		104	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/11/23		102	%	70 - 130
			Perfluorotetradecanoic Acid	2018/11/23		106	%	70 - 130
			Perfluorotridecanoic Acid	2018/11/23		109	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/11/23		105	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/11/23		105	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/11/23		105	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/23		102	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/11/23		110	%	70 - 130
5846951	AKH	RPD	6:2 Fluorotelomer sulfonate	2018/11/23	2.1		%	30
			8:2 Fluorotelomer sulfonate	2018/11/23	2.7		%	30
			Perfluorobutanoic acid	2018/11/23	1.6		%	30
			Perfluorobutane Sulfonate (PFBS)	2018/11/23	0.35		%	30
			Perfluorodecane Sulfonate	2018/11/23	3.1		%	30
			Perfluoroheptanoic Acid (PFHpA)	2018/11/23	5.4		%	30
			Perfluorohexanoic Acid (PFHxA)	2018/11/23	6.3		%	30
			Perfluorohexane Sulfonate (PFHxS)	2018/11/23	0.58		%	30
			Perfluorononanoic Acid (PFNA)	2018/11/23	3.5		%	30
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/23	2.8		%	30
			Perfluoropentanoic Acid (PFPeA)	2018/11/23	5.3		%	30
			Perfluorotetradecanoic Acid	2018/11/23	2.5		%	30
			Perfluorotridecanoic Acid	2018/11/23	0.086		%	30
			Perfluoroundecanoic Acid (PFUnA)	2018/11/23	4.9		%	30
			Perfluorodecanoic Acid (PFDA)	2018/11/23	4.5		%	30
			Perfluorododecanoic Acid (PFDoA)	2018/11/23	2.1		%	30
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/23	9.2		%	30
			Perfluorooctane Sulfonate (PFOS)	2018/11/23	3.7		%	30
5846951	AKH	Method Blank	13C2-6:2 Fluorotelomer sulfonate	2018/11/23		101	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/11/23		92	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/11/23		93	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/11/23		88	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/11/23		100	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/11/23		86	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/11/23		89	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/11/23		96	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/11/23		98	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/11/23		92	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/11/23		93	%	50 - 150
			13C5-Perfluorononanoic acid	2018/11/23		92	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/11/23		96	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/11/23		93	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/11/23		91	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/11/23	0.0066 U, MDL=0.0066		ug/L	
			8:2 Fluorotelomer sulfonate	2018/11/23	0.0066 U, MDL=0.0066		ug/L	
			Perfluorobutanoic acid	2018/11/23	0.0055 U, MDL=0.0055		ug/L	
			Perfluorobutane Sulfonate (PFBS)	2018/11/23	0.0054 U, MDL=0.0054		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorodecane Sulfonate	2018/11/23	0.0060 U, MDL=0.0060		ug/L	
			Perfluoroheptanoic Acid (PFHpA)	2018/11/23	0.0074 U, MDL=0.0074		ug/L	
			Perfluorohexanoic Acid (PFHxA)	2018/11/23	0.0035 U, MDL=0.0035		ug/L	
			Perfluorohexane Sulfonate (PFHxS)	2018/11/23	0.0056 U, MDL=0.0056		ug/L	
			Perfluorononanoic Acid (PFNA)	2018/11/23	0.0087 U, MDL=0.0087		ug/L	
			Perfluorooctane Sulfonamide (PFOSA)	2018/11/23	0.0034 U, MDL=0.0034		ug/L	
			Perfluoropentanoic Acid (PFPeA)	2018/11/23	0.0075 U, MDL=0.0075		ug/L	
			Perfluorotetradecanoic Acid	2018/11/23	0.0027 U, MDL=0.0027		ug/L	
			Perfluorotridecanoic Acid	2018/11/23	0.0038 U, MDL=0.0038		ug/L	
			Perfluoroundecanoic Acid (PFUnA)	2018/11/23	0.0025 U, MDL=0.0025		ug/L	
			Perfluorodecanoic Acid (PFDA)	2018/11/23	0.0061 U, MDL=0.0061		ug/L	
			Perfluorododecanoic Acid (PFDoA)	2018/11/23	0.0050 U, MDL=0.0050		ug/L	
			Perfluoro-n-Octanoic Acid (PFOA)	2018/11/23	0.0033 U, MDL=0.0033		ug/L	
			Perfluorooctane Sulfonate (PFOS)	2018/11/23	0.0060 U, MDL=0.0060		ug/L	

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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Maxxam Job #: B8U4293
Report Date: 2018/11/28

ESS Laboratory
Client Project #: 1811299
Your P.O. #: B02815

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Colm McNamara, Senior Analyst, Liquid Chromatography

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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ESS Laboratory Sample and Cooler Receipt Checklist

Client: Horsley Witten Group - KPB/HDM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1811299
Date Received: 11/12/2018
Project Due Date: 11/19/2018
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 1.8 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / (NA)
10. Were any analyses received outside of hold time? Yes / (No)

11. Any Subcontracting needed? (Yes) / No
    ESS Sample IDs: 1-7
    Analysis: PFAS PFAS
    TAT: 9to
12. Were VOAs received? Yes / (No)
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / NA
13. Are the samples properly preserved? (Yes) / No
    a. If metals preserved upon receipt: Date: ____ Time: ____ By: ____
    b. Low Level VOA vials frozen: Date: ____ Time: ____ By: ____

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / (No)
    a. Was there a need to contact the client? Yes / (No)
    Who was contacted? ____ Date: ____ Time: ____ By: ____

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
01	288748	Yes	NA	Yes	Other Poly - Unpres	NP	
02	288742	Yes	NA	Yes	250 mL Poly - Unpres	NP	
02	288747	Yes	NA	Yes	Other Poly - Unpres	NP	
03	288746	Yes	NA	Yes	Other Poly - Unpres	NP	
04	288741	Yes	NA	Yes	250 mL Poly - Unpres	NP	
04	288745	Yes	NA	Yes	Other Poly - Unpres	NP	
05	288740	Yes	NA	Yes	250 mL Poly - Unpres	NP	
05	288744	Yes	NA	Yes	Other Poly - Unpres	NP	
06	288743	Yes	NA	Yes	Other Poly - Unpres	NP	
07	288739	Yes	NA	Yes	250 mL Poly - Unpres	NP	

2nd Review
Are barcode labels on correct containers? (Yes) / No
Are all necessary stickers attached? (Yes) / No

Completed By: ____ Date & Time: 11·12·18 16:45
Reviewed By: ____ Date & Time: 11/12/18 1647
Delivered By: ____ 11/12/18 1647

ESS Laboratory

Division of Thielsch Engineering, Inc.
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CHAIN OF CUSTODY

ESS Lab # 1811299

Turn Time STANDARD Rush

Reporting Limits GW-1

Regulatory State MA

Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP

Electonic Deliverables ☐Limit Checker ☐Standard Excel ☑Other (Please Specify →) PDF

Company Name	Project #	Project Name
HORSLEY WITTEN GROUP	17027	BARN ON CAPE #4

Contact Person	Address
JOSEPHINE IBANEZ	90 ROUTE 6A

City	State	Zip Code	PO #
SANDWICH	MA	02563	

Telephone Number	FAX Number	Email Address
508-833-6600		jibanez@horsleywitten.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: PFAS-FullList	Analysis: PFAS-isotopic *
1	11/7/18	1038	GRAB	GW	HW-H	X	
2		1141			HW-I	X	X
3		1117			HW-J	X	
4		1251			HW-E	X	X
5		1218			HW-F	X	X
6		1437			HW-19D	X	
7	↓	1515	↓	SW	SW-2		X

Container Type:	AC-Air Cassette	AG-Amber Glass	B-BOD Bottle	C-Cubitainer	G - Glass	O-Other	(P-Poly)	S-Sterile	V-Vial		1	1
Container Volume:	(1-100 mL)	2-2.5 gal	(3-250 mL)	4-300 mL	5-500 mL	6-1L	7-VOA	8-2 oz	9-4 oz	10-8 oz	11-Other*	1	3
Preservation Code:	(1-Non Preserved)	2-HCl	3-H2SO4	4-HNO3	5-NaOH	6-Methanol	7-Na2S2O3	8-ZnAce, NaOH	9-NH4Cl	10-DI H2O	11-Ascorbic Acid	12-Other*	1	1
											Number of Containers per Sample:		1	1

Laboratory Use Only

Cooler Present: ✓

Seals Intact: ____

Cooler Temperature: 1.8 °C ICE RC

Sampled by : HW

Comments: Please specify "Other" preservative and containers types in this space

* ~~PFAS~~ isotopic = compound specific isotopic analysis (oxygen-hydrogen)

PFAS-FullList - Maxxam ; Isotopic - BH

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
[signature] 11/7/18 1615	HW FRIDGE 11/7/18 1615	HW FRIDGE 11/12/18 1300	[signature] 11/12/18 1300
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
[signature] 11/12/18 1543	[signature] 11.12.18 16:36		

CERTIFICATE OF ANALYSIS

Josphine Ibanez
Horsley & Witten
90 Route 6A
Sandwich, MA 02563

RE: Barn On-Call No. 4 (17027)
ESS Laboratory Work Order Number: 1812164

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 12:38 pm, Dec 20, 2018

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses
Maxxam Analytics - Cheektowaga, NY PFOS

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812164

SAMPLE RECEIPT

The following samples were received on December 06, 2018 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
1812164-01	HW-G S	Ground Water	SUB
1812164-02	HW-G M	Ground Water	SUB
1812164-03	HW-G D	Ground Water	SUB
1812164-04	HW-302	Ground Water	SUB
1812164-05	OW-9S	Ground Water	SUB
1812164-06	OW-9D	Ground Water	8270D SIM, SUB
1812164-07	OW-9DD	Ground Water	8270D SIM, SUB
1812164-08	OW-9M	Ground Water	SUB

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1812164

PROJECT NARRATIVE

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

C8L0209-TUN1 **Benzidine tailing factor >2.**

C8L0209-TUN1 **Pentachlorophenol tailing factor > 2.**

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812164

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-G S
Date Sampled: 12/03/18 11:05

ESS Laboratory Work Order: 1812164
ESS Laboratory Sample ID: 1812164-01
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-G M
Date Sampled: 12/03/18 11:54

ESS Laboratory Work Order: 1812164
ESS Laboratory Sample ID: 1812164-02
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-G D
Date Sampled: 12/03/18 12:57

ESS Laboratory Work Order: 1812164
ESS Laboratory Sample ID: 1812164-03
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-302
Date Sampled: 12/03/18 15:00

ESS Laboratory Work Order: 1812164
ESS Laboratory Sample ID: 1812164-04
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-9S
Date Sampled: 12/03/18 16:25

ESS Laboratory Work Order: 1812164
ESS Laboratory Sample ID: 1812164-05
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-9D
Date Sampled: 12/03/18 15:10
Percent Solids: N/A
Initial Volume: 500
Final Volume: 0.5
Extraction Method: 3535A

ESS Laboratory Work Order: 1812164
ESS Laboratory Sample ID: 1812164-06
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 12/10/18 18:20

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	ND (0.250)		8270D SIM		1	12/11/18 18:32	C8L0209	CL81047

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	47 %		15-115

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-9D
Date Sampled: 12/03/18 15:10

ESS Laboratory Work Order: 1812164
ESS Laboratory Sample ID: 1812164-06
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-9DD
Date Sampled: 12/03/18 14:00
Percent Solids: N/A
Initial Volume: 500
Final Volume: 0.5
Extraction Method: 3535A

ESS Laboratory Work Order: 1812164
ESS Laboratory Sample ID: 1812164-07
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 12/10/18 18:20

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	**0.732** (0.250)		8270D SIM		1	12/11/18 19:06	C8L0209	CL81047

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	*35 %*		*15-115*

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-9DD
Date Sampled: 12/03/18 14:00

ESS Laboratory Work Order: 1812164
ESS Laboratory Sample ID: 1812164-07
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-9M
Date Sampled: 12/03/18 16:00

ESS Laboratory Work Order: 1812164
ESS Laboratory Sample ID: 1812164-08
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFOS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812164

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution										
Batch CL81047 - 3535A										
Blank										
1,4-Dioxane	ND	0.250	ug/L							
Surrogate: 1,4-Dioxane-d8	*ND*		ug/L	*5.000*		*31*	*15-115*			
LCS										
1,4-Dioxane	11.7	0.250	ug/L	10.00		117	40-140			
Surrogate: 1,4-Dioxane-d8	*1.57*		ug/L	*5.000*		*31*	*15-115*			
LCS Dup										
1,4-Dioxane	10.9	0.250	ug/L	10.00		109	40-140	7	20	
Surrogate: 1,4-Dioxane-d8	*2.09*		ug/L	*5.000*		*42*	*15-115*			

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1812164

Notes and Definitions

Z-08	See Attached
U	Analyte included in the analysis, but not detected
PT	Pentachlorophenol tailing factor > 2.
BT	Benzidine tailing factor >2.
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812164

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

Your P.O. #: B02815
Your Project #: 1812164
Your C.O.C. #: n/a

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/12/19
Report #: R5532656
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8W9074
Received: 2018/12/08, 12:11

Sample Matrix: Water
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	8	2018/12/16	2018/12/17	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

U = Undetected at the limit of quantitation.
J = Estimated concentration between the EDL & RDL.
B = Blank Contamination.
Q = One or more quality control criteria failed.
E = Analyte concentration exceeds the maximum concentration level.
K = Estimated maximum possible concentration due to ion abundance ratio failure.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your P.O. #: B02815
Your Project #: 1812164
Your C.O.C. #: n/a

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/12/19
Report #: R5532656
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8W9074
Received: 2018/12/08, 12:11

Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B8W9074
Report Date: 2018/12/19

ESS Laboratory
Client Project #: 1812164
Your P.O. #: B02815

RESULTS OF ANALYSES OF WATER

Maxxam ID		IMU286	IMU287	IMU288	IMU289	IMU290			
Sampling Date		2018/12/03 11:05	2018/12/03 11:54	2018/12/03 12:57	2018/12/03 15:00	2018/12/03 16:25			
COC Number		n/a	n/a	n/a	n/a	n/a			
	UNITS	1812164-01	1812164-02	1812164-03	1812164-04	1812164-05	RDL	MDL	QC Batch
Miscellaneous Parameters									
6:2 Fluorotelomer sulfonate	ug/L	0.0066 U	0.0066 U	0.0066 U	0.13	0.0066 U	0.020	0.0066	5891269
8:2 Fluorotelomer sulfonate	ug/L	0.0066 U	0.0066 U	0.0066 U	0.0070 J	0.0066 U	0.020	0.0066	5891269
Perfluorobutanoic acid	ug/L	0.0055 U	0.0055 U	0.0055 U	0.014 J	0.071	0.020	0.0055	5891269
Perfluorobutane Sulfonate (PFBS)	ug/L	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.0054 U	0.020	0.0054	5891269
Perfluorodecane Sulfonate	ug/L	0.0060 U	0.0060 U	0.0060 U	0.0060 U	0.0060 U	0.020	0.0060	5891269
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.0074 U	0.0074 U	0.0074 U	0.015 J	0.048	0.020	0.0074	5891269
Perfluorohexanoic Acid (PFHxA)	ug/L	0.0035 U	0.0035 U	0.0035 U	0.027	0.16	0.020	0.0035	5891269
Perfluorohexane Sulfonate (PFHxS)	ug/L	0.0056 U	0.012 J	0.0056 U	0.016 J	0.023	0.020	0.0056	5891269
Perfluorononanoic Acid (PFNA)	ug/L	0.0087 U	0.011 J	0.0087 U	0.0097 J	0.0087 U	0.020	0.0087	5891269
Perfluorooctane Sulfonamide (PFOSA)	ug/L	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.0034 U	0.020	0.0034	5891269
Perfluoropentanoic Acid (PFPeA)	ug/L	0.0075 U	0.0075 U	0.0075 U	0.042	0.26	0.020	0.0075	5891269
Perfluorotetradecanoic Acid	ug/L	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.020	0.0027	5891269
Perfluorotridecanoic Acid	ug/L	0.0038 U	0.0038 U	0.0038 U	0.0038 U	0.0038 U	0.020	0.0038	5891269
Perfluoroundecanoic Acid (PFUnA)	ug/L	0.0025 U	0.0025 U	0.0025 U	0.021	0.0025 U	0.020	0.0025	5891269
Perfluorodecanoic Acid (PFDA)	ug/L	0.0061 U	0.0061 U	0.0061 U	0.0061 U	0.0061 U	0.020	0.0061	5891269
Perfluorododecanoic Acid (PFDoA)	ug/L	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.020	0.0050	5891269
Perfluoro-n-Octanoic Acid (PFOA)	ug/L	0.0033 U	0.0033 U	0.0033 U	0.030	0.032	0.020	0.0033	5891269
Perfluorooctane Sulfonate (PFOS)	ug/L	0.0060 U	0.036	0.0060 U	0.031	0.024	0.020	0.0060	5891269
Surrogate Recovery (%)									
13C2-6:2 Fluorotelomer sulfonate	%	96	99	100	94	98	N/A	N/A	5891269
13C2-8:2 Fluorotelomer sulfonate	%	95	91	89	80	89	N/A	N/A	5891269
13C2-Perfluorodecanoic acid	%	93	87	89	79	85	N/A	N/A	5891269
13C2-Perfluorododecanoic acid	%	82	74	75	65	76	N/A	N/A	5891269
13C2-Perfluorohexanoic acid	%	97	100	99	93	94	N/A	N/A	5891269
13C2-perfluorotetradecanoic acid	%	78	37 (1)	61	53	50	N/A	N/A	5891269
13C2-Perfluoroundecanoic acid	%	86	79	77	71	79	N/A	N/A	5891269
13C4-Perfluorobutanoic acid	%	95	100	97	95	99	N/A	N/A	5891269
13C4-Perfluoroheptanoic acid	%	93	104	98	96	99	N/A	N/A	5891269
13C4-Perfluorooctanesulfonate	%	101	88	86	77	84	N/A	N/A	5891269

