January 2021

Bureau of Waste Site Cleanup
Southeast Regional Office
Massachusetts Department of Environmental Protection
C/o Angela Gallagher
Site Remediation Section
20 Riverside Drive
Lakeville, MA 02347

RE: Immediate Response Action Status and Remedial Monitoring Report #48
Barnstable County Fire Training Academy FTA Facility
155 South Flint Rock Road
Hyannis, Massachusetts
DEP Release Tracking No. 4-26179
Project Number #6206

Dear Ms. Gallagher:

BETA Group, Inc. (BETA) has prepared this Immediate Response Action (IRA) Status and Remedial Monitoring Report (RMR) for the Disposal Site (the Site) referenced as the Barnstable Country Fire Training Academy (the FTA Facility) located at 155 South Flint Rock Road in Hyannis, MA on the behalf of Barnstable County. This report was completed on behalf of Barnstable County and in accordance with Massachusetts Contingency Plan (MCP) - 310 CMR 40.0000.

This is the 48th monthly IRA RMR Status report. It documents the IRA/RMR activities being conducted to address a release of PFOS/PFOA to groundwater, soils, surface water, and sediments located at the Site. A potential Imminent Hazard (IH) condition and Condition of Substantial Release Migration were previously identified at the Site. This letter report specifically addresses the status of the Site groundwater pumping and treatment systems (GWPTS) during the monthly reporting period from November 1 to November 30, 2020.

The completed BWSC105 Immediate Response Action (IRA) Transmittal Form and attached BWSC105A and BWSC105B IRA Remedial Monitoring Report Forms are being submitted to the MassDEP electronically via the eDEP system. This letter is being submitted to the Massachusetts Department of Environmental Protection (MassDEP) as an attachment to those forms. Copies of these forms prior to electronic signature are included as Attachment A.

REMEDIAL MONITORING REPORT – NOVEMBER 2020

During the November reporting period, the primary treatment system (GWTS #1) and secondary system (GWTS #2) were in operation for all or portions of approximately 19 days. There was one unscheduled shutdown during this reporting period for GWTS #1 and GWTS #2. Specifically, on November 13, 2020 GWTT (the operations and maintenance contractor for the systems) shut downed GWTS #1 and GWTS#2 after failure of the submersible pump at the recovery well PRW-4. The system was shut down for approximately 11 days for the repair and replacement of the well pump and force main. BETA collected performance samples from both GWTS #1 and GWTS #2 systems on November 24, 2020; both systems were in operation at the time of sample collection.

Health Advisories and Regulatory Standards Used for Comparison

During the initial two years of the GWPTS operation (July 2016 through June 2018), the USEPA revised Health Advisory (HA) of 0.070 µg/L for two PFAS chemicals, Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS), was used for comparison to the analytical results of GWPTS performance samples. The HA (revised downward to 0.070 µg/L in July 2016) applied to each compound individually or for the total concentration of the two (PFOS and PFOA). Subsequently, MassDEP adopted the USEPA HA. The USEPA considers its HA to still be in effect. However, for MCP purposes it has been superseded by MassDEP guidelines and regulatory actions.

On June 11, 2018, MassDEP's Office of Research and Standards (ORS) issued an updated ORS Guideline/HA that applied to the individual concentrations or the total summed of five PFAS chemicals: PFOS, PFOA, Perfluorononanoic Acid (PFNA), Perfluorohexanesulfonic Acid (PFHxS), and Perfluoroheptanoic Acid (PFHpA). From June 11, 2018 until December 2019, individual concentrations of any of these five compounds or the total concentrations of all were compared to the MassDEP ORS HA of 0.070 µg/L.

On April 19, 2019, MassDEP released the Public Comment Draft of proposed revisions to the MCP, which included proposed Method 1 groundwater risk standards for the five PFAS compounds, plus an additional PFAS compound, Perfluorodecanoic Acid (PFDA). A Method 1 GW-1 risk standard of 0.020 µg/L was proposed for the individual concentrations of any of these six compounds or the total concentrations of all six. From May 2019 through the current reporting period, tabulated treatment system analytical results have been compared to the six regulated PFAS compounds of concern for informational purposes.

In December 2019, MassDEP published the final MCP Method 1 risk standards for PFAS with an effective implementation date of December 27, 2019. The final MCP PFAS risk standards for groundwater include the 6 PFAS compounds of concern listed above and at 0.020 µg/L[1] the GW-1 numerical risk standard. These MCP risk standards are included in Table 1A and Table 1B. The total PFAS concentrations reported and discussed for comparison purposes in this report are based on the six regulated PFAS compounds included in the final MCP risk standards of December 27, 2019.

[1] Concentrations of PFAS are presented in the data tables of this report in nanograms per liter (ng/L), also referred to as parts per trillion (ppt) and are reported by the laboratory in those units. However the published MCP Method GW-1 numerical risk standards for PFAS compounds (PFOS, PFOA, PFNA, PFHpA, PFHxS, and PFDA) are in presented in or micrograms per liter (µg/L), also referred to as parts per billion (ppb). In the relevant sections of this report, both results are shown in both units.

GWTS # 1 System Monitoring Results

As noted, system samples were collected on November 24, 2020 from the Influent (PRW-4), Midpoint and Effluent ports and were submitted to Bureau Veritas Laboratories (formerly Maxxam Analytics) of Mississauga, Ontario (Bureau Veritas) for the laboratory analysis of Total PFAs via USEPA Method 537 M. For the analysis of the treatment system performance samples, Bureau Veritas uses a low-level detection variant of the US EPA 537M for the purpose of achieving the lowest method detection limits (MDLs) and reportable detection limits (RDLs) to allow for comparison to the MCP Method 1 GW-1 risk standards[2]. This method results in RDLs in the range of 2 to 4 ng/L and MDLs below 1 ng/L for the list of PFAS analytes reported by the laboratory. Bureau Veritas reports the results for 21 PFAS compounds, including two (2) PFAS precursor fluorotelomers. Details are presented in the laboratory report attached in Appendix B.

The total sum of the six Massachusetts regulated PFAS concentrations in the Influent (PRW-4) sample was 2,731 ng/L (2.731 µg/L), well above the GW-1 risk standards. Five of the six individually regulated PFAS compounds were detected at concentrations exceeding the new MCP GW-1 risk standard (0.020 µg/l); PFDA was detected at a concentration (18 ng/L) below the applicable standard. Refer to the attached Table 1A, for a summary of the GWTS #1 PFAS analytical data. Recovery well PRW-4 is the source of the Influent groundwater. Based on the splitting of flow from PRW-4 to both groundwater treatment systems, the Influent analytical results apply to GWTS #2, as well as GWTS #1.

Four of the six MA regulated PFAS compounds (PFOS, PFOA, PFHxS, and PFHpA) were detected above the laboratory reporting detection limits or method detection limits in both the Midpoint and Effluent samples. The sum of these detected PFAS compounds were below the applicable Method 1 GW-1 groundwater standard. It is BETA's opinion that due to the length of the system shutdown, iron oxide sediments may have significantly accumulated in the carbon vessels, which has the potential to reduce PFAS sorption – the iron sediments will cover the surface area of the carbon and remove area for PFAS sorption to occur. A backwash of the primary carbon vessel is typically conducted as a maintenance measure because of the iron-oxide sediment fouling; however due to the significantly low influent and effluent flow rates. Backwashes were not conducted during the month of November, but were resumed in December. At the time of the preparation of this report, the results of the December system sampling event were received and reviewed and the 21 PFAS compounds reported were below the laboratory detection limits.

Refer to the attached Table 1A, for a summary of the GWTS #1 PFAS analytical data in the Influent, Midpoint and Effluent samples. The complete laboratory report is attached in Appendix B. The laboratory report provides details of MDLs and RDLs for each PFAS compound included in the analyte list.

[2] The RDL is the smallest (quantity) or concentration value that can be reported by a laboratory and the MDL is the lowest concentration that can be detected using the specific method or instrumentation. The MDL is lower than the RDL because it is a statistical calculation (typically the standard deviation of the results around the true concentration value) below the point of calibration.

GWTS #1 Operational Details

The attached Table 2A presents the GWTS #1 performance data from April 2018 (following BETA's contract with the County to the November 2020 reporting period). For the November 2020 reporting period, the overall (average) system flow rate and gallons of groundwater treated are based on the effluent flow meter/totalizer readings reported for the system by the O&M contractor.

On this basis, approximately 0.065 million gallons of groundwater were treated during this November 2020 reporting period, at an average effluent flow rate of 2.4 gpm. The significant decrease in flow and gallons of groundwater treated is attributable to: the deteriorating operation of the PRW-4 well pump ending in breakdown on or before November 13, 2020 (see below) and the system being off for 11 days to arrange for the unexpected replacement of the submersible pump at PRW-4. Based on the approximate 0.065 million gallons treated and total influent concentration of 2.731 µg/L (November 2020 sample results), approximately 0.001 kilograms of PFAS were estimated to have been removed from the plume area during this reporting period.

The estimated, instantaneous combined influent flow rates (for both systems) ranged from approximately 4.9-6.2 gpm prior to the well pump failure and then increased to approximately 59.8-64.5 gpm after the pump's replacement. As detailed in the IRA Status and RMR reports from the previous 2020 reporting periods, iron-oxide sediment has significantly accumulated in the major system components and caused a significant decrease in the observed system flow rates.

On November 13, 2020, upon the GWTT operator's arrival to the system, the operator, he, observed no flow coming into the EQ tank (from PRW-4). GWTT inspected the electrical components at PRW-4; the electrical circuit breaker at the pump was reset, upon reset the breaker immediately tripped. Power was then shut off to the pump at PRW-4. It was the opinion of GWTT and BETA that the pump motor had failed and GWTT shutdown GWTS#1 and GWTS#2. Table 2A summarizes these observations and actions.

On November 17, 2020, Maher Services (Maher) of Reading, MA removed the well pump at PRW-4 for inspection. Maher determined that the pump, (which was heavily coated and clogged with iron sediment), and motor had failed. Maher added six gallons of water/ Pantonite mixture to the well and surged the well and well screen. Pantonite is a blend of acids specifically designed to remove iron and manganese fouling in drinking water systems. On November 20, 2020, Maher services replaced the pump and motor with a 4-inch Schaefer Legend 90 GPM, 3-horsepower (HP) submersible pump and Franklin Electric single phase, three wire, 3-HP motor. Additionally, due to significant fouling and accumulation on the walls of the pump riser piping, Maher replaced the piping on the pump riser with 3-inch Schedule 120 PVC piping. Following the replacement of the pump and associated piping, six gallons of muriatic acid was added to the well and pumped through the force main in an effort to descale the iron accumulation from within the force main piping.

On November 24, 2020, the system was restarted, and the acid was flushed through the system[3] Upon restart, the influent flow rate was estimated to be approximately 60 gpm and the treatment system / effluent flow rate was increased to approximately 50 gpm, which is the maximum flow rate for PFAS adsorption to the activated carbon.

To note, due to the method used to estimate the instantaneous influent flow rate (timing of rise of groundwater in the GWTS #1 Equalization Tank with both force mains discharging to it), the estimated influent flow rates noted above apply to both systems, combined.

Therefore, during the normal mode of operation, with the flow from each force main flowing to only one system, it is assumed that roughly 50% of the instantaneous influent rates stated above actually flows to GWTS #1 for treatment. However, the estimated, instantaneous combined influent flow rates are actual tabulated - assumed 50% values must be computed – (e.g., the actual average influent flow rate for GWTS #1 is estimated to be approximately 14.1 gpm on average for the period). Refer to the attached Table 2A for a summary of the GWTS #1 performance details.

GWTS # 2 Monitoring Results

As previously mentioned, BETA collected performance samples from GWTS #2 system on November 24, 2020. Samples collected from the Influent (PRW-4), Midpoint, and Effluent ports were submitted to Bureau Veritas for the laboratory analysis of Total PFAS via USEPA Method 537 M. As noted above, recovery well PRW-4 is the source of the Influent groundwater to both groundwater treatment systems. Therefore, the Influent analytical results apply to GWTS #2, as well as GWTS #1.

As previously mentioned, the tabulated treatment system analytical results from GWTS #2 are reported and compared to all six regulated PFAS compounds and their respective MCP Method 1 GW-1 Standards. The total sum of the six PFAS concentrations in the Influent sample was 2,731 ng/L (2.731 µg/L), well above the GW-1 risk standards.

The six individually regulated PFAS compounds were detected at concentrations above laboratory detection limits in the Midpoint sample and the sum of the concentrations of the 6 regulated PFAS compounds is greater than the applicable Method 1 GW-1 standards. As previously mentioned, it is BETA's opinion that due to the length of the system shutdown, iron oxide sediments may have significantly accumulated in the carbon vessels, which has the potential to reduce PFAS sorption. Similarly, backwashes were not conducted during the month of November, but were resumed in December.
Two of the six regulated PFAS compounds (PFOS and PFOA) were detected above the laboratory reporting limits but well below the Method 1 GW-1 standards in the Effluent sample; however, the remaining 19 reported PFAS compounds were below the laboratory detection limits and the applicable Method 1 GW-1 standards. The attached Table 1B, summarizes the GWTS #2 PFAS analytical data. The complete laboratory report is attached in Appendix B.

[3] Research has documented that PFAS primarily exist as anions with a net negative charge and will be repelled by GAC when the pH is above the GAC's point of zero charge (PZC), which can aid in predicting PFAS adsorption (Deng et al. 2015, Zhi & Liu 2015). Furthermore, several studies have shown increased adsorption capacity at lower pH and at positive zeta potential values (Chen et al. 2017, Deng et al. 2015).

As previously mentioned, for the purposes of achieving the lowest MDLs and RDLs (for comparison to the new MCP Method 1 Groundwater standards,) Bureau Veritas reports the results for 21 PFAS compounds, including two (2) PFAS precursors; this allows the laboratory to achieve RDLs in the range of 2 to 4 ng/L.

GWTS #2 Operational Details

The attached Table 2B presents the GWTS #2 performance data. For the November 2020 reporting period, the overall (average) system flow rate and gallons of groundwater treated are based on the effluent flow meter/totalizer readings reported for the system by the O&M contractor.

On this basis, approximately 0.05 million gallons of groundwater were treated during this November 2020 reporting period, at an average effluent flow rate of 1.9 gpm.

Based on the approximate 0.05 million gallons treated and total influent concentration of 2.731 µg/L (November 2020 sample results), approximately 0.0005 kilograms of PFAS were estimated to have been removed from the plume area during this reporting period.

The estimated, instantaneous influent flow rates for GWTS#2 ranged from approximately 2.5-3.1 gpm prior to the well pump failure at PRW-4 and then increased to approximately 29.9- 32.2 gpm after the pump's replacement; see Table 2B. As previously mentioned, the instantaneous flow rate to GWTS#2 is estimated to be 50% of the combined influent flow rates (for both systems), which for the November period ranged from approximately 4.9 gpm to 64.5 gpm (as shown on Table 2A) and the average influent flow rate (for GWTS#2) is estimated to be approximately 14. 1 gpm. As discussed above, the wide range in flow rates is a result of the well pump failure on November 13, 2020 and the replacement and restart of the system on November 24, 2020. Until the failure, the observed flow rates continued to significantly decrease which was a result of the decline of the well pump at PRW-4 due to the accumulation of iron-oxide sedimentation within the pump itself and within the well, riser pipe, and the force mains.

GROUNDWATER TREATMENT PUMPING AND TREATMENT SUMMARY

During the November 2020 reporting period, the two treatment systems, GWTS #1 and GWTS #2, were in operation for all or portions of approximately 19 days; there was one unscheduled shut down on November 13, 2020 due to the failure of the well pump at PRW-4. After the replacement of the well pump and descaling of the force main, the systems were restarted on November 24, 2020. The overall (average) system flow rate and gallons of groundwater treated are based on the Effluent flow totalizer readings reported for both systems by the O&M contractor. For the period of November 1 to 30, 2020 both systems treated an approximate combined 0.12 million gallons of groundwater from the downgradient recovery well PRW-4 at an average, total (of the two systems) effluent flow rate of 4.3 gpm. Based on the total 0.12 million gallons treated, approximately 0.0015 kilograms of PFAS were estimated to have been removed from the plume area.

Prior to failure of the PRW-4 well pump, recovery flow rates, equivalent to the estimated instantaneous influent flow rates for the systems, had dropped significantly to approximately 5 gpm.

Following complete replacement of the well pump, motor and riser piping and the descaling of the well and force mains, recovery flow rates rebounded to over 60 gpm, instantaneous.

Ongoing IRA Activities

Sampling results, system performance, and additional assessment work related to the ongoing response actions, such as system improvement and enhancement details, will be presented in the next IRA Status and RMR Report for the December 2020 reporting period.

Public Involvement Activities

A copy of the municipal notification to the Barnstable Town Manager, with copies to other town officials, is included as Appendix C.

The Site has been designated a Public Involvement Plan Site under the MCP. The Draft Public Involvement Plan (PIP) was presented at a public meeting held at the Barnstable Town Hall on May 2, 2019. Following the end of the comment period, the PIP was finalized and filed with MassDEP on June 30, 2019. In accordance with the final PIP, a copy of this status report will be placed in the public repository. The report will be available on-line via the County website.

Sincerely,

BETA Group, Inc.

Mykel Mendes
Environmental Engineer

Roger Thibault, P.E., LSP
Associate

Copy: Jack Yunits, Barnstable County Administrator
Steve Tebo, Assistant County Administrator

Attachments:

TABLES

Table 1A – Summary of Groundwater Pump and Treatment System PFAS Analytical Data – System #1
Table 1B - Summary of Groundwater Pump and Treatment System PFAS Analytical Data – System #2
Table 2A - Summary of Groundwater Pump and Treatment System Operating and Maintenance Data-System #1
Table 2B- Summary of Groundwater Pump and Treatment System Operating and Maintenance Data-System #2

APPENDICES

A: BWSC 105, 105A, 105B Forms
B: Laboratory Reports
C: Municipal Notification Letter to Town Manager

Table 1A - Summary of Groundwater Pump and Treatment System Total PFAs Analytical Data - GWTS #1
Barnstable County Fire and Rescue Training Academy
155 Flint Rock Road, Barnstable, MA
RTN 4-26179

SAMPLE ID	INFLUENT (PRW-4)						MIDPOINT						EFFLUENT					
USEPA Method 537.2	PFOS (ng/L)	PFOA (ng/L)	PFNA (ng/L)	PFHxS (ng/L)	PFHpA (ng/L)	PFDA (ng/L)	PFOS (ng/L)	PFOA (ng/L)	PFNA (ng/L)	PFHxS (ng/L)	PFHpA (ng/L)	PFDA (ng/L)	PFOS (ng/L)	PFOA (ng/L)	PFNA (ng/L)	PFHxS (ng/L)	PFHpA (ng/L)	PFDA (ng/L)
MCP Method 1 GW-1 Standard [3]	20 ng/L						20 ng/L						20 ng/L					
SAMPLE DATE																		
4/1/2015	760	60	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
7/17/2015	5600	460	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
8/4/2015	5900	550	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
9/30/2015	17000	840	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
10/15/2015	9900	560	--[A]	--[A]	--[A]	--[A]	BRL (<9.4)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]	9.4	BRL (<5.8)	--[A]	--[A]	--[A]	--[A]
11/12/2015	9000	BRL (<2000)	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)		--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
1/6/2016	7600	260	--[A]	--[A]	--[A]	--[A]	120	75	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
1/21/2016	5200	160	--[A]	--[A]	--[A]	--[A]	270	16	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
2/3/2016	3500	140	--[A]	--[A]	--[A]	--[A]	540	26	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
2/17/2016	4500	140	--[A]	--[A]	--[A]	--[A]	520	24	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
3/8/2016	3700	140	--[A]	--[A]	--[A]	--[A]	420	19	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
3/23/2016	5000	150	--[A]	--[A]	--[A]	--[A]	650	39	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
4/14/2016	4800	140	--[A]	--[A]	--[A]	--[A]	610	26	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
4/28/2016	6300	BRL (<200)	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	BRL (<20)	BRL (<20)	--[A]	--[A]	--[A]	--[A]
5/12/2016	6800	BRL (<200)	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	BRL (<20)	BRL (<20)	--[A]	--[A]	--[A]	--[A]
5/25/2016	6900	BRL (<210)	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
6/16/2016	7800	160	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
7/6/2016	7600	270	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	10	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
8/11/2016	13000	160	--[A]	--[A]	--[A]	--[A]	1600	54	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
Carbon change conducted after sample collection on 08/11/16.																		
8/18/2016	9500	210	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
9/8/2016	9500	190	--[A]	--[A]	--[A]	--[A]	8.5	5.3	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
10/6/2016	17000	250	--[A]	--[A]	--[A]	--[A]	110	8.3	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
10/20/2016	7200	130	--[A]	--[A]	--[A]	--[A]	1000	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
11/3/2016	7900	110	--[A]	--[A]	--[A]	--[A]	650	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
11/17/2016	5400	99	--[A]	--[A]	--[A]	--[A]	1200	NA	--[A]	--[A]	--[A]	--[A]	17	NA	--[A]	--[A]	--[A]	--[A]
12/1/2016	5300	100	--[A]	--[A]	--[A]	--[A]	400	14	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
12/14/2016	5700	95	--[A]	--[A]	--[A]	--[A]	82	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]	8.1	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
1/4/2017	4900	95	--[A]	--[A]	--[A]	--[A]	360	15	--[A]	--[A]	--[A]	--[A]	BRL (<3.3)	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
2/16/2017	2800	88	--[A]	--[A]	--[A]	--[A]	1000	39	--[A]	--[A]	--[A]	--[A]	25	BRL (<5.3)	--[A]	--[A]	--[A]	--[A]
3/1/2017	3700	120	--[A]	--[A]	--[A]	--[A]	1400	47	--[A]	--[A]	--[A]	--[A]	150	6.5	--[A]	--[A]	--[A]	--[A]
3/23/2017	3800	87	--[A]	--[A]	--[A]	--[A]	2000	71	--[A]	--[A]	--[A]	--[A]	160	9.5	--[A]	--[A]	--[A]	--[A]
5/3/2017	2400	86	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	BRL (<2.6)	BRL (<4.6)	--[A]	--[A]	--[A]	--[A]
Carbon change conducted on 04/13/17.																		
4/19/2017	3200	110	--[A]	--[A]	--[A]	--[A]	160	BRL (<4.6)	--[A]	--[A]	--[A]	--[A]	BRL (<2.6)	BRL (<4.6)	--[A]	--[A]	--[A]	--[A]
5/18/2017	3000	110	--[A]	--[A]	--[A]	--[A]	570	32	--[A]	--[A]	--[A]	--[A]	BRL (<2.6)	BRL (<4.6)	--[A]	--[A]	--[A]	--[A]
6/1/2017	3200	110	--[A]	--[A]	--[A]	--[A]	730	33	--[A]	--[A]	--[A]	--[A]	4.1	BRL (<4.6)	--[A]	--[A]	--[A]	--[A]
6/27/2017	2600	99	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	210	15	--[A]	--[A]	--[A]	--[A]
7/18/2017	3500	97	--[A]	--[A]	--[A]	--[A]	2300	72	--[A]	--[A]	--[A]	--[A]	49	25	--[A]	--[A]	--[A]	--[A]
Carbon change conducted on 8/09/17																		
8/16/2017	3000	110	--[A]	--[A]	--[A]	--[A]	BRL (<2.3)	BRL (<4.1)	--[A]	--[A]	--[A]	--[A]	BRL (<2.3)	BRL (<4.1)	--[A]	--[A]	--[A]	--[A]
8/28/2017	2900	100	--[A]	--[A]	--[A]	--[A]	27	BRL (<20)	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]
10/2/2017	3200	85	--[A]	--[A]	--[A]	--[A]	510	25	--[A]	--[A]	--[A]	--[A]	BRL (<2.6)	BRL (<4.6)	--[A]	--[A]	--[A]	--[A]
10/12/2017	4500	110	--[A]	--[A]	--[A]	--[A]	960	29	--[A]	--[A]	--[A]	--[A]	BRL (<2.6)	BRL (<4.6)	--[A]	--[A]	--[A]	--[A]
11/9/2017	2400	77	--[A]	--[A]	--[A]	--[A]	--	--	--[A]	--[A]	--[A]	--[A]	BRL (<6.0)	BRL (<3.3)	--[A]	--[A]	--[A]	--[A]
11/20/2017	2000	64	--[A]	--[A]	--[A]	--[A]	520	15	--[A]	--[A]	--[A]	--[A]	BRL (<6.0)	BRL (<3.3)	--[A]	--[A]	--[A]	--[A]
12/7/2017	1600	64	--[A]	--[A]	--[A]	--[A]	780	34	--[A]	--[A]	--[A]	--[A]	11	BRL (<3.3)	--[A]	--[A]	--[A]	--[A]
2/5/2018	2100	27	--[A]	--[A]	--[A]	--[A]	390	13	--[A]	--[A]	--[A]	--[A]	BRL (<6.0)	BRL (<3.3)	--[A]	--[A]	--[A]	--[A]
2/14/2018	2100	30	--[A]	--[A]	--[A]	--[A]	850	27	--[A]	--[A]	--[A]	--[A]	11	BRL (<3.3)	--[A]	--[A]	--[A]	--[A]
System shutdown on 2/14/18 due to transfer pump failure; system restart on 4/9/18.																		
4/9/2018	2,600	79	--[A]	--[A]	--[A]	--[A]	990	25	--[A]	--[A]	--[A]	--[A]	BRL (<20)	BRL (<20)	--[A]	--[A]	--[A]	--[A]
4/13/2018	3100	62	--[A]	--[A]	--[A]	--[A]	1500	35	--[A]	--[A]	--[A]	--[A]	30	BRL (<33)	--[A]	--[A]	--[A]	--[A]
5/9/2018	1800	73	--[A]	--[A]	--[A]	--[A]	490	26	--[A]	--[A]	--[A]	--[A]	BRL (<6.0)	BRL (<33)	--[A]	--[A]	--[A]	--[A]
System shutdown on 5/9/18 after sampling collection due to carbon breakthrough and influent pump alarm fail.																		
Carbon change conducted on 06/05/18; system restarted on 06/07/18.																		
6/14/2018	2800	120	79	540	110	--[A]	200	9.4	BRL (<8.7)	38	11	--[A]	BRL (<6.0)	BRL (<3.3)	BRL (<8.7)	BRL (<5.6)	BRL (<7.4)	--[A]
7/13/2018	2400	100	73	600	90	--[A]	1100	44	27	24	35	--[A]	BRL (<20)	BRL (<20)	BRL (<20)	BRL (<20)	BRL (<20)	--[A]
8/7/2018	2900	95	73	460	86	--[A]	630	31	22	130	34	--[A]	27	5.3	BRL (<8.7)	9.1	BRL (<7.4)	--[A]
9/27/2018	4300	69	50	360	190	--[A]	3600	69	49	330	65	--[A]	81	BRL (<3.3)	BRL (<8.7)	14	BRL (<7.4)	--[A]
Carbon change conducted on 09/28/18; system restarted on 10/01/18.																		
10/30/2018	2800	65	46	320	71	--[A]	100	6	8.7	16	78	--[A]	BRL (<6.0)	BRL (<3.3)	BRL (<8.7)	BRL (<5.6)	BRL (<7.4)	--[A]
11/16/2018	2900	62	50	290	77	--[A]	460	24	19	94	26	--[A]	BRL (<6.0)	BRL (<3.3)	BRL (<8.7)	BRL (<5.6)	BRL (<7.4)	--[A]
12/14/2018	1900	62	49	300	70	--[A]	1200	40	30	180	45	--[A]	BRL (<6.0)	BRL (<3.3)	BRL (<8.7)	BRL (<5.6)	BRL (<7.4)	--[A]
1/10/2019	2400	84	68	410	96	--[A]	2200	71	54	360	82	--[A]	21	BRL (<3.3)	BRL (<8.7)	BRL (<5.6)	BRL (<7.4)	--[A]
Carbon change conducted on 2/4/19; system restarted on 2/5/19.																		
2/15/2019	4600	130	120	550	110	--[A]	560	14	14	62	14	--[A]	BRL (<6.0)	BRL (<3.3)	BRL (<8.7)	BRL (<6.2)	BRL (<7.4)	--[A]
3/11/2019	5600	120	120	520	98	--[A]	63	BRL(<3.3)	BRL (<4.9)	BRL (<5.6)	BRL (<7.1)	--[A]	BRL (<6.0)	BRL (<3.3)	BRL (<4.9)	BRL (<5.6)	BRL (<7.1)	--[A]
Iron sediments pumped out of influent tank and transfer pump associated piping - 3/29/2019. Replaced VFD.																		
4/9/2019	6600	140	180	580	99	--[A]	400	7.4	9.9	31	BRL (<7.1)	--[A]	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	--[A]
5/21/2019	2500	83	59	290	100	8.6	3400	72	69	260	7.8	12	BRL (<12)	BRL (<7.4)	BRL(<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
Carbon change conducted on 06/13/19; system restarted on 06/14/19.																		
6/27/2019	8400	86	120	340	68	26	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
7/29/2019	9500	78	100	290	72	16	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
8/22/2019	8300	64	100	260	63	20	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
9/26/2019	4900	65	82	220	64	21	64	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
10/30/2019	3800	63	85	230	72	19	51	BRL (<7.4)	BRL (<4.9)	5.9	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
11/12/2019	4200	53	85	200	59	15	120	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
12/17/2019	1500	43	51	180	54	10	530	16	17	63	22	4.5	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
Carbon change conducted on 12/23/19; system restarted on 12/26/19.																		
1/17/2020	2200	57	60	220	69	13	11	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
2/13/2020	3100	74	66	310	92	17	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
3/3/2020	3300	72	64	300	81	14	7.4	BRL (<0.23)	BRL (<0.48)	BRL (<0.33)	BRL (<0.37)	BRL (<0.18)	0.60	BRL (<0.23)	BRL (<0.48)	BRL (<0.33)	BRL (<0.37)	BRL (<0.18)
4/28/2020	1900	52	42	210	56	42	86	2.7	2.2	10	3.4	0.51	BRL (<0.43)	BRL (<0.23)	BRL (<0.48)	BRL (<0.33)	BRL (<0.37)	BRL (<0.18)
5/21/2020	1800	46	40	200	50	11	110	3.5	2.9	12	3.9	0.8	BRL (<0.43)	BRL (<0.23)	BRL (<0.48)	BRL (<0.33)	BRL (<0.37)	BRL (<0.18)
6/24/2020	1400	41	41	160	49	19	64	3.3	2.7	15	5.4	1.4	3.30	0.94	0.84	0.83	1.2	BRL (<0.64)
7/28/2020	1700	44	43	200	52	12	130	3.4	3	13	3.9	0.96	BRL (<0.43)	BRL (<0.49)	BRL (<0.80	BRL (<0.53)	BRL (<0.51)	BRL (<0.64)
Carbon change conducted on 08/12/2020; system restarted on 08/14/2020.																		
8/27/2020	1400	42	38	170	48	9	0.92	BRL (<0.49)	BRL (<0.8)	BRL (<0.53)	BRL (<0.51)	BRL (<0.64)	BRL (<0.43)	BRL (<0.49)	BRL (<0.80)	BRL (<0.53)	BRL (<0.51)	BRL (<0.64)
9/23/2020	2000	46	50	200	57	14	BRL (<0.43)	BRL (<0.49)	BRL (<0.80)	BRL (<0.53)	BRL (<0.51)	BRL (<0.64)	BRL (<0.43)	BRL (<0.49)	BRL (<0.80)	BRL (<0.53)	BRL (<0.51)	BRL (<0.64)
10/20/2020	2300	49	50	230	63	15	1.1	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)	0.54	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)
11/24/2020	2300	59	43	240	71	18	14	1	BRL (<2.0)	2.1	1.3	BRL (<2.0)	10	0.94	BRL (<2.0)	1.9	1.2	BRL (<2.0)