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Extracted internal standard analyte recovery was below the defined lower control limit (LCL). Because quantitation is performed using isotope dilution techniques, any losses of the native compound that may occur during any of the sample preparation, extraction, cleanup or determinative steps will be mirrored by a similar loss of the labeled standard, and as such can be accounted for and corrected. Therefore, the quantification of these target compounds is not affected by the low extracted internal standard analyte recovery.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8W9074
Report Date: 2018/12/19

ESS Laboratory
Client Project #: 1812164
Your P.O. #: B02815

RESULTS OF ANALYSES OF WATER

Maxxam ID		IMU286	IMU287	IMU288	IMU289	IMU290			
Sampling Date		2018/12/03 11:05	2018/12/03 11:54	2018/12/03 12:57	2018/12/03 15:00	2018/12/03 16:25			
COC Number		n/a	n/a	n/a	n/a	n/a			
	UNITS	**1812164-01**	**1812164-02**	**1812164-03**	**1812164-04**	**1812164-05**	**RDL**	**MDL**	**QC Batch**
13C4-Perfluorooctanoic acid	%	95	101	97	95	94	N/A	N/A	5891269
13C5-Perfluorononanoic acid	%	96	103	94	90	92	N/A	N/A	5891269
13C5-Perfluoropentanoic acid	%	95	98	97	95	98	N/A	N/A	5891269
13C8-Perfluorooctane Sulfonamide	%	89	85	84	80	84	N/A	N/A	5891269
18O2-Perfluorohexanesulfonate	%	99	98	95	100	93	N/A	N/A	5891269

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8W9074
Report Date: 2018/12/19

ESS Laboratory
Client Project #: 1812164
Your P.O. #: B02815

RESULTS OF ANALYSES OF WATER

Maxxam ID		IMU291	IMU292	IMU293			
Sampling Date		2018/12/03 15:10	2018/12/03 14:00	2018/12/03 16:00			
COC Number		n/a	n/a	n/a			
	UNITS	1812164-06	1812164-07	1812164-08	RDL	MDL	QC Batch
Miscellaneous Parameters							
6:2 Fluorotelomer sulfonate	ug/L	0.19	0.062	0.64	0.020	0.0066	5891269
8:2 Fluorotelomer sulfonate	ug/L	0.0066 U	0.0066 U	0.0066 U	0.020	0.0066	5891269
Perfluorobutanoic acid	ug/L	0.028	0.010 J	0.12	0.020	0.0055	5891269
Perfluorobutane Sulfonate (PFBS)	ug/L	0.0054 U	0.0054 U	0.0054 U	0.020	0.0054	5891269
Perfluorodecane Sulfonate	ug/L	0.0060 U	0.0060 U	0.0060 U	0.020	0.0060	5891269
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.033	0.015 J	0.11	0.020	0.0074	5891269
Perfluorohexanoic Acid (PFHxA)	ug/L	0.069	0.027	0.25	0.020	0.0035	5891269
Perfluorohexane Sulfonate (PFHxS)	ug/L	0.12	0.042	0.0056 U	0.020	0.0056	5891269
Perfluorononanoic Acid (PFNA)	ug/L	0.10	0.038	0.044	0.020	0.0087	5891269
Perfluorooctane Sulfonamide (PFOSA)	ug/L	0.0034 U	0.0034 U	0.0034 U	0.020	0.0034	5891269
Perfluoropentanoic Acid (PFPeA)	ug/L	0.091	0.036	0.49	0.020	0.0075	5891269
Perfluorotetradecanoic Acid	ug/L	0.0027 U	0.0027 U	0.0027 U	0.020	0.0027	5891269
Perfluorotridecanoic Acid	ug/L	0.0038 U	0.0038 U	0.0038 U	0.020	0.0038	5891269
Perfluoroundecanoic Acid (PFUnA)	ug/L	0.0025 U	0.0025 U	0.0025 U	0.020	0.0025	5891269
Perfluorodecanoic Acid (PFDA)	ug/L	0.0061 U	0.0061 U	0.0061 U	0.020	0.0061	5891269
Perfluorododecanoic Acid (PFDoA)	ug/L	0.0050 U	0.0050 U	0.0050 U	0.020	0.0050	5891269
Perfluoro-n-Octanoic Acid (PFOA)	ug/L	0.057	0.020 J	0.052	0.020	0.0033	5891269
Perfluorooctane Sulfonate (PFOS)	ug/L	0.52	0.14	0.0081 J	0.020	0.0060	5891269
Surrogate Recovery (%)							
13C2-6:2 Fluorotelomer sulfonate	%	99	95	86	N/A	N/A	5891269
13C2-8:2 Fluorotelomer sulfonate	%	90	90	88	N/A	N/A	5891269
13C2-Perfluorodecanoic acid	%	87	86	84	N/A	N/A	5891269
13C2-Perfluorododecanoic acid	%	78	79	71	N/A	N/A	5891269
13C2-Perfluorohexanoic acid	%	97	98	97	N/A	N/A	5891269
13C2-perfluorotetradecanoic acid	%	67	67	59	N/A	N/A	5891269
13C2-Perfluoroundecanoic acid	%	78	86	79	N/A	N/A	5891269
13C4-Perfluorobutanoic acid	%	96	97	98	N/A	N/A	5891269
13C4-Perfluoroheptanoic acid	%	98	96	94	N/A	N/A	5891269
13C4-Perfluorooctanesulfonate	%	92	89	88	N/A	N/A	5891269
13C4-Perfluorooctanoic acid	%	98	94	98	N/A	N/A	5891269
13C5-Perfluorononanoic acid	%	100	99	94	N/A	N/A	5891269
13C5-Perfluoropentanoic acid	%	97	99	95	N/A	N/A	5891269
13C8-Perfluorooctane Sulfonamide	%	87	85	81	N/A	N/A	5891269
18O2-Perfluorohexanesulfonate	%	95	95	94	N/A	N/A	5891269

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8W9074
Report Date: 2018/12/19

ESS Laboratory
Client Project #: 1812164
Your P.O. #: B02815

TEST SUMMARY

Maxxam ID: IMU286 **Collected:** 2018/12/03
Sample ID: 1812164-01 **Shipped:**
Matrix: Water **Received:** 2018/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5891269	2018/12/16	2018/12/17	Marian Godax

Maxxam ID: IMU287 **Collected:** 2018/12/03
Sample ID: 1812164-02 **Shipped:**
Matrix: Water **Received:** 2018/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5891269	2018/12/16	2018/12/17	Marian Godax

Maxxam ID: IMU288 **Collected:** 2018/12/03
Sample ID: 1812164-03 **Shipped:**
Matrix: Water **Received:** 2018/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5891269	2018/12/16	2018/12/17	Marian Godax

Maxxam ID: IMU289 **Collected:** 2018/12/03
Sample ID: 1812164-04 **Shipped:**
Matrix: Water **Received:** 2018/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5891269	2018/12/16	2018/12/17	Marian Godax

Maxxam ID: IMU290 **Collected:** 2018/12/03
Sample ID: 1812164-05 **Shipped:**
Matrix: Water **Received:** 2018/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5891269	2018/12/16	2018/12/17	Marian Godax

Maxxam ID: IMU291 **Collected:** 2018/12/03
Sample ID: 1812164-06 **Shipped:**
Matrix: Water **Received:** 2018/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5891269	2018/12/16	2018/12/17	Marian Godax

Maxxam ID: IMU292 **Collected:** 2018/12/03
Sample ID: 1812164-07 **Shipped:**
Matrix: Water **Received:** 2018/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5891269	2018/12/16	2018/12/17	Marian Godax

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Maxxam Job #: B8W9074
Report Date: 2018/12/19

ESS Laboratory
Client Project #: 1812164
Your P.O. #: B02815

TEST SUMMARY

Maxxam ID: IMU293
Sample ID: 1812164-08
Matrix: Water

Collected: 2018/12/03
Shipped:
Received: 2018/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5891269	2018/12/16	2018/12/17	Marian Godax

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8W9074
Report Date: 2018/12/19

ESS Laboratory
Client Project #: 1812164
Your P.O. #: B02815

GENERAL COMMENTS

Results relate only to the items tested.

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Maxxam Job #: B8W9074
Report Date: 2018/12/19

ESS Laboratory
Client Project #: 1812164
Your P.O. #: B02815

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
5891269	M_G	Spiked Blank	13C2-6:2 Fluorotelomer sulfonate	2018/12/17		102	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/12/17		99	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/12/17		111	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/12/17		94	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/12/17		107	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/12/17		93	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/12/17		106	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/12/17		110	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/12/17		107	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/12/17		108	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/12/17		106	%	50 - 150
			13C5-Perfluorononanoic acid	2018/12/17		104	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/12/17		104	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/12/17		99	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/12/17		105	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/12/17		126	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/12/17		126	%	70 - 130
			Perfluorobutanoic acid	2018/12/17		119	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/12/17		122	%	70 - 130
			Perfluorodecane Sulfonate	2018/12/17		106	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/12/17		121	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/12/17		121	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/12/17		115	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/12/17		124	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/12/17		121	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/12/17		122	%	70 - 130
			Perfluorotetradecanoic Acid	2018/12/17		121	%	70 - 130
			Perfluorotridecanoic Acid	2018/12/17		122	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/12/17		114	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/12/17		116	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/12/17		123	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/12/17		122	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/12/17		121	%	70 - 130
5891269	M_G	Spiked Blank DUP	13C2-6:2 Fluorotelomer sulfonate	2018/12/17		98	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/12/17		96	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/12/17		98	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/12/17		88	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/12/17		98	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/12/17		85	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/12/17		94	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/12/17		101	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/12/17		99	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/12/17		96	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/12/17		103	%	50 - 150
			13C5-Perfluorononanoic acid	2018/12/17		99	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/12/17		99	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/12/17		90	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/12/17		96	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/12/17		120	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/12/17		118	%	70 - 130
			Perfluorobutanoic acid	2018/12/17		117	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/12/17		124	%	70 - 130
			Perfluorodecane Sulfonate	2018/12/17		112	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/12/17		118	%	70 - 130

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Maxxam Job #: B8W9074
Report Date: 2018/12/19

ESS Laboratory
Client Project #: 1812164
Your P.O. #: B02815

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorohexanoic Acid (PFHxA)	2018/12/17		121	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/12/17		116	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/12/17		119	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/12/17		119	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/12/17		118	%	70 - 130
			Perfluorotetradecanoic Acid	2018/12/17		119	%	70 - 130
			Perfluorotridecanoic Acid	2018/12/17		122	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/12/17		116	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/12/17		117	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/12/17		118	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/12/17		115	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/12/17		126	%	70 - 130
5891269	M_G	RPD	6:2 Fluorotelomer sulfonate	2018/12/17	4.9		%	30
			8:2 Fluorotelomer sulfonate	2018/12/17	6.2		%	30
			Perfluorobutanoic acid	2018/12/17	1.4		%	30
			Perfluorobutane Sulfonate (PFBS)	2018/12/17	1.2		%	30
			Perfluorodecane Sulfonate	2018/12/17	4.9		%	30
			Perfluoroheptanoic Acid (PFHpA)	2018/12/17	2.5		%	30
			Perfluorohexanoic Acid (PFHxA)	2018/12/17	0.37		%	30
			Perfluorohexane Sulfonate (PFHxS)	2018/12/17	1.0		%	30
			Perfluorononanoic Acid (PFNA)	2018/12/17	3.4		%	30
			Perfluorooctane Sulfonamide (PFOSA)	2018/12/17	1.3		%	30
			Perfluoropentanoic Acid (PFPeA)	2018/12/17	3.7		%	30
			Perfluorotetradecanoic Acid	2018/12/17	1.5		%	30
			Perfluorotridecanoic Acid	2018/12/17	0.20		%	30
			Perfluoroundecanoic Acid (PFUnA)	2018/12/17	1.7		%	30
			Perfluorodecanoic Acid (PFDA)	2018/12/17	1.1		%	30
			Perfluorododecanoic Acid (PFDoA)	2018/12/17	4.3		%	30
			Perfluoro-n-Octanoic Acid (PFOA)	2018/12/17	5.9		%	30
			Perfluorooctane Sulfonate (PFOS)	2018/12/17	3.8		%	30
5891269	M_G	Method Blank	13C2-6:2 Fluorotelomer sulfonate	2018/12/17		102	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/12/17		96	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/12/17		91	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/12/17		83	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/12/17		100	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/12/17		84	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/12/17		92	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/12/17		104	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/12/17		101	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/12/17		99	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/12/17		101	%	50 - 150
			13C5-Perfluorononanoic acid	2018/12/17		103	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/12/17		100	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/12/17		92	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/12/17		103	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/12/17	0.0066 U, MDL=0.0066		ug/L	
			8:2 Fluorotelomer sulfonate	2018/12/17	0.0066 U, MDL=0.0066		ug/L	
			Perfluorobutanoic acid	2018/12/17	0.0055 U, MDL=0.0055		ug/L	
			Perfluorobutane Sulfonate (PFBS)	2018/12/17	0.0054 U, MDL=0.0054		ug/L	

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Maxxam Job #: B8W9074
Report Date: 2018/12/19

ESS Laboratory
Client Project #: 1812164
Your P.O. #: B02815

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorodecane Sulfonate	2018/12/17	0.0060 U, MDL=0.0060		ug/L	
			Perfluoroheptanoic Acid (PFHpA)	2018/12/17	0.0074 U, MDL=0.0074		ug/L	
			Perfluorohexanoic Acid (PFHxA)	2018/12/17	0.0035 U, MDL=0.0035		ug/L	
			Perfluorohexane Sulfonate (PFHxS)	2018/12/17	0.0056 U, MDL=0.0056		ug/L	
			Perfluorononanoic Acid (PFNA)	2018/12/17	0.0087 U, MDL=0.0087		ug/L	
			Perfluorooctane Sulfonamide (PFOSA)	2018/12/17	0.0034 U, MDL=0.0034		ug/L	
			Perfluoropentanoic Acid (PFPeA)	2018/12/17	0.0075 U, MDL=0.0075		ug/L	
			Perfluorotetradecanoic Acid	2018/12/17	0.0027 U, MDL=0.0027		ug/L	
			Perfluorotridecanoic Acid	2018/12/17	0.0038 U, MDL=0.0038		ug/L	
			Perfluoroundecanoic Acid (PFUnA)	2018/12/17	0.0025 U, MDL=0.0025		ug/L	
			Perfluorodecanoic Acid (PFDA)	2018/12/17	0.0061 U, MDL=0.0061		ug/L	
			Perfluorododecanoic Acid (PFDoA)	2018/12/17	0.0050 U, MDL=0.0050		ug/L	
			Perfluoro-n-Octanoic Acid (PFOA)	2018/12/17	0.0033 U, MDL=0.0033		ug/L	
			Perfluorooctane Sulfonate (PFOS)	2018/12/17	0.0060 U, MDL=0.0060		ug/L	