Notes:
1. Concentrations presented in ng/L - nanograms per Liter - parts per trillion
2. * - Prior to June 11, 2018, the USEPA established the EPA Health Advisory for two PFAS chemicals, PFOA and PFOS, which was 70 ng/L. Subsequently, MassDEP's Office of Research and Standards (ORS) expanded on this Health Advisory and created the ORS Guideline that applied to the total summed of five PFAS chemicals, PFOS, PFOA, PFNA, PFHxS, and PFHpA, effective June 11, 2018.
3. On December 13, 2019, MassDEP published the newly established clean up standards for PFAS in soil and groundwater. These standards were effective as of December 27, 2019 and apply to the total sum of six PFAS chemicals, PFOS, PFOA, PFNA, PFHxS, PFHpA, and PFDA; the new standard is 20 ng/L or parts per trillion (ppt). Concentrations of the six PFAS compounds presented in the table were not compared to the new MassDEP standards until the January 2020 monthly system sample collection, which is after the effective date of December 27, 2019.
4. --[A]: Concentrations of the three additional PFAS chemicals, PFNA, PFHxS, and PFHpA were not presented prior to 06.11.18. The USEPA Health Advisory only applies to the PFOS and PFOA compounds. Concentrations of PFNA, PFHxS, and PFHpA were not presented/tabulated until after the MassDEP ORS Guideline was in effect on 06.11.18.
5. --[B]: Concentrations of the PFAS compound, PFDA, were not presented prior to the May 2019 sampling period. On April 19, 2019, MassDEP presented a draft of proposed risk standards for PFAS that included a sixth, PFAS compound, PFDA.
6. BRL - Below Laboratory Reporting Limits; reporting limit shown in parentheses.
7. Concentrations in bold exceed applicable MassDEP ORS Guideline and/or the MCP Method 1 GW-1 groundwater risk standard.
8. PFOS - Perfluorooctanesulfonic acid
9. PFOA - Perfluorooctanoic Acid
10. PFNA - Perfluorononanoic Acid
11. PFHxS - Perfluorohexanesulfonic Acid
12. PFHpA - Perfluoroheptanoic Acid
13. PFDA - Perfluorodecanoic Acid
14. NA - Concentration data not available

Table 1B - Summary of Groundwater Pump and Treatment System Total PFAs Analytical Data -GWTS #2
Barnstable County Fire and Rescue Training Academy
155 Flint Rock Road, Barnstable, MA
RTN 4-26179

SAMPLE ID	INFLUENT (PRW-4)						MIDPOINT						EFFLUENT					
USEPA Method 537.2	PFOS (ng/L)	PFOA (ng/L)	PFNA (ng/L)	PFHxS (ng/L)	PFHpA (ng/L)	PFDA (ng/L)	PFOS (ng/L)	PFOA (ng/L)	PFNA (ng/L)	PFHxS (ng/L)	PFHpA (ng/L)	PFDA (ng/L)	PFOS (ng/L)	PFOA (ng/L)	PFNA (ng/L)	PFHxS (ng/L)	PFHpA (ng/L)	PFDA (ng/L)
MassDEP ORS Guidline*	70 ng/L						70 ng/L						70 ng/L					
MCP Method 1 GW-1 Standard [15]	20 ng/L						20 ng/L						20 ng/L					
SAMPLE DATE																		
System Startup on 11/11/19.																		
11/12/2019	4200	53	85	200	59	15	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
11/15/2019	--	--	--	--	--	--	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
11/19/2019	--	--	--	--	--	--	BRL (<5.2)	44	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	42	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
12/17/2019 [16]	1500	43	51	180	54	10	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
1/17/2020	2200	57	60	220	69	13	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
2/13/2020	3100	74	66	310	92	17	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)	BRL (<5.2)	BRL (<7.4)	BRL (<4.9)	BRL (<5.2)	BRL (<7.1)	BRL (<4.1)
3/3/2020	3300	72	64	300	81	14	5.6	BRL (<0.23)	BRL (<0.48)	BRL (<0.33)	BRL (<0.37)	BRL (<0.18)	BRL (<0.43)	BRL (<0.23)	BRL (<0.48)	BRL (<0.33)	BRL (<0.37)	BRL (<0.18)
4/28/2020	1900	52	42	210	56	42	64	2.2	1.7	9.7	3.0	0.27	0.47	BRL (<0.23)	BRL (<0.48)	BRL (<0.33)	BRL (<0.37)	BRL (<0.18)
5/21/2020	1800	46	40	200	50	11	76	2.8	2.0	10	3.6	0.52	BRL (<0.43)	BRL (<0.23)	BRL (<0.48)	BRL (<0.33)	BRL (<0.37)	BRL (<0.18)
6/24/2020	1400	41	41	160	49	19	39	2.9	2.3	12	4.3	1.1	0.84	BRL (<0.49)	BRL (<0.80)	BRL (<0.53)	BRL (<0.51)	BRL (<0.64)
7/28/2020	1700	44	43	200	52	12	84	3.8	3.3	17	5.7	0.76	BRL (<0.43)	BRL (<0.49)	BRL (<0.80)	BRL (<0.53)	BRL (<0.51)	BRL (<0.64)
8/27/2020	1400	42	38	170	48	9	6.1	BRL (<0.49)	BRL (<0.80)	1.2	0.61	BRL (<0.64)	BRL (<0.43)	BRL (<0.49)	BRL (<0.80)	BRL (<0.53)	BRL (<0.51)	BRL (<0.64)
9/23/2020	2000	46	50	200	57	14	18	0.79	0.86	2.4	1.3	BRL (<0.64)	BRL (<0.43)	BRL (<0.49)	BRL (<0.80)	BRL (<0.53)	BRL (<0.51)	BRL (<0.64)
10/20/2020	2300	49	50	230	63	15	7.5	0.64	BRL (<2.0)	1.4	1.0	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)
11/24/2020	2300	59	43	240	71	18	120	3.2	2.40	17	5.0	0.92	1.5	0.52	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)	BRL (<2.0)

Notes:

1. Concentrations presented in ng/L - nanograms per Liter - parts per trillion
2. MassDEP's Office of Research and Standards (ORS) expanded upon the USEPA's Health Advisory and created the ORS Guideline that applies to the total summed of five PFAS chemicals, PFOS, PFOA, PFNA, PFHxS, and PFHpA, effective June 11, 2018.
3. Concentrations of the PFAS compound, PFDA, are presented based on the April 19, 2019, MassDEP draft of new/proposed groundwater standards for PFAS that includes a sixth, PFAS compound, PFDA. However the concentration of PFDA is not inclued in total PFAS removal calcuations.
5. BRL - Below Laboratory Reporting Limits; reporting limit shown in parentheses.
6. Concentrations in bold exceed applicable MassDEP ORS Guideline
7. PFOS - Perfluorooctanesulfonic acid
8. PFOA - Perfluorooctanoic Acid
9. PFNA - Perfluorononanoic Acid
10. PFHxS - Perfluorohexanesulfonic Acid
11. PFHpA - Perfluoroheptanoic Acid
12. PFDA - Perfluorodecanoic Acid
13. --: Concentration data not available and/or sample was not collected on that date.
14. Per MCP Regulations, the system was sampled one day, three days, and seven (7) days following the initial week of startup (11/11/19).
15. On December 13, 2019, MassDEP published the newly established clean up standards for PFAS in soil and groundwater. These standards were effective as of December 27, 2019 and apply to the total sum of six PFAS chemicals, PFOS, PFOA, PFNA, PFHxS, PFHpA, and PFDA. Concentrations of the six PFAS compounds presented in the table were not compared to the new MassDEP standards until the January 2020 monthly system sample collection.
16. The December monthly sample was collected from the system's effluent stream on 12/17/2019 following the receipt of the laboratory results from the 11/19/2019 sampling event on 12/16/2019. The effluent was resampled again to ensure significant breakthrough was not occurring from the secondary carbon vessel.

Table 2A - Summary of Groundwater Pump and Treatment System Operating and Maintenance Data - System No. 1 (GWTS #1)
Barnstable County Fire and Rescue Training Academy
155 Flint Rock Road, Barnstable, MA
RTN 4-26179

Date	Operator[1]	System Operating on Arrival	Influent Bag Filter Differential Pressure (psi) [5]		Pre-Filter Changeout Differential Pressure (psi)		Post-Filter Changeout Differential Pressure (psi)		6" Influent Tank Fill Rate (min)	INFLUENT	Days System Operating	EFFLUENT					Estimated Total PFAs Removal (kg)[9]	System Operating on Departure	System Sampled	Comments
			Pre	Post	Gauge: P1	Gauge: P2	Gauge: P1	Gauge: P2		Combined Instantaneous Estimated Influent Flow Rate (GPM)[7]		Instant. Effluent Flow Rate (GPM)[8]	Instantaneous Effluent Flow Rate (GPM)[2,9]	Totalizer (Gal)	Total Gallons Treated	Average Effluent Flow Rate (GPM)[10]				
4/9/2018	CE	No	75	NA	NA	NA	75	NA	NA	NA	0	--	--	--	--	--		Yes	Yes	Conducted system pressure checks after restart.
4/10/2018	CE	Yes	94	74	NA	NA	77	74	2.07	59.3	1	--	--	--	--	--	0.001	Yes	No	Changed 3 bag filters (5 µm) and conducted system pressure checks.
4/11/2018	CE	Yes	76	NA	NA	NA	76	NA	2.78	44.0	2	--	--	--	--	--	0.001	Yes	No	Carbon vessels were backwashed individually from 1313 to 1427.
4/12/2018	CE	Yes	NA	NA	NA	NA	75	75	2.78	44.0	3	--	--	--	--	--	0.002	Yes	No	Transfer pump is drawing down influent./holding tank faster than PRW-4 well is filling tank. No bag filter changes.
4/13/2018	CE	Yes	88	74	NA	NA	75	74	2.80	43.8	4	--	--	--	--	--	0.003	Yes	Yes	Changed 3 bag filters (5 µm) and conducted system pressure checks.
4/16/2018	CE	Yes	86	74	NA	NA	74	74	2.83	43.2	7	--	--	--	--	--	0.005	Yes	No	system pressure checks.
4/19/2018	CE	Yes	83		NA	NA	75		NA	NA	10	--	--	--	--	--	NA	Yes	No	Transfer pump is maintaining drawdown and flow through system ahead of the PRW-4 well pump, no bag changes.
4/20/2018	CE	Yes	89	75	NA	NA	75	75	3.07	39.9	11	--	--	--	--	--	0.007	Yes	No	Changed 3 bag filters (5 µm) and conducted system pressure checks.
4/23/2018	CE	Yes	92	76	NA	NA	77	76	3.18	38.5	14	--	--	--	--	--	0.009	Yes	No	control panel, PRW-4 restarted at 14:55. Transfer pump maintaining flow ahead of PRW-4 well pump. Both carbon vessels backwashed. Changed 3 bag
4/24/2018	CE	Yes	74	NA	NA	NA	76		3.18	38.5	15	--	--	--	--	--	0.009	Yes	No	No bag change, conducted system pressure checks.
4/25/2018	CE	Yes	79	NA	NA	NA	75		3.30	37.1	16	--	--	--	--	--	0.009	Yes	No	Pressure differential of 4 psi, no bag filter change, transfer pump is maintaining flow ahead of the PRW-4 well pump.
4/26/2018	CE	Yes	83	NA	NA	NA	76		3.37	36.4	17	--	--	--	--	--	0.010	Yes	No	and PRW-4 well pump are on and operating, treatment takes 28 seconds to drawn down 1 inch in influent tank (~17.5 gallons)
4/27/2018	CE	Yes	84	73	NA	NA	75	75	3.42	35.8	18	--	--	--	--	--	0.010	Yes	No	Changed 3 bag filters (5 µm) and conducted system pressure checks.
4/30/2018	CE	Yes	87	73	NA	NA	75	75	3.53	34.7	21.00	--	--	--	--	--	0.012	Yes	No	Changed 3 bag filters (5 µm) and conducted system pressure checks.
	Totals - April 2018									41.3	21.00						0.014			
5/1/2018	CS	Yes	83		NA	NA	75		3.83	32.0	0.00	--	--	--	--	--	0.0000	Yes	No	min
5/2/2018	CS	Yes	94	75	NA	NA	80	75	3.63	33.7	1.00	--	--	--	--	--	0.0006	Yes	No	float switch relay stuck in on position, PRW-4 shutoff at 0733 and restarted at 08.26 with float switch working properly. Adjusted transfer pump rate back to
5/4/2018	JES	Yes	110	73	NA	NA	73	75	3.65	33.6	3.00	--	--	--	--	--	0.0017	Yes	No	Changed 3 bag filters (10 um) and conducted system pressure checks.
5/7/2018	JES	Yes	110	73	NA	NA	74	74	3.7	33.1	6.00	--	--	--	--	--	0.0034	Yes	No	Changed 3 bag filters (5 um) and conducted system pressure checks.
	Totals - May 2018									33.1	8.00						0.004			
6/5/2018	CE/MM	No	--	--	NR	NR	NR	NR	--	--	0	--	--	--	--	--	0	--	--	Carbon Change out- filled vessels with water and let to sit for ~24 hours, changed 3 bag filters (5 um)
6/6/2018	CE	Yes	--	--	NR	NR	NR	NR	3.45	35.5	1	--	--	--	--	--	0.001	No	No	Pump floats not operating correctly, low float turns pump off and when low float is in water again, transfer pump starts. System remained off.
6/7/2018	CE	Yes	62	52	NR	NR	NR	NR	3.18	38.5	2	--	--	--	--	--	0.001	Yes	No	Electrian on site in morning to correct float error, system operating normally.
6/11/2018	CE	Yes	56	61	NR	NR	NR	NR	3.63	33.7	6	--	--	--	--	--	0.003	Yes	No	No bag change, conducted system pressure checks.
6/12/2018	CE	Yes	56	63	NR	NR	NR	NR	3.68	33.3	7	--	--	--	--	--	0.004	Yes	No	No bag change, conducted system pressure checks.
6/13/2018	CE	Yes	58	54	NR	NR	NR	NR	3.46	35.4	8	--	--	--	--	--	0.005	Yes	No	Changed 3 bag filters.
6/13/2018	MM	Yes	--	--	NR	NR	NR	NR	--	--	8	--	--	--	--	--	--	--	Yes	Did not collect system data, only collected samples from Influent, Midpoint, and Effluent sample ports/locations.
6/16/2018	CE	Yes	77	60	NR	NR	NR	NR	--	--	11	--	--	--	--	--	--	--	No	Changed 3 bag filters.
6/19/2018	CE	Yes	92	65	NR	NR	NR	NR	--	--	14	--	--	--	--	--	--	No	No	on/off and did not hear contact relay pull in. System remained off until electrical issue in recovery well is fixed. Fixed at 15:45
6/20/2018	CE	Yes	72	60	NR	NR	NR	NR	3.73	32.8	15	--	--	--	--	--	0.008	Yes	No	No bag change, conducted system pressure checks.
6/21/2018	CE	Yes	79	60	NR	NR	NR	NR	--		16	--	--	--	--	--				speed.
6/22/2018	CE	Yes	87	67	NR	NR	NR	NR	3.72	32.9	17	--	--	--	--	--	0.009	Yes	No	Changed 3 bag filters, conducted system pressure checks.
6/25/2018	CE	Yes	81	68	NR	NR	NR	NR	3.77	32.5	20	--	--	--	--	--	0.011	Yes	No	Changed 3 bag filters, conducted system pressure checks.
6/27/2018	CE	Yes	79	68	NR	NR	NR	NR	3.73	32.8	22	--	--	--	--	--	0.012	Yes	No	Changed 3 bag filters, conducted system pressure checks.
6/29/2018	CE	Yes	78	68	NR	NR	NR	NR	3.68	33.3	24	--	--	--	--	--	0.014	Yes	No	Changed 3 bag filters, conducted system pressure checks.
	Totals - June 2018									33.9	24						0.013			
7/2/2018	CE	Yes	83	69	NR	NR	NR	NR	3.95	31.0	2	--	--	--	--	--	0.001	Yes	No	Changed 3 bag filters, conducted system pressure checks.
7/5/2018	CE	No	--	--	NR	NR	NR	NR	--	--	5	--	--	--	--	--	--	No	No	No power supplied to the recovery well.
7/6/2018	CE	Yes	86	69	NR	NR	NR	NR	3.87	31.7	5	--	--	--	--	--	0.003	Yes	No	Changed 3 bag filters, conducted system pressure checks.
7/9/2018	CE	Yes	89	72	NR	NR	NR	NR	3.77	32.5	8	--	--	--	--	--	0.004	Yes	No	Changed 3 bag filters, conducted system pressure checks.
7/11/2018	CE	Yes	88	72	NR	NR	NR	NR	3.85	31.8	10	--	--	--	--	--	0.005	Yes	No	Changed 3 bag filters, conducted system pressure checks.
7/13/2018	CE	Yes	89	72	NR	NR	NR	NR	4.08	30.0	12	--	--	--	--	--	0.006	Yes	Yes	Changed 3 bag filters, conducted system pressure checks.
7/16/2018	CE	Yes	98	70	NR	NR	NR	NR	3.97	30.9	15	--	--	--	--	--	0.007	Yes	No	Changed 3 bag filters, conducted system pressure checks.
7/18/2018	CE	No	--	--	NR	NR	NR	NR	--	--	--	--	--	--	--	--	--	No	No	No power supplied to the recovery well. Contact relay at recovery well pump out.
7/19/2018	CE	Yes	94	72	NR	NR	NR	NR	4.03	30.4	17	--	--	--	--	--	0.008	Yes	No	Electrician replaced the contact relay; recovery well operating again. Changed 3 bag filters and collected system pressure checks.
7/20/2018	CE	Yes	81	72	NR	NR	NR	NR	--	--	--	--	--	--	--	--	--	Yes	No	Changed 3 bag filters, conducted system pressure checks. Backwashed carbon vessels.
7/23/2018	CE	Yes	84	72	NR	NR	NR	NR	4.47	27.4	21	--	--	--	--	--	0.009	Yes	No	Changed 3 bag filters, conducted system pressure checks.
7/25/2018	CE	Yes	84	72	NR	NR	NR	NR	--	--	--	--	--	--	--	--	--	Yes	No	Collected system pressure checks.
7/26/2018	CE	Yes	80	72	NR	NR	NR	NR	--	--	--	--	--	--	--	--	--	Yes	No	Collected system pressure checks.
7/27/2018	CE	Yes	88	72	NR	NR	NR	NR	4.8	25.5	25	--	--	--	--	--	0.010	Yes	No	Changed 3 bag filters, conducted system pressure checks.
7/30/2018	CE	Yes	91	71	NR	NR	NR	NR	4.95	24.7	28	--	--	--	--	--	0.011	Yes	No	Changed 3 bag filters, conducted system pressure checks.
	Totals - July 2018									29.6	28						0.015			
8/2/2018	CE	Yes	89	70					5.17	23.7	2						0.001	Yes	No	Changed 3 bag filters, conducted system pressure checks.
8/6/2018	CE	Yes	94	72					5.22	23.5	6						0.002	Yes	No	Changed 3 bag filters, conducted system pressure checks.
8/10/2018	CE	Yes	98	72					4.32	28.4	6						0.003	Yes	No	Changed 3 bag filters, conducted system pressure checks.
8/14/2018	CE	Yes	82	69					4.8	25.5	6						0.002	Yes	No	Changed 3 bag filters, conducted system pressure checks.
8/2/2018	CE	Yes	89	70	NR	NR	NR	NR	5.17	23.7	2	--	--	--	--	--	0.001	Yes	No	Changed 3 bag filters, conducted system pressure checks.
8/6/2018	CE	Yes	94	72	NR	NR	NR	NR	5.22	23.5	6	--	--	--	--	--	0.003	Yes	No	Changed 3 bag filters, conducted system pressure checks.
8/10/2018	CE	Yes	98	72	NR	NR	NR	NR	4.32	28.4	10	--	--	--	--	--	0.006	Yes	No	Changed 3 bag filters, conducted system pressure checks. System was sampled on August 7, 2018.
8/14/2018	CE	Yes	82	69	NR	NR	NR	NR	4.8	25.5	14	--	--	--	--	--	0.007	Yes	No	Changed 3 bag filters, conducted system pressure checks.
8/17/2018	CE	Yes	81	64	NR	NR	NR	NR	5.0	24.5	17	--	--	--	--	--	0.008	Yes	No	Changed 3 bag filters, conducted system pressure checks. Backwashed carbon vessels.
8/21/2018	CE	No	78	68	NR	NR	NR	NR	5.2	23.6	20	--	--	--	--	--	0.009	Yes	No	Recovery well down, due to contactor burnout/failure. System restarted at 14.45.
8/24/2018	CE	Yes	77	68	NR	NR	NR	NR	5.32	23.0	23	--	--	--	--	--	0.010	Yes	No	Changed 3 bag filters, conducted system pressure checks.
8/28/2018	CE	Yes	89	69	NR	NR	NR	NR	6.03	20.3	27	--	--	--	--	--	0.011	Yes	No	Changed 3 bag filters, conducted system pressure checks.
	Totals - August 2018									24.1	30						0.014			
9/4/2018	CE	Yes	89	67	NR	NR	NR	NR	5.87	20.9	4	--	--	--	--	--	0.002	Yes	No	Changed 3 bag filters, conducted system pressure checks.
9/7/2018	CE	Yes	82	70	NR	NR	NR	NR	6.52	18.8	7	--	--	--	--	--	0.004	Yes	No	Changed 3 bag filters, conducted system pressure checks.
9/11/2018	CE	Yes	88	70	NR	NR	NR	NR	7.03	17.4	11	--	--	--	--	--	0.005	Yes	No	Changed 3 bag filters, conducted system pressure checks.
9/14/2018	CE	Yes	86	70	NR	NR	NR	NR	7.18	17.1	14	--	--	--	--	--	0.006	Yes	No	Changed 3 bag filters, conducted system pressure checks.
9/18/2018	CE	Yes	91	74	NR	NR	NR	NR	8.02	15.3	18	--	--	--	--	--	0.007	Yes	No	Changed 3 bag filters, conducted system pressure checks.
9/21/2018	CE	No	74	70	NR	NR	NR	NR	--	--	--	--	--	--	--	--	--	No	No	Recovery well down.
9/24/2018	CE	Yes	94	70	NR	NR	NR	NR	8.03	15.3	23	--	--	--	--	--	0.010	Yes	No	Changed 3 bag filters, conducted system pressure checks.
9/28/2018	CE	Yes	--	--	NR	NR	NR	NR	--	--	--	--	--	--	--	--	--	--	--	Carbon Change out- filled vessels with water and let to sit for ~24 hours, changed 3 bag filters (5 um), system sampled on 09/27/18.
	Totals - September 2018									17.4	28						0.010			

Table 2A - Summary of Groundwater Pump and Treatment System Operating and Maintenance Data - System No. 1 (GWTS #1)
Barnstable County Fire and Rescue Training Academy
155 Flint Rock Road, Barnstable, MA
RTN 4-26179