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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Maxxam Job #: B8W9074
Report Date: 2018/12/19

ESS Laboratory
Client Project #: 1812164
Your P.O. #: B02815

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Colm McNamara, Senior Analyst, Liquid Chromatography

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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ESS Laboratory

Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 18 12164

Turn Time STANDARD Rush
Regulatory State MA
Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP
Reporting Limits GW-1
Electonic Deliverables ☐Limit Checker ☐Standard Excel ☑Other (Please Specify →) PDF

Company Name: HORSLEY WITTEN GROUP
Contact Person: JOSEPHINE IBANEZ
Project #: 17027
Project Name: BARN ON CALL #4
Address: 90 ROUTE 6A, UNIT 1
City: SANDWICH
State: MA
Zip Code: 02563
PO #:
Telephone Number: 508-833-6600
FAX Number: 508-833-3150
Email Address: jibanez@horsleywitten.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: PFAS - Full List	Isotopic Analysis*	1,4 Dioxane
1	12/3/18	1105	GRAB	GW	HW-G(S)	X	X	
2		1154			HW-G(M)		X	
3		1257			HW-G(D)		X	
4		1500			HW-302			
5		1625			OW-9S		X	
6		1510			OW-9D		X	X
7		1400			OW-9DD		X	X
8	X	1600	X	X	OW-9M	X	X	

Container Type: AC-Air Cassette, AG-Amber Glass, B-BOD Bottle, C-Cubitainer, G - Glass, O-Other, P-Poly, S-Sterile, V-Vial
Container Volume: 1-100 mL, 2-2.5 gal, 3-250 mL, 4-300 mL, 5-500 mL, 6-1L, 7-VOA, 8-2 oz, 9-4 oz, 10-8 oz, 11-Other*
Preservation Code: 1-Non Preserved, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-Methanol, 7-Na2S2O3, 8-ZnAce, NaOH, 9-NH4Cl, 10-DI H2O, 11-Ascorbic Acid, 12-Other*

Container Type:	P	P	AG
Container Volume:	1	3	6
Preservation Code:	1	1	1
Number of Containers per Sample:	1	1	2

Laboratory Use Only
Cooler Present: ✓
Seals Intact: ____
Cooler Temperature: 0.8 °C ICE RC

Sampled by: HW, BJM

Comments: Please specify "Other" preservative and containers types in this space
* Isotopic analysis = compound specific analysis (oxygen - hydrogen)
PFAS - Full List = MaxXam; Isotopic - BU* Report isotopic analysis results in separate report

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
RC 12/3/18 1725	HW FRIDGE 12/3/18 1725	HW FRIDGE 12/6/18 1045	RC 12/6/18 1045
RC 12/6/18 1537	12/6/18 1713		

ESS Laboratory

Division of Thielsch Engineering, Inc.
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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 18 12164

Turn Time STANDARD Rush

Reporting Limits GW-1

Regulatory State MA

Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP

Electonic Deliverables ☐Limit Checker ☑Standard Excel ☑Other (Please Specify →) PDF

Company Name	Project #	Project Name
HORSLEY WITTEN GROUP	17027	BARN ON CALL #4

Contact Person	Address		
JOSEPHINE IBANEZ	90 ROUTE 6A, UNIT 1		
City	**State**	**Zip Code**	**PO #**
SANDWICH	MA	02563	
Telephone Number	**FAX Number**	**Email Address**	
508-833-6600	508-833-3150	jibanez@horsleywitten.com	

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: PFAS - Full List	Isotopic Analysis*	1,4 Dioxane
1	12/3/18	1105	GRAB	GW	HW-G(S)	X	X	
2		1154			HW-G(M)		X	
3		1257			HW-G(D)		X	
4		1500			HW-302			
5		1625			OW-9S		X	
6		1510			OW-9D		X	X
7		1400			OW-9DD		X	X
8	X	1600	X	X	OW-9M	X	X	

Container Type: AC-Air Cassette, AG-Amber Glass, B-BOD Bottle, C-Cubitainer, G - Glass, O-Other, P-Poly, S-Sterile, V-Vial

Container Volume: 1-100 mL, 2-2.5 gal, 3-250 mL, 4-300 mL, 5-500 mL, 6-1L, 7-VOA, 8-2 oz, 9-4 oz, 10-8 oz, 11-Other*

Preservation Code: 1-Non Preserved, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-Methanol, 7-Na2S2O3, 8-ZnAce, NaOH, 9-NH4Cl, 10-DI H2O, 11-Ascorbic Acid, 12-Other*

	P	P	AG
	1	3	6
	1	1	1
Number of Containers per Sample:	1	1	2

Laboratory Use Only
Cooler Present: ✓
Seals Intact: ____
Cooler Temperature: 0.8 °C ICE RC

Sampled by: HW, BJM

Comments: Please specify "Other" preservative and containers types in this space
* Isotopic analysis = compound specific analysis (oxygen-hydrogen)
PFAS-Full List by MaxXam; Isotopic - BU *Report isotopic analysis results in separate report

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
[signature] 12/3/18 1725	HW FRIDGE 12/3/18 1725	HW FRIDGE 12/6/18 1045	R Cudney 12/6/18 1045
R Cudney 12/6/18 1537	[signature] 12/6/18 1713		

CERTIFICATE OF ANALYSIS

Josphine Ibanez
Horsley & Witten
90 Route 6A
Sandwich, MA 02563

RE: Barn On-Call No. 4 (17027)
ESS Laboratory Work Order Number: 1812198

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 2:47 pm, Jan 28, 2019

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analvses

Boston University Stable Isotipe Lboratory - Boston, MA	Isotopic - Compound Specific

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812198

SAMPLE RECEIPT

The following samples were received on December 06, 2018 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
1812198-01	HW-G S	Ground Water	SUB
1812198-02	HW-G M	Ground Water	SUB
1812198-03	HW-G D	Ground Water	SUB
1812198-04	OW-9S	Ground Water	SUB
1812198-05	OW-9D	Ground Water	SUB
1812198-06	OW-9DD	Ground Water	SUB
1812198-07	OW-9M	Ground Water	SUB

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812198

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812198

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-G S
Date Sampled: 12/03/18 11:05

ESS Laboratory Work Order: 1812198
ESS Laboratory Sample ID: 1812198-01
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-G M
Date Sampled: 12/03/18 11:54

ESS Laboratory Work Order: 1812198
ESS Laboratory Sample ID: 1812198-02
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: HW-G D
Date Sampled: 12/03/18 12:57

ESS Laboratory Work Order: 1812198
ESS Laboratory Sample ID: 1812198-03
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-9S
Date Sampled: 12/03/18 16:25

ESS Laboratory Work Order: 1812198
ESS Laboratory Sample ID: 1812198-04
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-9D
Date Sampled: 12/03/18 15:10

ESS Laboratory Work Order: 1812198
ESS Laboratory Sample ID: 1812198-05
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-9DD
Date Sampled: 12/03/18 14:00

ESS Laboratory Work Order: 1812198
ESS Laboratory Sample ID: 1812198-06
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-9M
Date Sampled: 12/03/18 16:00

ESS Laboratory Work Order: 1812198
ESS Laboratory Sample ID: 1812198-07
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1812198

Notes and Definitions

Z-08	See Attached
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812198

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

BOSTON UNIVERSITY STABLE ISOTOPE LABORATORY

Data Sheet ^{18}O Water

Date: 28 January 2019
Client: Kevin Braga
Project: ESS Laboratory
Data emailed: 1/28/19
Samples Returned/Archived:
Data Location: MF 79-79a

Samples arrived: 11/14/18; 12/10/18
Job Number: 18OH 65; 18OH 74
Comments: combined 2 jobs
File name: br18OH65 18OH74.xls

Data normalized to V-SMOW/SLAP scale

Volume Water used: 100 ul per sample

IMPORTANT DISCLAIMER: Due to a quirk in Excel, numbers are shown to 9 decimal places.
Values MUST be rounded to 2 decimal places. The accuracy of the data are reliable to 2 decimal places ONLY.

Sample ID	δ^{18}O (V-SMOW)	Atm %	Comments
IAEA OH-14	-5.64	0.19899	
IAEA OH-15	-9.59	0.19820	
1811299-2	-6.92	0.19874	
1811299-2	-6.77	0.19877	
1811299-4	-6.79	0.19876	
1811299-4	-6.85	0.19875	
1811299-5	-6.90	0.19874	
1811299-5	-6.88	0.19875	
1811299-7	-2.67	0.19959	
1811299-7	-2.61	0.19960	
1812198-1	-6.74	0.19877	
1812198-1	-6.93	0.19874	
1812198-2	-7.53	0.19861	
1812198-2	-7.57	0.19861	
1812198-3	-7.18	0.19868	
1812198-3	-7.45	0.19863	
1812198-4	-7.29	0.19866	
1812198-4	-7.41	0.19864	
1812198-5	-7.76	0.19857	
1812198-5	-7.71	0.19858	
Antarc IC	-29.83	0.19416	
1812198-6	-7.52	0.19862	
1812198-6	-7.57	0.19861	
1812198-7	-7.13	0.19870	
1812198-7	-7.24	0.19867	
1812232-1	-7.58	0.19860	
1812232-1	-7.54	0.19861	
1812232-2	-6.95	0.19873	
1812232-2	-6.89	0.19874	
1812232-3	-7.28	0.19867	
1812232-3	-7.36	0.19865	
IAEA OH-16	-15.72	0.19698	

Expected Values:	
IAEA OH-14	**-5.60**
IAEA OH-15	**-9.41**
IAEA OH-16	**-15.41**
Ant. IC	**-30.00**

BOSTON UNIVERSITY STABLE ISOTOPE LABORATORY

Client Data Sheet ^{2}H Water

Date: 22 January 2019
Client: Kevin Braga
Project: ESS Laboratory
Data emailed: 1/28/19
Samples Returned/Archived:
Data Location: MF 79-79a
Volume Water used: 100 ul per sample

Samples arrived: 11/14/18; 12/10/18
Job Number: 18OH 65; 18OH 74
Comments: combined 2 jobs
File name: br18OH65 18OH74.xls

Data normalized to VSMOW/SLAP scale

IMPORTANT DISCLAIMER: Due to a quirk in Excel, numbers are shown to 9 decimal places.
Values MUST be rounded to 2 decimal places. The accuracy of the data are reliable to 2 decimal places ONLY.

Sample ID	δD (V-SMOW)	Atm %	Comments
IAEA OH-14	-37.45	0.01499	
IAEA OH-15	-77.89	0.01436	
1811299-2	-40.41	0.01494	
1811299-2	-40.17	0.01495	
1811299-4	-38.56	0.01497	
1811299-4	-38.87	0.01497	
1811299-5	-38.28	0.01498	
1811299-5	-38.15	0.01498	
1811299-7	-18.65	0.01528	
1811299-7	-20.42	0.01526	
1811299-7	-23.04	0.01521	
1812198-1	-38.19	0.01498	
1812198-1	-37.87	0.01498	
1812198-2	-44.34	0.01488	
1812198-2	-44.39	0.01488	
1812198-3	-44.15	0.01489	
1812198-3	-44.56	0.01488	
1812198-4	-41.86	0.01492	
1812198-4	-42.94	0.01490	
1812198-5	-47.91	0.01483	
1812198-5	-46.82	0.01484	
1812198-5	-47.20	0.01484	
1812198-6	-45.58	0.01486	
1812198-6	-45.48	0.01487	
1812198-7	-41.44	0.01493	
1812198-7	-43.40	0.01490	
1812232-1	-49.29	0.01481	
1812232-1	-49.66	0.01480	
1812232-2	-42.64	0.01491	
1812232-2	-42.57	0.01491	
1812232-3	-44.76	0.01488	*
1812232-3	-41.61	0.01493	*

Expected Values:	
IAEA OH-1	**-37.70**
IAEA OH-1	**-78.00**
IAEA OH-1	**-113.80**
Ant. IC	**-239.69**

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Horsley Witten Group - KPB/HDM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1812198
Date Received: 12/7/2018
Project Due Date: 12/14/2018
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: .8 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / (NA)
10. Were any analyses received outside of hold time? Yes / (No)

11. Any Subcontracting needed? (Yes) / No
    ESS Sample IDs: 1812198 1-7
    Analysis: Isotopic analysis
    TAT: STD
12. Were VOAs received? Yes / (No)
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / NA
13. Are the samples properly preserved? (Yes) / No
    a. If metals preserved upon receipt: Date: _____ Time: _____ By: _____
    b. Low Level VOA vials frozen: Date: _____ Time: _____ By: _____

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / (No)
    a. Was there a need to contact the client? Yes / (No)
    Who was contacted? _____ Date: _____ Time: _____ By: _____

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
01	300122	Yes	NA	Yes	250 mL Poly - Unpres	NP	
02	300121	Yes	NA	Yes	250 mL Poly - Unpres	NP	
03	300120	Yes	NA	Yes	250 mL Poly - Unpres	NP	
04	300119	Yes	NA	Yes	250 mL Poly - Unpres	NP	
05	300118	Yes	NA	Yes	250 mL Poly - Unpres	NP	
06	300117	Yes	NA	Yes	250 mL Poly - Unpres	NP	
07	300116	Yes	NA	Yes	250 mL Poly - Unpres	NP	

2nd Review
Are barcode labels on correct containers? (Yes) / No
Are all necessary stickers attached? (Yes) / No

Completed By: _____ Date & Time: 12/7/18 13:27
Reviewed By: _____ Date & Time: 12/7/18 1453
Delivered By: _____ 12/7/18 1453

ESS Laboratory **BU**

Division of Thielsch Engineering, Inc.