Date	Operator[1]	System Operating on Arrival	Influent Bag Filter Differential Pressure (psi) [5]		Pre-Filter Changeout Differential Pressure (psi)		Post-Filter Changeout Differential Pressure (psi)		6" Influent Tank Fill Rate (min)	INFLUENT	Days System Operating	EFFLUENT					Estimated Total PFAs Removal (kg)[7]	System Operating on Departure	System Sampled	Comments
			Pre	Post	Gauge: P1	Gauge: P2	Gauge: P1	Gauge: P2		Combined Instantaneous Estimated Influent Flow Rate (GPM)[7]		Instant. Effluent Flow Rate (GPM)[8]	Instantaneous Effluent Flow Rate (GPM)[2,9]	Totalizer (Gal)	Total Gallons Treated	Average Effluent Flow Rate (GPM)[10]				
10/1/2018	CE	No	78	57	NR	NR	NR	NR	5.83	21.0	1	--	--	--	--	--	0.000	Yes	No	System restarted after scheduled shutdown for carbon exchange. Changed 3 bag filters, conducted system pressure checks.
10/5/2018	CE	Yes	65	55	NR	NR	NR	NR	6.35	19.3	5	--	--	--	--	--	0.002	Yes	No	Changed 3 bag filters, conducted system pressure checks.
10/10/2018	CE	Yes	56	57	NR	NR	NR	NR	6.95	17.6	10	--	--	--	--	--	0.003	Yes	No	Changed 3 bag filters, conducted system pressure checks.
10/12/2018	CE	Yes	60	55	NR	NR	NR	NR	--	--	12	--	--	--	--	--	--	Yes	No	No bag change necessary.
10/15/2018	CE	Yes	70	60	NR	NR	NR	NR	6.9	17.8	15	--	--	--	--	--	0.005	Yes	No	Changed 3 bag filters, conducted system pressure checks. Repaired filter basket.
10/19/2018	CE	Yes	71	60	NR	NR	NR	NR	7.12	17.2	19	--	--	--	--	--	0.006	Yes	No	Changed 3 bag filters, conducted system pressure checks.
10/23/2018	CE	Yes	76	63	NR	NR	NR	NR	7.73	15.8	23	--	--	--	--	--	0.007	Yes	No	Changed 3 bag filters, conducted system pressure checks. Repaired holding basket in filter vessel.
10/26/2018	CE	Yes	72	64	NR	NR	NR	NR	8.83	13.9	26	--	--	--	--	--	0.007	Yes	No	Changed 3 bag filters, conducted system pressure checks.
10/30/2018	CE	Yes	80	65	NR	NR	NR	NR	7.52	16.3	30	--	--	--	--	--	0.009	Yes	Yes	Changed 3 bag filters, conducted system pressure checks. Repaired bag holder (basket) in filter vessel.
Totals - October 2018										17.4	31						0.011			
11/2/2018	CE	Yes	71	62	NR	NR	NR	NR	7.86	15.6	2	--	--	--	--	--	0.001	Yes	No	Changed 3 bag filters, conducted system pressure checks.
11/6/2018	CE	Yes	71	62	NR	NR	NR	NR	--	--	6	--	--	--	--	--		No	No	Changed 3 bag filters, conducted system pressure checks. Backwashed both carbon vessels. System shutdown at 10:00 for force main descaling and flush.
11/8/2018	CE	Yes	65	45	NR	NR	NR	NR	5.25	23.3	6	--	--	--	--	--	0.004	Yes	No	Changed 3 bag filters, conducted system pressure checks. System restarted at 12:40 following the completion of the force main descaling.
11/9/2018	CE	Yes	55	44	NR	NR	NR	NR	5.2	23.6	7	--	--	--	--	--	0.004	Yes	No	Changed 3 bag filters, conducted system pressure checks.
11/12/2018	CE	Yes	51	47	NR	NR	NR	NR	5.03	24.4	10	--	--	--	--	--	0.007	Yes	No	Conducted system pressure checks.
11/13/2018	CE	Yes	52	47	NR	NR	NR	NR	4.88	25.1	11	--	--	--	--	--	0.007	Yes	No	Conducted system pressure checks.
11/14/2018	CE	Yes	54	47	NR	NR	NR	NR	4.92	24.9	12	--	--	--	--	--	0.008	Yes	No	Conducted system pressure checks.
11/15/2018	CE	Yes	55	47	NR	NR	NR	NR	--	--	13	--	--	--	--	--	--	Yes	No	Conducted system pressure checks.
11/16/2018	CE	Yes	54	50	NR	NR	NR	NR	4.63	26.5	14	--	--	--	--	--	0.010	Yes	Yes	Changed 3 bag filters, conducted system pressure checks.
11/21/2018	CE	Yes	63	53	NR	NR	NR	NR	5.08	24.1	19	--	--	--	--	--	0.012	Yes	No	Changed 3 bag filters, conducted system pressure checks.
11/27/2018	CE	Yes	69	55	NR	NR	NR	NR	5.75	21.3	25	--	--	--	--	--	0.014	Yes	No	Changed 3 bag filters, conducted system pressure checks.
11/30/2018	CE	Yes	77	58	NR	NR	NR	NR	5.85	20.9	28	--	--	--	--	--	0.016	Yes	No	Changed 3 bag filters, conducted system pressure checks.
Totals - November 2018										23.0	28						0.012			
12/3/2018	CE	Yes	63	62	NR	NR	NR	NR	5.33	23.0	3	--	--	--	--	--	0.001	Yes	No	Changed 3 bag filters, conducted system pressure checks.
12/7/2018	CE	Yes	83	67	NR	NR	NR	NR	5.58	22.0	7	--	--	--	--	--	0.002	Yes	No	Changed 3 bag filters, conducted system pressure checks.
12/11/2018	CE	Yes	75	65	NR	NR	NR	NR	5.8	21.1	11	--	--	--	--	--	0.003	Yes	No	Changed 3 bag filters, conducted system pressure checks.
12/14/2018	CE	Yes	70	63	NR	NR	NR	NR	5.4	22.7	14	--	--	--	--	--	0.004	Yes	Yes	Changed 3 bag filters, conducted system pressure checks.
12/18/2018	CE	Yes	70	65	NR	NR	NR	NR	6.72	18.2	18	--	--	--	--	--	0.004	Yes	No	Changed 3 bag filters, conducted system pressure checks.
12/21/2018	CE	Yes	70	67	NR	NR	NR	NR	6.7	18.3	21	--	--	--	--	--	0.005	Yes	No	Changed 3 bag filters, conducted system pressure checks.
12/26/2018	CE	Yes	78	71	NR	NR	NR	NR	7.38	16.6	26	--	--	--	--	--	0.006	Yes	No	Changed 3 bag filters, conducted system pressure checks.
12/28/2018	CE	Yes	82	70	NR	NR	NR	NR	7.35	16.7	28	--	--	--	--	--	0.006	Yes	No	Changed 3 bag filters, conducted system pressure checks.
12/31/2018	CE	Yes	82	71	NR	NR	NR	NR	7.38	16.6	31	--	--	--	--	--	0.007	Yes	No	Changed 3 bag filters, conducted system pressure checks.
Totals - December 2018										19.5	31						0.008			
1/4/2019	RPT	Yes	72	72	NR	NR	NR	NR	6.5	18.8	4	--	--	--	--	--	0.001	Yes	No	Changed 3 bag filters, conducted system pressure checks, observed hole in pre-filter basket.
1/7/2019	PCB	Yes	80	71	NR	NR	NR	NR	6.2	19.8	7	--	--	--	--	--	0.002	Yes	No	Change 3 bag filters, conducted system pressure checks.
1/10/2018	RPT	Yes	75	70	NR	NR	NR	NR	7.03	17.4	10	--	--	--	--	--	0.003	Yes	No	Conducted system pressure checks.
1/11/2018	MDM	Yes	79	71	NR	NR	NR	NR	7.62	16.1	11	--	--	--	--	--	0.003	Yes	Yes	Change 3 bag filters, conducted system pressure checks.
1/14/2019	PCB	Yes	76	71	NR	NR	NR	NR	--	--	14	--	--	--	--	--	--	Yes	No	Conducted system pressure checks.
1/15/2019	PCB	Yes	80	71	NR	NR	NR	NR	--	--	15	--	--	--	--	--	--	Yes	No	Change 3 bag filters, conducted system pressure checks.
1/18/2019	PCB	Yes	76	71	NR	NR	NR	NR	8.65	14.2	18	--	--	--	--	--	0.004	Yes	No	Change 3 bag filters, conducted system pressure checks.
1/21/2019	SCT	Yes	80	71	NR	NR	NR	NR	8.15	15.0	21	--	--	--	--	--	0.005	Yes	No	Change 3 bag filters, conducted system pressure checks.
1/24/2019	SCT	Yes	85	69	NR	NR	NR	NR	9.1	13.5	24	--	--	--	--	--	0.005	Yes	No	Change 3 bag filters, conducted system pressure checks.
1/27/2019	SCT	Yes	85	68	NR	NR	NR	NR	8.25	14.8	27	--	--	--	--	--	0.007	Yes	No	Change 3 bag filters, conducted system pressure checks.
1/30/2019	PCB	Yes	86	71	NR	NR	NR	NR	9	13.6	30	--	--	--	--	--	0.007	Yes	No	Change 3 bag filters, conducted system pressure checks.
1/31/2019	PCB	Yes	83	71	NR	NR	NR	NR	--	--	31	--	--	--	--	--	--	Yes	No	Change 3 bag filters, conducted system pressure checks.
Totals - January 2019										14.5	31						0.008			
2/4/2019	RPT	Yes	--	--	NR	NR	NR	NR	--	--	--	--	--	--	--	--	--	--	No	Carbon Change out- filled vessels with water and let to sit for ~24 hours, changed 3 bag filters (5 um).
2/5/2019	RPT	No	52	35	NR	NR	NR	NR	7.33	16.7	4	--	222.7	--	--	--	0.002	Yes	No	System restarted after scheduled shutdown for carbon exchange. Changed bag filters and conducted system pressure checks.
2/11/2019	PCB	Yes	83	45	NR	NR	NR	NR	11.58	10.6	10	--	--	--	--	--	--	Yes	No	Changed 3 bag filters, conducted system pressure checks.
2/13/2019	ST	Yes	55	43	NR	NR	NR	NR	8.12	15.1	12	--	--	--	--	--	--	Yes	No	Changed 3 bag filters, conducted system checks.
2/15/2019	MDM	Yes	--	--	NR	NR	NR	NR	7.5	16.3	14	--	131.7	--	--	--	0.007	Yes	Yes	Sampled system and collected system pressure checks.
2/22/2019	ST	Yes	--	--	NR	NR	NR	NR	10.75	11.4	21	--	43.75	--	--	--	0.007	Yes	No	Changed 3 bag filters, repaired filter basket, adjusted and lowered the speed drive on the transfer/discharge pump.
2/25/2019	MDM	Yes	25	15	NR	NR	NR	NR	7.5	16.3	23	--	--	--	--	--	--	Yes	No	System shutdown at 09:33 for the replacement of the submersible pump at PRW-4 and restarted at 14:04.
Totals - February 2019										14.4	26		132.7				0.011	Yes	No	
3/1/2019	ST	Yes	43	40	NR	NR	NR	NR	7.55	16.2	1	--	76.6	--	--	--	0.001	Yes	No	Conducted system pressure checks.
3/3/2019	ST	Yes	45	40	NR	NR	NR	NR	--	--	3	--	--	--	--	--	--	Yes	No	Conducted system pressure checks, changed bag filters, installed/replaced filters baskets with new stainless steel filter baskets.
3/5/2019	PCB	Yes	46	40	NR	NR	NR	NR	--	--	5	--	--	--	--	--	--	Yes	No	Conducted system pressure checks.
3/7/2019	PCB/ST	Yes	50	40	NR	NR	NR	NR	8.16	15.0	7	--	--	--	--	--	0.004	Yes	No	Conducted system pressure checks and changed bag filters.
3/9/2019	ST	Yes	44	41	NR	NR	NR	NR	7.75	15.8	9	--	--	--	--	--	0.005	Yes	No	Changed bag filters.
3/11/2019	ST	Yes	58	50	NR	NR	NR	NR	7.92	15.5	11	--	68.1	--	--	--	0.006	Yes	Yes	Changed bag filters
3/13/2019	ST	Yes	65	50	NR	NR	NR	NR	4.62	26.5	13	--	--	--	--	--	--	Yes	No	Noticed low speed on transfer pump, adjusted VFD to increase pump speed to 55 Hz. Changed 3 bag filters twice.
3/14/2019	ST	Yes	75	50	NR	NR	NR	NR	5.16	23.7	14	--	70.0	--	--	--	0.012	Yes	No	Conducted system pressure checks and collected samples from EQ tank for analysis at County lab for disposal criteria.
3/16/2019	PCB	No	62	60	NR	NR	NR	NR	--	--	15	--	--	--	--	--	--	Yes	No	Pump at PRW-4 shut off upon arrival to system, contact relay failure, possibly due to power surge from thunderstorm. Restarted system after contact relay was replaced.
3/22/2019	ST	Yes	28	20	NR	NR	NR	NR	2.38	51.5	21	--	51.5	--	--	--	0.038	Yes	No	Replaced VFD drive for effluent transfer pump inside system shed.
3/23/2019	ST	Yes	23	20	NR	NR	NR	NR	--	--	22	--	--	--	--	--	--	No	No	Changed bag filters before system shutdown. System shutdown due to slow flow rate from transfer pump as a result of accumulating iron sediments in EQ tank from slow influent flow rate as a result of a the failing PRW-4 well pump.
3/29/2019	RPT/ST	No	--	--	NR	NR	NR	NR	--	--	23	--	--	--	--	--	--	Yes	No	Removed/pumped out the contents of the influent equalization (EQ) tank, repaired the system's pump electrical components, adjusted VFD on transfer pump, installed unions on influent piping manifold, replaced bag filters at discharge into the EQ tank, and restarted the system at 1645.
Totals - March 2019										29.3	25		63.2				0.022			
4/1/2019	ST	Yes	--	--	40	28	40	39	2.25	54.4	1	--	--	--	--	--	0.002	Yes	No	Conducted system pressure checks and changed bag filters.
4/3/2019	ST	Yes	--	--	40	39	--	--	--	--	3	--	--	--	--	--	--	Yes	No	Conducted system pressure checks.
4/6/2019	ST	Yes	--	--	50	41	50	50	2.23	54.9	6	--	--	--	--	--	0.014	Yes	No	Conducted system pressure checks and changed bag filters.
4/9/2019	GWTT	Yes	--	--	40	50	--	--	1.6	76.6	9	--	18.85	--	--	--	0.029	Yes	Yes	Conducted system pressure checks, backwashed the primary carbon vessel for ~30 minutes; inspected the transfer pump and removed excess iron oxide sedimentation from the inlet piping.
4/10/2019	ST	Yes	--	--	50	15	23	25	--	--	10	--	--	--	--	--	--	Yes	No	Conducted system pressure checks and changed bag filters.
4/11/2019	ST	Yes	--	--	40	35	35	35	--	--	11	--	--	--	--	--	--	Yes	No	Conducted system pressure checks and changed bag filters.
4/12/2019	GWTT	Yes	--	--	50	40	44	46	3	40.8	12	--	--	--	--	--	0.020	Yes	No	Conducted system pressure checks and changed bag filters.
4/15/2019	GWTT	Yes	--	--	55	45	55	55	4.08	30.0	15	--	--	--	--	--	0.019	Yes	No	Conducted system pressure checks and changed bag filters.
4/19/2019	GWTT	Yes	--	--	58	55	35	40	2.5	49.0	19	--		--	--	--	0.039	Yes	No	Conducted system pressure checks and changed bag filters.
4/23/2019	GWTT	Yes	--	--	48	47	50	55	4.00	30.6	23	--	33.4	--	--	--	0.029	Yes	No	Conducted system pressure checks and changed bag filters.
4/26/2019	GWTT	Yes	--	--	58	50	55	60	--	--	26	--	20.3	--	--	--	--	Yes	No	Conducted system pressure checks and changed bag filters, conducted general housekeeping duties.
4/30/2019	GWTT	No	--	--	--	--	--	--	--	--	29	--	--	--	--	--	--	--	Yes	System off on arrival due to contact relay failure for transfer pump operation; system restarted at 16:29 after contact relay was replaced.
Totals - April 2019										48.1	29		24.2				0.058			

Table 2A - Summary of Groundwater Pump and Treatment System Operating and Maintenance Data - System No. 1 (GWTS #1)
Barnstable County Fire and Rescue Training Academy
155 Flint Rock Road, Barnstable, MA
RTN 4-26179

Date	Operator[1]	System Operating on Arrival	Influent Bag Filter Differential Pressure (psi) [3]		Pre-Filter Changeout Differential Pressure (psi)		Post-Filter Changeout Differential Pressure (psi)		6" Influent Tank Fill Rate (min)	INFLUENT	Days System Operating	EFFLUENT					Estimated Total PFAs Removal (kg)[9]	System Operating on Departure	System Sampled	Comments
			Pre	Post	Gauge: P1	Gauge: P2	Gauge: P1	Gauge: P2		Combined Instantaneous Estimated Influent Flow Rate (GPM)[7]		Instant. Effluent Flow Rate (GPM)[8]	Instantaneous Effluent Flow Rate (GPM)[2,9]	Totalizer (Gal)	Total Gallons Treated	Average Effluent Flow Rate (GPM)[10]				
5/3/2019	GWTT	Yes	--	--	55	35	45	50	2.18	56.2	3	--	32.93	--	--	--	0.003	Yes	No	Conducted system pressure checks and changed bag filters.
5/7/2019	GWTT	Yes	--	--	58	38	50	55	2.05	59.8	7	--	31.57	--	--	--	0.007	Yes	No	Conducted system pressure checks and changed bag filters.
5/10/2019	GWTT	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	System down as a result of failed VFD for transfer pump operation, changed bag filters.
5/17/2019	GWTT	No	--	--	55	38	--	--	--	--	10	--	--	--	--	--	--	Yes	No	Installed new VFD drive, system shutdown due to power surge from thunderstorm. Electrician added 15 minute- electrical control delay at the control panel in the system shed; creating a 15 minute delay before the pump at PRW-4 powers on at the "high level" float switch.
5/21/2019	MDM	No	--	--	57	30	57	60	1.83	66.9	14	--	33.38	--	--	--	0.016	Yes	Yes	Power surge from rogue ground voltage at electrical easement "fried" the electrical delay at control panel in system shed. Electrican bypassed delay to allow system restart at 11:15. Electrician will change coil at PRW-4 panel to lower voltage at later date. Conducted system pressure checks and changed bag filters.
5/24/2019	GWTT	Yes	--	--	58	35	58	60	2.083	58.8	17	--	25.36	--	--	--	0.017	Yes	No	Conducted system pressure checks and changed bag filters. Bypass installed to allow 15 minute delay on PRW-4 submersible pump float switch.
5/28/2019	GWTT	Yes	--	--	56	46	55	60	2.65	46.2	21	--	52.10	--	--	--	0.016	Yes	No	Conducted system pressure checks and changed bag filters twice. Backwashed both carbon vessels.
5/31/2019	GWTT	Yes	--	--	58	35	55	60	2.17	56.5	24	--	36.90	--	--	--	0.022	Yes	No	Conducted system pressure checks and changed bag filters. 3" butterfly valve on INF of LGACs #2 replaced. Installed a 3 inch flow totalizer and meter on effluent discharge piping.
Totals - May 2019										57.4	24		35.4				0.023			
6/4/2019	GWTT	Yes	--	--	57	48	57	62	2.46	49.8	4	--	20.2	--	--	--	0.010	Yes	No	Conducted system pressure checks and changed bag filter. Replaced in-kind flow meter previously installed on 5/31/19.
6/7/2019	GWTT	Yes	--	--	57	45	57	62	2.43	50.4	7	--	16.2	--	--	--	0.017	Yes	No	Conducted system pressure checks and changed bag filters.
6/11/2019	GWTT	Yes	--	--	76	78	70	82	2.53	48.4	11	--	17.3	--	--	--	0.026	Yes	No	Conducted system pressure checks and changed bag filters. System shutdown due to high pressure measurement on the LGAC vessels, (from iron fouling); carbon change to occur on 6/13/19.
6/13/2019	MDM	No	--	--	--	--	--	--	--	--	11	--	--	--	--	--	--	No	No	System off for carbon change out.
6/14/2019	GWTT	No	--	--	--	--	25	28	2.3	53.3	12	--	167.1	--	--	--	0.032	Yes	No	System restarted at 13:00, adjusted flow rate via VFD to 55 Hz. GWTT recorded Effluent flow rate from drop in site glass to be 44 seconds, immediately after adjusting the VFD.
6/18/2019	GWTT	Yes	--	--	25	10	11	15	2.23	54.9	16	--	56.2	--	--	--	0.043	Yes	No	Conducted system checks, changed bag filters, adjusted VFD to 55 GPM.
6/21/2019	GWTT	Yes	--	--	17	15	17	20	2.12	57.8	19	--	58.6	--	--	--	0.054	Yes	No	Conducted system checks, changed bag filters, adjusted VFD to 28 Hz.
6/25/2019	GWTT	Yes	--	--	20	18	20	25	2.3	53.3	23	--	59.0	--	--	--	0.060	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 28 to 35 Hz.
6/27/2019	MDM	Yes	--	--	33	21	--	--	3.2	38.3	25	--	17.5	--	--	--	0.047	Yes	Yes	Conducted system checks, system VFD at 35 Hz; pressure gauges at LGAC 2 are 0 psi.
6/28/2019	GWTT	Yes	--	--	33	22	30	35	2.4	51.0	26	--	60.9	--	--	--	0.065	Yes	No	Conducted system checks, changed bag filters, VFD at 35 Hz. Effluent flow rate increased after bag filter changeout.
Totals - June 2019										50.8	27		62.4		NR[11]		0.068			
7/2/2019	GWTT	Yes	--	--	32	20	30	32	2.52	48.6	2	NR	52.6	20575	--	--	0.005	Yes	No	Conducted system checks, changed bag filters.
7/5/2019	GWTT	Yes	--	--	25	23	30	35	2.53	48.4	5	NR	52.6	242970	222395	--	0.013	Yes	No	Conducted system checks, changed bag filters, VFD at 35 Hz. Effluent flow rate increased after bag filter changeout.
7/9/2019	GWTT	Yes	--	--	32	25	36	40	2.35	52.1	9	NR	58.6	311680	68710	--	0.026	Yes	No	Conducted system checks, changed bag filters, VFD at 35 Hz. Effluent flow rate increased after bag filter changeout. Primary LGAC vessel requires a
7/12/2019	GWTT	Yes	--	--	39	35	39	43	2.42	50.6	12	NR	55.7	407920	96240	--	0.033	Yes	No	Conducted system checks, changed bag filters, adjusted VFD to 42 Hz.
7/15/2019	GWTT	Yes	--	--	46	40	35	50	3.00	40.8	15	NR	55.7	587740	179820	--	0.034	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 42 Hz to 40 Hz.
7/18/2019	GWTT	Yes	--	--	45	28	55	60	2.83	43.3	18	NR	47.48	NR	NR	--	0.043	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 40 Hz to 45 Hz.
7/23/2019	GWTT	Yes	--	--	56	43	55	61	3.22	38.0	23	NR	25.63	717580	129840	--	0.048	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 40 Hz to 45 Hz.
7/26/2019	GWTT	Yes	--	--	56	50	56	60	--	--	26	NR	11.93	722700	5120	--	--	Yes	No	Conducted system checks, changed bag filters.
7/29/2019	GWTT	Yes	--	--	--	--	56	60	2.50	49.0	29	NR	53.3	723360	660	--	0.078	Yes	Yes	Pumped out contents of exterior totes and conducted backwash of system (6,800 gallons removed by Global). Shutdown system for ~2 hours. VFD at 23 Hz on departure.
Totals - July 2019										46.9	31		45.1		NR[11]		0.079			
8/2/2019	GWTT	Yes	--	--	15	5	18	9	2.68	50.6	2	NR	19.68	723960	0	0.0	0.006	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 23 Hz to 28 Hz.
8/5/2019	GWTT	Yes	--	--	21	8	16	20	2.50	52.8	5	NR	49.00	726280	2320	0.5	0.014	Yes	No	Conducted system checks, changed bag filters, VFD at 28 Hz.
8/8/2019	GWTT	Yes	--	--	20	19	22	27	2.23	54.9	8	NR	53.50	729450	3170	0.7	0.024	Yes	No	Conducted system checks, changed bag filters, adjusted VFD to 32 Hz and 31 Hz. Visability of site glass impaired due to iron fouling, possible obstruction in site glass causing error in flow calculations.
8/13/2019	GWTT	Yes	--	--	27	23	28	30	2.17	56.5	13	NR	56.45	738390	8940	1.2	0.040	Yes	No	Conducted system checks, changed bag filters, adjusted VFD to 23 Hz. Obstruction in site glass seems apparent, affecting flow rate calculations.
8/16/2019	GWTT	Yes	--	--	32	26	30	35	1.04	117.8	16	NR	34.83	744020	5630	1.3	0.103			Conducted system checks, changed bag filters, adjusted VFD from 23 Hz to 28 Hz.
8/20/2019	GWTT	Yes	--	--	40	27	36	38	NR	NR	20	NR	NR	757990	13970	2.4	--	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 38 Hz to 39 Hz. Could not calculate influent flow rate due to obstruction in site glass
8/23/2019	GWTT	Yes	--	--	41	29	38	44	--	--	23	NR	50.00	790720	32730	7.6	0.063	Yes	Yes	Conducted system checks, changed bag filters, and adjusted VFD from 39 Hz to 40 Hz. Collected montly system samples on 8/22/19.
8/27/2019	GWTT	Yes	--	--	45	35	44	49	--	--	27	NR	50.00	873750	83030	14.4	0.074	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 40 Hz to 42 Hz.
8/30/2019	GWTT	Yes	--	--	49	37	8	10	--	--	30	NR	49.00	976540	102790	23.8	0.081	Yes	No	Conducted system checks, changed bag filters after backwash of primary vessel.
Totals - August 2019										66.5	31		NR[11]		252580	6.5	0.113			
9/3/2019	GWTT	Yes	--	--	18	7	10	14	NA	NA	3	--	NR	1044190	67650	15.7	0.001	Yes	No	Conducted system checks, changed bag filters, "High High Level" Alarm indicated, adjusted VFD, site glass plugged due to iron oxide sludge build up at bottom of EQ tank, could not collect influent flow rate.
9/6/2019	GWTT	Yes	--	--	27	14	22	25	NA	NA	6	--	NR	NR	NR	NR	--	Yes	No	Conducted system checks, changed bag filters, "High High Level" Alarm indicated, adjusted VFD to 35 Hz from 31 Hz.
9/10/2019	GWTT	Yes	--	--	35	18	30	35	NA	NA	10	--	NR	1203690	159500	27.7	0.008	Yes	No	
9/13/2019	GWTT	Yes	--	--	40	25	40	42	NA	NA	13	--	NR	1311290	107600	24.9	0.009	Yes	No	Conducted system checks, changed bag filters, observed approximately 20 in. of sludge in EQ Tank, and adjusted VFD to 40 Hz from 38 Hz.
9/16/2019	GWTT	Yes	--	--	45	26	44	48	NA	NA	16	--	NR	1413970	102680	23.8	0.011	Yes	No	Conducted system checks, changed bag filters, and adjusted VFD to 48 Hz.
9/20/2019	GWTT	Yes	--	--	68	35	12	14	NA	NA	20	--	NR	1543040	129070	22.4	0.013	Yes	No	Conducted system checks, changed bag filters, backwashed primary GAC vessel, and adjusted VFD to 29 Hz.
9/23/2019	GWTT	Yes	--	--	24	8	23	27	NA	NA	23	--	NR	1563850	20810	4.8	0.003	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 29 Hz to 34 Hz.
9/27/2019	GWTT	Yes	--	--	32	17	42	44	NA	NA	27	--	NR	1577890	14040	2.4	0.002	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 34 Hz to 42 Hz, system samples collected on 9/26/19.
Totals - September 2019[12]										NA[7]	30		NR[11]		601350	17.4	0.015			
10/1/2019	GWTT	Yes	--	--	50	28	18	19	NA	NA	1	--	NR	1620400	--	--	--	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 42 Hz to 31 Hz. Operator noticed a loud sound on discharge pipes at LGAC #1 as well as a pressure drop across the entire system, system was instantly turned off and restarted after the VFD was adjusted. Operator assumed an obstruction (i.e. iron oxide precipitates) was in LGAC#1 restricting flow and loud sound was the obstruction being dislodged.
10/3/2019	GWTT	Yes	--	--	--	--	--	--	NA	NA	3	--	NR	1639940	19540	6.8	0.0005	Yes	No	System was shut off at 8:00 during excavation of the effluent discharge piping. The discharge piping was repaired and the system was restarted at 16:00. The bag filters were changed.
10/7/2019	GWTT	Yes	--	--	27	14	22	20	NA	NA	6	--	NR	1645550	5610	1.3	0.0002	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 31 Hz to 35 Hz.
10/11/2019	GWTT	Yes	--	--	32	30	19	20	NA	NA	10	--	NR	1663870	38320	6.7	0.0015	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 35 Hz to 32 Hz.
10/15/2019	GWTT	Yes	--	--	29	20	27	30	NA	NA	14	--	NR	1755270	71400	12.4	0.0040	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 32 Hz to 39 Hz.
10/18/2019	GWTT	Yes	--	--	38	22	30	35	NA	NA	18	--	NR	1867270	112000	19.4	0.0082	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 39 Hz to 35 Hz.
10/22/2019	GWTT	Yes	--	--	34	13	31	35	NA	NA	21	--	NR	1946590	79320	18.4	0.0090	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 35 Hz to 43 Hz.
10/25/2019	GWTT	Yes	--	--	44	34	35	42	NA	NA	24	--	NR	2043780	97190	22.5	0.0126	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 43 Hz to 40 Hz.
10/28/2019	GWTT	Yes	--	--	44	34	35	42	5.38	22.8	27	--	NR	2123880	80100	18.5	0.0117	Yes	No	Conducted system checks, changed bag filters, Global Cycle on site to vacuum pump out the contents from the EQ tank, bag filter unit, totes containing water from GAC vessel backwashes. The VFD was adjusted from 40 Hz to 24 Hz. Pressure gauge at P5 was replaced. System sampled on 10/30/19.
Totals - October 2019[12]										NA[7]	30		NR[11]		503480	11.7	0.008			
11/1/2019	GWTT	Yes	--	--	15	2	19	19	5.00	24.5	1	NR	53.26	2128040	4160	2.9	--	Yes	No	Conducted system checks, changed bag filters, and adjusted the VFD frequency.
11/4/2019	GWTT	Yes	--	--	26	8	21	17	4.28	28.60	4	NR	45.37	2131870	3830	0.9	--	Yes	No	Conducted system checks, changed bag filters, and the VFD was adjusted from 30 Hz to 29 Hz.
11/7/2019	GWTT	Yes	--	--	25	10	30	27	3.70	33.1	7	NR	44.0	2042122	--	--	--	Yes	No	Conducted system checks, changed bag filters, exchanged 3" flow meter to 2" pulse turbine flow meter/totalizer. Adjusted the VFD from 29 Hz to 34 Hz on departure.
11/11/2019	GWTT	Yes	--	--	32	18	31	35	3.70	33.1	11	35	NR	2119390	77268	13.4	0.0037	Yes	Yes	Conducted system checks, changed bag filters, VFD left at 34 Hz. Force main Influent flow was split; temporary GWTPS expansion system started. System sampled on 11/12/19.
11/15/2019	GWTT	Yes	--	--	32	21	32	36	4.47	27.4	14	43	NR	2190828	71438	16.5	0.0058	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 34 Hz to 38 Hz on departure.
11/18/2019	GWTT	Yes	--	--	40	30	42	46	4.43	27.6	17	37	NR	2273202	82374	19.1	0.0081	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 38 Hz to 39 Hz upon departure.
11/22/2019	GWTT	Yes	--	--	42	27	41	45	3.50	35.0	21	33	NR	2391315	118113	20.5	0.0108	Yes	No	Conducted system checks, changed bag filters. VFD kept at 39 Hz. Cleared sludged out of bottom of sight glas on EQ tank.
11/25/2019	GWTT	Yes	--	--	43	32	43	46	3.90	31.4	24	42	NR	2486658	95343	22.1	0.0133	Yes	No	Conducted system checks, changed bag filters. VFD kept at 39 Hz.
11/29/2019	GWTT	Yes	--	--	45	32	44	48	4.10	29.9	28	39	NR	2601976	115318	20.0	0.0141	Yes	No	Conducted system checks, changed bag filters.
Totals - November 2019[12]										30.1	29		NR[11]		559854	21.6	0.016			