185 Frances Avenue,Cranston RI 02910-2211
Tel. (401)461-7181 Fax (401)461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1812198

Turn Time ___X__Standard Other_____

Reporting Limits - ___GW-1_____

Regulatory State: **MA** RI CT NH NJ NY ME Other_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Electonic Deliverables Excel Access PDF

Co. Name: **ESS Laboratory**	Project #	Project Name: **1812198**	
Contact Person: **Shawn Morrell**	Proj. Location		
Address	City , State	Zip	PO #
Tel. ext 3083	email: smorrell@thielsch.com		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis: Stable Isotope for Hydrogen and Oxygen
	12/3/18	1105	G	GW	1812198-01	1	1	P		X
	12/3/18	1154	G	GW	1812198-02	1	1	P		X
	12/3/18	1257	G	GW	1812198-03	1	1	P		X
	12/3/18	1625	G	GW	1812198-04	1	1	P		X
	12/3/18	1510	G	GW	1812198-05	1	1	P		X
	12/3/18	1400	G	GW	1812198-06	1	1	P		X
	12/3/18	1600	G	GW	1812198-07	1	1	P		X

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_____

Cooler Present _____Yes _____No

Seals Intact ____ Yes _____No NA:____

Cooler Temperature:

Internal Use Only

[ ] Pickup

[ ] Technician

Sampled by :

Comments:

Relinquished by: (Signature, Date & Time) 12/6/18 12:17	Received by: (Signature, Date & Time) 12/10/18 12:18pm	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)

collected in accordance with MADEP CAM VIIA

Report Method Blank & Laboratory Control Sample Results

5 Cummington Mall
Boston MA 02215

CERTIFICATE OF ANALYSIS

Josphine Ibanez
Horsley & Witten
90 Route 6A
Sandwich, MA 02563

RE: Barn On-Call No. 4 (17027)
ESS Laboratory Work Order Number: 1812231

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 5:19 pm, Dec 28, 2018

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses
Maxxam Analytics - Cheektowaga, NY PFAS

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812231

SAMPLE RECEIPT

The following samples were received on December 10, 2018 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
1812231-01	OW-18 S	Ground Water	SUB
1812231-02	OW-18 M	Ground Water	SUB
1812231-03	OW-18 D	Ground Water	8270D SIM, SUB
1812231-04	OW-19 D	Ground Water	8270D SIM

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1812231

PROJECT NARRATIVE

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

C8L0209-TUN1 **Benzidine tailing factor >2.**

C8L0209-TUN1 **Pentachlorophenol tailing factor > 2.**

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812231

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-18 S
Date Sampled: 12/07/18 15:00

ESS Laboratory Work Order: 1812231
ESS Laboratory Sample ID: 1812231-01
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFAS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-18 M
Date Sampled: 12/07/18 14:30

ESS Laboratory Work Order: 1812231
ESS Laboratory Sample ID: 1812231-02
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFAS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-18 D
Date Sampled: 12/07/18 13:15
Percent Solids: N/A
Initial Volume: 500
Final Volume: 0.5
Extraction Method: 3535A

ESS Laboratory Work Order: 1812231
ESS Laboratory Sample ID: 1812231-03
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 12/10/18 21:45

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	ND (0.250)		8270D SIM		1	12/11/18 22:34	C8L0209	CL81047

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	51 %		15-115

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-18 D
Date Sampled: 12/07/18 13:15

ESS Laboratory Work Order: 1812231
ESS Laboratory Sample ID: 1812231-03
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFAS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-19 D
Date Sampled: 12/07/18 16:20
Percent Solids: N/A
Initial Volume: 500
Final Volume: 0.5
Extraction Method: 3535A

ESS Laboratory Work Order: 1812231
ESS Laboratory Sample ID: 1812231-04
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 12/10/18 21:45

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	ND (0.250)		8270D SIM		1	12/11/18 23:08	C8L0209	CL81047

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	*55 %*		*15-115*

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812231

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution										
Batch CL81047 - 3535A										
Blank										
1,4-Dioxane	ND	0.250	ug/L							
Surrogate: 1,4-Dioxane-d8	*ND*		ug/L	*5.000*		*31*	*15-115*			
LCS										
1,4-Dioxane	11.7	0.250	ug/L	10.00		117	40-140			
Surrogate: 1,4-Dioxane-d8	*1.57*		ug/L	*5.000*		*31*	*15-115*			
LCS Dup										
1,4-Dioxane	10.9	0.250	ug/L	10.00		109	40-140	7	20	
Surrogate: 1,4-Dioxane-d8	*2.09*		ug/L	*5.000*		*42*	*15-115*			

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1812231

Notes and Definitions

Z-08	See Attached
U	Analyte included in the analysis, but not detected
PT	Pentachlorophenol tailing factor > 2.
BT	Benzidine tailing factor >2.
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812231

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

Maxxam
A Bureau Veritas Group Company

Your P.O. #: B02623
Your Project #: 1812231
Your C.O.C. #: N/A

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/12/28
Report #: R5541728
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8X2497
Received: 2018/12/12, 13:56

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	3	2018/12/20	2018/12/21	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

U = Undetected at the limit of quantitation.
J = Estimated concentration between the EDL & RDL.
B = Blank Contamination.
Q = One or more quality control criteria failed.
E = Analyte concentration exceeds the maximum concentration level.
K = Estimated maximum possible concentration due to ion abundance ratio failure.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your P.O. #: B02623
Your Project #: 1812231
Your C.O.C. #: N/A

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2018/12/28
Report #: R5541728
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8X2497
Received: 2018/12/12, 13:56

Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B8X2497
Report Date: 2018/12/28

ESS Laboratory
Client Project #: 1812231
Your P.O. #: B02623

RESULTS OF ANALYSES OF WATER

Maxxam ID		INO754	INO755	INO756			
Sampling Date		2018/12/07 15:00	2018/12/07 14:30	2018/12/07 13:15			
	UNITS	1812231-01	1812231-02	1812231-03	RDL	MDL	QC Batch
Miscellaneous Parameters							
6:2 Fluorotelomer sulfonate	ug/L	0.0066 U	0.0066 U	0.0066 U	0.020	0.0066	5899483
8:2 Fluorotelomer sulfonate	ug/L	0.0066 U	0.0066 U	0.0066 U	0.020	0.0066	5899483
Perfluorobutanoic acid	ug/L	0.0055 U	0.0071 J	0.0074 J	0.020	0.0055	5899483
Perfluorobutane Sulfonate (PFBS)	ug/L	0.0054 U	0.0054 U	0.0054 U	0.020	0.0054	5899483
Perfluorodecane Sulfonate	ug/L	0.0060 U	0.0060 U	0.0060 U	0.020	0.0060	5899483
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.0074 U	0.0074 U	0.014 J	0.020	0.0074	5899483
Perfluorohexanoic Acid (PFHxA)	ug/L	0.0073 J	0.027	0.033	0.020	0.0035	5899483
Perfluorohexane Sulfonate (PFHxS)	ug/L	0.0056 U	0.073	0.13	0.020	0.0056	5899483
Perfluorononanoic Acid (PFNA)	ug/L	0.0087 U	0.0087 U	0.0087 U	0.020	0.0087	5899483
Perfluorooctane Sulfonamide (PFOSA)	ug/L	0.0034 U	0.0034 U	0.0034 U	0.020	0.0034	5899483
Perfluoropentanoic Acid (PFPeA)	ug/L	0.010 J	0.036	0.027	0.020	0.0075	5899483
Perfluorotetradecanoic Acid	ug/L	0.0027 U	0.0027 U	0.0027 U	0.020	0.0027	5899483
Perfluorotridecanoic Acid	ug/L	0.0038 U	0.0038 U	0.0038 U	0.020	0.0038	5899483
Perfluoroundecanoic Acid (PFUnA)	ug/L	0.0025 U	0.0025 U	0.0025 U	0.020	0.0025	5899483
Perfluorodecanoic Acid (PFDA)	ug/L	0.0061 U	0.0061 U	0.0061 U	0.020	0.0061	5899483
Perfluorododecanoic Acid (PFDoA)	ug/L	0.0050 U	0.0050 U	0.0050 U	0.020	0.0050	5899483
Perfluoro-n-Octanoic Acid (PFOA)	ug/L	0.012 J	0.0060 J	0.019 J	0.020	0.0033	5899483
Perfluorooctane Sulfonate (PFOS)	ug/L	0.028	0.24	0.32	0.020	0.0060	5899483
Surrogate Recovery (%)							
13C2-6:2 Fluorotelomer sulfonate	%	84	85	87	N/A	N/A	5899483
13C2-8:2 Fluorotelomer sulfonate	%	82	92	77	N/A	N/A	5899483
13C2-Perfluorodecanoic acid	%	95	91	89	N/A	N/A	5899483
13C2-Perfluorododecanoic acid	%	88	100	85	N/A	N/A	5899483
13C2-Perfluorohexanoic acid	%	92	98	93	N/A	N/A	5899483
13C2-perfluorotetradecanoic acid	%	76	98	82	N/A	N/A	5899483
13C2-Perfluoroundecanoic acid	%	94	101	86	N/A	N/A	5899483
13C4-Perfluorobutanoic acid	%	105	100	103	N/A	N/A	5899483
13C4-Perfluoroheptanoic acid	%	91	95	95	N/A	N/A	5899483
13C4-Perfluorooctanesulfonate	%	92	100	92	N/A	N/A	5899483
13C4-Perfluorooctanoic acid	%	92	91	86	N/A	N/A	5899483
13C5-Perfluorononanoic acid	%	83	94	95	N/A	N/A	5899483
13C5-Perfluoropentanoic acid	%	94	99	97	N/A	N/A	5899483
13C8-Perfluorooctane Sulfonamide	%	77	83	83	N/A	N/A	5899483
18O2-Perfluorohexanesulfonate	%	86	85	88	N/A	N/A	5899483

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8X2497
Report Date: 2018/12/28

ESS Laboratory
Client Project #: 1812231
Your P.O. #: B02623

TEST SUMMARY

Maxxam ID: INO754 **Collected:** 2018/12/07
Sample ID: 1812231-01 **Shipped:**
Matrix: Water **Received:** 2018/12/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5899483	2018/12/20	2018/12/21	Janet Dalisay

Maxxam ID: INO755 **Collected:** 2018/12/07
Sample ID: 1812231-02 **Shipped:**
Matrix: Water **Received:** 2018/12/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5899483	2018/12/20	2018/12/21	Janet Dalisay

Maxxam ID: INO756 **Collected:** 2018/12/07
Sample ID: 1812231-03 **Shipped:**
Matrix: Water **Received:** 2018/12/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	5899483	2018/12/20	2018/12/21	Janet Dalisay

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

GENERAL COMMENTS

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8X2497
Report Date: 2018/12/28

ESS Laboratory
Client Project #: 1812231
Your P.O. #: B02623

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
5899483	JDA	Spiked Blank	13C2-6:2 Fluorotelomer sulfonate	2018/12/21		100	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/12/21		91	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/12/21		102	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/12/21		95	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/12/21		100	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/12/21		102	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/12/21		106	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/12/21		107	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/12/21		93	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/12/21		100	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/12/21		92	%	50 - 150
			13C5-Perfluorononanoic acid	2018/12/21		98	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/12/21		103	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/12/21		92	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/12/21		88	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/12/21		108	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/12/21		106	%	70 - 130
			Perfluorobutanoic acid	2018/12/21		102	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/12/21		118	%	70 - 130
			Perfluorodecane Sulfonate	2018/12/21		96	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/12/21		110	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2018/12/21		102	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/12/21		124	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/12/21		108	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/12/21		103	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/12/21		102	%	70 - 130
			Perfluorotetradecanoic Acid	2018/12/21		89	%	70 - 130
			Perfluorotridecanoic Acid	2018/12/21		103	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/12/21		100	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/12/21		98	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/12/21		117	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/12/21		118	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/12/21		99	%	70 - 130
5899483	JDA	Spiked Blank DUP	13C2-6:2 Fluorotelomer sulfonate	2018/12/21		97	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/12/21		88	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/12/21		84	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/12/21		78	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/12/21		95	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/12/21		85	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/12/21		85	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/12/21		108	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/12/21		97	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/12/21		98	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/12/21		96	%	50 - 150
			13C5-Perfluorononanoic acid	2018/12/21		95	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/12/21		99	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/12/21		77	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/12/21		94	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/12/21		110	%	70 - 130
			8:2 Fluorotelomer sulfonate	2018/12/21		99	%	70 - 130
			Perfluorobutanoic acid	2018/12/21		105	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2018/12/21		97	%	70 - 130
			Perfluorodecane Sulfonate	2018/12/21		104	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2018/12/21		104	%	70 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorohexanoic Acid (PFHxA)	2018/12/21		103	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2018/12/21		109	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2018/12/21		110	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2018/12/21		107	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2018/12/21		103	%	70 - 130
			Perfluorotetradecanoic Acid	2018/12/21		90	%	70 - 130
			Perfluorotridecanoic Acid	2018/12/21		104	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2018/12/21		112	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2018/12/21		112	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2018/12/21		123	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2018/12/21		111	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2018/12/21		105	%	70 - 130
5899483	JDA	RPD	6:2 Fluorotelomer sulfonate	2018/12/21	2.0		%	30
			8:2 Fluorotelomer sulfonate	2018/12/21	7.0		%	30
			Perfluorobutanoic acid	2018/12/21	3.3		%	30
			Perfluorobutane Sulfonate (PFBS)	2018/12/21	20		%	30
			Perfluorodecane Sulfonate	2018/12/21	7.8		%	30
			Perfluoroheptanoic Acid (PFHpA)	2018/12/21	5.4		%	30
			Perfluorohexanoic Acid (PFHxA)	2018/12/21	0.78		%	30
			Perfluorohexane Sulfonate (PFHxS)	2018/12/21	13		%	30
			Perfluorononanoic Acid (PFNA)	2018/12/21	2.0		%	30
			Perfluorooctane Sulfonamide (PFOSA)	2018/12/21	4.4		%	30
			Perfluoropentanoic Acid (PFPeA)	2018/12/21	0.78		%	30
			Perfluorotetradecanoic Acid	2018/12/21	1.1		%	30
			Perfluorotridecanoic Acid	2018/12/21	0.58		%	30
			Perfluoroundecanoic Acid (PFUnA)	2018/12/21	12		%	30
			Perfluorodecanoic Acid (PFDA)	2018/12/21	13		%	30
			Perfluorododecanoic Acid (PFDoA)	2018/12/21	5.7		%	30
			Perfluoro-n-Octanoic Acid (PFOA)	2018/12/21	6.3		%	30
			Perfluorooctane Sulfonate (PFOS)	2018/12/21	5.1		%	30
5899483	JDA	Method Blank	13C2-6:2 Fluorotelomer sulfonate	2018/12/21		69	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2018/12/21		85	%	50 - 150
			13C2-Perfluorodecanoic acid	2018/12/21		92	%	50 - 150
			13C2-Perfluorododecanoic acid	2018/12/21		91	%	50 - 150
			13C2-Perfluorohexanoic acid	2018/12/21		91	%	50 - 150
			13C2-perfluorotetradecanoic acid	2018/12/21		87	%	50 - 150
			13C2-Perfluoroundecanoic acid	2018/12/21		101	%	50 - 150
			13C4-Perfluorobutanoic acid	2018/12/21		89	%	50 - 150
			13C4-Perfluoroheptanoic acid	2018/12/21		90	%	50 - 150
			13C4-Perfluorooctanesulfonate	2018/12/21		85	%	50 - 150
			13C4-Perfluorooctanoic acid	2018/12/21		89	%	50 - 150
			13C5-Perfluorononanoic acid	2018/12/21		82	%	50 - 150
			13C5-Perfluoropentanoic acid	2018/12/21		91	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2018/12/21		78	%	50 - 150
			18O2-Perfluorohexanesulfonate	2018/12/21		74	%	50 - 150
			6:2 Fluorotelomer sulfonate	2018/12/21	0.0066 U, MDL=0.0066		ug/L	
			8:2 Fluorotelomer sulfonate	2018/12/21	0.0066 U, MDL=0.0066		ug/L	
			Perfluorobutanoic acid	2018/12/21	0.0055 U, MDL=0.0055		ug/L	
			Perfluorobutane Sulfonate (PFBS)	2018/12/21	0.0054 U, MDL=0.0054		ug/L	

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluorodecane Sulfonate	2018/12/21	0.0060 U, MDL=0.0060		ug/L	
			Perfluoroheptanoic Acid (PFHpA)	2018/12/21	0.0074 U, MDL=0.0074		ug/L	
			Perfluorohexanoic Acid (PFHxA)	2018/12/21	0.0035 U, MDL=0.0035		ug/L	
			Perfluorohexane Sulfonate (PFHxS)	2018/12/21	0.0056 U, MDL=0.0056		ug/L	
			Perfluorononanoic Acid (PFNA)	2018/12/21	0.0087 U, MDL=0.0087		ug/L	
			Perfluorooctane Sulfonamide (PFOSA)	2018/12/21	0.0034 U, MDL=0.0034		ug/L	
			Perfluoropentanoic Acid (PFPeA)	2018/12/21	0.0075 U, MDL=0.0075		ug/L	
			Perfluorotetradecanoic Acid	2018/12/21	0.0027 U, MDL=0.0027		ug/L	
			Perfluorotridecanoic Acid	2018/12/21	0.0038 U, MDL=0.0038		ug/L	
			Perfluoroundecanoic Acid (PFUnA)	2018/12/21	0.0025 U, MDL=0.0025		ug/L	
			Perfluorodecanoic Acid (PFDA)	2018/12/21	0.0061 U, MDL=0.0061		ug/L	
			Perfluorododecanoic Acid (PFDoA)	2018/12/21	0.0050 U, MDL=0.0050		ug/L	
			Perfluoro-n-Octanoic Acid (PFOA)	2018/12/21	0.0033 U, MDL=0.0033		ug/L	
			Perfluorooctane Sulfonate (PFOS)	2018/12/21	0.0060 U, MDL=0.0060		ug/L	

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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Maxxam Job #: B8X2497
Report Date: 2018/12/28

ESS Laboratory
Client Project #: 1812231
Your P.O. #: B02623

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Colm McNamara, Senior Analyst, Liquid Chromatography

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

ESS Laboratory

Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1812231

Turn Time STANDARD Rush
Regulatory State MA
Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP

Reporting Limits GW-1

Electonic Deliverables ☑Limit Checker ☑Standard Excel ☑Other (Please Specify →) PDF

Company Name	Project #	Project Name
HORSLEY WITTEN GROUP	17027	BARN. ON CALL #4

Contact Person	Address
JOSEPHINE IBANEZ	90 ROUTE 6A, UNIT 1

City	State	Zip Code	PO #
SANDWICH	MA	02563	

Telephone Number	FAX Number	Email Address
508-833-6600	508-833-3150	jibanez@horsleywitten.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: PFAS-Full List	Analysis: 1,4 Dioxane (SIM)
1	12/7/18	1500	GRAB	GW	OW-18S	X	
2	↓	1430	↓	↓	OW-18M	X	
3		1315			OW-18D	X	X
4	↓	1620	↓	↓	OW-19D		X

Container Type:	AC-Air Cassette	AG-Amber Glass	B-BOD Bottle	C-Cubitainer	G - Glass	O-Other	P-Poly	S-Sterile	V-Vial	P	AG
Container Volume:	1-100 mL	2-2.5 gal	3-250 mL	4-300 mL	5-500 mL	6-1L	7-VOA	8-2 oz	9-4 oz	10-8 oz	11-Other*	1	6
Preservation Code:	1-Non Preserved	2-HCl	3-H2SO4	4-HNO3	5-NaOH	6-Methanol	7-Na2S2O3	8-ZnAce, NaOH	9-NH4Cl	10-DI H2O	11-Ascorbic Acid	12-Other*	1	1
											Number of Containers per Sample:		1	2

Laboratory Use Only
Cooler Present: ✓
Seals Intact: ____
Cooler Temperature: 2.6 °C ICE RC

Sampled by: HW

Comments: Please specify "Other" preservative and containers types in this space
Limit Checker for 1,4 Dioxane results

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
12/8/18 1000	HW Fridge 12/8/18 1000	HW FRIDGE 12/10/18 1330	12/10/18 1330
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
12/10/18 1508	12/8/18 1553		

CERTIFICATE OF ANALYSIS

Josphine Ibanez
Horsley & Witten
90 Route 6A
Sandwich, MA 02563

RE: Barn On-Call No. 4 (17027)
ESS Laboratory Work Order Number: 1812232

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 2:50 pm, Jan 28, 2019

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analvses

Boston University Stable Isotipe Lboratory - Boston, MA	Isotopic - Compound Specific

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812232

SAMPLE RECEIPT

The following samples were received on December 10, 2018 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
1812232-01	OW-18 S	Ground Water	SUB
1812232-02	OW-18 M	Ground Water	SUB
1812232-03	OW-18 D	Ground Water	SUB

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1812232

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812232

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-18 S
Date Sampled: 12/07/18 15:00

ESS Laboratory Work Order: 1812232
ESS Laboratory Sample ID: 1812232-01
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-18 M
Date Sampled: 12/07/18 14:30

ESS Laboratory Work Order: 1812232
ESS Laboratory Sample ID: 1812232-02
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: OW-18 D
Date Sampled: 12/07/18 13:15

ESS Laboratory Work Order: 1812232
ESS Laboratory Sample ID: 1812232-03
Sample Matrix: Ground Water

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Isotopic - Compound Specific	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1812232

Notes and Definitions

Z-08	See Attached
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812232

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

BOSTON UNIVERSITY STABLE ISOTOPE LABORATORY

Data Sheet ^{18}O Water

Date: 28 January 2019
Client: Kevin Braga
Project: ESS Laboratory
Data emailed: 1/28/19
Samples Returned/Archived:
Data Location: MF 79-79a

Samples arrived: 11/14/18; 12/10/18
Job Number: 18OH 65; 18OH 74
Comments: combined 2 jobs
File name: br18OH65 18OH74.xls

Data normalized to V-SMOW/SLAP scale

Volume Water used: 100 ul per sample

IMPORTANT DISCLAIMER: Due to a quirk in Excel, numbers are shown to 9 decimal places.
Values MUST be rounded to 2 decimal places. The accuracy of the data are reliable to 2 decimal places ONLY.

Sample ID	δ^{18}O (V-SMOW)	Atm %	Comments
IAEA OH-14	-5.64	0.19899	
IAEA OH-15	-9.59	0.19820	
1811299-2	-6.92	0.19874	
1811299-2	-6.77	0.19877	
1811299-4	-6.79	0.19876	
1811299-4	-6.85	0.19875	
1811299-5	-6.90	0.19874	
1811299-5	-6.88	0.19875	
1811299-7	-2.67	0.19959	
1811299-7	-2.61	0.19960	
1812198-1	-6.74	0.19877	
1812198-1	-6.93	0.19874	
1812198-2	-7.53	0.19861	
1812198-2	-7.57	0.19861	
1812198-3	-7.18	0.19868	
1812198-3	-7.45	0.19863	
1812198-4	-7.29	0.19866	
1812198-4	-7.41	0.19864	
1812198-5	-7.76	0.19857	
1812198-5	-7.71	0.19858	
Antarc IC	-29.83	0.19416	
1812198-6	-7.52	0.19862	
1812198-6	-7.57	0.19861	
1812198-7	-7.13	0.19870	
1812198-7	-7.24	0.19867	
1812232-1	-7.58	0.19860	
1812232-1	-7.54	0.19861	
1812232-2	-6.95	0.19873	
1812232-2	-6.89	0.19874	
1812232-3	-7.28	0.19867	
1812232-3	-7.36	0.19865	
IAEA OH-16	-15.72	0.19698	

Expected Values:	
IAEA OH-14	**-5.60**
IAEA OH-15	**-9.41**
IAEA OH-16	**-15.41**
Ant. IC	**-30.00**

BOSTON UNIVERSITY STABLE ISOTOPE LABORATORY

Client Data Sheet ^{2}H Water

Date: 22 January 2019
Client: Kevin Braga
Project: ESS Laboratory
Data emailed: 1/28/19
Samples Returned/Archived:
Data Location: MF 79-79a
Volume Water used: 100 ul per sample

Samples arrived: 11/14/18; 12/10/18
Job Number: 18OH 65; 18OH 74
Comments: combined 2 jobs
File name: br18OH65 18OH74.xls

Data normalized to VSMOW/SLAP scale

IMPORTANT DISCLAIMER: Due to a quirk in Excel, numbers are shown to 9 decimal places.
Values MUST be rounded to 2 decimal places. The accuracy of the data are reliable to 2 decimal places ONLY.

Sample ID	δD (V-SMOW)	Atm %	Comments
IAEA OH-14	-37.45	0.01499	
IAEA OH-15	-77.89	0.01436	
1811299-2	-40.41	0.01494	
1811299-2	-40.17	0.01495	
1811299-4	-38.56	0.01497	
1811299-4	-38.87	0.01497	
1811299-5	-38.28	0.01498	
1811299-5	-38.15	0.01498	
1811299-7	-18.65	0.01528	
1811299-7	-20.42	0.01526	
1811299-7	-23.04	0.01521	
1812198-1	-38.19	0.01498	
1812198-1	-37.87	0.01498	
1812198-2	-44.34	0.01488	
1812198-2	-44.39	0.01488	
1812198-3	-44.15	0.01489	
1812198-3	-44.56	0.01488	
1812198-4	-41.86	0.01492	
1812198-4	-42.94	0.01490	
1812198-5	-47.91	0.01483	
1812198-5	-46.82	0.01484	
1812198-5	-47.20	0.01484	
1812198-6	-45.58	0.01486	
1812198-6	-45.48	0.01487	
1812198-7	-41.44	0.01493	
1812198-7	-43.40	0.01490	
1812232-1	-49.29	0.01481	
1812232-1	-49.66	0.01480	
1812232-2	-42.64	0.01491	
1812232-2	-42.57	0.01491	
1812232-3	-44.76	0.01488	*
1812232-3	-41.61	0.01493	*

Expected Values:	
IAEA OH-1	**-37.70**
IAEA OH-1	**-78.00**
IAEA OH-1	**-113.80**
Ant. IC	**-239.69**

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Horsley Witten Group - KPB/HDM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1812232
Date Received: 12/10/2018
Project Due Date: 12/17/2018
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 2.6 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / (NA)
10. Were any analyses received outside of hold time? Yes / (No)

11. Any Subcontracting needed? (Yes) / No
    ESS Sample IDs: **1--3**
    Analysis: **Isotopic**
    TAT: **5 day**
12. Were VOAs received? Yes / (No)
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / NA
13. Are the samples properly preserved? (Yes) / No
    a. If metals preserved upon receipt: Date: ____ Time: ____ By: ____
    b. Low Level VOA vials frozen: Date: ____ Time: ____ By: ____

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / (No)
    a. Was there a need to contact the client? Yes / (No)
    Who was contacted? ____ Date: ____ Time: ____ By: ____

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
01	300767	Yes	NA	Yes	Other Poly - Unpres	NP	
02	300766	Yes	NA	Yes	Other Poly - Unpres	NP	
03	300765	Yes	NA	Yes	Other Poly - Unpres	NP	

2nd Review
Are barcode labels on correct containers? (Yes) / No
Are all necessary stickers attached? (Yes) / No

Completed By: ____ Date & Time: 12/10/18 2003
Reviewed By: ____ Date & Time: 12/10/18 2007
Delivered By: ____ 12/10/18 2007

ESS Laboratory **BU**

Division of Thielsch Engineering, Inc.

185 Frances Avenue, Cranston RI 02910-2211
Tel. (401)461-7181 Fax (401)461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1812232

Turn Time ___X__Standard Other_____

Reporting Limits - ___GW-1_____

Regulatory State: **MA** RI CT NH NJ NY ME Other_____

Electonic Deliverables Excel Access PDF

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Co. Name: ESS Laboratory	Project #:	Project Name: 1812232	
Contact Person: Shawn Morrell	Proj. Location:		
Address:	City , State:	Zip:	PO #:
Tel. ext 3083	email: smorrell@thielsch.com		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis		Stable Isotope for Hydrogen and Oxygen								
	12/7/18	1500	G	GW	1812232-01	1	1	P				X								
	12/7/18	1430	G	GW	1812232-02	1	1	P				X								
	12/7/18	1315	G	GW	1812232-03	1	1	P				X								

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_____

Cooler Present _____Yes _____No

Internal Use Only

Seals Intact ____ Yes _____No NA:____

[ ] Pickup

Cooler Temperature:

[ ] Technician

Sampled by :

Comments:

Relinquished by: (Signature, Date & Time) 12/12/18 1310	Received by: (Signature, Date & Time) 12/12/18 1320	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)

collected in accordance with MADEP CAM VIIA

Report Method Blank & Laboratory Control Sample Results

5 Cummington Mall
Boston MA 02215

CERTIFICATE OF ANALYSIS

Josphine Ibanez
Horsley & Witten
90 Route 6A
Sandwich, MA 02563

RE: Barn On-Call No. 4 (17027)
ESS Laboratory Work Order Number: 1812487

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 4:25 pm, Jan 18, 2019

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses
Maxxam Analytics - Cheektowaga, NY PFAS

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812487

SAMPLE RECEIPT

The following samples were received on December 19, 2018 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
1812487-01	1991 A-B	Soil	SUB
1812487-02	1991 C-D	Soil	SUB

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812487

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812487

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 04-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: 1991 A-B
Date Sampled: 12/14/18 11:15

ESS Laboratory Work Order: 1812487
ESS Laboratory Sample ID: 1812487-01
Sample Matrix: Soil

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFAS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4
Client Sample ID: 1991 C-D
Date Sampled: 12/14/18 12:14

ESS Laboratory Work Order: 1812487
ESS Laboratory Sample ID: 1812487-02
Sample Matrix: Soil

Subcontracted Analysis

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
PFAS	**See Attached** (N/A)								

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4 ESS Laboratory Work Order: 1812487

Notes and Definitions

Z-08	See Attached
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Horsley & Witten
Client Project ID: Barn On-Call No. 4

ESS Laboratory Work Order: 1812487

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

Your P.O. #: B02623
Your Project #: 1812487
Your C.O.C. #: NA

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2019/01/17
Report #: R5561235
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8Y2990
Received: 2018/12/21, 13:07

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Moisture	2	N/A	2018/12/24	CAM SOP-00445	Carter 2nd ed 51.2 m
PFOS and PFOA in soil by SPE/LCMS (1)	2	2019/01/08	2019/01/17	CAM SOP-00894	EPA537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

U = Undetected at the limit of quantitation.
J = Estimated concentration between the EDL & RDL.
B = Blank Contamination.
Q = One or more quality control criteria failed.
E = Analyte concentration exceeds the maximum concentration level.
K = Estimated maximum possible concentration due to ion abundance ratio failure.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your P.O. #: B02623
Your Project #: 1812487
Your C.O.C. #: NA

Attention: Shawn Morrell

ESS Laboratory
185 Frances Ave
Cranston, RI
USA 02910

Report Date: 2019/01/17
Report #: R5561235
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8Y2990
Received: 2018/12/21, 13:07

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: SPollen@maxxam.ca
Phone# (905) 817-5700

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B8Y2990
Report Date: 2019/01/17

ESS Laboratory
Client Project #: 1812487
Your P.O. #: B02623

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IPT152	IPT153			
Sampling Date		2018/12/14 11:15	2018/12/14 12:19			
COC Number		NA	NA			
	UNITS	1812487-01	1812487-02	RDL	MDL	QC Batch
Inorganics						
Moisture	%	2.8	6.0	1.0	0.50	5904160
Miscellaneous Parameters						
6:2 Fluorotelomer sulfonate	ug/kg	0.26 U	0.26 U	1.0	0.26	5918143
8:2 Fluorotelomer sulfonate	ug/kg	0.33 U	0.33 U	1.0	0.33	5918143
EtFOSA	ug/kg	0.65 U	0.65 U	1.0	0.65	5918143
EtFOSAA	ug/kg	0.15 U	0.15 U	1.0	0.15	5918143
EtFOSE	ug/kg	0.41 U	0.41 U	1.0	0.41	5918143
MeFOSA	ug/kg	0.60 U	0.60 U	1.0	0.60	5918143
MeFOSAA	ug/kg	0.26 U	0.26 U	1.0	0.26	5918143
MeFOSE	ug/kg	0.31 U	0.31 U	1.0	0.31	5918143
Perfluorobutane Sulfonate (PFBS)	ug/kg	0.17 U	0.17 U	1.0	0.17	5918143
Perfluorobutanoic acid	ug/kg	0.23 U	0.23 U	1.0	0.23	5918143
Perfluorodecane Sulfonate	ug/kg	0.39 U	0.39 U	1.0	0.39	5918143
Perfluorodecanoic Acid (PFDA)	ug/kg	0.28 U	0.28 U	1.0	0.28	5918143
Perfluorododecanoic Acid (PFDoA)	ug/kg	0.28 U	0.28 U	1.0	0.28	5918143
Perfluoroheptane sulfonate	ug/kg	0.39 U	0.39 U	1.0	0.39	5918143
Perfluoroheptanoic Acid (PFHpA)	ug/kg	0.19 U	0.19 U	1.0	0.19	5918143
Perfluorohexane Sulfonate (PFHxS)	ug/kg	0.24 U	0.24 U	1.0	0.24	5918143
Perfluorohexanoic Acid (PFHxA)	ug/kg	0.14 U	0.14 U	1.0	0.14	5918143
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	0.25 U	0.25 U	1.0	0.25	5918143
Perfluorononanoic Acid (PFNA)	ug/kg	0.22 U	0.22 U	1.0	0.22	5918143
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	0.14 U	0.14 U	1.0	0.14	5918143
Perfluorooctane Sulfonate (PFOS)	ug/kg	0.30 J	0.42 J	1.0	0.26	5918143
Perfluoropentanoic Acid (PFPeA)	ug/kg	0.25 U	0.25 U	1.0	0.25	5918143
Perfluorotetradecanoic Acid	ug/kg	0.31 U	0.31 U	1.0	0.31	5918143
Perfluorotridecanoic Acid	ug/kg	0.33 U	0.33 U	1.0	0.33	5918143
Perfluoroundecanoic Acid (PFUnA)	ug/kg	0.34 U	0.34 U	1.0	0.34	5918143
Surrogate Recovery (%)						
13C2-6:2 Fluorotelomer sulfonate	%	88	85	N/A	N/A	5918143
13C2-8:2 Fluorotelomer sulfonate	%	73	80	N/A	N/A	5918143
13C2-Perfluorodecanoic acid	%	81	75	N/A	N/A	5918143
13C2-Perfluorododecanoic acid	%	80	71	N/A	N/A	5918143
13C2-Perfluorohexanoic acid	%	86	86	N/A	N/A	5918143
13C2-perfluorotetradecanoic acid	%	75	74	N/A	N/A	5918143