Table 2A - Summary of Groundwater Pump and Treatment System Operating and Maintenance Data - System No. 1 (GWTS #1)
Barnstable County Fire and Rescue Training Academy
155 Flint Rock Road, Barnstable, MA
RTN 4-26179

Date	Operator[1]	System Operating on Arrival	Influent Bag Filter Differential Pressure (psi) [5]		Pre-Filter Changeout Differential Pressure (psi)		Post-Filter Changeout Differential Pressure (psi)		6" Influent Tank Fill Rate (min)	INFLUENT	Days System Operating	EFFLUENT					Estimated Total PFAs Removal (kg)[9]	System Operating on Departure	System Sampled	Comments
			Pre	Post	Gauge: P1	Gauge: P2	Gauge: P1	Gauge: P2		Combined Instantaneous Estimated Influent Flow Rate (GPM)[7]		Instant. Effluent Flow Rate (GPM)[8]	Instantaneous Effluent Flow Rate (GPM)[2,9]	Totalizer (Gal)	Total Gallons Treated	Average Effluent Flow Rate (GPM)[10]				
12/2/2019	BETA	Yes	--	--	--	--	--	--	--	--	2	--	--	2685088	83112	28.9	0.001	No	No	System shutdown at 10:00 for force main de-scale process.
12/4/2019	BETA	No	--	--	--	--	52	60	4.55	26.9	2	--	NR	2685088	0	0.0	0.000	Yes	No	Bag filters changed prior to system restart. System (PRW-4 and system) restarted at 12:12 following the force main de-scale and purging process. Collected post-bag filter checks after system restart.
12/6/2019	GWTT	Yes	--	--	55	25	52	58	2.17	62.0	4	50	NR	2735900	50812	17.6	0.001	Yes	No	Conducted system checks, flow into system #2 shutoff PRW-4 due to high level alarm. Changed the bag filters, and adjusted the VFD from 44 Hz to 46 Hz.
12/9/2019	GWTT	Yes	--	--	59	22	58	63	2.12	62.0	7	50	NR	2854135.0	118235	27.4	0.002	Yes	No	Conducted system checks, changed bag filters, adjusted VFD to 48 Hz to increase the discharge/effluent flow rate. GWTT communicated that carbon vessels should be backwashed since the differential pressure between P3 and P4 is 50 psi.
12/13/2019	GWTT	Yes	--	--	64	66	45	71	1.95	62.8	11	--	48.0	3002260.0	148125	25.7	0.003	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 48 Hz to 49 Hz (49 GPM) at departure. GWTT noted the pressure on the carbon vessels was approaching their maximum limit.
12/16/2019	GWTT	Yes	--	--	66	70	56	74	2.02	60.6	14	--	40.0	3122091.0	119831	27.7	0.004	Yes	Yes	Conducted system pressure checks, changed bag filters, adjusted the VFD from 49 Hz to 50 Hz (45 GPM). GWTT noted the pressure on the carbon vessels was approaching their maximum limit. System sampled on 12/17/19.
12/20/2019	GWTT	Yes	--	--	45	63	41	67	NR	NR	18	--	16.00	3239075.0	116984	20.3	0.004	Yes	No	Conducted system pressure checks and changed bag filters and adjusted the VFD from 40 Hz to 47 Hz. Water waste from force main descale process removed from totes off-site by Global Cycle.
12/23/2019	GWTT	Yes	--	--	NR	NR	NR	NR	NR	NR	21	--	NR	--	--	--	--	No	No	System shutdown for carbon changeout at 08:00. Spent carbon removed from both vessels and replaced with new virgin carbon.
12/26/2019	GWTT	No	--	--	NR	11	NR	14	2.25	54.4	22	--	NR	3317372.0	78297	54.4	0.012	Yes	No	System restarted and requilibrated at 08:00 following carbon changeout and carbon hydration. Conducted system pressure checks, changed bag filters, adjusted the VFD to 23 Hz upon departure.
12/30/2019	GWTT	Yes	--	--	19	11	6	13	2.42	50.6	26	--	52.00	3460145.0	142773	24.8	0.006	Yes	No	Conducted system checks and changed bag filters, VFD at 26 Hz.
Totals - December 2019[11]										54.2	27		39.0		858169	22.1	0.006			
1/3/2020	GWTT	Yes	--	--	18	8	14	15	2.37	51.8	3	--	49.00	3588009.0	127864	29.6	0.001	Yes	No	Conducted system checks and changed bag filters, and adjusted VFD.
1/6/2020	GWTT	Yes	--	--	18	11	14	15	2.92	42.0	6	--	45.00	3692480.0	104471	24.2	0.002	Yes	No	Conducted system checks and changed bag filters, and adjusted VFD.
1/10/2020	GWTT	Yes	--	--	21	12	17	20	3.00	40.8	10	--	46.00	3809788.0	117308	20.4	0.003	Yes	No	Conducted system checks and changed bag filters, VFD at 27 Hz.
1/13/2020	GWTT	Yes	--	--	21	16	18	21	3.35	36.6	13	--	39.00	3899180.0	89392	20.7	0.004	Yes	No	Conducted system checks and changed bag filters.
1/17/2020	GWTT	Yes	--	--	25	20	23	26	3.62	33.9	17	--	24.00	3992818.0	93638	16.3	0.004	Yes	Yes	Conducted system checks and changed bag filters. Adjusted VFD to 33 Hz. Flushed iron sludge/sediment out of bottom of sight glass on EQ holding tank.
1/20/2020	GWTT	Yes	--	--	28	21	26	29	3.97	30.9	20	--	37.00	4065780.0	72962	16.9	0.005	Yes	No	Conducted system checks and changed bag filters.
1/24/2020	GWTT	Yes	--	--	29	22	27	30	5.13	23.9	24	--	34.00	4150180.0	84400	14.7	0.005	Yes	No	Conducted system checks and changed bag filters.
1/26/2020	GWTT	Yes	--	--	26	24	25	28	5.75	21.3	27	--	39.00	4205753.0	55573	12.9	0.005	Yes	No	Conducted system checks and changed bag filters.
1/31/2020	GWTT	Yes	--	--	28	23	26	30	6.80	18.0	31	--	36.00	4272375.0	66622	11.6	0.005	Yes	No	Conducted system checks, changed bag filters, cleaned sight glass on EQ tank; about 4-5 inches of sludge accumulated at bottom.
Totals - January 2020[12]										33.2	30.9		38.8		812230	18.3	0.009			
2/4/2020	GWTT	Yes	--	--	28	22	26	30	8.00	15.3	4	--	36.00	4325997	120244	20.9	0.002	Yes	No	Conducted system checks and changed bag filters.
2/7/2020	GWTT	Yes	--	--	26	25	24	28	7.90	15.5	7	--	38.00	4360208	34211	7.9	0.001	Yes	No	Conducted system checks and changed bag filters.
2/11/2020	GWTT	Yes	--	--	26	25	26	30	11.07	11.1	11	--	43.00	4399300	39092	6.8	0.001	Yes	No	Conducted system checks and changed bag filters. Backwashed primary LGAC vessel, adjusted transfer pump from 33 Hz to 23 Hz after backwash.
2/13/2020	GWTT	Yes	--	--	9	8	7	9	12.33	9.9	13	--	42.00	4418200	18900	6.6	0.002	Yes	Yes	Conducted system checks and changed bag filters. Adjusted transfer pump from 33 Hz to 23 Hz, recycled backwash water into GWTS #2 for treatment.
2/18/2020	GWTT	Yes	--	--	12	6	8	9	16.63	7.4	18	--	42.00	4454815	36615	5.1	0.002	Yes	No	Conducted system checks and changed bag filters.
2/21/2020	GWTT	Yes	--	--	10	8	9	11	22.67	5.4	21	--	40.00	4471238	16423	3.8	0.002	Yes	No	Conducted system checks and changed bag filters.
2/24/2020	GWTT	Yes	--	--	15	5	13	15	2.65	46.2	24	--	44.00	4490425	19187	4.4	0.002	Yes	No	Conducted system checks and changed bag filters. Bag filters packed with significant iron-oxide sediments, influent flow rate into EQ tank significantly increased; slug of iron-oxide must have broke through from accumulation in the force main. Adjusted VFD from 23 Hz to 30 Hz.
2/26/2020	GWTT	Yes	--	--	25	10	20	24	2.60	47.1	26	--	37.00	4519500	29075	10.1	0.005	Yes	No	Conducted system checks and change bag filters. Increase discharge flow through VFD from 30 Hz to 35 Hz. Pressure readings at primary LGAC vessel indicating a need for a backwash.
2/28/2020	GWTT	Yes	--	--	29	10	13	15	2.55	48.0	28	--	52.00	4556491	36991	12.8	0.007	Yes	No	Conducted system checks and change bag filters. Conducted a backwash on primary LGAC vessel. Initial instantaneous Effluent flow rate was measured at 75 GPM after backwash. Adjusted VFD from 35 Hz to 26 Hz.
Totals - February 2020[12]										22.9	29		41.6		350738	8.4	0.004			
3/2/2020	GWTT	Yes	--	--	21	6	12	14	2.83	43.2	2	--	46.00	4645525	89034	20.6	0.001	Yes	Yes	Conducted system checks, changed bag filter, pumped water from large exterior tote through GWTS #2. System sampled on 3/3/2020
3/6/2020	GWTT	Yes	--	--	19	10	16	19	3.00	40.8	6	--	38.00	4723654	78129	13.6	0.002	Yes	No	Conducted system checks, changed bag filters, adjusted VFD from 26 Hz to 30 Hz.
3/9/2020	GWTT	Yes	--	--	25	18	11	15	3.00	40.8	9	--	51.00	4785425	61771	14.3	0.003	Yes	No	Conducted system checks, changed bag filters, at departure, instantaneous effluent flow rate at 51 gpm (30 Hz).
3/13/2020	GWTT	Yes	--	--	23	8	13	16	3.23	37.9	13	--	51.00	4898555	113130	19.6	0.005	Yes	No	Conducted system checks, changed bag filters.
3/16/2020	GWTT	Yes	--	--	23	9	14	17	3.75	32.7	16	--	50.00	4968818	70263	16.3	0.005	Yes	No	Conducted system checks, changed bag filters.
3/20/2020	GWTT	Yes	--	--	25	9	18	21	3.60	34.0	20	--	42.00	5052480	83662	14.5	0.006	Yes	No	Conducted system checks, changed bag filters, backwashed the primary LGAC vessel, adjusted the VFD from 30 Hz to 25 Hz: 42 GPM. Observed significant iron-oxide sedimentation accumulation in EQ tank.
3/23/2020	GWTT	Yes	--	--	17	9	15	17	3.00	40.8	23	--	48.00	5097785	45305	10.5	0.005	Yes	No	Conducted system checks; had to change the bag filters twice because the accumulated iron-oxide sediment in the EQ tank is getting pulled into the transfer pump affecting total gallons treated. Sight glass on EQ tank was flushed. Adjusted VFD from 25 Hz to 35 Hz.
3/26/2020	GWTT	Yes	--	--	34	17	27	29	3.00	40.8	26	--	48.00	5163530	65745	15.2	0.008	Yes	No	Conducted system checks, changed bag filters and increased the VFD from 35 Hz to 38 Hz.
3/30/2020	GWTT	Yes	--	--	38	14	34	38	3.27	37.5	30	--	42.00	5264195	100665	17.5	0.011	Yes	No	Conducted system checks, changed bag filters and increased the VFD from 38 Hz to 40 Hz.
Totals - March 2020[12]										38.7	31		46.2		707704	15.9	0.012			
4/2/2020	GWTT	Yes	--	--	34	30	31	35	2.95	41.5	2	--	51.00	5304740	40545	14.1	0.000	Yes	No	Conducted system checks and changed bag filters.
4/6/2020	GWTT	Yes	--	--	33	33	31	35	3.12	39.3	6	--	50.00	5354280	49540	8.6	0.001	Yes	No	Conducted system checks and changed bag filters. Transfer pump VFD at 40 Hz.
4/9/2020	GWTT	Yes	--	--	--	--	15	18	3.47	35.3	8.5	--	49.00	5413745	59465	16.5	0.002	Yes	No	System shutdown for 2-4 hours at 7am for vac out of EQ tank and backwash of primary carbon vessel. Global removed 2,989 gallons of iron-oxide water mixture from EQ tank and exterior totes. Conducted system checks and changed bag filters. Adjusted VFD from 40 Hz (74 gpm) to 28 Hz (49 gpm).
4/13/2020	GWTT	Yes	--	--	16	10	11	15	3.92	31.3	12.5	--	44.00	5497360	83615	14.5	0.002	Yes	No	Conducted system checks and changed bag filters
4/16/2020	GWTT	Yes	--	--	18	15	15	19	4.32	28.4	15.5	--	35.00	5552940	55580	12.9	0.003	Yes	No	Conducted system checks and changed bag filters
4/20/2020	GWTT	Yes	--	--	19	14	19	23	5.00	24.5	19.5	--	30.00	5620048	67108	11.7	0.003	Yes	No	Conducted system checks and changed bag filters, adjusted VFD from 28 Hz to 32 Hz to allow higher pressure/flow through bag filters to help with iron-oxide sediment fouling.
4/24/2020	GWTT	Yes	--	--	26	21	26	30	5.25	23.3	23.5	--	30.00	5679610	59562	10.3	0.003	Yes	No	Conducted system checks and changed bag filters, adjusted the VFD from 32 Hz to 35 Hz.
4/27/2020	GWTT	Yes	--	--	30	28	30	34	6.37	19.2	26.5	--	28.00	5723132	43522	10.1	0.003	Yes	Yes	Conducted system checks and changed bag filters. System sampled on 4/28/2020.
Totals - April 2020[12]										30.4	29.5		39.6		458937	10.8	0.004			
5/1/2020	GWTT	Yes	--	--	31	26	31	35	3.75	32.7	1	--	26.00	5756710	33578	23.3	0.0003	Yes	No	Conducted system checks and changed bag filters.
5/5/2020	GWTT	Yes	--	--	31	20	30	35	3.40	36.0	5	--	26.00	5772378	15668	2.7	0.0002	Yes	No	Conducted system checks and changed bag filters.
5/8/2020	GWTT	Yes	--	--	33	24	14	15	3.38	36.2	8	--	48.00	5843400	71022	16.4	0.0015	Yes	No	Conducted system checks and changed bag filters. Backwashed primary LGAC vessel, adjusted transfer pump from 35 Hz to 30 Hz after backwash.
5/11/2020	GWTT	Yes	--	--	24	11	17	20	3.72	33.0	11	--	47.00	5922710	79310	18.4	0.0024	Yes	No	Conducted system checks and changed bag filters.
5/15/2020	GWTT	Yes	--	--	27	16	24	28	4.80	25.5	15	--	35.00	6012638	89928	15.6	0.0027	Yes	No	Conducted system checks and changed bag filters.
5/18/2020	GWTT	Yes	--	--	26	26	25	30	4.60	26.6	18	--	35.00	6075320	62682	14.5	0.0031	Yes	No	Conducted system checks and changed bag filters. System sampled on 5/21/2020.
5/22/2020	GWTT	Yes	--	--	30	27	34	40	5.10	24.0	22	--	32.00	6154187	78867	13.7	0.0035	Yes	Yes	Conducted system checks and changed bag filters. Adjusted VFD from 35 Hz to 38 Hz.
5/26/2020	GWTT	Yes	--	--	35	34	34	40	4.15	29.5	26	--	32.00	6196369	42182	7.3	0.0022	Yes	No	Conducted system checks and changed bag filters.
5/29/2020	GWTT	Yes	--	--	32	36	32	38	4.15	29.5	29	--	35.00	6221412	25043	5.8	0.0020	Yes	No	Conducted system checks and changed bag filters.
Totals - May 2020[12]										30.3	31		35.1		498280	11.2	0.0041			
6/2/2020	GWTT	Yes	--	--	34	35	14	17	4.27	28.7	2	--	46.00	6230577	9165	3.2	0.000	Yes	No	Conducted system checks and changed bag filters. Backwashed primary LGAC vessel; Transfer pump flow rate initially at 68 gpm after backwash. Adjusted VFD from 38 Hz to 30 Hz.
6/5/2020	GWTT	Yes	--	--	24	5	15	19	3.47	35.3	5	--	40.00	6273600	43023	10.0	0.000	Yes	No	Conducted system checks and changed bag filters.
6/9/2020	GWTT	Yes	--	--	24	10	19	24	3.85	31.8	9	--	40.00	6334345	60745	10.5	0.001	Yes	No	Conducted system checks and changed bag filters. Adjusted VFD from 30 Hz to 35 Hz.
6/12/2020	GWTT	Yes	--	--	31	16	28	32	4.12	29.8	12	--	30.00	6404810	70465	16.3	0.002	Yes	No	Conducted system checks and changed bag filters..
6/16/2020	GWTT	Yes	--	--	32	24	30	35	4.67	26.3	16	--	47.00	6495449	90639	15.7	0.002	Yes	No	Conducted system checks and changed bag filters. Adjusted VFD to 30 Hz and backwashed primary LGAC vessel.
6/19/2020	GWTT	Yes	--	--	22	8	14	18	5.00	24.5	19	--	43.00	6568815	73366	17.0	0.003	Yes	No	Conducted system checks and changed bag filters. Adjusted VFD to 32 Hz.
6/22/2020	GWTT	Yes	--	--	24	14	19	24	5.72	21.4	22	--	36.00	6634380	65565	15.2	0.003	Yes	No	Conducted system checks and changed bag filters. Adjusted VFD to 36 Hz.
6/25/2020	GWTT	Yes	--	--	24	19	22	25	5.63	21.7	25	--	40.00	6690810	56430	13.1	0.003	Yes	No	Conducted system checks and changed bag filters. Adjusted VFD to 32 Hz. System samples collected on 6/24/2020.
6/29/2020	GWTT	Yes	--	--	27	18	13	15	5.15	23.8	29	--	43.00	6764833	74023	12.9	0.003	Yes	No	Conducted system checks and changed bag filters twice, backwashed primary LGAC vessel, and flushed iron oxide sediment from sight glass on EQ tank.
Totals - June 2020[12]										27.0	30		40.6		543421	12.6	0.0035			

Table 2A - Summary of Groundwater Pump and Treatment System Operating and Maintenance Data - System No. 1 (GWTS #1)
Barnstable County Fire and Rescue Training Academy
155 Flint Rock Road, Barnstable, MA
RTN 4-26179

Date	Operator[1]	System Operating on Arrival	Influent Bag Filter Differential Pressure (psi) [5]		Pre-Filter Changeout Differential Pressure (psi)		Post-Filter Changeout Differential Pressure (psi)		6" Influent Tank Fill Rate (min)	INFLUENT	Days System Operating	EFFLUENT					Estimated Total PFAs Removal (kg)[9]	System Operating on Departure	System Sampled	Comments
			Pre	Post	Gauge: P1	Gauge: P2	Gauge: P1	Gauge: P2		Combined Instantaneous Estimated Influent Flow Rate (GPM)[7]		Instant. Effluent Flow Rate (GPM)[8]	Instantaneous Effluent Flow Rate (GPM)[2,9]	Totalizer (Gal)	Total Gallons Treated	Average Effluent Flow Rate (GPM)[10]				
7/2/2020	GWTT	Yes	--	--	25	13	20	25	4.60	26.6	2	--	39.00	6837610	72777	25.3	0.001	Yes	No	Conducted system checks and changed bag filters. Adjusted VFD from 32 Hz to 34 Hz.
7/6/2020	GWTT	Yes	--	--	36	19	36	24	4.97	24.7	6	--	36.00	6913169	75559	13.1	0.001	Yes	No	Conducted system checks and changed bag filters, flushed out sight glass on the EQ tank. Adjusted VFD to 34 Hz.
7/10/2020	GWTT	Yes	--	--	24	24	22	28	4.97	24.7	10	--	39.00	6948605	35436	6.2	0.001	Yes	No	Conducted system checks and changed bag filters. Adjusted VFD to 36Hz.
7/13/2020	GWTT	Yes	--	--	28	26	26	32	5.28	23.2	13	--	42.00	6996929	48324	11.2	0.002	Yes	No	Conducted system checks and changed bag filters. Adjusted VFD to 38Hz.
7/16/2020	GWTT	Yes	--	--	32	33	11	15	6.03	20.3	16	--	44.00	7040815	43886	10.2	0.002	Yes	No	Conducted system checks and changed bag filters and adjusted VFD to 29 Hz. Conducted a backwash of primary LGAC vessel after initial readings. Reduced the transfer pump speed to reduce carry over of the iron-oxide sedimentation from the EQ tank into the bag filters and LGAC vessels.
7/20/2020	GWTT	Yes	--	--	13	11	9	13	6.57	18.7	20	--	41.00	7091010	50195	8.7	0.002	Yes	No	Conducted system checks and changed bag filters filters and LGAC vessels.
7/24/2020	GWTT	Yes	--	--	15	12	11	16	7.20	17.0	24	--	39.00	7129271	38261	6.6	0.002	Yes	No	Conducted system checks and changed bag filters, VFD at 29 Hz.
7/27/2020	GWTT	Yes	--	--	18	8	11	15	7.50	16.3	27	--	40.00	7140929	11658	2.7	0.001	Yes	Yes	Conducted system checks and changed bag filters. System sampled on 7/28/2020.
7/30/2020	GWTT	Yes	--	--	12	14	11	15	6.80	18.0	30	--	40.00	7161465	20536	4.8	0.002	Yes	No	Conducted system checks and changed bag filters.
Totals - July 2020[12]										21.1	31		40.0		396632	8.9	0.0031			
8/4/2020	GWTT	Yes	--	--	22	2	16	18	6.43	19.0	4	--	38.00	7187415	25950	4.5	0.000	Yes	No	Conducted system checks and changed bag filters twice due to excess iron-oxide precipitate carry over from accumulation in EQ tank. Adjusted VFD to 32Hz.
8/7/2020	GWTT	Yes	--	--	27	11	22	27	6.38	19.2	7	--	31.00	7228091	40676	9.4	0.001	Yes	No	Conducted system checks and changed bag filters, flushed out sight glass on the EQ tank.
8/10/2020	GWTT	Yes	--	--	27	13	24	29	6.52	18.8	10	--	25.00	7269613	41522	9.6	0.001	Yes	No	Conducted system checks and changed bag filters twice due to iron-oxide accumulation in the EQ tank; tank needs to be emptied. System shutdown on 8/12/2020 for carbon changeout.
System Shutdown for carbon changeout from 8/12/2020 to 8/14/2020																				
8/14/2020	GWTT	Yes	--	--	--	--	0	3	6.95	17.6	12	--	44.00	7307487	37874	13.2	0.001	Yes	No	Restarted system after carbon changeout. Conducted system checks and changed bag filters. Adjusted VFD to 26Hz.
8/17/2020	GWTT	Yes	--	--	18	5	5	9	7.00	17.5	15	--	38.00	7360064	52577	12.2	0.002	Yes	No	Conducted system checks and changed bag filters twice.
8/20/2020	GWTT	No	--	--	17	5	8	10	7.07	17.3	18	--	36.00	7405440	45376	10.5	0.002	Yes	No	Conducted system checks and changed bag filters twice. Transfer pump off on arrival due to high level alarm in EQ tank.
8/24/2020	GWTT	Yes	--	--	16	7	7	11	7.98	15.3	22	--	36.00	7469749	64309	11.2	0.002	Yes	No	Conducted system checks and changed bag filters.
8/28/2020	GWTT	Yes	--	--	16	7	10	11	7.42	16.5	26	--	30.00	7525700	55951	9.7	0.002	Yes	No	Conducted system checks and changed bag filters. System sampled on 8/27/2020. Iron sediment vacuumed pumped out from the EQ tank on 8/27/2020.
8/31/2020	GWTT	Yes	--	--	16	7	9	13	7.67	16.0	29	--	34.00	7575421	49721	11.5	0.003	Yes	No	Conducted system checks and changed bag filters.
Totals - August 2020[12]										17.5	29		34.7		413956	9.9	0.003			
9/4/2020	GWTT	Yes	--	--	16	7	9	13	9.75	12.6	4	--	32.00	7636205	60784	10.6	0.001	Yes	No	Conducted system checks and changed bag filters.
9/8/2020	GWTT	Yes	--	--	16	10	8	15	6.88	17.8	8	--	36.00	7684065	47860	8.3	0.001	Yes	No	Conducted system checks and changed bag filters. Increased VFD to 28 Hz.
9/11/2020	GWTT	Yes	--	--	10	10	5	10	8.60	14.2	11	--	36.00	7713895	29830	6.9	0.001	Yes	No	Conducted system checks and changed bag filters.
9/15/2020	GWTT	Yes	--	--	11	10	0	5	9.33	13.1	15	--	46.00	7751139	37244	6.5	0.001	Yes	No	Conducted system checks and changed bag filters. Backwashed primary carbon vessel.
9/18/2020	GWTT	Yes	--	--	7	5	2	6	11.05	11.1	18	--	45.00	7773921	22782	5.3	0.001	Yes	No	Conducted system checks and changed bag filters.
9/21/2020	GWTT	Yes	--	--	6	7	4	7	11.28	10.9	21	--	43.00	7794640	20719	4.8	0.001	Yes	No	Conducted system checks and changed bag filters.
9/25/2020	GWTT	Yes	--	--	2	5	2	5	12.53	9.8	25	--	43.00	7816800	22160	3.8	0.001	Yes	No	Conducted system checks and changed bag filters. System samples collected on September 23, 2020.
9/28/2020	GWTT	Yes	--	--	2	6	2	7	12.18	10.1	28	--	43.00	7827753	10953	2.5	0.001	Yes	No	Conducted system checks and changed bag filters.
Totals - September 2020[12]										12.4	30		40.5		252332	5.8	0.002			
10/2/2020	GWTT	Yes	--	--	2	5	0	5	13.63	9.0	2	--	43.00	7836549	8796	3.1	0.00009	Yes	No	Conducted system checks and changed bag filters.
10/5/2020	GWTT	Yes	--	--	16	7	5	10	12.77	9.6	5	--	40.00	7866820	30271	7.0	0.00045	Yes	No	Conducted system checks and changed bag filters.
10/13/2020	GWTT	Yes	--	--	22	8	13	16	12.90	9.5	13	--	31.00	7945077	78257	6.8	0.00114	Yes	No	Conducted system checks and changed bag filters.
10/16/2020	GWTT	Yes	--	--	15	10	10	15	14.52	8.4	16	--	42.00	7971820	26743	6.2	0.00128	Yes	No	Conducted system checks and changed bag filters.
10/19/2020	GWTT	Yes	--	--	19	10	12	15	16.32	7.5	19	--	33.00	7998570	26750	6.2	0.00152	Yes	Yes	Conducted system checks and changed bag filters. System sampled on 10/20/2020.
10/23/2020	GWTT	Yes	--	--	17	10	12	15	18.00	6.8	23	--	30.00	8035300	36730	6.4	0.00189	Yes	No	Conducted system checks and changed bag filters.
10/26/2020	GWTT	Yes	--	--	19	11	13	16	19.08	6.4	26	--	31.00	8060659	25359	5.9	0.00197	Yes	No	Conducted system checks and changed bag filters.
10/30/2020	GWTT	Yes	--	--	11	12	10	14	21.00	5.8	30	--	35.00	8081921	21262	3.7	0.00143	Yes	No	Conducted system checks and changed bag filters.
Totals - October 2020[12]										7.9	31		35.6		254168	5.7	0.002			
11/2/2020	GWTT	Yes	--	--	10	12	10	13	22.87	5.4	2	--	36.00	8093094	11173	3.9	0.00012	Yes	No	Conducted system checks and changed bag filters.
11/6/2020	GWTT	Yes	--	--	8	12	8	13	24.83	4.9	6	--	36.00	8101590	8496	1.5	0.00013	Yes	No	Conducted system checks and changed bag filters.
11/9/2020	GWTT	Yes	--	--	18	12	12	16	19.80	6.2	9	--	32.00	8121953	20363	4.7	0.00063	Yes	No	Conducted system checks and changed bag filters.
11/13/2020	GWTT	No	--	--	--	--	--	--	--	--	12	--	--	8130535	8582	2.0	--	No	No	GWTT observed no influent flow coming into the EQ tank. GWTT inspected the electrical components at PRW-4 and reset the power, after power reset, electrical current was at 77 A and power tripped and shut off. GWTT operator suggest the pump has locked up or the motor has failed. GWTT shut down both systems.
System Shutdown due to pump failure at recovery well PRW-4; pump replaced on 11/20/2020.																				
11/24/2020	GWTT	Yes	--	--	--	--	14	16	2.05	59.8	13	--	50.00	8133427	2892	2.0	0.00039	Yes	Yes	Following the replacement of the well pump at PRW-4 on 11/202/2020; GWTT restarted both systems, adjusted the transfer pump flow rate (38 Hz), changed the bag filters twice.
11/27/2020	GWTT	Yes	--	--	15	18	14	17	1.90	64.5	16	--	55.00	8146998	13571	3.1	0.00075	Yes	No	Following the replacement of the well pump at PRW-4 on 11/202/2020; GWTT restarted both systems, adjusted the transfer pump flow rate (38 Hz), changed the bag filters twice.
Totals - November 2020[12]										28.1	19		41.8		65077	2.4	0.001			

Notes:
1. CE - Coastal Engineering, GWTT - Groundwater Treatment Technologies
2. Prior to November 2019, the instantaneous Influent (INF) and effluent (EFF) flow rates are calculated based on the cross-sectional volume per vertical foot of the influent tank and the measured/timed filling (INF) rate or draining (EFF) of the tank. The diameter of the influent tank is approximately 78 inches. The cross-sectional volume of the tank is approximately 33.1 cubic feet per vertical linear foot. Therefore the flow rate calculation factor is approximately 122.5 gallons per 6 inches. Since 11/7/2019 (following the replacement of the effluent totalizer, ONLY INF flow rates (from PRW-4) are calculated based on an approximation.
This Combined Influent flow rate represents the combined flow within both force main pipes from recovery well PRW-4.
3. Prior to November 2019 the total mass of PFAS removed is calculated based on the calcuated influent flow rate, the number of days the system has been operating, and the average total Influent PFAs concentration for the month. Since November 2019, the total mass of PFAS removed is calculated based on the effluent flow rate.
4. NA or -- Not Applicable.
5. NR - Not Reported
6. As of April 1, 2019; the system's O&M data reporting was changed to include the differential pressure readings from the bag filter unit's pressure gauges before and after the bag filters are changed/replaced, if applicable.
7. Prior to November 2019, the average influent flow rate could not reliably be calculated/measured from September to (most of) October due to a blockage in the site glass on the EQ tank from accumulated iron-oxide precipitates in the bottom of the tank. The iron-oxide precipitates were removed from the EQ tank on Oct. 28, 2019.
8. Following the separation of the two force mains and the installation of GWTPS #2 on November 7, 2019, Instantaneous influent flow rates are estimated by approximating 50% of the Combined Instantaneou Influent flow rate values.
9. Instantaneous Effluent Flow Rate is recorded as the instantaneous flow rate as calculated or indicated from the totalizer flow meter on the system's effluent discharge piping - reading is collected after bag filter change and/or backwashing.
10. The Average effluent flow rate is calculated from the net gallons (Total Gallons Treated) obtained from the system's effluent totalizer flow meter and days that the system was in operation.
11. Prior to Nov. 7, 2019, calculated average effluent flow rates and the estimated PFAS removed total were calculated based on the reported totalizer readings. The totalizer flow meter readings on the effluent discharge piping were not reliable at flow rates less than 40 GPM.
Therefore the data are shaded to indicate that they are approximations only and for this reason the July through October data are also considered approximates.
12. As of September 2019, the "Totals" shown (from left to right) include the Average Instantaneous Influent Flow Rate, Total Days of System Operation, Average Instantaneous Effluent Flow Rate, Total Gallons Treated, Average Net Effluent Flow Rate, and Estimated PFAS Removed for the respective monthly reporting period.
Running average values shown for the effluent flow rate. Prior to November 7, 2019, totals shown (from left to right) included the Average Instantaneous Influent Flow Rate, Total Days of Operation, Average Instantaneous Effluent Flow Rate, and Estimated PFAS Removed for the respective monthly reporting period.

Table 2B - Summary of Groundwater Pump and Treatment System Operating and Maintenance Data - System No. 2 (GWTS #2)
Barnstable County Fire and Rescue Training Academy
155 Flint Rock Road, Barnstable, MA
RTN 4-26179

Date	Operator[1]	System Operating on Arrival	Days System Operating	Transfer Pump Pres. (psi)	Pre-Filter Changeout Differential Pressure (psi)[2]		Post-Filter Changeout Differential Pressure (psi)		Carbon Vessels. Pre-change out (psi)		Carbon Vessels. Post-change out (psi)		Instantaneous Estimated INFLUENT[7]	EFFLUENT				Estimated Total PFAs Removal (kg)	System Operating on Departure	System Sampled	Comments
				Gauge: P1	Gauge: P2	Gauge: P3	Gauge: P2	Gauge: P3	Gauge: P4	Gauge: P5	Gauge: P4	Gauge: P5	Flow Rate (GPM)[3,4]	Totalizer (Gal)	Instant. Flow Rate (GPM)[8]	Total Net Gallons Treated [4]	Average Effluent Flow Rate (GPM)[5]				
11/11/2019	GWTT	Yes	1	38	0	0	0	0	<2	0	2	2	12.56	416900	32.00	0.0	--	0.00032	Yes	No	Influent flow stream from PRW-4 split and started system #2. Conducted system checks, changed bag filters after initial flush.
11/15/2019	GWTT	Yes	4	40	24	2	5	2	2	2	2	2	34.00	451645	34.00	34745.0	8.043	0.0008	Yes	Yes	Conducted system pressure checks and changed the bag filters. System shutdown temporarily to calculate influent flow rate at GWTPS #1. Collected system startup samples on 11/12/19 and 11/15/19.
11/18/2019	GWTT	Yes	7	--	32	2	6	6	2	2	4	4	44.00	491280	33.00	39635.0	9.175	0.0016	Yes	No	Conducted system pressure checks and changed the bag filters. System shutdown temporarily to calculate influent flow rate at GWTPS #1.
11/22/2019	GWTT	Yes	11	40	31	4	7	7	4	4	6	5	12.50	549022	34.00	57742.0	10.025	0.0028	Yes	No	Conducted system pressure checks and changed the bag filters. System shutdown temporarily to calculate influent flow rate at GWTPS #1.Collected system startup samples on 11/19/19.
11/25/2019	GWTT	Yes	14	40	15	6	7	7	4	5	5	6	12.50	594623	33.00	45601.0	10.556	0.0037	Yes	No	Conducted system pressure checks and changed the bag filters.
11/29/2019	GWTT	Yes	18	40	18	6	8	8	3	3	4	4	NR	649150	34.00	54527.0	9.466	0.0043	Yes	No	Conducted system pressure checks and changed the bag filters.
Totals - November 2019[6]			19										23.11		33	232250	8.49	0.0040			
12/2/2019	BETA	Yes	2		--	--	--	--	--	--	--	--	--	686500	--	37350.0	13.0	--	No	Yes	System shutdown at 10:00 for force main de-scale process; system locked out and tagged out.
12/4/2019	BETA	No	2	40	--	--	7	7	--	--	4	4	22.70	686700	30.00	200.0	0.069	0.00000	Yes	No	System restarted at 12:12 upon finishing the de-scale purging process and restarted PRW-4.
12/6/2019	GWTT	No	4	35	--	--	14	13	--	--	10	8	25.0	707866	47.00	21166.0	7.349	0.00029	Yes	No	System off upon arrival and bag filters were completed clogged with iron sediments. Bag filters had to be changed after 20 minutes of operation. GWTT observed a high amount of solids floating in the EQ tank and pumped down the EQ tank and observed significant iron sediment sludge on the bottom of the tank. GWTT notified BETA that they would raise the floats in EQ tank to help lessen the agitation of the sludge and carryover into the bag filters. System was on high level alarm and continued to shutoff of PRW-4, which shut off system #1 due to significant iron oxide sediment accumulation in EQ tank.
12/9/2019	GWTT	Yes	7	37	39	8	16	16	7	5	14	8	25.0	813065	46.00	105199.0	24.4	0.00171	Yes	No	Conducted system checks, changed bag filters. Raising floats in EQ tank has not affected the iron sediment at the bottom.
12/13/2019	GWTT	Yes	11	38	43	11	21	20	10	5	18	7	25.0	943807	42.00	130742.0	22.7	0.00250	Yes	No	Conducted system checks, changed bag filters.
12/16/2019	GWTT	Yes	14	45	43	13	23	22	10	3	21	5	25.0	1049390	41.00	105583.0	24.4	0.00343	Yes	No	Conducted system checks, changed bag filters, EQ tank "High Level" alarm triggered.
12/20/2019	GWTT	Yes	18	42	33	14	20	20	10	4	18	6.00	25.0	1148998	43.00	99608.0	17.3	0.00312	Yes	No	Conducted system checks and changed the bag filters. System shutdown temporarily for pump out of iron oxide sediment accumulation in EQ tank.
12/23/2019	GWTT	Yes	21	--	--	--	--	--	--	--	--	--	--	1209649	NR	60651.0	14.0	0.00296	Yes	No	System shutdown at 08:00 for carbon changeout conducted on System #1.
12/26/2019	GWTT	Yes	22	38	30	15	19	19	14	6	18	7	24.2	1209820	42.00	171.0	0.1	0.00003	Yes	No	System restarted at 09:30 AM following carbon changeout conducted on System #1. Conducted system checks and changed bag filters.
12/30/2019	GWTT	Yes	26	38	38	13	22	22	12	5	20	7	24.00	1320824	40.00	111004.0	19.3	0.00503	Yes	No	Conducted system pressure checks and changed the bag filters. Reset pump control floats in EQ tank back to original depths (following the removal of iron sediments at bottom of the tank).
Totals - December 2019[6]			27										24.49		41	671674	17.3	0.005			
1/3/2020	GWTT	Yes	3	43	35	13	20	20	10	4	18	6	--	1422315	42.00	101491.0	23.5	0.00101	Yes	No	Conducted system checks, changed bag filters.
1/6/2020	GWTT	Yes	6	40	27	15	19	19	11	5	16	8	20.98	1507290	43.00	84975.0	19.7	0.00169	Yes	No	Conducted system checks, changed bag filters.
1/10/2020	GWTT	Yes	10	38	29	15	19	19	13	5	17	6	20.42	1602935	43.00	95645.0	16.6	0.00237	Yes	No	Conducted system checks, changed bag filters.
1/13/2020	GWTT	Yes	13	38	26	16	19	19	18	6	6	8	18.28	1674840	41.00	71905.0	16.6	0.00309	Yes	No	Conducted system checks, changed bag filters.
1/17/2020	GWTT	Yes	17	--	28	16	20	20	15	6	18	7	16.94	1750933	41.00	76093.0	13.2	0.00321	Yes	No	Conducted system checks, changed bag filters.
1/20/2020	GWTT	Yes	20	38	25	16	11	11	15	6	18	7	15.44	1808630	48.00	57697.0	13.4	0.00382	Yes	No	Conducted system checks, changed bag filters. Backwashed primary LGAC vessel.
1/24/2020	GWTT	Yes	24	35	19	9	11.5	11.5	6	7	8	8	11.93	1872940	48.00	64310.0	11.2	0.00383	Yes	No	Conducted system checks, changed bag filters.
1/27/2020	GWTT	Yes	27	35	16	10	12	11	7	7	9	8.00	10.65	1915785	46.00	42845.0	9.9	0.00383	Yes	No	Conducted system checks, changed bag filters, pumped backwash water through system's influent stream.
1/31/2020	GWTT	Yes	31	36	18	10	12	12	9	8	8	7	9.01	1962050	--	46265.0	8.0	0.00356	Yes	No	Conducted system checks, changed bag filters.
Totals - January 2020[6]			31										15.46		44	641226	14.4	0.004			
2/4/2020	GWTT	Yes	4	2	18	10	12	12	9	8	8	7	7.66	2000333	46.00	38283	6.6	0.00053	Yes	No	Conducted system checks, changed bag filters.
2/7/2020	GWTT	Yes	7	36	14	11	12	11	8	7	8	6	7.75	2023878	46.00	23545	5.5	0.00076	Yes	No	Conducted system checks, changed bag filters.
2/11/2020	GWTT	Yes	11	35	14	12	13	13	9	8	10	8	5.53	2049888	47.00	26010	4.5	0.00099	Yes	No	Conducted system checks, changed bag filters.
2/13/2020	GWTT	Yes	13	36	13	12	14	13	10	8	10	8	4.97	2060169	46.00	10281	3.6	0.00093	Yes	Yes	Conducted system checks, changed bag filters. Pumped backwash water from GWTS #1 through system.
2/18/2020	GWTT	Yes	18	36	15	12	13	14	9	8	9	8	3.68	2081950	57.00	21781	3.0	0.00109	Yes	Yes	Conducted system checks, changed bag filters.
2/21/2020	GWTT	Yes	21	36	15	13	14	13	10	8	10	8	2.70	2094054	48.00	12104	2.8	0.00117	Yes	Yes	Conducted system checks, changed bag filters.
2/24/2020	GWTT	Yes	24	37	43	5	16	16	2	2	13	7	23.11	2108080	47.00	14026	3.2	0.00156	Yes	Yes	Conducted system checks, changed bag filters. Bag filters packed with significant iron-oixde sediments, influent flow rate into EQ tank significantly increased; slug of iron must have broke through. Had to change bag filters twice.
2/26/2020	GWTT	Yes	26	36	43	6	16	15	6	2	16	8	23.56	2134241	45.00	26161	9.1	0.00472	Yes	Yes	Conducted system checks and changed bag filters.
2/28/2020	GWTT	Yes	28	36	44	5	21	20	5	2	18	7	24.02	2168295	42.00	34054	11.8	0.00661	Yes	Yes	Conducted system checks, changed bag filters. Approximately 6 inch of iron-oxide sludge has accumulated on bottom of EQ tank; control float switches were raised to reduce disruption of settled sludge.
Totals - February 2020[6]			29										11.44		47	206245	4.9	0.003			
3/2/2020	GWTT	Yes	2	36	35	10	15	15	9	5	10	11	21.6	2249000	48.00	80705	18.7	0.00078	Yes	Yes	Conducted system checks, changed bag filters. Backwashed primary LGAC vessel, vaccumed the iron-oxide sludge out of the EQ tank, and into 55-gal drums on site; water from the drum can be decanted back through the system. System sampled on 3/3/2020.
3/6/2020	GWTT	Yes	6	37	25	10	16	15	8	8	12	10	20.4	2315739	47.00	66739	11.6	0.00145	Yes	No	Conducted system checks, changed bag filters. System shutdown temporarily to pump backwash water from exterior totes through system.
3/9/2020	GWTT	Yes	9	37	30	9	16	16	7	6.5	14	10	20.4	2366315	44.00	50576	11.7	0.00220	Yes	No	Conducted system checks, changed bag filters.
3/13/2020	GWTT	Yes	13	38	37	9	20	20	8	5	18	10	18.9	2476035	42.00	109720	19.0	0.00518	Yes	No	Conducted system checks, changed bag filters.
3/16/2020	GWTT	Yes	16	38	29	15	20	20	12	8	18	10	16.3	2544858	41.00	68823	15.9	0.00533	Yes	No	Conducted system checks, changed bag filters.
3/20/2020	GWTT	Yes	20	38	28	17	19	19	10	7	17	10	17.0	2615618	41.00	70760	12.3	0.00514	Yes	No	Conducted system checks, changed bag filters. Observed significant iron-oxide accumulation in EQ tank.
3/23/2020	GWTT	Yes	23	38	26	16	21	20	14	8.5	18	10	20.4	2636761	41.00	21143	4.9	0.00235	Yes	No	Conducted system checks, changed bag filters.
3/26/2020	GWTT	Yes	26	38	29	14	20	19	14	8.5	18	10	20.4	2663514	41.00	26753	6.2	0.00337	Yes	No	Conducted system checks, changed bag filters.
3/30/2020	GWTT	Yes	30	46	44	5	24	24	2	1	20	9	18.8	2721065	37.00	57551	10.0	0.00627	Yes	No	Conducted system checks, changed bag filters.
Totals - March 2020[6]			31										19.37		42	552770	12.4	0.00549			
4/2/2020	GWTT	Yes	2	42	42	13	24	23	10	3	21	5	20.8	2768543	27.00	47478	16.5	0.00041	Yes	No	Conducted system checks, changed bag filters, and slowed down the effluent discharge flow rate to reduce carry over of significant iron sludge into the bag filters.
4/6/2020	GWTT	Yes	6	42.5	42	12	27	27	10	3	25	6	19.7	2833368	25.00	64825	11.3	0.00085	Yes	No	Conducted system checks and changed bag filters.
4/9/2020	GWTT	Yes	8.5	39	--	--	9	8	7	6.5	7	6.5	17.7	2903750	39.00	70382	19.6	0.00209	Yes	No	System shutdown for 2-4 hours at 7am for vac out of EQ holding tank and backwash of primary carbon vessel. Conducted system checks and changed bag filters.
4/13/2020	GWTT	Yes	12.5	39	24.5	7	10	9	4	5	8	6.0	15.6	3004475	38.00	100725	17.5	0.00275	Yes	No	Conducted system checks and changed bag filters. Lowered transfer pump "off control" float in EQ holding tank to allow longer run time and less cycling.
4/16/2020	GWTT	Yes	15.5	40	20.8	8	11	10	7	6	8	6.0	14.2	3074510	36.00	70035	16.2	0.00316	Yes	No	Conducted system checks and changed bag filters, pumped backwash water from exterior totes into (system #2) holding tank.
4/20/2020	GWTT	Yes	19.5	40	25	8	11	10	6	5	9	6.0	12.3	3156813	37.00	82303	14.3	0.00350	Yes	No	Conducted system checks and changed bag filters. Lowered transfer pump "off control" float in EQ holding tank to allow longer run time and less cycling.
4/24/2020	GWTT	Yes	23.5	42	26	10	15	14	7	5	10	6.0	11.7	3225480	33.00	68667	11.9	0.00352	Yes	No	Conducted system checks and changed bag filters.
4/27/2020	GWTT	Yes	26.5	40	21	12	15	14	10	6	12	6.0	9.6	3271810	33.00	46330	10.7	0.00357	Yes	Yes	Conducted system checks and changed bag filters. Collected system samples on 4/28/2020.
Totals - April 2020[6]			29.5										15.2		34	550745	13.0	0.00481			

Table 2B - Summary of Groundwater Pump and Treatment System Operating and Maintenance Data - System No. 2 (GWTS #2)
Barnstable County Fire and Rescue Training Academy
155 Flint Rock Road, Barnstable, MA
RTN 4-26179