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8Y2990
Report Date: 2019/01/17

ESS Laboratory
Client Project #: 1812487
Your P.O. #: B02623

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IPT152	IPT153			
Sampling Date		2018/12/14 11:15	2018/12/14 12:19			
COC Number		NA	NA			
	UNITS	1812487-01	1812487-02	RDL	MDL	QC Batch
13C2-Perfluoroundecanoic acid	%	81	74	N/A	N/A	5918143
13C4-Perfluorobutanoic acid	%	86	86	N/A	N/A	5918143
13C4-Perfluoroheptanoic acid	%	88	87	N/A	N/A	5918143
13C4-Perfluorooctanesulfonate	%	84	76	N/A	N/A	5918143
13C4-Perfluorooctanoic acid	%	84	84	N/A	N/A	5918143
13C5-Perfluorononanoic acid	%	84	84	N/A	N/A	5918143
13C5-Perfluoropentanoic acid	%	87	87	N/A	N/A	5918143
13C8-Perfluorooctane Sulfonamide	%	74	74	N/A	N/A	5918143
18O2-Perfluorohexanesulfonate	%	82	78	N/A	N/A	5918143
D3-MeFOSAA	%	80	72	N/A	N/A	5918143
D5-EtFOSAA	%	75	72	N/A	N/A	5918143
D7-MeFOSE	%	69	63	N/A	N/A	5918143
D9-EtFOSE	%	67	62	N/A	N/A	5918143

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8Y2990
Report Date: 2019/01/17

ESS Laboratory
Client Project #: 1812487
Your P.O. #: B02623

TEST SUMMARY

Maxxam ID: IPT152
Sample ID: 1812487-01
Matrix: Soil

Collected: 2018/12/14
Shipped:
Received: 2018/12/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5904160	N/A	2018/12/24	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5918143	2019/01/08	2019/01/17	Marian Godax

Maxxam ID: IPT153
Sample ID: 1812487-02
Matrix: Soil

Collected: 2018/12/14
Shipped:
Received: 2018/12/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5904160	N/A	2018/12/24	Prgya Panchal
PFOS and PFOA in soil by SPE/LCMS	LCMS	5918143	2019/01/08	2019/01/17	Marian Godax

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

GENERAL COMMENTS

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
5904160	JS9	RPD - Sample/Sample Dup	Moisture	2018/12/24	2.2		%	20
5918143	M_G	Matrix Spike	13C2-6:2 Fluorotelomer sulfonate	2019/01/17		68	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2019/01/17		72	%	50 - 150
			13C2-Perfluorodecanoic acid	2019/01/17		67	%	50 - 150
			13C2-Perfluorododecanoic acid	2019/01/17		64	%	50 - 150
			13C2-Perfluorohexanoic acid	2019/01/17		75	%	50 - 150
			13C2-perfluorotetradecanoic acid	2019/01/17		64	%	50 - 150
			13C2-Perfluoroundecanoic acid	2019/01/17		67	%	50 - 150
			13C4-Perfluorobutanoic acid	2019/01/17		73	%	50 - 150
			13C4-Perfluoroheptanoic acid	2019/01/17		74	%	50 - 150
			13C4-Perfluorooctanesulfonate	2019/01/17		72	%	50 - 150
			13C4-Perfluorooctanoic acid	2019/01/17		72	%	50 - 150
			13C5-Perfluorononanoic acid	2019/01/17		74	%	50 - 150
			13C5-Perfluoropentanoic acid	2019/01/17		74	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2019/01/17		60	%	50 - 150
			18O2-Perfluorohexanesulfonate	2019/01/17		74	%	50 - 150
			6:2 Fluorotelomer sulfonate	2019/01/17		132 (1)	%	70 - 130
			8:2 Fluorotelomer sulfonate	2019/01/17		100	%	70 - 130
			D3-MeFOSAA	2019/01/17		60	%	50 - 150
			D5-EtFOSAA	2019/01/17		62	%	50 - 150
			D7-MeFOSE	2019/01/17		47 (2)	%	50 - 150
			D9-EtFOSE	2019/01/17		47 (3)	%	50 - 150
			EtFOSA	2019/01/17		91	%	70 - 130
			EtFOSAA	2019/01/17		98	%	70 - 130
			EtFOSE	2019/01/17		99	%	70 - 130
			MeFOSA	2019/01/17		92	%	70 - 130
			MeFOSAA	2019/01/17		103	%	70 - 130
			MeFOSE	2019/01/17		101	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2019/01/17		98	%	70 - 130
			Perfluorobutanoic acid	2019/01/17		99	%	70 - 130
			Perfluorodecane Sulfonate	2019/01/17		97	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2019/01/17		105	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2019/01/17		104	%	70 - 130
			Perfluoroheptane sulfonate	2019/01/17		98	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2019/01/17		97	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2019/01/17		97	%	70 - 130
			Perfluorotetradecanoic Acid	2019/01/17		102	%	70 - 130
			Perfluorotridecanoic Acid	2019/01/17		105	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2019/01/17		105	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2019/01/17		100	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2019/01/17		98	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2019/01/17		99	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2019/01/17		103	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2019/01/17		109	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2019/01/17		96	%	70 - 130
5918143	M_G	Spiked Blank	13C2-6:2 Fluorotelomer sulfonate	2019/01/17		84	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2019/01/17		88	%	50 - 150
			13C2-Perfluorodecanoic acid	2019/01/17		94	%	50 - 150
			13C2-Perfluorododecanoic acid	2019/01/17		89	%	50 - 150
			13C2-Perfluorohexanoic acid	2019/01/17		88	%	50 - 150
			13C2-perfluorotetradecanoic acid	2019/01/17		82	%	50 - 150
			13C2-Perfluoroundecanoic acid	2019/01/17		92	%	50 - 150
			13C4-Perfluorobutanoic acid	2019/01/17		90	%	50 - 150
			13C4-Perfluoroheptanoic acid	2019/01/17		90	%	50 - 150

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			13C4-Perfluorooctanesulfonate	2019/01/17		83	%	50 - 150
			13C4-Perfluorooctanoic acid	2019/01/17		86	%	50 - 150
			13C5-Perfluorononanoic acid	2019/01/17		87	%	50 - 150
			13C5-Perfluoropentanoic acid	2019/01/17		88	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2019/01/17		76	%	50 - 150
			18O2-Perfluorohexanesulfonate	2019/01/17		84	%	50 - 150
			6:2 Fluorotelomer sulfonate	2019/01/17		107	%	70 - 130
			8:2 Fluorotelomer sulfonate	2019/01/17		98	%	70 - 130
			D3-MeFOSAA	2019/01/17		81	%	50 - 150
			D5-EtFOSAA	2019/01/17		74	%	50 - 150
			D7-MeFOSE	2019/01/17		65	%	50 - 150
			D9-EtFOSE	2019/01/17		60	%	50 - 150
			EtFOSA	2019/01/17		100	%	70 - 130
			EtFOSAA	2019/01/17		102	%	70 - 130
			EtFOSE	2019/01/17		102	%	70 - 130
			MeFOSA	2019/01/17		90	%	70 - 130
			MeFOSAA	2019/01/17		100	%	70 - 130
			MeFOSE	2019/01/17		101	%	70 - 130
			Perfluorobutane Sulfonate (PFBS)	2019/01/17		105	%	70 - 130
			Perfluorobutanoic acid	2019/01/17		101	%	70 - 130
			Perfluorodecane Sulfonate	2019/01/17		95	%	70 - 130
			Perfluorodecanoic Acid (PFDA)	2019/01/17		99	%	70 - 130
			Perfluorododecanoic Acid (PFDoA)	2019/01/17		101	%	70 - 130
			Perfluoroheptane sulfonate	2019/01/17		96	%	70 - 130
			Perfluorononanoic Acid (PFNA)	2019/01/17		104	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2019/01/17		104	%	70 - 130
			Perfluorotetradecanoic Acid	2019/01/17		109	%	70 - 130
			Perfluorotridecanoic Acid	2019/01/17		108	%	70 - 130
			Perfluoroundecanoic Acid (PFUnA)	2019/01/17		102	%	70 - 130
			Perfluoroheptanoic Acid (PFHpA)	2019/01/17		100	%	70 - 130
			Perfluorohexane Sulfonate (PFHxS)	2019/01/17		105	%	70 - 130
			Perfluorohexanoic Acid (PFHxA)	2019/01/17		103	%	70 - 130
			Perfluoro-n-Octanoic Acid (PFOA)	2019/01/17		107	%	70 - 130
			Perfluorooctane Sulfonate (PFOS)	2019/01/17		104	%	70 - 130
			Perfluoropentanoic Acid (PFPeA)	2019/01/17		99	%	70 - 130
5918143	M_G	Method Blank	13C2-6:2 Fluorotelomer sulfonate	2019/01/17		90	%	50 - 150
			13C2-8:2 Fluorotelomer sulfonate	2019/01/17		85	%	50 - 150
			13C2-Perfluorodecanoic acid	2019/01/17		86	%	50 - 150
			13C2-Perfluorododecanoic acid	2019/01/17		77	%	50 - 150
			13C2-Perfluorohexanoic acid	2019/01/17		86	%	50 - 150
			13C2-perfluorotetradecanoic acid	2019/01/17		74	%	50 - 150
			13C2-Perfluoroundecanoic acid	2019/01/17		81	%	50 - 150
			13C4-Perfluorobutanoic acid	2019/01/17		87	%	50 - 150
			13C4-Perfluoroheptanoic acid	2019/01/17		87	%	50 - 150
			13C4-Perfluorooctanesulfonate	2019/01/17		83	%	50 - 150
			13C4-Perfluorooctanoic acid	2019/01/17		85	%	50 - 150
			13C5-Perfluorononanoic acid	2019/01/17		81	%	50 - 150
			13C5-Perfluoropentanoic acid	2019/01/17		88	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2019/01/17		71	%	50 - 150
			18O2-Perfluorohexanesulfonate	2019/01/17		89	%	50 - 150
			6:2 Fluorotelomer sulfonate	2019/01/17	0.26 U, MDL=0.26		ug/kg	
			8:2 Fluorotelomer sulfonate	2019/01/17	0.33 U, MDL=0.33		ug/kg	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			D3-MeFOSAA	2019/01/17		79	%	50 - 150
			D5-EtFOSAA	2019/01/17		76	%	50 - 150
			D7-MeFOSE	2019/01/17		61	%	50 - 150
			D9-EtFOSE	2019/01/17		60	%	50 - 150
			EtFOSA	2019/01/17	0.65 U, MDL=0.65		ug/kg	
			EtFOSAA	2019/01/17	0.15 U, MDL=0.15		ug/kg	
			EtFOSE	2019/01/17	0.41 U, MDL=0.41		ug/kg	
			MeFOSA	2019/01/17	0.60 U, MDL=0.60		ug/kg	
			MeFOSAA	2019/01/17	0.26 U, MDL=0.26		ug/kg	
			MeFOSE	2019/01/17	0.31 U, MDL=0.31		ug/kg	
			Perfluorobutane Sulfonate (PFBS)	2019/01/17	0.17 U, MDL=0.17		ug/kg	
			Perfluorobutanoic acid	2019/01/17	0.23 U, MDL=0.23		ug/kg	
			Perfluorodecane Sulfonate	2019/01/17	0.39 U, MDL=0.39		ug/kg	
			Perfluorodecanoic Acid (PFDA)	2019/01/17	0.28 U, MDL=0.28		ug/kg	
			Perfluorododecanoic Acid (PFDoA)	2019/01/17	0.28 U, MDL=0.28		ug/kg	
			Perfluoroheptane sulfonate	2019/01/17	0.39 U, MDL=0.39		ug/kg	
			Perfluorononanoic Acid (PFNA)	2019/01/17	0.22 U, MDL=0.22		ug/kg	
			Perfluorooctane Sulfonamide (PFOSA)	2019/01/17	0.14 U, MDL=0.14		ug/kg	
			Perfluorotetradecanoic Acid	2019/01/17	0.31 U, MDL=0.31		ug/kg	
			Perfluorotridecanoic Acid	2019/01/17	0.33 U, MDL=0.33		ug/kg	
			Perfluoroundecanoic Acid (PFUnA)	2019/01/17	0.34 U, MDL=0.34		ug/kg	
			Perfluoroheptanoic Acid (PFHpA)	2019/01/17	0.19 U, MDL=0.19		ug/kg	
			Perfluorohexane Sulfonate (PFHxS)	2019/01/17	0.24 U, MDL=0.24		ug/kg	
			Perfluorohexanoic Acid (PFHxA)	2019/01/17	0.14 U, MDL=0.14		ug/kg	
			Perfluoro-n-Octanoic Acid (PFOA)	2019/01/17	0.25 U, MDL=0.25		ug/kg	
			Perfluorooctane Sulfonate (PFOS)	2019/01/17	0.26 U, MDL=0.26		ug/kg	
			Perfluoropentanoic Acid (PFPeA)	2019/01/17	0.25 U, MDL=0.25		ug/kg	
5918143	M_G	RPD - Sample/Sample Dup	6:2 Fluorotelomer sulfonate	2019/01/17	15		%	30
			8:2 Fluorotelomer sulfonate	2019/01/17	24		%	30
			EtFOSA	2019/01/17	NC		%	30
			EtFOSAA	2019/01/17	NC		%	30
			EtFOSE	2019/01/17	NC		%	30

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			MeFOSA	2019/01/17	NC		%	30
			MeFOSAA	2019/01/17	NC		%	30
			MeFOSE	2019/01/17	NC		%	30
			Perfluorobutane Sulfonate (PFBS)	2019/01/17	NC		%	30
			Perfluorobutanoic acid	2019/01/17	NC		%	30
			Perfluorodecane Sulfonate	2019/01/17	NC		%	30
			Perfluorodecanoic Acid (PFDA)	2019/01/17	NC		%	30
			Perfluorododecanoic Acid (PFDoA)	2019/01/17	NC		%	30
			Perfluoroheptane sulfonate	2019/01/17	NC		%	30
			Perfluorononanoic Acid (PFNA)	2019/01/17	NC		%	30
			Perfluorooctane Sulfonamide (PFOSA)	2019/01/17	NC		%	25
			Perfluorotetradecanoic Acid	2019/01/17	NC		%	30
			Perfluorotridecanoic Acid	2019/01/17	NC		%	30
			Perfluoroundecanoic Acid (PFUnA)	2019/01/17	NC		%	30
			Perfluoroheptanoic Acid (PFHpA)	2019/01/17	NC		%	30
			Perfluorohexane Sulfonate (PFHxS)	2019/01/17	NC		%	30
			Perfluorohexanoic Acid (PFHxA)	2019/01/17	NC		%	30
			Perfluoro-n-Octanoic Acid (PFOA)	2019/01/17	NC		%	30
			Perfluorooctane Sulfonate (PFOS)	2019/01/17	NC		%	30
			Perfluoropentanoic Acid (PFPeA)	2019/01/17	NC		%	30

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery of the matrix spike was above the upper control limit. Laboratory spiked soil resulted in satisfactory recovery of the compound of interest. When considered together, these QC data suggest that matrix interferences may be biasing the data high. For results that were not detected (ND), this potential bias has no impact.

(2) Extracted internal standard analyte recovery was below the defined lower control limit (LCL). Laboratory spiked soil resulted in satisfactory recovery of the extracted internal standard analyte. When considered together, these QC data suggest that matrix interferences may be biasing the data low. Because quantitation is performed using isotope dilution techniques, any losses of the native compound that may occur during any of the sample preparation, extraction, cleanup or determinative steps will be mirrored by a similar loss of the labeled standard, and as such can be accounted for and corrected. Therefore, the quantification of these target compounds is not affected by the low extracted internal standard analyte recovery.

(3) cted internal standard analyte recovery was below the defined lower control limit (LCL). Laboratory spiked soil resulted in satisfactory recovery of the extracted internal standard analyte. When considered together, these QC data suggest that matrix interferences may be biasing the data low. Because quantitation is performed using isotope dilution techniques, any losses of the native compound that may occur during any of the sample preparation, extraction, cleanup or determinative steps will be mirrored by a similar loss of the labeled standard, and as such can be accounted for and corrected. Therefore, the quantification of these target compounds is not affected by the low extracted internal standard analyte recovery.

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Maxxam Job #: B8Y2990
Report Date: 2019/01/17

ESS Laboratory
Client Project #: 1812487
Your P.O. #: B02623

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Sin Chii Chia, Scientific Services

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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ESS Laboratory

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CHAIN OF CUSTODY

ESS Lab # 1812487

Turn Time STANDARD Rush
Regulatory State MA
Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP
Reporting Limits GW-1 / S-1
Electonic Deliverables ☐Limit Checker ☑Standard Excel ☑Other (Please Specify →) PDF

Company Name	Project #	Project Name
HORSLEY WITTEN GROUP	17027	BARN. ON CAPE #4

Contact Person	Address
JOSEPHINE IBANEZ	90 ROUTE 6A, UNIT 1

City	State	Zip Code	PO #
SANDWICH	MA	02563	

Telephone Number	FAX Number	Email Address
508-833-6600	508-833-3150	jibanez@horsleywitten.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: PFAS-Full List
1	12/14/18	1115	GRAB	SOIL	1991 A-B	X
2	12/14/18	1214	GRAB	SOIL	1991 C-D	X

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer G - Glass O-Other P-Poly S-Sterile V-Vial — P
Container Volume: 1-100 mL 2-2.5 gal 3-250 ml 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other* — 3
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Ascorbic Acid 12-Other* — 1
Number of Containers per Sample: 1

Laboratory Use Only
Cooler Present: ✓
Seals Intact: ____
Cooler Temperature: 1.1 °C ICE RC

Sampled by : HW

Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
12/14/18 1340	HW FRIDGE 12/14/18 1340	HW FRIDGE 12/19/18 1000	12/19/18 1050
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
12/19/18 1524	12/19/18 1946		

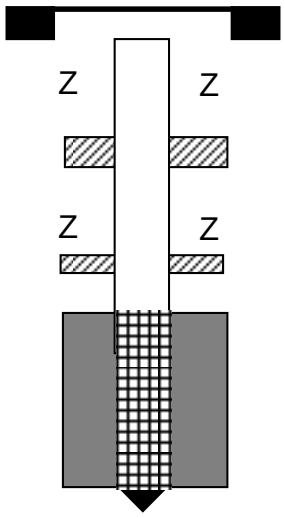
APPENDIX B

Cape Cod Test Boring	Project	Boring No. HW-G(s)
5 Rayber Road, Orleans, MA 02653	Horsley Witten Group	
(508) 240-1000	Barnstable, 480 Barnstable Road	Sheet 1 of 1
div. Desmond Well Drilling, Inc.	Hyannis, MA	

Driller: Tommy Desmond	Boring location:
Helper: Sean Morgan	Ground Surface Elevation:
Inspector: Josephine Ibanez	Date start: 10/3/2018 Date end: 10/3/2018

Sampler consists of a two inch split spoon driven using a 140 lb. hammer falling thirty inches	Notes: Shallow	Auger Size: 6 1/4" x 4" H.S.A Casing Size: 2"x18.45' SCH40 PVC FJT Screen Size: 2"x10'X.010 SCH40 PVC FJT

Depth	Sample				Sample Description	Well Installation
(FT)	NO	PEN/REC	DEPTH/FT	BLOWS 6"		
2					Drilled straight with H.S.A.	
0			0 -10		F-M-C brown sand; Gravel. Dry.	
-2						
-4						
-6						
-8						
-10			10 - 40		F-M-C brown sand.	
-12					Water encountered at 22.29'.	
-14						
-16						
-18						
-20						
-22						
-24						
-26						
-28						
-30						
-32						
-34						
-36						
-38						
-40						
-42						
-44						
-46						
-48						
-50						
-52						Well Depth: 28.45'
-54						Static: 22.29'
-56						Well screen: 18.45' to 28.45'
-58						Bentonite seal: 8' to 10'
-60						Bentonite seal: 15' to 16'
-62						Sand pack: 18.25' to 28.45'
-64						End of boring: 30'
-66						End of sample: n/a



Granular Soils		Cohesive Soils		Proportions Used
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0 - 4	V. LOOSE	> 2	V. SOFT	Trace 0 - 10%
4 - 10	LOOSE	2 - 4	SOFT	Little 10 - 20%
10 - 30	M. DENSE	4 - 8	M. STIFF	Some 20 - 35%
30 - 50	DENSE	8 - 15	STIFF	And 35 - 50%
> 50	V. DENSE	15 - 30	V. STIFF	
		> 30	HARD	

Well Installation Key
- CONCRETE
- SAND PACK
- Z - SOIL BACKFILL
- BENTONITE
- SCREEN
- APPROX. WATER LEVEL

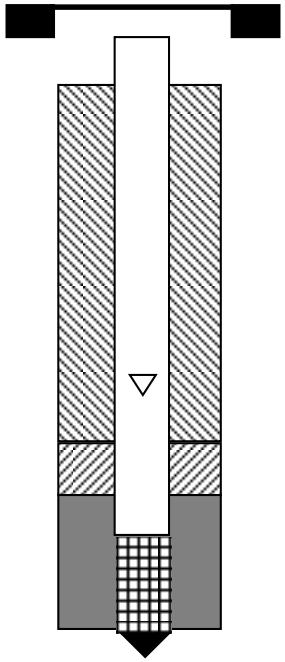
CAPE COD TEST BORING	**BORING NO. GW - Shallow well**

Cape Cod Test Boring	Project	Boring No. HW-G(m)
5 Rayber Road, Orleans, MA 02653	Horsley Witten Group	
(508) 240-1000	Barnstable, 480 Barnstable Road	Sheet 1 of 1
div. Desmond Well Drilling, Inc.	Hyannis, MA	

Driller: Tommy Desmond	Boring location:
Helper: Sean Morgan	Ground Surface Elevation:
Inspector: Josephine Ibanez	Date start: 10/3/2018 Date end: 10/3/2018

Sampler consists of a two inch split spoon driven using a 140 lb. hammer falling thirty inches	Notes: Middle	Auger Size: 6 1/4" x 4" H.S.A Casing Size: 2"x33.25' SCH40 PVC FJT Screen Size: 2"x5'X.010 SCH40 PVC FJT

Depth	Sample				Sample Description	Well Installation
(FT)	NO	PEN/REC	DEPTH/FT	BLOWS 6"		
2					Drilled straight with H.S.A.	
0			0 - 10		F-M-C brown sand; gravel. Dry.	
-2						
-4						
-6						
-8						
-10			10 - 40		F-M-C brown sand.	
-12					Water encountered at 22.35'.	
-14						
-16						
-18						
-20						
-22						
-24						
-26						
-28						
-30						
-32						
-34						
-36						
-38						
-40						
-42						
-44						
-46						
-48						
-50						
-52						Well Depth: 38.25'
-54						Static: 22.35'
-56						Well screen: 33.25' to 38.25'
-58						Grout: 5' to 27.25'
-60						Bentonite seal: 27.25' to 30.25'
-62						Sand pack: 30.25' to 38.25'
-64						End of boring: 40'
-66						End of sample: n/a



Granular Soils		Cohesive Soils		Proportions Used
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0 - 4	V. LOOSE	> 2	V. SOFT	Trace 0 - 10%
4 - 10	LOOSE	2 - 4	SOFT	Little 10 - 20%
10 - 30	M. DENSE	4 - 8	M. STIFF	Some 20 - 35%
30 - 50	DENSE	8 - 15	STIFF	And 35 - 50%
> 50	V. DENSE	15 - 30	V. STIFF	
		> 30	HARD	

Well Installation Key
- CONCRETE
- SAND PACK
- GROUT
- BENTONITE
- SCREEN
- APPROX. WATER LEVEL

CAPE COD TEST BORING **BORING NO. GW - Middle well**

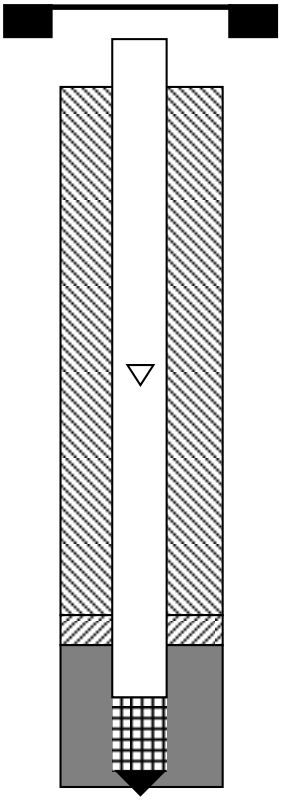
Cape Cod Test Boring	Project	Boring No. HW-G(d)
02653	Horsley Witten Group	
(508) 240-1000	Barnstable, 480 Barnstable Road	Sheet 1 of 1
div. Desmond Well Drilling, Inc.	Hyannis, MA	

Driller: Tommy Desmond	Boring location:
Helper: Sean Morgan	Ground Surface Elevation:
Inspector: Josephine Ibanez	Date start: 10/1/2018 Date end: 10/2/2018

Sampler consists of a two inch split spoon driven using a 140 lb. hammer falling thirty inches	Notes:	Auger Size: 6 1/4" x 4" H.S.A Casing Size: 2"x43.3' SCH40 PVC FJT Screen Size: 2"x5'X.010 SCH40 PVC FJT

Depth	Sample			Sample Description
(FT)	NO	PEN/REC	DEPTH/FT	
2				
0	1	24/14	0 - 2	Loamy sand. F-M-trace C brown sand. Dry.
-2	2	24/14	2 - 4	F-M-C brown sand; trace gravel. Dry.
-4	3	24/13	4 - 6	F-M-C brown sand; some cobble. Dry.
-6	4	24/15	6 - 8	F-M-C brown sand; trace cobble. Dry.
-8	5	24/14	8 - 10	F-M-C brown sand; some cobble. Dry.
-10	6	24/15	10 - 12	F-M-C brown sand; some cobble. Dry.
-12	7	24/14	12 - 14	F-M-C brown sand; trace cobble. Dry.
-14	8	24/17	14 - 16	F-M-C brown sand; trace gravel. Dry.
-16	9	24/17	16 - 18	F-M-C brown sand; trace gravel. Dry.
-18	10	24/17	18 - 20	F-M-C brown sand; trace gravel. Dry.
-20	11	24/17	20 - 22	F-M-C brown sand; trace gravel. Dry.
-22	12	24/13	22 - 24	F-M-C brown sand. Wet at 24'.
-24	13	24/3	24 - 26	Rock jammed in top of spoon.
-26	14	24/0	26 - 28	No recovery basket broke.
-28	15		28 - 30	F-M-C brown sand; trace gravel. Wet.
-30	16	24/11	30 - 32	F-M-C brown sand; trace gravel. Wet.
-32	17	24/13	32 -34	F-M-C brown sand; trace gravel. Wet.
-34	18	24/10	34 - 36	F-M-C brown sand; trace gravel. Wet.
-36	19	24/0	36 - 38	No recovery.
-38	20	24/12	38 - 40	F-M-C brown sand; trace silt, trace gravel. Wet.
-40	21	24/11	40 - 42	F-M-C brown sand; trace gravel. Wet.
-42	22	24/9	42 - 44	F-M-C brown sand; trace gravel. Wet.
-44	23	24/13	44 - 46	F-M-C light brown sand. Wet.
-46	24	24/12	46 - 48	F-M-C brown sand; trace silt. Wet.
-48	25	24/13	48 - 50	F-M-C brown sand; trace silt; trace clay. Wet.
-50	26	24/19	50 - 52	Blue clay. Wet.
-52				
-54				
-56				
-58				
-60				
-62				
-64				
-66				

Well Installation



Well Depth: 48.30'
Static: 22.30'
Well screen: 43.3' to 48.3'
Grout: 5' to 38'
Bentonite seal: 38' to 40'
Sand pack: 40' to 48.3'
End of boring: 50'
End of sample: 52'

Granular Soils		Cohesive Soils		Proportions Used
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0 - 4	V. LOOSE	> 2	V. SOFT	Trace 0 - 10%
4 - 10	LOOSE	2 - 4	SOFT	Little 10 - 20%
10 - 30	M. DENSE	4 - 8	M. STIFF	Some 20 - 35%
30 - 50	DENSE	8 - 15	STIFF	And 35 - 50%
> 50	V. DENSE	15 - 30	V. STIFF	
		> 30	HARD	

Well Installation Key
- CONCRETE
- SAND PACK
- GROUT
- BENTONITE
- SCREEN
- APPROX. WATER LEVEL

CAPE COD TEST BORING	**BORING NO. GW - Deep well**

Cape Cod Test Boring	Project	Boring No. HW - F
5 Rayber Road, Orleans, MA 02653	Horsley Witten Group	
(508) 240-1000	Barnstable, 480 Barnstable Road	Sheet 1 of 1
div. Desmond Well Drilling, Inc.	Hyannis, MA	

Driller: Tommy Desmond	Boring location:
Helper: Sean Morgan	Ground Surface Elevation:
Inspector: Josephine Ibanez	Date start: 10/4/2018 Date end: 10/4/2018

Direct push sampler consists of 4' x 2 3/8" G3 dual tube direct push steel tooling with 4' x 1 1/2" PVC liner with 201 ft lb hydraulic hammer (percussion rate 2200 bpm)	Direct push steel tooling: 2 3/8" G3 dual tube

Depth	Sample				Sample Description
(FT)	NO	PEN/REC	DEPTH/FT	BLOWS 6"	
+2					
0	1	N/R	0 - 4	N/R	Loamy; F-M-C brown sand; trace F gravel.
2					
4	2		4 - 8		F-M-C brown sand; trace very C brown sand; trace F gravel.
6					
8	3		8 - 12		F-M-C brown sand; little F gravel.
10					
12	4		12 - 16		F-M-C brown sand.
14					
16					
18					
20					
22					
24					
26					
28					
30					
32					
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50					
52					
54					
56					
58					
60					End of probe: 16'
62					End of sample: 16'
64					
66					

Granular Soils		Cohesive Soils		Proportions Used
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0 - 4	V. LOOSE	> 2	V. SOFT	Trace 0 - 10%
4 - 10	LOOSE	2 - 4	SOFT	Little 10 - 20%
10 - 30	M. DENSE	4 - 8	M. STIFF	Some 20 - 35%
30 - 50	DENSE	8 - 15	STIFF	And 35 - 50%
> 50	V. DENSE	15 - 30	V. STIFF	
		> 30	HARD	

Well Installation Key
- CONCRETE
- SAND PACK
- Z - SOIL BACKFILL
- BENTONITE
- SCREEN
- APPROX. WATER LEVEL

CAPE COD TEST BORING **BORING NO. HW - F**

Cape Cod Test Boring	Project	Boring No. HW - H
5 Rayber Road, Orleans, MA 02653	Horsley Witten Group	
(508) 240-1000	Barnstable, 480 Barnstable Road	Sheet 1 of 1
div. Desmond Well Drilling, Inc.	Hyannis, MA	