Date	Operator[1]	System Operating on Arrival	Days System Operating	Transfer Pump Pres. (psi)	Pre-Filter Changeout Differential Pressure (psi)[2]		Post-Filter Changeout Differential Pressure (psi)		Carbon Vessels. Pre-change out (psi)		Carbon Vessels. Post-change out (psi)		Instantaneous Estimated INFLUENT[7]	EFFLUENT				Estimated Total PFAs Removal (kg)	System Operating on Departure	System Sampled	Comments
				Gauge: P1	Gauge: P2	Gauge: P3	Gauge: P2	Gauge: P3	Gauge: P4	Gauge: P5	Gauge: P4	Gauge: P5	Flow Rate (GPM)[3,4]	Totalizer (Gal)	Instant. Flow Rate (GPM)[8]	Total Net Gallons Treated[4]	Average Effluent Flow Rate (GPM)[5]				
5/1/2020	GWTT	Yes	1	47	43	9	22	22	8	3	20	5.0	16.3	3320924	32.00	49114	8.5	0.00310	Yes	No	Conducted system checks and changed bag filters twice during visit, system on idle upon arrival due to high level.
5/5/2020	GWTT	Yes	5	42	42	12	26	26	10	3	23	5.0	18.0	3359082	25.00	38158	6.6	0.00241	Yes	No	Conducted system checks and changed bag filters twice; influent flow rate has spiked but has caused a large influx of iron sediments.
5/8/2020	GWTT	Yes	8	42	35	13	22	22	10	4	20	6.0	18.1	3426824	34.00	67742	15.7	0.00570	Yes	No	Conducted system checks and changed bag filters.
5/11/2020	GWTT	Yes	11	42	25	16	22	22	14	5	20	6.0	16.5	3485100	32.00	58276	13.5	0.00490	Yes	No	Conducted system checks and changed bag filters. Pumped down green exterior tote holding backwash water from system #1.
5/15/2020	GWTT	Yes	15	39	35	17	8.5	8	16	4	7	6.0	12.8	3562051	38.00	76951	13.4	0.00485	Yes	No	Conducted system checks and changed bag filters. Backwashed primary LGAC vessel.
5/18/2020	GWTT	Yes	18	39	16	8	9	9	6	6	7	6.0	13.3	3614934	39.00	52883	12.2	0.00445	Yes	Yes	Conducted system checks and changed bag filters. Pumped down green exterior tote holding backwash water from 5.15.20 through System #2. System sampled on 5/21/2020.
5/22/2020	GWTT	Yes	22	42	24	7	10	10	4	4	7	6.0	12.0	3682536	36.00	67602	11.7	0.00426	Yes	No	Conducted system checks and changed bag filters.
5/26/2020	GWTT	Yes	26	41	44	4	17	16	0	0	14	5.0	14.8	3735642	34.00	53106	9.2	0.00335	Yes	No	Conducted system checks and changed bag filters twice.
5/29/2020	GWTT	Yes	29	40	44	4	21	19	4	1	15	4.0	14.8	3785810	34.00	50168	11.6	0.00422	Yes	No	Conducted system checks and changed bag filters twice.
Totals - May 2020[6]			31										15.2		33.8	514000	11.5	0.00418			
6/2/2020	GWTT	Yes	2	43	42	8	23	23	8	3	21	5.0	14.4	3832928	32.00	47118	16.4	0.00471	Yes	No	Conducted system checks and changed bag filters, primary carbon vessel needs to be backwashed.
6/5/2020	GWTT	Yes	5	40	35	9	13	13	2	2	10	5.0	17.7	3887828	35.00	54900	12.7	0.00366	Yes	No	Conducted system checks and changed bag filters.
6/9/2020	GWTT	Yes	9	40	21	10	7.5	7	8	5	6	5.0	15.9	3922210	35.00	34382	6.0	0.00172	Yes	No	Conducted system checks and changed bag filters. Bakcwashed primary LGAC vessel, pumped down outside holding tank through system before backwashing carbon vessel.
6/12/2020	GWTT	Yes	12	40	21	10	7.5	7	8	5	6	5.0	14.9	3970210	35.00	48000	11.1	0.00320	Yes	No	Conducted system checks and changed bag filters.
6/16/2020	GWTT	Yes	16	41	23	8	10	10	6	5	8	6.0	13.1	4029179	36.00	58969	10.2	0.00295	Yes	No	Conducted system checks and changed bag filters. Pumped backwash water from exterior holding totes through system.
6/19/2020	GWTT	Yes	19	40	21	10	7.5	7	8	5	6	5.0	12.3	4069514	38.00	40335	9.3	0.00269	Yes	No	Conducted system checks and changed bag filters.
6/22/2020	GWTT	Yes	22	41	14	10	11	11	9	5	9	5.0	10.7	4102439	37.00	32925	7.6	0.00219	Yes	No	Conducted system checks and changed bag filters.
6/25/2020	GWTT	Yes	25	42	16	12	10	10	8	4	5	5.0	10.9	4128010	35.00	25571	5.9	0.00170	Yes	No	Conducted system checks and changed bag filters.
6/29/2020	GWTT	Yes	29	41	16	9	10	10	8	5	9	5.0	11.9	4154842	35.00	26832	4.7	0.00134	Yes	No	Conducted system checks and changed bag filters.
Totals - June 2020[6]			30										13.5		35.3	369032	8.5	0.00238			
7/2/2020	GWTT	Yes	2	42	43	4	12	11	0	0	10	5.0	13.3	4173048	34.00	18206	6.3	0.00219	Yes	No	Conducted system checks and changed bag filters.
7/6/2020	GWTT	Yes	6	42	37	8	16.5	16	7	3	14	5.0	12.3	4243300	34.00	70252	12.2	0.00423	Yes	No	Conducted system checks and changed bag filters.
7/9/2020	GWTT	Yes	9	43	42	8	23	23	8	3	21	5.0	12.3	4279505	31.00	36205	8.4	0.00291	Yes	No	Conducted system checks and changed bag filters.
7/12/2020	GWTT	Yes	12	47	47	18	18	18	7	3	16	5.0	11.6	4329440	32.00	49935	11.6	0.00401	Yes	No	Conducted system checks and changed bag filters.
7/16/2020	GWTT	Yes	16	42	25	13	16.5	16	12	5	14	7.0	10.2	4374349	33.00	44909	7.8	0.00271	Yes	No	Conducted system checks and changed bag filters.
7/20/2020	GWTT	Yes	20	40	34	12	7.5	7	10	3	6	5.0	9.3	4435010	40.00	60661	10.5	0.00365	Yes	No	Conducted system checks and changed bag filters. Pumped backwash water from System #1 through system and then backwashed primary LGAC vessel.
7/24/2020	GWTT	Yes	24	40	37	4	9.5	9	2	2	8	6.0	8.5	4493135	40.00	58125	10.1	0.00350	Yes	No	Changed bag filters and pumped excess backwash water through system.
7/27/2020	GWTT	Yes	27	41	43	6	13	12	2	0	10	5.0	8.2	4521639	38.00	28504	6.6	0.00229	Yes	No	Conducted system checks and changed bag filters twice due to iron-oixde accumulation in the EQ tank.
7/30/2020	GWTT	Yes	30	41	32	7	14	13	6	3	10	5.0	9.0	4585515	37.00	63876	14.8	0.00513	Yes	No	Conducted system checks; the system is receiving more water (influent) that GWTS#1, operator assumes it's related to the build up of iron in the force main piping.
Totals - July 2020[6]			31										10.5		35.4	430673	9.6	0.00335			
8/4/2020	GWTT	No	4	41	41	7	17	16	5	3	14	5.5	9.5	4669181	38.00	83666	14.5	0.00419	Yes	No	System down on arrival due to split/rupture of 2 inch hard hose connecting the transfer pump to the bag filters. Hose was replaced and system restarted on 8/4/2020. Conducted system checks and changed bag filters.
8/7/2020	GWTT	Yes	7	41	18	14	16	15	12	6	12	6.0	9.6	4686019	34.00	16838	3.9	0.00113	Yes	No	Conducted system checks and changed bag filters.
8/10/2020	GWTT	Yes	10	40.5	16.5	14	15	14	11	5	12	6.0	9.4	4701138	31.00	15119	3.5	0.00101	Yes	No	Conducted system checks and changed bag filters. System shutdown on 8/12/2020 for carbon changeout.
8/14/2020	GWTT	Yes	12	40	--	--	15	14	--	--	10.5	6.0	8.8	4714722	41.00	13584	4.7	0.00136	Yes	No	Restarted system after carbon changeout. Conducted system checks and changed bag filters.
8/17/2020	GWTT	Yes	15	40	16.5	13.5	15	14	10	6	12	6.0	8.8	4732036	41.00	17314	4.0	0.00116	Yes	No	Conducted system checks and changed bag filters.
8/20/2020	GWTT	Yes	18	44	22	12	15	14	10	5	12	6.0	8.7	4744901	40.00	12865	3.0	0.00086	Yes	No	Conducted system checks and changed bag filters.
8/24/2020	GWTT	Yes	22	41	19	13	15	14	10	5	12	6.0	7.7	4774135	40.00	29234	5.1	0.00147	Yes	No	Conducted system checks and changed bag filters.
8/28/2020	GWTT	Yes	26	30	18	14	25	23	10	5	20	12.0	8.3	4793800	40.00	19665	3.4	0.00099	Yes	No	Conducted system checks and changed bag filters. System sampled on 8/27/2020 and iron sediment vacuum removed from EQ tank on 8/27/2020.
8/31/2020	GWTT	Yes	29	40	20	12	14	12	8	6	10	7.0	8.0	4807524	42.00	13724	3.2	0.00092	Yes	No	Conducted system checks and changed bag filters.
Totals - August 2020[6]			29										8.7		38.6	222009	5.3	0.00144			
9/4/2020	GWTT	Yes	4	40	15	12	13	13	8	6	10	6.0	6.3	4821810	42.00	14286	2.5	0.00099	Yes	No	Conducted system checks and changed bag filters.
9/8/2020	GWTT	Yes	8	40	45	4	9	8	0	0	6	6.0	8.9	4834498	38.00	12688	2.2	0.00088	Yes	No	Conducted system checks and changed bag filters.
9/11/2020	GWTT	Yes	11	44	16	6	9	7	5	5	6	5.0	7.1	4866725	38.00	32227	7.5	0.00299	Yes	No	Conducted system checks and changed bag filters.
9/15/2020	GWTT	Yes	15	42	19	7	8	7	6	5	6	8.0	6.6	4907555	38.00	40830	7.1	0.00284	Yes	No	Conducted system checks and changed bag filters.
9/18/2020	GWTT	Yes	18	42	9.5	8	8	7	6	5	6	5.0	5.5	4937021	37.00	29466	6.8	0.00273	Yes	No	Conducted system checks and changed bag filters.
9/21/2020	GWTT	Yes	21	35	14	8	9	9	6	5	6	5.0	5.4	4963941	37.00	26920	6.2	0.00250	Yes	No	Conducted system checks and changed bag filters.
9/25/2020	GWTT	Yes	25	45	21	7	8	7	4	4	4	5.0	4.9	4999400	35.00	35459	6.2	0.00247	Yes	No	Conducted system checks and changed bag filters.
9/28/2020	GWTT	Yes	28	43	43	3	10	10	8	5	8	5.0	5.0	5032229	35.00	32829	7.6	0.00304	Yes	No	Conducted system checks and changed bag filters.
Totals - September 2020[6]			30										6.2		37.5	224705	5.2	0.00202			

Table 2B - Summary of Groundwater Pump and Treatment System Operating and Maintenance Data - System No. 2 (GWTS #2)
Barnstable County Fire and Rescue Training Academy
155 Flint Rock Road, Barnstable, MA
RTN 4-26179

Date	Operator[1]	System Operating on Arrival	Days System Operating	Transfer Pump Pres. (psi)	Pre-Filter Changeout Differential Pressure (psi)[2]		Post-Filter Changeout Differential Pressure (psi)		Carbon Vessels. Pre-change out (psi)		Carbon Vessels. Post-change out (psi)		Instantaneous Estimated INFLUENT[7]	EFFLUENT				Estimated Total PFAs Removal (kg)	System Operating on Departure	System Sampled	Comments
				Gauge: P1	Gauge: P2	Gauge: P3	Gauge: P2	Gauge: P3	Gauge: P4	Gauge: P5	Gauge: P4	Gauge: P5	Flow Rate (GPM)[2,4]	Totalizer (Gal)	Instant. Flow Rate (GPM)[8]	Total Net Gallons Treated[4]	Average Effluent Flow Rate (GPM)[5]				
10/2/2020	GWTT	Yes	2	43	28	6	9	8	5	4	7	5.0	4.5	5076447	34.00	44218	15.4	0.00703	Yes	No	Conducted system checks and changed bag filters.
10/5/2020	GWTT	Yes	5	40	15	12	13	13	8	6	10	6.0	4.8	5088882	35.00	12435	2.9	0.00132	Yes	No	Conducted system checks and changed bag filters.
10/8/2020	GWTT	Yes	8	42	10	9	9	9	6	5	6	5.0	4.8	5097900	35.00	9018	2.1	0.00096	Yes	No	Conducted system checks and changed bag filters.
10/13/2020	GWTT	Yes	13	42	11	9	10	9	7	5	7	5.0	4.7	5107054	35.00	9154	1.3	0.00058	Yes	No	Conducted system checks and changed bag filters.
10/16/2020	GWTT	Yes	16	42	10	8	8	8	4	6	4	4.0	4.2	5117300	35.00	10246	2.4	0.00109	Yes	No	Conducted system checks and changed bag filters.
10/19/2020	GWTT	Yes	19	42	10	9	10	9	7	6	7	6.0	3.8	5124608	35.00	7308	1.7	0.00077	Yes	No	Conducted system checks and changed bag filters.
10/23/2020	GWTT	Yes	23	42	10	9	9	9	7	6	4	6.0	3.4	5127608	35.00	3000	0.5	0.00024	Yes	No	Conducted system checks and changed bag filters.
10/26/2020	GWTT	Yes	26	42	10.5	9	10	9.5	7	6	8	6.0	3.2	5129753	34.00	2145	0.5	0.00023	Yes	No	Conducted system checks and changed bag filters.
10/30/2020	GWTT	Yes	30	42	14	10	10	9	7	6	8	6.0	2.9	5142555	34.00	12802	2.2	0.00102	Yes	No	Conducted system checks and changed bag filters.
Totals - October 2020[6]			31										4.0		34.7	110326	2.5	0.00113			
11/2/2020	GWTT	Yes	2	42	19	8	10	10	6	5	8	6.0	2.7	5155575	34.00	13020	4.5	0.00209	Yes	No	Conducted system checks and changed bag filters.
11/6/2020	GWTT	Yes	6	43	22	8	10	10	6	5	8	6.0	2.5	5175583	34.00	20008	3.5	0.00160	Yes	No	Conducted system checks and changed bag filters.
11/9/2020	GWTT	Yes	9	43	28	6	9	8	5	4	7	5.0	3.1	5181542	34.00	5959	1.4	0.00064	Yes	No	Conducted system checks and changed bag filters.
11/13/2020	GWTT	No	12	--	--	--	--	--	--	--	--	--	--	5182921	--	1379	0.3	0.00015	No	No	GWTT observed no influent flow coming into the EQ tank. GWTT inspected the electrical components at PRW-4 and reset the power, after power reset, electrical current was at 77 A and power tripped and shut off. GWTT operator suggest the pump has locked up or the motor has failed. GWTT shut down both systems.
11/24/2020	GWTT	No	13	43	--	--	11	11	--	--	9	6.0	29.9	5184025	34.00	1104	0.8	0.00035	No	Yes	GWTT restarted system following the replacement of the pump at PRW-4 on 11/20/2020. Well was surged and cleaned, changed out bag filters multiple times and conducted system checks.
11/27/2020	GWTT	Yes	16	44	45	4	11	11	0	0	9.5	6.0	32.2	5195180	32.00	11155	2.6	0.00119	Yes	No	Conducted system checks and changed bag filters twice.
Totals - November 2020[6]			19										14.1		33.6	52625	1.9	0.00054			

Notes:
1. GWTT - Groundwater Treatment Technologies
2. Pressure readings before filter bag chang 30
3. Influent flow is an instantaneous estimate of the flow rate from the submersible Well Pump at PRW-4.
4. During monthly reporting periods the net gallons are calculated from previous effluent totalizer readings. (Difference between the current totalizer reading - the last dated totalizer reading).
5. The Average effluent flow rate is calculated from the net gallons obtained from the system's effluent totalizer flow meter and days that the system was in operation.
6. The "Totals" shown (from left to right) include the, Total Days of System Operation, Average Instantaneous Influent Flow Rate, Average Instantaneous Effluent Flow Rate, Total Gallons Treated, Average Net Effluent Flow Rate, and Estimated PFAS Removed for the respective monthly reporting period.
7. Instantaneous influent flow rates are estimated by approximating 50% of the influent flow rate values calculated from GWPTS #1 (See Table 2A).
8. Instantaneous effluent flow rate estimated by stopwatch at totalizer meter.
9. Flow calculated based on gallons marking on EQ tank. Estimated flow rate = 25 GPM (i.e. flow is calculated based on an in-situ observation of flow into the EQ tank, and 100 gallons of groundwater flows into the EQ tank for a 4 minute duration.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

Immediate Response Action (IRA) Transmittal Form
Pursuant to 310 CMR 40.0424 - 40.0427 (Subpart D)

BWSC 105

Release Tracking Number
4 - 26179

A. SITE LOCATION:

1. Release Name/Location Aid: BARNSTABLE COUNTY FIRE TRAINING ACADEMY

2. Street Address: 155 SOUTH FLINT ROCK ROAD

3. City/Town: BARNSTABLE 4. Zip Code: 026300000

☐ 5. Check here if this location is Adequately Regulated, pursuant to 310 CMR 40.0110-0114.

☐ a. CERCLA ☐ b. HSWA Corrective Action ☐ c. Solid Waste Management

☐ d. RCRA State Program (21C Facilities)

B. THIS FORM IS BEING USED TO: (check all that apply)

1. List Submittal Date of Initial IRA Written Plan (if previously submitted): 9/26/2016

☐ 2. Submit an **Initial IRA Plan**.

☐ 3. Submit a **Modified IRA Plan** of a previously submitted written IRA Plan.

☐ 4. Submit an **Imminent Hazard Evaluation**. (check one)

☐ a. An Imminent Hazard exists in connection with this Release or Threat of Release.

☐ b. An Imminent Hazard does not exist in connection with this Release or Threat of Release.

☐ c. It is unknown whether an Imminent Hazard exists in connection with this Release or Threat of Release, and further assessment activities will be undertaken.

☐ d. It is unknown whether an Imminent Hazard exists in connection with this Release or Threat of Release. However, response actions will address those conditions that could pose an Imminent Hazard.

☐ 5. Submit a request to **Terminate an Active Remedial System or Response Action(s) Taken to Address an Imminent Hazard**.

☐ 6. Submit an **IRA Status Report**

☑ 7. Submit a **Remedial Monitoring Report**. (This report can only be submitted through eDEP.)

a. Type of Report: (check one) ☐ i. Initial Report ☑ ii. Interim Report ☐ iii. Final Report

b. Frequency of Submittal: (check all that apply)

☑ i. A Remedial Monitoring Report(s) submitted monthly to address an Imminent Hazard.

☐ ii. A Remedial Monitoring Report(s) submitted monthly to address a Condition of Substantial Release Migration.

☐ iii. A Remedial Monitoring Report(s) submitted every six months, concurrent with an IRA Status Report.

☐ iv. A Remedial Monitoring Report(s) submitted annually, concurrent with an IRA Status Report.

c. Number of Remedial Systems and/or Monitoring Programs: 2

A separate BWSC105A, IRA Remedial Monitoring Report, must be filled out for each Remedial System and/or Monitoring Program addressed by this transmittal form.

☐ 8. Submit an **IRA Completion Statement**.

☐ a. Check here if future response actions addressing this Release or Threat of Release notification condition will be conducted as part of the Response Actions planned or ongoing at a Site that has already been Tier Classified under a different Release Tracking Number (RTN)

b. Provide Release Tracking Number of Tier Classified Site (Primary RTN): _____ _____

These additional response actions must occur according to the deadlines applicable to the Primary RTN. Use the Primary RTN when making all future submittals for the site unless specifically relating to this Immediate Response Action.

☐ 9. Submit a **Revised IRA Completion Statement**.

☐ 10. Submit a **Plan for the Application of Remedial Additives** near a sensitive receptor, pursuant to 310 CMR 40.0046(3).

(All sections of this transmittal form must be filled out unless otherwise noted above)

C. RELEASE OR THREAT OF RELEASE CONDITIONS THAT WARRANT IRA:

1. Media Impacted and Receptors Affected: (check all that apply)
☐ a. Paved Surface ☐ b. Basement ☐ c. School
☑ d. Public Water Supply ☑ e. Surface Water ☑ f. Zone 2 ☑ g. Private Well ☐ h. Residence ☑ i. Soil
☑ j. Groundwater ☑ k. Sediments ☐ l. Wetland ☐ m. Storm Drain ☐ n. Indoor Air ☐ o. Air
☐ p. Soil Gas ☐ q. Sub-Slab Soil Gas ☐ r. Critical Exposure Pathway ☐ s. NAPL ☐ t. Unknown
☐ r. Others Specify: _____

2. Sources of the Release or TOR: (check all that apply)
☐ a. Transformer ☐ b. Fuel Tank ☐ c. Pipe
☐ d. OHM Delivery ☐ e. AST ☐ f. Drums ☐ g. Tanker Truck ☐ h. Hose ☐ i. Line
☐ j. UST Describe: _____ ☐ k. Vehicle ☐ l. Boat/Vessel
☐ m. Unknown ☑ n. Other: FIREFIGHTING FOAMS

3. Type of Release or TOR: (check all that apply)
☐ a. Dumping ☐ b. Fire ☐ c. AST Removal ☐ d. Overfill
☐ e. Rupture ☐ f. Vehicle Accident ☐ g. Leak ☐ h. Spill ☐ i. Test failure ☐ j. TOR Only
☐ k. UST Removal Describe: _____
☐ l. Unknown ☑ m. Other: HISTORIC FOAM USE

4. Identify Oils and Hazardous Materials Released: (check all that apply)
☐ a. Oils ☐ b. Chlorinated Solvents
☐ c. Heavy Metals ☑ d. Others Specify: PFAS

D. DESCRIPTION OF RESPONSE ACTIONS: (check all that apply, for volumes list cumulative amounts)

☑ 1. Assessment and/or Monitoring Only
☑ 2. Temporary Covers or Caps
☐ 3. Deployment of Absorbent or Containment Materials
☐ 4. Temporary Water Supplies
☐ 5. Structure Venting System/HVAC Modification System
☐ 6. Temporary Evacuation or Relocation of Residents
☐ 7. Product or NAPL Recovery
☐ 8. Fencing and Sign Posting
☑ 9. Groundwater Treatment Systems
☐ 10. Soil Vapor Extraction
☐ 11. Remedial Additives
☐ 12. Air Sparging
☐ 13. Active Exposure Pathway Mitigation System
☐ 14. Passive Exposure Pathway Mitigation System

D. DESCRIPTION OF RESPONSE ACTIONS: (cont.)

☑ 15. Excavation of Contaminated Soils.

☐ a. Re-use, Recycling or Treatment ☐ i. On Site Estimated volume in cubic yards

☐ ii. Off Site Estimated volume in cubic yards

iia. Receiving Facility: Town: State:

iib. Receiving Facility: Town: State:

iii. Describe:

☐ b. Store ☐ i. On Site Estimated volume in cubic yards

☐ ii. Off Site Estimated volume in cubic yards

iia. Receiving Facility: Town: State:

iib. Receiving Facility: Town: State:

☑ c. Landfill ☐ i. Cover Estimated volume in cubic yards

Receiving Facility: Town: State:

☑ ii. Disposal Estimated volume in cubic yards 200

Receiving Facility: TAUNTON LANDFILL Town: TAUNTON State: MA

☐ 16. Removal of Drums, Tanks, or Containers:

a. Describe Quantity and Amount:

b. Receiving Facility: Town: State:

c. Receiving Facility: Town: State:

☐ 17. Removal of Other Contaminated Media:

a. Specify Type and Volume:

☐ 18. Other Response Actions:

Describe:

☐ 19. Use of Innovative Technologies:

Describe:

E. LSP SIGNATURE AND STAMP:

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisionsof 309 CMR 4.02(2) and (3), and 309 CMR 4.03(2), and (iii) the provisions of 309 CMR 4.03(3), to the best of my knowledge, information and belief,

> if Section B of this form indicates that an **Immediate Response Action Plan** is being submitted, the response action(s) that is(are) the subject of this submittal (i) has (have) been developed in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is(are) appropriate and reasonable to accomplish thepurposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> if Section B of this form indicates that an **Imminent Hazard Evaluation** is being submitted, this Imminent Hazard Evaluation was developed in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and the assessment activity(ies) undertaken to support this Imminent Hazard Evaluation comply(ies) with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000;

> if Section B of this form indicates that an **Immediate Response Action Status Report** and/or a **Remedial Monitoring Report** is(are) being submitted, the response action(s) that is (are) the subject of this submittal (i) is (are) being implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000,(ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> if Section B of this form indicates that an **Immediate Response Action Completion Statement** or a request to **Terminate an Active Remedial System or Response Action(s) Taken to Address an Imminent Hazard** is being submitted, the response action(s) that is(are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is(are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal.

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

1. LSP #: 1443

2. First Name: ROGER P 3. Last Name: THIBAULT

4. Telephone: 508-331-2700 5. Ext: 6. Email:

7. Signature:

8. Date: *(mm/dd/yyyy)* 9. LSP Stamp:

F. PERSON UNDERTAKING IRA:

1. Check all that apply: ☐ a. change in contact name ☐ b. change of address ☐ c. change in the person undertaking response actions

2. Name of Organization: BARNSTABLE COUNTY COMMISSIONERS

3. Contact First Name: JACK 4. Last Name: YUNITS

5. Street: 3195 MAIN ST 6. Title:

7. City/Town: BARNSTABLE 8. State: MA 9. Zip Code: 026301105

10. Telephone: 508-375-6643 11. Ext: 12. Email: JYUNITS@BARNSTABLECOUNTY.ORG

G. RELATIONSHIP TO RELEASE OR THREAT OF RELEASE OF PERSON UNDERTAKING IRA:

☐ Check here to change relationship

☑ 1. RP or PRP ☑ a. Owner ☐ b. Operator ☐ c. Generator ☐ d. Transporter

☐ e. Other RP or PRP Specify Relationship:

☐ 2. Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ 3. Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ 4. Any Other Person Undertaking Response Actions: Specify Relationship:

H. REQUIRED ATTACHMENT AND SUBMITTALS:

☐ 1. Check here if any Remediation Waste, generated as a result of this IRA, will be stored, treated, managed, recycled or reused at the site following submission of the IRA Completion Statement. If this box is checked, you must submit one of the following plans, along with the appropriate transmittal form.

☐ a. A Release Abatement Measure (RAM) Plan (BWSC106) ☐ b. Phase IV Remedy Implementation Plan (BWSC108)

☑ 2. Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by MassDEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

☑ 3. Check here to certify that the Chief Municipal Officer and the Local Boardof Health were notified of the implementation of an Immediate Response Action taken to control, prevent, abate or eliminate an Imminent Hazard.

☐ 4. Check here to certify that the Chief Municipal Officer and the Local Boardof Health were notified of the submittal of a Completion Statement for an Immediate Response Action taken to control, prevent, abate or eliminate an Imminent Hazard.

☐ 5. Check here if any non-updatable information provided on this form is incorrect, e.g. Release Address/Location Aid. Send corrections to BWSC.eDEP@state.ma.us.

☑ 6. Check here to certify that the LSP Opinion containing the material facts, data, and other information is attached.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC 105

Immediate Response Action (IRA) Transmittal Form
Pursuant to 310 CMR 40.0424 - 40.0427 (Subpart D)

Release Tracking Number
4 - 26179

I. CERTIFICATION OF PERSON UNDERTAKING IRA:

1. I, _____, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form; (ii) that, based on my inquiry of the/those individual(s) immediately responsible for obtaining the information, the material information contained herein is, to the best of my knowledge, information and belief, true, accurate and complete; (iii) that, to the best of my knowledge, information and belief, I/the person(s) or entity(ies) on whose behalf this submittal is made satisfy(ies) the criteria in 310 CMR 40.0183(2); (iv) that I/the person(s) or entity(ies) on whose behalf this submittal is made have provided notice in accordance with 310 CMR 40.0183(5); and (v) that I am fully authorized to make this attestation on behalf of the person(s) or entity(ies) legally responsible for this submittal. I/the person(s) or entity(ies) on whose behalf this submittal is made is/are aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

2. By: _____ 3. Title: _____

4. For: BARNSTABLE COUNTY COMMISSIONERS 5. Date: _____ (mm/dd/yyyy)

☐ 6. Check here if the address of the person providing certification is different from address recorded in Section F.

7. Street: _____

8. City/Town: _____ 9. State: _____ 10. Zip Code: _____

11. Telephone: _____ 12. Ext: _____ 13. Email: _____

YOU ARE SUBJECT TO AN ANNUAL COMPLIANCE ASSURANCE FEE OF UP TO $10,000 PER BILLABLE YEAR FOR THIS DISPOSAL SITE. YOU MUST LEGIBLY COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE.

Date Stamp (DEP USE ONLY:)

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup
IRA REMEDIAL MONITORING REPORT
Pursuant to 310 CMR 40.0400 (SUBPART D)
Remedial System or Monitoring Program: 1 of: 2

BWSC105 -A

Release Tracking Number
4 - 26179

A. DESCRIPTION OF ACTIVE OPERATION AND MAINTENANCE ACTIVITY:

1. Type of Active Operation and Maintenance Activity: (check all that apply)

☑ a. Active Remedial System: (check all that apply)

☐ i. NAPL Recovery ☐ ii. Soil Vapor Extraction/Bioventing ☐ iii. Vapor-phase Carbon Adsorption
☑ iv. Groundwater Recovery ☐ v. Dual/Multi-phase Extraction ☑ vi. Aqueous-phase Carbon Adsorption
☐ vii. Air Stripping ☐ viii. Sparging/Biosparging ☐ ix. Cat/Thermal Oxidation
☐ x. Other Describe:

☐ b. Active Exposure Pathway Elimination Measure
Active Exposure Pathway Mitigation System to address (check one): ☐ i. Indoor Air ☐ ii. Drinking Water

☐ c. Application of Remedial Additives: (check all that apply)
☐ i. To the Subsurface ☐ ii. To Groundwater (Injection) ☐ iii. To the Surface

☐ d. Active Remedial Monitoring Program Without the Application of Remedial Additives: (check all that apply; Sections C, D and E are not required; attach supporting information, data, maps and/or sketches needed by checking Section G5)
☐ i. Reactive Wall ☐ ii. Natural Attenuation ☐ iii. Other Describe:

2. Mode of Operation: (check one)
☑ a. Continuous ☐ b. Intermittent ☐ c. Pulsed ☐ d. One-time Event Only ☐ e. Other:

3. System Effluent/Discharge: (check all that apply)
☐ a. Sanitary Sewer/POTW
☑ b. Groundwater Re-infiltration/Re-injection: (check one) ☐ i. Downgradient ☑ ii. Upgradient
☐ c. Vapor-phase Discharge to Ambient Air: (check one) ☐ i. Off-gas Controls ☐ ii. No Off-gas Controls
☐ d. Drinking Water Supply
☐ e. Surface Water (including Storm Drains)
☐ f. Other Describe:

B. MONITORING FREQUENCY:

1. Reporting period that is the subject of this submittal: From: 11/1/2020 (mm/dd/yyyy) To: 11/30/2020 (mm/dd/yyyy)

2. Number of monitoring events during the reporting period: (check one)
☐ a. System Startup: (if applicable)
☐ i. Days 1, 3, 6, and then weekly thereafter, for the first month.
☐ ii. Other Describe:
☑ b. Post-system Startup (after first month) or Monitoring Program:
☑ i. Monthly
☐ ii. Quarterly
☐ iii. Annually
☐ iv. Other Describe:

☑ 3. Check here to certify that the number of required monitoring events were conducted during the reporting period.