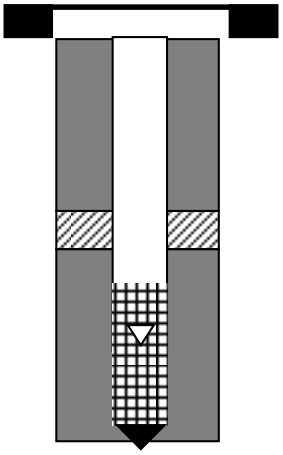
Driller: Tommy Desmond	Boring location:
Helper: Sean Morgan	Ground Surface Elevation:
Inspector: Josephine Ibanez	Date start: 10/4/2018 Date end: 10/4/2018

Direct push sampler consists of 4' x 2 3/8" G3 dual tube direct push steel tooling with 4' x 1 1/2" PVC liner with 201 ft lb hydraulic hammer (percussion rate 2200 bpm)

Auger Size: 6 1/4" x 4" H.S.A
Casing Size: 2"x17.11' SCH40 PVC FJT
Screen Size: 2"x10'X.010 SCH40 PVC FJT

Depth	Sample				Sample Description
(FT)	NO	PEN/REC	DEPTH/FT	BLOWS 6"	
2					
0	1	N/R	0 - 4	N/R	Loamy; F-M brown sand; trace silt.
-2					Dry.
-4	2		4 - 8		F-M-C brown sand; little F-M
-6					gravel. Dry.
-8	3		8 - 12		F-M-C brown sand; trace F gravel.
-10					Dry.
-12	4		12 - 16		F-M-C brown sand. Dry.
-14					
-16	5		16 - 20		F-M-C brown sand; trace F gravel.
-18					Dry.
-20	6		20 - 24		F-M-C brown sand. Wet.
-22					
-24	7		24 - 28		F-M-C brown sand. Wet.
-26					
-28					
-30					
-32					
-34					
-36					
-38					
-40					
-42					
-44					
-46					
-48					
-50					
-52					
-54					
-56					
-58					
-60					
-62					
-64					
-66					

Well Installation



Well Depth: 27.11'
Static: 20.68'
Well screen: 17.11' to 27.11'
Sand pack: 0' to 13'
Bentonite seal: 13' to 15'
Sand pack: 15' to 27.11'
End of boring: 24'
End of sample: 28'

Granular Soils		Cohesive Soils	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	> 2	V. SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M. DENSE	4 - 8	M. STIFF
30 - 50	DENSE	8 - 15	STIFF
> 50	V. DENSE	15 - 30	V. STIFF
		> 30	HARD

Proportions Used

Trace 0 - 10%
Little 10 - 20%
Some 20 - 35%
And 35 - 50%

Well Installation Key

- CONCRETE
- SAND PACK
- SOIL BACKFILL
- BENTONITE
- SCREEN
- APPROX. WATER LEVEL

CAPE COD TEST BORING **BORING NO. HW - H**

Cape Cod Test Boring	Project	Boring No. HW - I
5 Rayber Road, Orleans, MA 02653	Horsley Witten Group	
(508) 240-1000	Barnstable, 480 Barnstable Road	Sheet 1 of 1
div. Desmond Well Drilling, Inc.	Hyannis, MA	

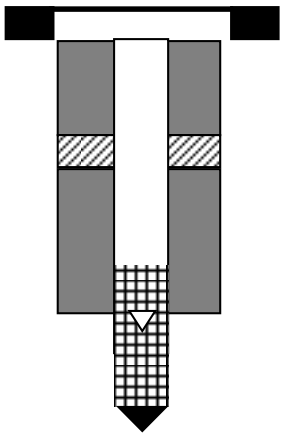
Driller: Tommy Desmond	Boring location:
Helper: Sean Morgan	Ground Surface Elevation:
Inspector: Josephine Ibanez	Date start: 10/4/2018 Date end: 10/4/2018

Direct push sampler consists of 4' x 2 3/8" G3 dual tube direct push steel tooling with 4' x 1 1/2" PVC liner with 201 ft lb hydraulic hammer (percussion rate 2200 bpm)

Auger Size: 6 1/4" x 4" H.S.A
Casing Size: 2"x15.1' SCH40 PVC FJT
Screen Size: 2"x10'X.010 SCH40 PVC FJT

Depth	Sample				Sample Description
(FT)	NO	PEN/REC	DEPTH/FT	BLOWS 6"	
2					
0	1	N/R	0 - 4	N/R	Loamy; silty sand; F-M gravel;
-2					F-M-C brown sand. Dry.
-4	2		4 - 8		F-M-C brown sand; trace F gravel.
-6					Dry.
-8	3		8 - 12		F-M-C brown sand. Dry.
-10					
-12	4		12 - 16		F-M-C brown sand. Dry.
-14					
-16	5		16 - 20		F-M-C brown sand; trace very C
-18					brown sand; trace F gravel. Wet.
-20	6		20 - 24		F-M-C brown sand. Wet.
-22					
-24	7		24 - 28		F-M-C brown sand. Wet.
-26					
-28					
-30					
-32					
-34					
-36					
-38					
-40					
-42					
-44					
-46					
-48					
-50					
-52					
-54					
-56					
-58					
-60					
-62					
-64					
-66					

Well Installation



Well Depth: 25.10'
Static: 18.62'
Well screen: 15.1' to 25.1'
Sand pack: 0' to 8'
Bentonite seal: 8' to 10'
Sand pack: 10' to 18.62'
End of boring: 24'
End of sample: 28'

Granular Soils		Cohesive Soils		Proportions Used
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0 - 4	V. LOOSE	> 2	V. SOFT	Trace 0 - 10%
4 - 10	LOOSE	2 - 4	SOFT	Little 10 - 20%
10 - 30	M. DENSE	4 - 8	M. STIFF	Some 20 - 35%
30 - 50	DENSE	8 - 15	STIFF	And 35 - 50%
> 50	V. DENSE	15 - 30	V. STIFF	
		> 30	HARD	

Well Installation Key
- CONCRETE
- SAND PACK
- SOIL BACKFILL
- BENTONITE
- SCREEN
- APPROX. WATER LEVEL

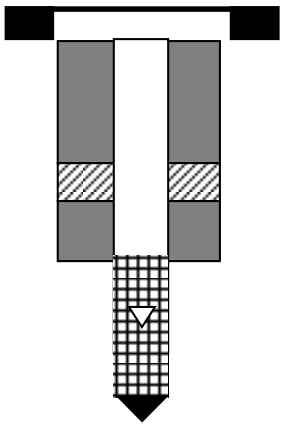
CAPE COD TEST BORING **BORING NO. HW - I**

Cape Cod Test Boring	Project	Boring No. HW - J
5 Rayber Road, Orleans, MA 02653	Horsley Witten Group	
(508) 240-1000	Barnstable, 480 Barnstable Road	Sheet 1 of 1
div. Desmond Well Drilling, Inc.	Hyannis, MA	

Driller: Tommy Desmond	Boring location:
Helper: Sean Morgan	Ground Surface Elevation:
Inspector: Josephine Ibanez	Date start: 10/4/2018 Date end: 10/4/2018

Direct push sampler consists of 4' x 2 3/8" G3 dual tube direct push steel tooling with 4' x 1 1/2" PVC liner with 201 ft lb hydraulic hammer (percussion rate 2200 bpm)

Auger Size: 6 1/4" x 4" H.S.A
Casing Size: 2"x___' SCH40 PVC FJT
Screen Size: 2"x___'X.010 SCH40 PVC FJT

Depth	Sample				Sample Description	Well Installation
(FT)	NO	PEN/REC	DEPTH/FT	BLOWS 6"		
2						
0	1	N/R	0 - 4	N/R	Loamy; F-M brown sand; F-M-C	
-2					brown sand; trace F gravel. Dry.	
-4	2		4 - 8		F-M-C brown sand. Dry.	
-6						
-8	3		8 - 12		F-M-C brown sand;	
-10					trace F gravel (lense). Dry.	
-12	4		12 - 16		F-M-C brown sand; trace F-M	
-14					gravel. Dry.	
-16	5		16 - 20		F-M-C brown sand; little F-M	
-18					gravel. Wet.	
-20	6		20 - 24		F-M-C brown sand. Wet.	
-22						
-24	7		24 - 28		F-M-C brown sand. Wet.	
-26						
-28						
-30						
-32						
-34						
-36						
-38						
-40						
-42						
-44						
-46						
-48						
-50						
-52						Well Depth: 24.35'
-54						Static: 19.56'
-56						Well screen: 14.35' to 24.35'
-58						Sand pack: 0' to 10'
-60						Bentonite seal: 10' to 12'
-62						Sand pack: 12' to 14.35'
-64						End of boring: 24'
-66						End of sample: 28'

Granular Soils		Cohesive Soils		Proportions Used	Well Installation Key
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY		
0 - 4	V. LOOSE	> 2	V. SOFT	Trace 0 - 10%	- CONCRETE
4 - 10	LOOSE	2 - 4	SOFT	Little 10 - 20%	- SAND PACK
10 - 30	M. DENSE	4 - 8	M. STIFF	Some 20 - 35%	Z - SOIL BACKFILL
30 - 50	DENSE	8 - 15	STIFF	And 35 - 50%	- BENTONITE
> 50	V. DENSE	15 - 30	V. STIFF		- SCREEN
		> 30	HARD		- APPROX. WATER LEVEL

CAPE COD TEST BORING **BORING NO. HW - J**

Cape Cod Test Boring	Project	Boring No. ARFF - 3
5 Rayber Road, Orleans, MA 02653	Horsley Witten Group	
(508) 240-1000	Barnstable, 480 Barnstable Road	Sheet 1 of 1
div. Desmond Well Drilling, Inc.	Hyannis, MA	

Driller: Tommy Desmond	Boring location:
Helper: Sean Morgan	Ground Surface Elevation:
Inspector: Josephine Ibanez	Date start: 10/9/2018 Date end: 10/9/2018

Direct push sampler consists of 4' x 2 3/8" G3 dual tube direct push steel tooling with 4' x 1 1/2" PVC liner with 201 ft lb hydraulic hammer (percussion rate 2200 bpm)	Direct push steel tooling: 2 3/8" G3 dual tube

Depth	Sample				Sample Description
(FT)	NO	PEN/REC	DEPTH/FT	BLOWS 6"	
+2					
0	1	N/R	0 - 4	N/R	Loamy; F-M-C brown sand and F gravel. Dry.
2					
4	2		4 - 8		F-M-C brown sand and F-M gravel. Dry.
6					
8	3		8 - 12		F-M-C brown sand. Dry.
10					
12					
14					
16					
18					
20					
22					
24					
26					
28					
30					
32					
34					
36					
38					
40					
42					
44					
46					
48					
50					
52					
54					
56					
58					
60					End of probe: 12'
62					End of sample: 12'
64					
66					

Granular Soils		Cohesive Soils		Proportions Used
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0 - 4	V. LOOSE	> 2	V. SOFT	Trace 0 - 10%
4 - 10	LOOSE	2 - 4	SOFT	Little 10 - 20%
10 - 30	M. DENSE	4 - 8	M. STIFF	Some 20 - 35%
30 - 50	DENSE	8 - 15	STIFF	And 35 - 50%
> 50	V. DENSE	15 - 30	V. STIFF	
		> 30	HARD	

Well Installation Key
- CONCRETE
- SAND PACK
- Z - SOIL BACKFILL
- BENTONITE
- SCREEN
- APPROX. WATER LEVEL

CAPE COD TEST BORING **BORING NO. ARFF - 3**

Cape Cod Test Boring	Project	Boring No. DL - 11
5 Rayber Road, Orleans, MA 02653	Horsley Witten Group	
(508) 240-1000	Barnstable, 480 Barnstable Road	Sheet 1 of 1
div. Desmond Well Drilling, Inc.	Hyannis, MA	

Driller: Tommy Desmond	Boring location:
Helper: Sean Morgan	Ground Surface Elevation:
Inspector: Josephine Ibanez	Date start: 10/3/2018 Date end: 10/3/2018

Direct push sampler consists of 4' x 2 3/8" G3 dual tube direct push steel tooling with 4' x 1 1/2" PVC liner with 201 ft lb hydraulic hammer (percussion rate 2200 bpm)	Direct push steel tooling: 2 3/8" G3 dual tube

Depth	Sample				Sample Description
(FT)	NO	PEN/REC	DEPTH/FT	BLOWS 6"	
	1	24/18	4 - 6		F-M-C brown sand; trace of cobble. Dry.
					Switched to Probe
0	1	N/R	0 - 4	N/R	Loamy material; F-M-C brown sand; trace F-M gravel. Dry.
2					
4	2		4 - 8		F-M-C brown sand; trace F-M gravel. Dry.
6					
8	3		8 - 12		F-M-C brown sand; trace very C brown sand. Dry.
10					
12	4		12 - 16		F-M-C brown sand; trace very C brown sand. Dry.
14					
16					
18					
20					
22					
24					
26					
28					
30					
32					
34					
36					
38					
40					
42					
44					
46					
48					
50					
52					
54					
56					End of probe: 16'
58					End of sample: 16'
60					
62					

Granular Soils		Cohesive Soils		Proportions Used
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0 - 4	V. LOOSE	> 2	V. SOFT	Trace 0 - 10%
4 - 10	LOOSE	2 - 4	SOFT	Little 10 - 20%
10 - 30	M. DENSE	4 - 8	M. STIFF	Some 20 - 35%
30 - 50	DENSE	8 - 15	STIFF	And 35 - 50%
> 50	V. DENSE	15 - 30	V. STIFF	
		> 30	HARD	

Well Installation Key
- CONCRETE
- SAND PACK
- Z - SOIL BACKFILL
- BENTONITE
- SCREEN
- APPROX. WATER LEVEL

CAPE COD TEST BORING **BORING NO. DL - 11**

Cape Cod Test Boring	Project	Boring No. DL - 14
5 Rayber Road, Orleans, MA 02653	Horsley Witten Group	
(508) 240-1000	Barnstable, 480 Barnstable Road	Sheet 1 of 1
div. Desmond Well Drilling, Inc.	Hyannis, MA	

Driller: Tommy Desmond	Boring location:
Helper: Sean Morgan	Ground Surface Elevation:
Inspector: Josephine Ibanez	Date start: Date end:

Direct push sampler consists of 4' x 2 3/8" G3 dual tube direct push steel tooling with 4' x 1 1/2" PVC liner with 201 ft lb hydraulic hammer (percussion rate 2200 bpm)	Direct push steel tooling: 2 3/8" G3 dual tube

Depth	Sample				Sample Description
(FT)	NO	PEN/REC	DEPTH/FT	BLOWS 6"	
+2					
0	1	N/R	0 - 4	N/R	Subsurface road material. Loamy; silty sand; F-M-C brown sand;
2					trace F gravel. Dry.
4	2		4 - 8		F-M-C brown sand; some F-M gravel. Dry.
6					
8	3		8 - 12		F-M-C brown sand; trace F gravel. Dry.
10					
12	4		12 - 16		F-M-C brown sand. Dry.
14					
16					
18					
20					
22					
24					
26					
28					
30					
32					
34					
36					
38					
40					
42					
44					
46					
48					
50					
52					
54					
56					
58					
60					End of probe: 16'
62					End of sample: 16'
64					
66					

Granular Soils		Cohesive Soils		Proportions Used
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0 - 4	V. LOOSE	> 2	V. SOFT	Trace 0 - 10%
4 - 10	LOOSE	2 - 4	SOFT	Little 10 - 20%
10 - 30	M. DENSE	4 - 8	M. STIFF	Some 20 - 35%
30 - 50	DENSE	8 - 15	STIFF	And 35 - 50%
> 50	V. DENSE	15 - 30	V. STIFF	
		> 30	HARD	

Well Installation Key

- CONCRETE
- SAND PACK
- Z - SOIL BACKFILL
- BENTONITE
- SCREEN
- APPROX. WATER LEVEL

CAPE COD TEST BORING **BORING NO. DL - 14**