C. EFFLUENT/DISCHARGE REGULATION: (check one to indicate how the effluent/discharge limits were established)

☐ 1. NPDES: (check one) ☐ a. Remediation General Permit ☐ b. Individual Permit
☐ c. Emergency Exclusion Effective Date of Permit: (mm/dd/yyyy)

☐ 2. MCP Performance Standard MCP Citations(s):

☑ 3. DEP Approval Letter Date of Letter: 11/18/2016 (mm/dd/yyyy)

☐ 4. Other Describe:

D. WASTEWATER TREATMENT PLANT OPERATOR: (check one)

☑ 1. Required due to Remedial Wastewater Treatment Plant in place for more than 30 days.

a. Name: TJ MCGOFF b. Grade: 4

c. License No: 15570 d. License Exp. Date: 12/31/2021 (mm/dd/yyyy)

☐ 2. Not Required

☐ 3. Not Applicable

E. STATUS OF ACTIVE REMEDIAL SYSTEM OR ACTIVE REMEDIAL MONITORING PROGRAM DURING REPORTING PERIOD: (check all that apply)

☑ 1. The Active Remedial System was functional one or more days during the Reporting Period.

a. Days System was Fully Functional: 19 b. GW Recovered (gals): 65277

c. NAPL Recovered (gals): d. GW Discharged (gals): 65277

e. Avg. Soil Gas Recovery Rate (scfm): f. Avg. Sparging Rate (scfm):

☐ 2. Remedial Additives: (check all that apply)

☐ a. No Remedial Additives applied during the Reporting Period.

☐ b. Enhanced Bioremediation Additives applied: (total quantity applied at the site for the current reporting period)

☐ i. Nitrogen/Phosphorus:

Name of Additive	Date	Quantity	Units

☐ ii. Peroxides:

Name of Additive	Date	Quantity	Units

☐ iii. Microorganisms:

Name of Additive	Date	Quantity	Units

☐ iv. Other:

Name of Additive	Date	Quantity	Units

☐ c. Chemical oxidation/reduction additives applied: (total quantity applied at the site for the current reporting period)

☐ i. Permanganates:

Name of Additive	Date	Quantity	Units

☐ ii. Peroxides:

Name of Additive	Date	Quantity	Units

☐ iii. Persulfates:

Name of Additive	Date	Quantity	Units

☐ iv. Other:

Name of Additive	Date	Quantity	Units

E. STATUS OF ACTIVE REMEDIAL SYSTEM OR ACTIVE REMEDIAL MONITORING PROGRAM DURING REPORTING PERIOD: (cont.)

☐ d. Other additives applied: (total quantity applied at the site for the current reporting period)

Name of Additive	Date	Quantity	Units

Name of Additive	Date	Quantity	Units

☐ e. Check here if any additional Remedial Additives were applied. Attach list of additional additives and include Name of Additive, Date Applied, Quantity Applied and Units (in gals. or lbs.)

F. SHUTDOWNS OF ACTIVE REMEDIAL SYSTEM OR ACTIVE REMEDIAL MONITORING PROGRAM: (check all that apply)

☑ 1. The Active Remedial System had unscheduled shutdowns on one or more occasions during the Reporting Period.

a. Number of Unscheduled Shutdowns: 1 b. Total Number of Days of Unscheduled Shutdowns: 11

c. Reason(s) for Unscheduled Shutdowns: FAILURE OF THE WELL PUMP AT RECOVERY WELL PRW-4

☐ 2. The Active Remedial System had scheduled shutdowns on one or more occasions during the Reporting Period.

a. Number of Scheduled Shutdowns: _____ b. Total Number of Days of Scheduled Shutdowns: _____

c. Reason(s) for Scheduled Shutdowns: _____

☐ 3. The Active Remedial System or Active Remedial Monitoring Program was permanently shutdown/discontinued during the Reporting Period.

a. Date of Final System or Monitoring Program Shutdown: _____ (mm/dd/yyyy)

☐ b. No Further Effluent Discharges.

☐ c. No Further Application of Remedial Additives planned; sufficient monitoring completed to demonstrate compliance with 310 CMR 40.0046.

☐ d. No Further Submittals Planned.

☐ e. Other: Describe: _____

G. SUMMARY STATEMENTS: (check all that apply for the current reporting period)

☑ 1. All Active Remedial System checks and effluent analyses required by the approved plan and/or permit were performed when applicable.

☐ 2. There were no significant problems or prolonged (>25% of reporting period) unscheduled shutdowns of the Active Remedial System.

☑ 3. The Active Remedial System or Active Remedial Monitoring Program operated in conformance with the MCP, and all applicable approval conditions and/or permits.

4. Indicate any Operational Problems or Notes:

☐ 5. Check here if additional/supporting Information, data, maps, and/or sketches are attached to the form.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup
IRA REMEDIAL MONITORING REPORT
MEASUREMENTS
Pursuant to 310 CMR 40.0400 (SUBPART D)
Remedial System or Monitoring Program: 1 of: 2

BWSC105 -B

Release Tracking Number
4 26179

For each Point of Measurement, related to concentration indicate the highest concentration detected during the reporting period, of each oil, hazardous material and/or remedial additive.
For each Point of Measurement for pressure differentials, indicate the lowest pressure differential detected during the reporting period.

Point of Measurement	Date (mm/dd/yyyy)	Contaminant, Measurement and/or Indicator Parameter	Influent Concentration (where applicable)	Midpoint Concentration (where applicable)	(check one) ☑ Discharge ☐ GroundWater Concentration ☐ Pressure Differential	Check here, if ND/BDL	Permissible Concentration or Pressure Differential	Units	Within Permissible Limits? (Y/N)
SYSTEM	11/24/2020	PFAS	2.731	0.018	0.014	☐	0.020	UG/L	YES

☐ Check here if any additional BWSC105 B, Measurements Form(s), are needed.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup
IRA REMEDIAL MONITORING REPORT
Pursuant to 310 CMR 40.0400 (SUBPART D)
Remedial System or Monitoring Program: 2 of: 2

BWSC105 -A

Release Tracking Number
4 - 26179

A. DESCRIPTION OF ACTIVE OPERATION AND MAINTENANCE ACTIVITY:

1. Type of Active Operation and Maintenance Activity: (check all that apply)

☑ a. Active Remedial System: (check all that apply)

☐ i. NAPL Recovery ☐ ii. Soil Vapor Extraction/Bioventing ☐ iii. Vapor-phase Carbon Adsorption
☑ iv. Groundwater Recovery ☐ v. Dual/Multi-phase Extraction ☑ vi. Aqueous-phase Carbon Adsorption
☐ vii. Air Stripping ☐ viii. Sparging/Biosparging ☐ ix. Cat/Thermal Oxidation
☐ x. Other Describe:

☐ b. Active Exposure Pathway Elimination Measure
Active Exposure Pathway Mitigation System to address (check one): ☐ i. Indoor Air ☐ ii. Drinking Water

☐ c. Application of Remedial Additives: (check all that apply)
☐ i. To the Subsurface ☐ ii. To Groundwater (Injection) ☐ iii. To the Surface

☐ d. Active Remedial Monitoring Program Without the Application of Remedial Additives: (check all that apply; Sections C, D and E are not required; attach supporting information, data, maps and/or sketches needed by checking Section G5)
☐ i. Reactive Wall ☐ ii. Natural Attenuation ☐ iii. Other Describe:

2. Mode of Operation: (check one)
☑ a. Continuous ☐ b. Intermittent ☐ c. Pulsed ☐ d. One-time Event Only ☐ e. Other:

3. System Effluent/Discharge: (check all that apply)
☐ a. Sanitary Sewer/POTW
☑ b. Groundwater Re-infiltration/Re-injection: (check one) ☐ i. Downgradient ☑ ii. Upgradient
☐ c. Vapor-phase Discharge to Ambient Air: (check one) ☐ i. Off-gas Controls ☐ ii. No Off-gas Controls
☐ d. Drinking Water Supply
☐ e. Surface Water (including Storm Drains)
☐ f. Other Describe:

B. MONITORING FREQUENCY:

1. Reporting period that is the subject of this submittal: From: 11/1/2020 (mm/dd/yyyy) To: 11/30/2020 (mm/dd/yyyy)

2. Number of monitoring events during the reporting period: (check one)
☐ a. System Startup: (if applicable)
☐ i. Days 1, 3, 6, and then weekly thereafter, for the first month.
☐ ii. Other Describe:
☑ b. Post-system Startup (after first month) or Monitoring Program:
☑ i. Monthly
☐ ii. Quarterly
☐ iii. Annually
☐ iv. Other Describe:

☐ 3. Check here to certify that the number of required monitoring events were conducted during the reporting period.

C. EFFLUENT/DISCHARGE REGULATION: (check one to indicate how the effluent/discharge limits were established)

☐ 1. NPDES: (check one) ☐ a. Remediation General Permit ☐ b. Individual Permit
☐ c. Emergency Exclusion Effective Date of Permit: (mm/dd/yyyy)

☐ 2. MCP Performance Standard MCP Citations(s):

☑ 3. DEP Approval Letter Date of Letter: 11/18/2016 (mm/dd/yyyy)

☐ 4. Other Describe:

D. WASTEWATER TREATMENT PLANT OPERATOR: (check one)

☑ 1. Required due to Remedial Wastewater Treatment Plant in place for more than 30 days.

a. Name: TJ MCGOFF b. Grade: 4

c. License No: 15570 d. License Exp. Date: 12/31/2021 (mm/dd/yyyy)

☐ 2. Not Required

☐ 3. Not Applicable

E. STATUS OF ACTIVE REMEDIAL SYSTEM OR ACTIVE REMEDIAL MONITORING PROGRAM DURING REPORTING PERIOD: (check all that apply)

☑ 1. The Active Remedial System was functional one or more days during the Reporting Period.

a. Days System was Fully Functional: 19 b. GW Recovered (gals): 52625

c. NAPL Recovered (gals): d. GW Discharged (gals): 52625

e. Avg. Soil Gas Recovery Rate (scfm): f. Avg. Sparging Rate (scfm):

☐ 2. Remedial Additives: (check all that apply)

☐ a. No Remedial Additives applied during the Reporting Period.

☐ b. Enhanced Bioremediation Additives applied: (total quantity applied at the site for the current reporting period)

☐ i. Nitrogen/Phosphorus:

Name of Additive	Date	Quantity	Units

☐ ii. Peroxides:

Name of Additive	Date	Quantity	Units

☐ iii. Microorganisms:

Name of Additive	Date	Quantity	Units

☐ iv. Other:

Name of Additive	Date	Quantity	Units

☐ c. Chemical oxidation/reduction additives applied: (total quantity applied at the site for the current reporting period)

☐ i. Permanganates:

Name of Additive	Date	Quantity	Units

☐ ii. Peroxides:

Name of Additive	Date	Quantity	Units

☐ iii. Persulfates:

Name of Additive	Date	Quantity	Units

☐ iv. Other:

Name of Additive	Date	Quantity	Units

E. STATUS OF ACTIVE REMEDIAL SYSTEM OR ACTIVE REMEDIAL MONITORING PROGRAM DURING REPORTING PERIOD: (cont.)

☐ d. Other additives applied: (total quantity applied at the site for the current reporting period)

Name of Additive	Date	Quantity	Units

Name of Additive	Date	Quantity	Units

☐ e. Check here if any additional Remedial Additives were applied. Attach list of additional additives and include Name of Additive, Date Applied, Quantity Applied and Units (in gals. or lbs.)

F. SHUTDOWNS OF ACTIVE REMEDIAL SYSTEM OR ACTIVE REMEDIAL MONITORING PROGRAM: (check all that apply)

☑ 1. The Active Remedial System had unscheduled shutdowns on one or more occasions during the Reporting Period.

a. Number of Unscheduled Shutdowns: 1 b. Total Number of Days of Unscheduled Shutdowns: 11

c. Reason(s) for Unscheduled Shutdowns: FAILURE OF THE WELL PUMP AT RECOVERY WELL PRW-4

☐ 2. The Active Remedial System had scheduled shutdowns on one or more occasions during the Reporting Period.

a. Number of Scheduled Shutdowns: _____ b. Total Number of Days of Scheduled Shutdowns: _____

c. Reason(s) for Scheduled Shutdowns: _____

☐ 3. The Active Remedial System or Active Remedial Monitoring Program was permanently shutdown/discontinued during the Reporting Period.

a. Date of Final System or Monitoring Program Shutdown: _____ (mm/dd/yyyy)

☐ b. No Further Effluent Discharges.

☐ c. No Further Application of Remedial Additives planned; sufficient monitoring completed to demonstrate compliance with 310 CMR 40.0046.

☐ d. No Further Submittals Planned.

☐ e. Other: Describe: _____

G. SUMMARY STATEMENTS: (check all that apply for the current reporting period)

☑ 1. All Active Remedial System checks and effluent analyses required by the approved plan and/or permit were performed when applicable.

☐ 2. There were no significant problems or prolonged (>25% of reporting period) unscheduled shutdowns of the Active Remedial System.

☑ 3. The Active Remedial System or Active Remedial Monitoring Program operated in conformance with the MCP, and all applicable approval conditions and/or permits.

4. Indicate any Operational Problems or Notes:

☐ 5. Check here if additional/supporting Information, data, maps, and/or sketches are attached to the form.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup
IRA REMEDIAL MONITORING REPORT
MEASUREMENTS
Pursuant to 310 CMR 40.0400 (SUBPART D)
Remedial System or Monitoring Program: 2 of: 2

BWSC105 -B

Release Tracking Number
4 26179

For each Point of Measurement, related to concentration indicate the highest concentration detected during the reporting period, of each oil, hazardous material and/or remedial additive.
For each Point of Measurement for pressure differentials, indicate the lowest pressure differential detected during the reporting period.

Point of Measurement	Date (mm/dd/yyyy)	Contaminant, Measurement and/or Indicator Parameter	Influent Concentration (where applicable)	Midpoint Concentration (where applicable)	(check one) ☑ Discharge ☐ GroundWater Concentration ☐ Pressure Differential	Check here, if ND/BDL	Permissible Concentration or Pressure Differential	Units	Within Permissible Limits? (Y/N)
SYSTEM	11/24/2020	PFAS	2.731	0.148	0.002	☐	0.020	UG/L	YES

☐ Check here if any additional BWSC105 B, Measurements Form(s), are needed.

Your Project #: BFTA
Site#: 6206
Site Location: BARNSTABLE COUNTY
Your C.O.C. #: 778920-03-01

Attention: Steven Tebo

Barnstable County
3195 Main Street
PO Box 427
Barnstable, MA
USA 02630

Report Date: 2020/12/17
Report #: R6452824
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C0W6405
Received: 2020/12/08, 14:20

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Low level PFOS and PFOA by SPE/LCMS (1)	5	2020/12/10	2020/12/10	CAM SOP-00894	EPA 537 m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs 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.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs 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 BV Labs, unless otherwise agreed in writing. BV Labs 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 BV Labs, 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.

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Your Project #: BFTA
Site#: 6206
Site Location: BARNSTABLE COUNTY
Your C.O.C. #: 778920-03-01

Attention: Steven Tebo

Barnstable County
3195 Main Street
PO Box 427
Barnstable, MA
USA 02630

Report Date: 2020/12/17
Report #: R6452824
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C0W6405
Received: 2020/12/08, 14:20

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Account Manager, Ultra Trace Analysis
Email: Stephanie.Pollen@bvlabs.com
Phone# (905)817-5830
==========
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

RESULTS OF ANALYSES OF WATER

BV Labs ID		OIZ532				OIZ533			
Sampling Date		2020/11/24 12:15				2020/11/24 11:50			
COC Number		778920-03-01				778920-03-01			
	UNITS	INFLUENT PRW-4	RDL	MDL	QC Batch	SYSTEM #1 MIDPOINT	RDL	MDL	QC Batch
Perfluorinated Compounds									
Perfluorobutanoic acid (PFBA)	ng/L	34	20	6.7	7101883	1.3	2.0	0.67	7101883
Perfluoropentanoic acid (PFPeA)	ng/L	110	20	5.2	7101883	2.4	2.0	0.52	7101883
Perfluorohexanoic acid (PFHxA)	ng/L	110	20	7.0	7101883	2.2	2.0	0.70	7101883
Perfluoroheptanoic acid (PFHpA)	ng/L	71	20	5.1	7101883	1.3	2.0	0.51	7101883
Perfluorooctanoic acid (PFOA)	ng/L	59	20	4.9	7101883	1.0	2.0	0.49	7101883
Perfluorononanoic acid (PFNA)	ng/L	43	20	8.0	7101883	<0.80	2.0	0.80	7101883
Perfluorodecanoic acid (PFDA)	ng/L	18	20	6.4	7101883	<0.64	2.0	0.64	7101883
Perfluoroundecanoic acid (PFUnA)	ng/L	31	20	7.7	7101883	<0.77	2.0	0.77	7101883
Perfluorododecanoic acid (PFDoA)	ng/L	<5.9	20	5.9	7101883	<0.59	2.0	0.59	7101883
Perfluorotridecanoic acid (PFTRDA)	ng/L	<4.8	20	4.8	7101883	<0.48	2.0	0.48	7101883
Perfluorotetradecanoic acid(PFTEDA)	ng/L	<3.7	20	3.7	7101883	<0.37	2.0	0.37	7101883
Perfluorobutanesulfonic acid (PFBS)	ng/L	14	20	4.7	7101883	<0.47	2.0	0.47	7101883
Perfluoropentanesulfonic acid PFPes	ng/L	24	20	7.3	7101883	<0.73	2.0	0.73	7101883
Perfluorohexanesulfonic acid(PFHxS)	ng/L	240	20	5.3	7101883	2.1	2.0	0.53	7101883
Perfluoroheptanesulfonic acid PFHpS	ng/L	15	20	5.7	7101883	<0.57	2.0	0.57	7101883
Perfluorooctanesulfonic acid (PFOS)	ng/L	2300	200	43	7101883	14	2.0	0.43	7101883
Perfluorononanesulfonic acid (PFNS)	ng/L	<6.4	20	6.4	7101883	<0.64	2.0	0.64	7101883
Perfluorodecanesulfonic acid (PFDS)	ng/L	<5.3	20	5.3	7101883	<0.53	2.0	0.53	7101883
Perfluorooctane Sulfonamide (PFOSA)	ng/L	9.0	40	8.1	7101883	<0.81	4.0	0.81	7110594
6:2 Fluorotelomer sulfonic acid	ng/L	150	40	5.9	7101883	1.8	4.0	0.59	7101883
8:2 Fluorotelomer sulfonic acid	ng/L	240	40	7.5	7101883	2.1	4.0	0.75	7101883
Surrogate Recovery (%)									
13C2-6:2-Fluorotelomersulfonic Acid	%	80	N/A	N/A	7101883	89	N/A	N/A	7101883
13C2-8:2-Fluorotelomersulfonic Acid	%	86	N/A	N/A	7101883	80	N/A	N/A	7101883
13C2-Perfluorodecanoic acid	%	74	N/A	N/A	7101883	65	N/A	N/A	7101883
13C2-Perfluorododecanoic acid	%	79	N/A	N/A	7101883	67	N/A	N/A	7101883
13C2-Perfluorohexanoic acid	%	89	N/A	N/A	7101883	46 (1)	N/A	N/A	7101883

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 water resulted in satisfactory recovery of the extracted internal standard analyte. When considered together, these QC data suggest that matrix interferences may be increasing the variability of the associated native analyte result (Perfluorohexanoic acid - PFHxA).

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

RESULTS OF ANALYSES OF WATER

BV Labs ID		OIZ532				OIZ533			
Sampling Date		2020/11/24 12:15				2020/11/24 11:50			
COC Number		778920-03-01				778920-03-01			
	UNITS	INFLUENT PRW-4	RDL	MDL	QC Batch	SYSTEM #1 MIDPOINT	RDL	MDL	QC Batch
13C2-perfluorotetradecanoic acid	%	64	N/A	N/A	7101883	49 (1)	N/A	N/A	7101883
13C2-Perfluoroundecanoic acid	%	80	N/A	N/A	7101883	68	N/A	N/A	7101883
13C3-Perfluorobutanesulfonic acid	%	96	N/A	N/A	7101883	98	N/A	N/A	7101883
13C4-Perfluorobutanoic acid	%	89	N/A	N/A	7101883	42 (2)	N/A	N/A	7101883
13C4-Perfluoroheptanoic acid	%	84	N/A	N/A	7101883	53	N/A	N/A	7101883
13C4-Perfluorooctanesulfonic acid	%	83	N/A	N/A	7101883	81	N/A	N/A	7101883
13C4-Perfluorooctanoic acid	%	80	N/A	N/A	7101883	59	N/A	N/A	7101883
13C5-Perfluorononanoic acid	%	75	N/A	N/A	7101883	62	N/A	N/A	7101883
13C5-Perfluoropentanoic acid	%	86	N/A	N/A	7101883	40 (3)	N/A	N/A	7101883
13C8-Perfluorooctane Sulfonamide	%	34	N/A	N/A	7101883	63	N/A	N/A	7110594
18O2-Perfluorohexanesulfonic acid	%	94	N/A	N/A	7101883	95	N/A	N/A	7101883

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 water resulted in satisfactory recovery of the extracted internal standard analyte. When considered together, these QC data suggest that matrix interferences may be increasing the variability of the associated native analyte result (Perfluorotetradecanoic acid - PFTeDA).

(2) Extracted internal standard analyte recovery was below the defined lower control limit (LCL). Laboratory spiked water resulted in satisfactory recovery of the extracted internal standard analyte. When considered together, these QC data suggest that matrix interferences may be increasing the variability of the associated native analyte result (Perfluorobutanoic acid - PFBA).

(3) Extracted internal standard analyte recovery was below the defined lower control limit (LCL). Laboratory spiked water resulted in satisfactory recovery of the extracted internal standard analyte. When considered together, these QC data suggest that matrix interferences may be increasing the variability of the associated native analyte result (Perfluoropentanoic acid - PFPeA).

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

RESULTS OF ANALYSES OF WATER

BV Labs ID		OIZ534				OIZ535			
Sampling Date		2020/11/24 11:55				2020/11/24 12:20			
COC Number		778920-03-01				778920-03-01			
	UNITS	SYSTEM #1 EFFLUENT	RDL	MDL	QC Batch	SYSTEM #2 MIDPOINT	RDL	MDL	QC Batch
Perfluorinated Compounds									
Perfluorobutanoic acid (PFBA)	ng/L	1.0	2.0	0.67	7101883	21	2.0	0.67	7101883
Perfluoropentanoic acid (PFPeA)	ng/L	2.1	2.0	0.52	7101883	26	2.0	0.52	7101883
Perfluorohexanoic acid (PFHxA)	ng/L	2.0	2.0	0.70	7101883	16	2.0	0.70	7101883
Perfluoroheptanoic acid (PFHpA)	ng/L	1.2	2.0	0.51	7101883	5.0	2.0	0.51	7101883
Perfluorooctanoic acid (PFOA)	ng/L	0.94	2.0	0.49	7101883	3.2	2.0	0.49	7101883
Perfluorononanoic acid (PFNA)	ng/L	<0.80	2.0	0.80	7101883	2.4	2.0	0.80	7101883
Perfluorodecanoic acid (PFDA)	ng/L	<0.64	2.0	0.64	7101883	0.92	2.0	0.64	7101883
Perfluoroundecanoic acid (PFUnA)	ng/L	<0.77	2.0	0.77	7101883	1.1	2.0	0.77	7101883
Perfluorododecanoic acid (PFDoA)	ng/L	<0.59	2.0	0.59	7101883	<0.59	2.0	0.59	7101883
Perfluorotridecanoic acid (PFTRDA)	ng/L	<0.48	2.0	0.48	7101883	<0.48	2.0	0.48	7101883
Perfluorotetradecanoic acid(PFTEDA)	ng/L	<0.37	2.0	0.37	7101883	<0.37	2.0	0.37	7101883
Perfluorobutanesulfonic acid (PFBS)	ng/L	<0.47	2.0	0.47	7101883	1.9	2.0	0.47	7101883
Perfluoropentanesulfonic acid PFPes	ng/L	<0.73	2.0	0.73	7101883	2.9	2.0	0.73	7101883
Perfluorohexanesulfonic acid(PFHxS)	ng/L	1.9	2.0	0.53	7101883	17	2.0	0.53	7101883
Perfluoroheptanesulfonic acid PFHpS	ng/L	<0.57	2.0	0.57	7101883	1.3	2.0	0.57	7101883
Perfluorooctanesulfonic acid (PFOS)	ng/L	10	2.0	0.43	7101883	120	20	4.3	7101883
Perfluorononanesulfonic acid (PFNS)	ng/L	<0.64	2.0	0.64	7101883	<0.64	2.0	0.64	7101883
Perfluorodecanesulfonic acid (PFDS)	ng/L	<0.53	2.0	0.53	7101883	<0.53	2.0	0.53	7101883
Perfluorooctane Sulfonamide (PFOSA)	ng/L	<0.81	4.0	0.81	7110594	<0.81	4.0	0.81	7101883
6:2 Fluorotelomer sulfonic acid	ng/L	1.6	4.0	0.59	7101883	9.8	4.0	0.59	7101883
8:2 Fluorotelomer sulfonic acid	ng/L	1.4	4.0	0.75	7101883	7.9	4.0	0.75	7101883
Surrogate Recovery (%)									
13C2-6:2-Fluorotelomersulfonic Acid	%	83	N/A	N/A	7101883	81	N/A	N/A	7101883
13C2-8:2-Fluorotelomersulfonic Acid	%	80	N/A	N/A	7101883	84	N/A	N/A	7101883
13C2-Perfluorodecanoic acid	%	69	N/A	N/A	7101883	86	N/A	N/A	7101883
13C2-Perfluorododecanoic acid	%	69	N/A	N/A	7101883	75	N/A	N/A	7101883
13C2-Perfluorohexanoic acid	%	51	N/A	N/A	7101883	76	N/A	N/A	7101883
13C2-perfluorotetradecanoic acid	%	66	N/A	N/A	7101883	50	N/A	N/A	7101883
13C2-Perfluoroundecanoic acid	%	70	N/A	N/A	7101883	79	N/A	N/A	7101883
13C3-Perfluorobutanesulfonic acid	%	94	N/A	N/A	7101883	105	N/A	N/A	7101883
13C4-Perfluorobutanoic acid	%	44 (1)	N/A	N/A	7101883	73	N/A	N/A	7101883

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 water resulted in satisfactory recovery of the extracted internal standard analyte. When considered together, these QC data suggest that matrix interferences may be increasing the variability of the associated native analyte result (Perfluorobutanoic acid - PFBA).

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BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

RESULTS OF ANALYSES OF WATER

BV Labs ID		OIZ534				OIZ535			
Sampling Date		2020/11/24 11:55				2020/11/24 12:20			
COC Number		778920-03-01				778920-03-01			
	UNITS	SYSTEM #1 EFFLUENT	RDL	MDL	QC Batch	SYSTEM #2 MIDPOINT	RDL	MDL	QC Batch
13C4-Perfluoroheptanoic acid	%	58	N/A	N/A	7101883	79	N/A	N/A	7101883
13C4-Perfluorooctanesulfonic acid	%	83	N/A	N/A	7101883	75	N/A	N/A	7101883
13C4-Perfluorooctanoic acid	%	63	N/A	N/A	7101883	83	N/A	N/A	7101883
13C5-Perfluorononanoic acid	%	67	N/A	N/A	7101883	86	N/A	N/A	7101883
13C5-Perfluoropentanoic acid	%	44 (1)	N/A	N/A	7101883	71	N/A	N/A	7101883
13C8-Perfluorooctane Sulfonamide	%	54	N/A	N/A	7110594	44	N/A	N/A	7101883
18O2-Perfluorohexanesulfonic acid	%	88	N/A	N/A	7101883	98	N/A	N/A	7101883

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 water resulted in satisfactory recovery of the extracted internal standard analyte. When considered together, these QC data suggest that matrix interferences may be increasing the variability of the associated native analyte result (Perfluoropentanoic acid - PFPeA).

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BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

RESULTS OF ANALYSES OF WATER

BV Labs ID		OIZ536			
Sampling Date		2020/11/24 12:25			
COC Number		778920-03-01			
	UNITS	SYSTEM #2 EFFLUENT	RDL	MDL	QC Batch
Perfluorinated Compounds					
Perfluorobutanoic acid (PFBA)	ng/L	<0.67	2.0	0.67	7101883
Perfluoropentanoic acid (PFPeA)	ng/L	<0.52	2.0	0.52	7101883
Perfluorohexanoic acid (PFHxA)	ng/L	<0.70	2.0	0.70	7101883
Perfluoroheptanoic acid (PFHpA)	ng/L	<0.51	2.0	0.51	7101883
Perfluorooctanoic acid (PFOA)	ng/L	0.57	2.0	0.49	7101883
Perfluorononanoic acid (PFNA)	ng/L	<0.80	2.0	0.80	7101883
Perfluorodecanoic acid (PFDA)	ng/L	<0.64	2.0	0.64	7101883
Perfluoroundecanoic acid (PFUnA)	ng/L	<0.77	2.0	0.77	7101883
Perfluorododecanoic acid (PFDoA)	ng/L	<0.59	2.0	0.59	7101883
Perfluorotridecanoic acid (PFTRDA)	ng/L	<0.48	2.0	0.48	7101883
Perfluorotetradecanoic acid(PFTEDA)	ng/L	<0.37	2.0	0.37	7101883
Perfluorobutanesulfonic acid (PFBS)	ng/L	<0.47	2.0	0.47	7101883
Perfluoropentanesulfonic acid PFPes	ng/L	<0.73	2.0	0.73	7101883
Perfluorohexanesulfonic acid(PFHxS)	ng/L	<0.53	2.0	0.53	7101883
Perfluoroheptanesulfonic acid PFHpS	ng/L	<0.57	2.0	0.57	7101883
Perfluorooctanesulfonic acid (PFOS)	ng/L	1.5	2.0	0.43	7101883
Perfluorononanesulfonic acid (PFNS)	ng/L	<0.64	2.0	0.64	7101883
Perfluorodecanesulfonic acid (PFDS)	ng/L	<0.53	2.0	0.53	7101883
Perfluorooctane Sulfonamide (PFOSA)	ng/L	<0.81	4.0	0.81	7101883
6:2 Fluorotelomer sulfonic acid	ng/L	0.78	4.0	0.59	7101883
8:2 Fluorotelomer sulfonic acid	ng/L	<0.75	4.0	0.75	7101883
Surrogate Recovery (%)					
13C2-6:2-Fluorotelomersulfonic Acid	%	82	N/A	N/A	7101883
13C2-8:2-Fluorotelomersulfonic Acid	%	83	N/A	N/A	7101883
13C2-Perfluorodecanoic acid	%	81	N/A	N/A	7101883
13C2-Perfluorododecanoic acid	%	72	N/A	N/A	7101883
13C2-Perfluorohexanoic acid	%	85	N/A	N/A	7101883
13C2-perfluorotetradecanoic acid	%	57	N/A	N/A	7101883
13C2-Perfluoroundecanoic acid	%	74	N/A	N/A	7101883
13C3-Perfluorobutanesulfonic acid	%	103	N/A	N/A	7101883
13C4-Perfluorobutanoic acid	%	80	N/A	N/A	7101883
13C4-Perfluoroheptanoic acid	%	85	N/A	N/A	7101883

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

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BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

RESULTS OF ANALYSES OF WATER

BV Labs ID		OIZ536			
Sampling Date		2020/11/24 12:25			
COC Number		778920-03-01			
	UNITS	SYSTEM #2 EFFLUENT	RDL	MDL	QC Batch
13C4-Perfluorooctanesulfonic acid	%	88	N/A	N/A	7101883
13C4-Perfluorooctanoic acid	%	86	N/A	N/A	7101883
13C5-Perfluorononanoic acid	%	85	N/A	N/A	7101883
13C5-Perfluoropentanoic acid	%	81	N/A	N/A	7101883
13C8-Perfluorooctane Sulfonamide	%	23	N/A	N/A	7101883
18O2-Perfluorohexanesulfonic acid	%	97	N/A	N/A	7101883

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

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BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

TEST SUMMARY

BV Labs ID: OIZ532 **Collected:** 2020/11/24
Sample ID: INFLUENT PRW-4 **Shipped:**
Matrix: Water **Received:** 2020/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Low level PFOS and PFOA by SPE/LCMS	LCMS	7101883	2020/12/10	2020/12/10	Xinhe Xing (Helena)

BV Labs ID: OIZ533 **Collected:** 2020/11/24
Sample ID: SYSTEM #1 MIDPOINT **Shipped:**
Matrix: Water **Received:** 2020/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Low level PFOS and PFOA by SPE/LCMS	LCMS	7101883	2020/12/10	2020/12/10	Xinhe Xing (Helena)

BV Labs ID: OIZ534 **Collected:** 2020/11/24
Sample ID: SYSTEM #1 EFFLUENT **Shipped:**
Matrix: Water **Received:** 2020/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Low level PFOS and PFOA by SPE/LCMS	LCMS	7101883	2020/12/10	2020/12/10	Xinhe Xing (Helena)

BV Labs ID: OIZ535 **Collected:** 2020/11/24
Sample ID: SYSTEM #2 MIDPOINT **Shipped:**
Matrix: Water **Received:** 2020/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Low level PFOS and PFOA by SPE/LCMS	LCMS	7101883	2020/12/10	2020/12/10	Xinhe Xing (Helena)

BV Labs ID: OIZ536 **Collected:** 2020/11/24
Sample ID: SYSTEM #2 EFFLUENT **Shipped:**
Matrix: Water **Received:** 2020/12/08

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Low level PFOS and PFOA by SPE/LCMS	LCMS	7101883	2020/12/10	2020/12/10	Xinhe Xing (Helena)

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BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

GENERAL COMMENTS

Sample OIZ532 [INFLUENT PRW-4] : Per- and polyfluoroalkyl substances (PFAS): Analysis was performed past the method defined holding time. Because of their chemical structure, PFAS are chemically and biologically stable in the environment and resist typical environmental degradation processes. This would suggest a hold time exceedance would not have a significant impact on the data. Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample OIZ533 [SYSTEM #1 MIDPOINT] : Per- and polyfluoroalkyl substances (PFAS): Analysis was performed past the method defined holding time. Because of their chemical structure, PFAS are chemically and biologically stable in the environment and resist typical environmental degradation processes. This would suggest a hold time exceedance would not have a significant impact on the data.

Sample OIZ534 [SYSTEM #1 EFFLUENT] : Per- and polyfluoroalkyl substances (PFAS): Analysis was performed past the method defined holding time. Because of their chemical structure, PFAS are chemically and biologically stable in the environment and resist typical environmental degradation processes. This would suggest a hold time exceedance would not have a significant impact on the data.

Sample OIZ535 [SYSTEM #2 MIDPOINT] : Per- and polyfluoroalkyl substances (PFAS): Analysis was performed past the method defined holding time. Because of their chemical structure, PFAS are chemically and biologically stable in the environment and resist typical environmental degradation processes. This would suggest a hold time exceedance would not have a significant impact on the data. Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample OIZ536 [SYSTEM #2 EFFLUENT] : Per- and polyfluoroalkyl substances (PFAS): Analysis was performed past the method defined holding time. Because of their chemical structure, PFAS are chemically and biologically stable in the environment and resist typical environmental degradation processes. This would suggest a hold time exceedance would not have a significant impact on the data.

Sample OIZ533, Low level PFOS and PFOA by SPE/LCMS: Test repeated.
Sample OIZ534, Low level PFOS and PFOA by SPE/LCMS: Test repeated.

Results relate only to the items tested.

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BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
7101883	XIN	Matrix Spike	13C2-6:2-Fluorotelomersulfonic Acid	2020/12/10		73	%	50 - 150
			13C2-8:2-Fluorotelomersulfonic Acid	2020/12/10		78	%	50 - 150
			13C2-Perfluorodecanoic acid	2020/12/10		87	%	50 - 150
			13C2-Perfluorododecanoic acid	2020/12/10		82	%	50 - 150
			13C2-Perfluorohexanoic acid	2020/12/10		86	%	50 - 150
			13C2-perfluorotetradecanoic acid	2020/12/10		83	%	50 - 150
			13C2-Perfluoroundecanoic acid	2020/12/10		82	%	50 - 150
			13C3-Perfluorobutanesulfonic acid	2020/12/10		88	%	50 - 150
			13C4-Perfluorobutanoic acid	2020/12/10		79	%	50 - 150
			13C4-Perfluoroheptanoic acid	2020/12/10		87	%	50 - 150
			13C4-Perfluorooctanesulfonic acid	2020/12/10		90	%	50 - 150
			13C4-Perfluorooctanoic acid	2020/12/10		89	%	50 - 150
			13C5-Perfluorononanoic acid	2020/12/10		88	%	50 - 150
			13C5-Perfluoropentanoic acid	2020/12/10		77	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2020/12/10		57	%	20 - 130
			18O2-Perfluorohexanesulfonic acid	2020/12/10		94	%	50 - 150
			Perfluorobutanoic acid (PFBA)	2020/12/10		101	%	70 - 130
			Perfluoropentanoic acid (PFPeA)	2020/12/10		105	%	70 - 130
			Perfluorohexanoic acid (PFHxA)	2020/12/10		103	%	70 - 130
			Perfluoroheptanoic acid (PFHpA)	2020/12/10		103	%	70 - 130
			Perfluorooctanoic acid (PFOA)	2020/12/10		101	%	70 - 130
			Perfluorononanoic acid (PFNA)	2020/12/10		104	%	70 - 130
			Perfluorodecanoic acid (PFDA)	2020/12/10		101	%	70 - 130
			Perfluoroundecanoic acid (PFUnA)	2020/12/10		101	%	70 - 130
			Perfluorododecanoic acid (PFDoA)	2020/12/10		97	%	70 - 130
			Perfluorotridecanoic acid (PFTRDA)	2020/12/10		93	%	70 - 130
			Perfluorotetradecanoic acid(PFTEDA)	2020/12/10		98	%	70 - 130
			Perfluorobutanesulfonic acid (PFBS)	2020/12/10		103	%	70 - 130
			Perfluoropentanesulfonic acid PFPes	2020/12/10		122	%	70 - 130
			Perfluorohexanesulfonic acid(PFHxS)	2020/12/10		96	%	70 - 130
			Perfluoroheptanesulfonic acid PFHpS	2020/12/10		104	%	70 - 130
			Perfluorooctanesulfonic acid (PFOS)	2020/12/10		101	%	70 - 130
			Perfluorononanesulfonic acid (PFNS)	2020/12/10		94	%	70 - 130
			Perfluorodecanesulfonic acid (PFDS)	2020/12/10		91	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2020/12/10		93	%	70 - 130
			6:2 Fluorotelomer sulfonic acid	2020/12/10		103	%	70 - 130
			8:2 Fluorotelomer sulfonic acid	2020/12/10		105	%	70 - 130
7101883	XIN	Spiked Blank	13C2-6:2-Fluorotelomersulfonic Acid	2020/12/10		93	%	50 - 150
			13C2-8:2-Fluorotelomersulfonic Acid	2020/12/10		95	%	50 - 150
			13C2-Perfluorodecanoic acid	2020/12/10		95	%	50 - 150
			13C2-Perfluorododecanoic acid	2020/12/10		87	%	50 - 150
			13C2-Perfluorohexanoic acid	2020/12/10		101	%	50 - 150
			13C2-perfluorotetradecanoic acid	2020/12/10		82	%	50 - 150
			13C2-Perfluoroundecanoic acid	2020/12/10		93	%	50 - 150
			13C3-Perfluorobutanesulfonic acid	2020/12/10		106	%	50 - 150
			13C4-Perfluorobutanoic acid	2020/12/10		98	%	50 - 150
			13C4-Perfluoroheptanoic acid	2020/12/10		99	%	50 - 150
			13C4-Perfluorooctanesulfonic acid	2020/12/10		97	%	50 - 150
			13C4-Perfluorooctanoic acid	2020/12/10		100	%	50 - 150
			13C5-Perfluorononanoic acid	2020/12/10		98	%	50 - 150
			13C5-Perfluoropentanoic acid	2020/12/10		99	%	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
			13C8-Perfluorooctane Sulfonamide	2020/12/10		83	%	20 - 130
			18O2-Perfluorohexanesulfonic acid	2020/12/10		100	%	50 - 150
			Perfluorobutanoic acid (PFBA)	2020/12/10		96	%	70 - 130
			Perfluoropentanoic acid (PFPeA)	2020/12/10		97	%	70 - 130
			Perfluorohexanoic acid (PFHxA)	2020/12/10		97	%	70 - 130
			Perfluoroheptanoic acid (PFHpA)	2020/12/10		96	%	70 - 130
			Perfluorooctanoic acid (PFOA)	2020/12/10		96	%	70 - 130
			Perfluorononanoic acid (PFNA)	2020/12/10		96	%	70 - 130
			Perfluorodecanoic acid (PFDA)	2020/12/10		95	%	70 - 130
			Perfluoroundecanoic acid (PFUnA)	2020/12/10		94	%	70 - 130
			Perfluorododecanoic acid (PFDoA)	2020/12/10		96	%	70 - 130
			Perfluorotridecanoic acid (PFTRDA)	2020/12/10		97	%	70 - 130
			Perfluorotetradecanoic acid(PFTEDA)	2020/12/10		95	%	70 - 130
			Perfluorobutanesulfonic acid (PFBS)	2020/12/10		93	%	70 - 130
			Perfluoropentanesulfonic acid PFPes	2020/12/10		100	%	70 - 130
			Perfluorohexanesulfonic acid(PFHxS)	2020/12/10		92	%	70 - 130
			Perfluoroheptanesulfonic acid PFHpS	2020/12/10		92	%	70 - 130
			Perfluorooctanesulfonic acid (PFOS)	2020/12/10		99	%	70 - 130
			Perfluorononanesulfonic acid (PFNS)	2020/12/10		88	%	70 - 130
			Perfluorodecanesulfonic acid (PFDS)	2020/12/10		88	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2020/12/10		91	%	70 - 130
			6:2 Fluorotelomer sulfonic acid	2020/12/10		96	%	70 - 130
			8:2 Fluorotelomer sulfonic acid	2020/12/10		93	%	70 - 130
7101883	XIN	Method Blank	13C2-6:2-Fluorotelomersulfonic Acid	2020/12/10		95	%	50 - 150
			13C2-8:2-Fluorotelomersulfonic Acid	2020/12/10		92	%	50 - 150
			13C2-Perfluorodecanoic acid	2020/12/10		87	%	50 - 150
			13C2-Perfluorododecanoic acid	2020/12/10		79	%	50 - 150
			13C2-Perfluorohexanoic acid	2020/12/10		97	%	50 - 150
			13C2-perfluorotetradecanoic acid	2020/12/10		78	%	50 - 150
			13C2-Perfluoroundecanoic acid	2020/12/10		82	%	50 - 150
			13C3-Perfluorobutanesulfonic acid	2020/12/10		102	%	50 - 150
			13C4-Perfluorobutanoic acid	2020/12/10		96	%	50 - 150
			13C4-Perfluoroheptanoic acid	2020/12/10		97	%	50 - 150
			13C4-Perfluorooctanesulfonic acid	2020/12/10		92	%	50 - 150
			13C4-Perfluorooctanoic acid	2020/12/10		94	%	50 - 150
			13C5-Perfluorononanoic acid	2020/12/10		93	%	50 - 150
			13C5-Perfluoropentanoic acid	2020/12/10		97	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2020/12/10		68	%	20 - 130
			18O2-Perfluorohexanesulfonic acid	2020/12/10		98	%	50 - 150
			Perfluorobutanoic acid (PFBA)	2020/12/10	<0.67		ng/L	
			Perfluoropentanoic acid (PFPeA)	2020/12/10	<0.52		ng/L	
			Perfluorohexanoic acid (PFHxA)	2020/12/10	<0.70		ng/L	
			Perfluoroheptanoic acid (PFHpA)	2020/12/10	<0.51		ng/L	
			Perfluorooctanoic acid (PFOA)	2020/12/10	<0.49		ng/L	
			Perfluorononanoic acid (PFNA)	2020/12/10	<0.80		ng/L	
			Perfluorodecanoic acid (PFDA)	2020/12/10	<0.64		ng/L	
			Perfluoroundecanoic acid (PFUnA)	2020/12/10	<0.77		ng/L	
			Perfluorododecanoic acid (PFDoA)	2020/12/10	<0.59		ng/L	
			Perfluorotridecanoic acid (PFTRDA)	2020/12/10	<0.48		ng/L	
			Perfluorotetradecanoic acid(PFTEDA)	2020/12/10	<0.37		ng/L	
			Perfluorobutanesulfonic acid (PFBS)	2020/12/10	<0.47		ng/L	

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BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Perfluoropentanesulfonic acid PFPes	2020/12/10	<0.73		ng/L	
			Perfluorohexanesulfonic acid(PFHxS)	2020/12/10	<0.53		ng/L	
			Perfluoroheptanesulfonic acid PFHpS	2020/12/10	<0.57		ng/L	
			Perfluorooctanesulfonic acid (PFOS)	2020/12/10	<0.43		ng/L	
			Perfluorononanesulfonic acid (PFNS)	2020/12/10	<0.64		ng/L	
			Perfluorodecanesulfonic acid (PFDS)	2020/12/10	<0.53		ng/L	
			Perfluorooctane Sulfonamide (PFOSA)	2020/12/10	<0.81		ng/L	
			6:2 Fluorotelomer sulfonic acid	2020/12/10	<0.59		ng/L	
			8:2 Fluorotelomer sulfonic acid	2020/12/10	<0.75		ng/L	
7101883	XIN	RPD - Sample/Sample Dup	Perfluorobutanoic acid (PFBA)	2020/12/10	2.9		%	30
			Perfluoropentanoic acid (PFPeA)	2020/12/10	3.3		%	30
			Perfluorohexanoic acid (PFHxA)	2020/12/10	4.1		%	30
			Perfluoroheptanoic acid (PFHpA)	2020/12/10	1.4		%	30
			Perfluorooctanoic acid (PFOA)	2020/12/10	NC		%	30
			Perfluorononanoic acid (PFNA)	2020/12/10	NC		%	30
			Perfluorodecanoic acid (PFDA)	2020/12/10	NC		%	30
			Perfluoroundecanoic acid (PFUnA)	2020/12/10	NC		%	30
			Perfluorododecanoic acid (PFDoA)	2020/12/10	NC		%	30
			Perfluorotridecanoic acid (PFTRDA)	2020/12/10	NC		%	30
			Perfluorotetradecanoic acid(PFTEDA)	2020/12/10	NC		%	30
			Perfluorobutanesulfonic acid (PFBS)	2020/12/10	NC		%	30
			Perfluorohexanesulfonic acid(PFHxS)	2020/12/10	9.8		%	30
			Perfluoroheptanesulfonic acid PFHpS	2020/12/10	NC		%	30
			Perfluorooctanesulfonic acid (PFOS)	2020/12/10	4.0		%	30
			Perfluorodecanesulfonic acid (PFDS)	2020/12/10	NC		%	30
			Perfluorooctane Sulfonamide (PFOSA)	2020/12/10	NC		%	30
			6:2 Fluorotelomer sulfonic acid	2020/12/10	NC		%	30
			8:2 Fluorotelomer sulfonic acid	2020/12/10	NC		%	30
7110594	YPL	Matrix Spike	13C8-Perfluorooctane Sulfonamide	2020/12/16		59	%	20 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2020/12/16		102	%	70 - 130
7110594	YPL	Spiked Blank	13C8-Perfluorooctane Sulfonamide	2020/12/16		75	%	20 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2020/12/16		96	%	70 - 130
7110594	YPL	Method Blank	13C8-Perfluorooctane Sulfonamide	2020/12/16		66	%	20 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2020/12/16	<0.81		ng/L	
7110594	YPL	RPD - Sample/Sample Dup	Perfluorooctane Sulfonamide (PFOSA)	2020/12/16	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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BV Labs Job #: C0W6405
Report Date: 2020/12/17

Barnstable County
Client Project #: BFTA
Site Location: BARNSTABLE COUNTY
Sampler Initials: MM

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

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Page 1 of 1

CHAIN OF CUSTODY RECORD

AIR

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#29803 Barnstable County	Company Name:	BETA Group Inc	Quotation #:	B57344	BV Labs Job #:	Bottle Order #: 778920
Attention:	Accounts Payable	Attention:	Steven Tebo / Roger Thibault	P.O. #:			
Address:	3195 Main Street PO Box 427 Barnstable MA 02630	Address:	701 Geerge Washington Hwy Lincoln, RI (rthibault@beta-inc.com)	Project:	BARNSTABLE COUNTY	COC #: C#778920-03-01	Project Manager: Stephanie Pollen
Tel:	(508) 362-3828 Ext: 1234 Fax:	Tel:	(508) 375-6603 Fax:	Project Name:	BFTA		
Email:	eoconnell@barnstablecounty.org, stebo@barnstableco	Email:	stebo@barnstablecounty.org, rthibault@neverarmstrong	Site #:	6206		
				Sampled By:	Mykel Mendes		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___	☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ___ ☐ PWQO ☐ Other ___	please use lower RDL values

Include Criteria on Certificate of Analysis (Y/N)? ___

ANALYSIS REQUESTED (PLEASE BE SPECIFIC):

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: X
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Total PFAS EPA 537 m	# of Bottles	Comments
1		INFLUENT PPW-4	20/11/24	1215	GW		X	2	
2		SYSTEM #1 MIDPOINT		1150			X	2	
3		SYSTEM #1 EFFLUENT		1155			X	2	
4		SYSTEM #2 MIDPOINT		1220			X	2	
5		SYSTEM #2 EFFLUENT	20/11/24	1225	GW		X	2	
6									
7									
8									
9									
10									

08-Dec-20 14:20
Stephanie Pollen
C0W6405
NP4 ENV-1335

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Mykel Mendes / Mykel Mendes	20/12/06	1130	[illegible]	20/12/08	14:20	

Laboratory Use Only				
Time Sensitive	Temperature (°C) on Recei	Custody Seal Present	Yes	No
	4.7 2.9 2.9	Intact	✓	

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

January 2021

Mark S. Ells, Town Manager
Town of Barnstable
200 Main Street
Hyannis, MA 02601

RE: Immediate Response Action Status and Remedial Monitoring Report #48
Barnstable County Fire and Rescue Training Academy
155 South Flint Rock Road
Barnstable, Massachusetts
DEP Release Tracking No. 4-26179
Project File #6206

Dear Mr. Ells,

As required by the Massachusetts Contingency Plan (MCP) 310 CMR 40.1403(3)(e) and 40.1403(6), BETA Group, Inc.(BETA) is notifying you on behalf of our client, Barnstable County, that an Immediate Response Action (IRA) Status and Remedial Monitoring Report (RMR) No. 48 is being submitted to the Massachusetts Department of Environmental Protection – Bureau of Waste Site Cleanup (MassDEP – BWSC) for the release site referenced as the Barnstable County Fire and Rescue Training Academy (BCFRTA) located at 155 South Flint Rock Road in Barnstable, Massachusetts (the site). This Report summarizes the IRA activities that occurred from November 1 to November 30, 2020.

Pursuant to the Massachusetts Contingency Plan (310 CMR 40.0480), an Initial Site Investigation has been performed at the site. A release of oils and/or hazardous materials has occurred at the site. In August 2016, MassDEP Southeast Regional Office issued a Notice of Responsibility (NOR) to Barnstable County, as current owner and operator of the Barnstable County Fire and Rescue Training Academy (BCFRTA), that the detection of elevated concentrations of poly- and perfluorylalkyl substances (PFAS) in groundwater at the site constituted a release under the MCP. MassDEP issued Release Tracking Number (RTN) 4-26179 to this release. As summarized in the NOR, based on the detected PFAS concentrations in soil and groundwater at the BCFRTA and the inferred groundwater flow, MassDEP determined that the releases of PFAS from the use of aqueous film-forming foam (AFFF) at the BCFRTA is a source of PFAS detected in the Mary Dunn wells.

During the November 2020 reporting period, the treatment system was operable for approximately 19 days. The overall (average) system flow rate and total gallons of groundwater treated are based on the available Effluent flow totalizer readings reported for both systems by the O&M contractor. For the November 2020 reporting period, both systems treated an approximate combined 0.12 million gallons of groundwater from the downgradient recovery well PRW-4 at an average total (of the two systems) effluent flow rate of 4.3 gpm. The system flow rates were affected by the significant iron-oxide sediment accumulation within the system and the system shutdown as a result of the failure and replacement of the well pump at PRW-4. Additional details regarding the pump replacement are provided in the full report.

BETA Group Inc.
701 George Washington Highway, Lincoln, RI 02865
P : 401.333.2832 |F: 401.333.9225 |W: beta-inc.com

Approximately 0.003 kilograms of PFAs were estimated to have been removed from the plume area during this reporting period.

The annual groundwater monitoring activities as part of the long-term monitoring sampling plan for Site-wide groundwater monitoring was conducted during this October 2020 reporting period. A total of twenty (20) monitoring wells were sampled within the Disposal Site. Additional details regarding the sampling and analysis are provided in the full report.

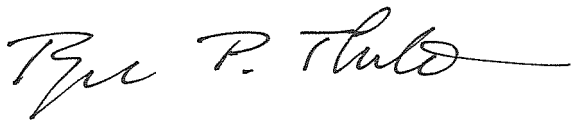
At this time, IRA activities are ongoing. Continuing IRA activities will include operation and monitoring of the on--Site Groundwater Pump and Treatment Systems (GWPTS), including performance sampling of GWPTS, review and evaluation of the on-Site GWPTS operation and maintenance activities as they affect groundwater treatment, and periodic groundwater monitoring. Additional details regarding the continuing IRA activities are included in the IRA Status and RMR No. 48 report document.

The IRA Status and RMR document is available electronically via the searchable sites database of the MassGOV / MassDEP website via the following link:

https://eeaonline.eea.state.ma.us/portal#!/wastesite/4-0026179

If you have any questions or comments, please do not hesitate to contact our office.

Sincerely,
BETA Group, Inc.



Roger P. Thibault, P.E., LSP
Senior Environmental Engineer

Copies: Mass Department of Environmental Protection
Southeast Regional Office
20 Riverside Drive
Lakeville, MA 02347

Thomas Mckean, Director
Town of Barnstable Health Division
200 Main Street
Hyannis, MA 02601

Hans Keijser, Supervisor
Town of Barnstable Water Supply Division
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