2019 PER- AND POLYFLUOROALKYL SUBSTANCES GROUNDWATER INVESTIGATION REPORT LOCKHEED MARTIN CORPORATION MIDDLE RIVER COMPLEX 2323 EASTERN BOULEVARD MIDDLE RIVER, MARYLAND

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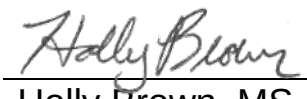

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ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Technical Services, Inc.
COC(s)	chain(s) of custody
DFR	daily field report
DO	dissolved oxygen
FTS	Fluorotelomer sulfonate
GIS	geographic information system
HAL	health advisory limit
LFSP	low-flow sampling procedure
Lockheed Martin	Lockheed Martin Corporation
LTM	laboratory task manager
MDE	Maryland Department of the Environment
MRC	Middle River Complex
msl	mean sea level
MW	monitoring well
ORP	oxidation-reduction potential
PFAS	Per- and polyfluoroalkyl substances
PFBS	Perfluorobutanesulfonic acid
PFHpA	Perfluoroheptanoic acid
PFHxS	Perfluorohexanesulfonic acid
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
ppt	parts per trillion
Tetra Tech	Tetra Tech, Inc.
THQ	Target Hazard Quotient
Tilley	Tilley Chemical Company
TPH	Total Petroleum Hydrocarbons

USEPA	United States Environmental Protection Agency
USDOT	United States Department of Transportation
UST	underground storage tank
µg/L	microgram(s) per liter

EXECUTIVE SUMMARY

On behalf of Lockheed Martin Corporation, AECOM Technical Services, Inc., has prepared this per- and polyfluoroalkyl substances groundwater investigation report for the October 2019 groundwater sampling near the reported former fire training area in Tax Block E and former plating operations in Tax Blocks E and I at the Middle River Complex in Middle River, Maryland. This report is part of the per- and polyfluoroalkyl substances investigative groundwater sampling program at the Middle River Complex, conducted in accordance with the approved *Per- and Polyfluoroalkyl Substances Investigation Work Plan* and its associated addenda (AECOM, 2019). Groundwater was sampled from October 21 to 28, 2019.

The findings of the October 2019 groundwater sampling analyses for the Lockheed Martin Corporation Middle River Complex are summarized as follows:

Per- and polyfluoroalkyl substances

- Detections for seven of the eight analyzed per- and polyfluoroalkyl substances compounds were seen throughout the site, with only two wells displaying detections above the USEPA screening level (40 parts per trillion) for perfluorooctane sulfonate. Per- and polyfluoroalkyl substances concentrations detected site-wide, including in designated background wells, are ubiquitous in nature and extent. No correlation was observed between per- and polyfluoroalkyl substances concentration trends and suspected sources pertaining to former plating operations and fire-fighting training. Therefore, an evaluation of per- and polyfluoroalkyl substances concentrations in relation to historic hexavalent chromium detections and impacts to groundwater remedial action activities was not performed.

Total petroleum hydrocarbon diesel range organics/gasoline range organics

- Field sample detections were only observed in samples from intermediate wells, with four detections for total petroleum hydrocarbon-gasoline range organics and two for total petroleum hydrocarbon-diesel range organics. Samples collected within the former firefighter training area, a suspected potential source area, were all non-detect from intermediate aquifer wells. The intermediate well sampled outside the former firefighter training area, but closest to this potential source area (MRC-MW74B) showed a total petroleum hydrocarbon-gasoline range organics detection of 7,800 micrograms per liter. The MRC-MW74A and B well cluster is directly downgradient of the former 500-gallon underground storage tank. Total petroleum hydrocarbon impacted-groundwater in this area of the site will be addressed during the Blocks E and F groundwater remedial action.

SECTION 1
INTRODUCTION AND OVERVIEW

On behalf of Lockheed Martin Corporation, AECOM Technical Services, Inc., has prepared this 2019 per- and polyfluoroalkyl substances groundwater investigation report summarizing the October 2019 groundwater sampling event. The sampling occurred near the reported former fire training area in Tax Block E and former plating operations in Tax Blocks E and I at the Middle River Complex in Middle River, Maryland. Figure 1 shows the location of the Middle River Complex. As described in the per- and polyfluoroalkyl substances investigation work plan (AECOM, 2019), the objectives of this program include delineating the nature and extent of per- and polyfluoroalkyl substances in groundwater and identifying any potential source areas. This was accomplished by:

- Sampling and chemical analysis of existing groundwater wells in the vicinity, upgradient, and downgradient of the potential per- and polyfluoroalkyl substances use areas to evaluate whether groundwater at the Middle River Complex has been impacted by per- and polyfluoroalkyl substances

- Sampling and chemical analysis of existing groundwater wells in the vicinity, upgradient, and downgradient of the former firefighting training area in Block E, known to have used accelerants such as gasoline to further evaluate and potentially confirm the location of the firefighting training area in addition to potential per- and polyfluoroalkyl substances sampling

To meet these objectives, the following investigative activities were conducted in October 2019:

- Collection of 11 groundwater samples from the former fire training area in Block E and downgradient near Dark Head Cove in Block F (Figure 2)

- Collection of 29 groundwater samples from the former plating operations areas in Blocks E and I. Groundwater samples were also collected from upgradient and downgradient wells in Blocks A, F, and G

This report presents analytical data for selected monitoring wells as part of the per- and polyfluoroalkyl substances investigative groundwater sampling program at the Middle River Complex.

This report is organized into the following sections:

Section 1—Introduction: Presents the site objectives for the groundwater monitoring program.

Section 2—Site Background: Briefly describes site history, subsurface conditions, and previous investigations.

Section 3—Investigation Approach and Methodology: Presents the technical approaches to field activities and data management and describes the field methodologies employed.

Section 4—Groundwater Sampling Results: Presents investigation results, interpretation, and data-quality review.

Section 5—Summary and Conclusions: Summarizes the results of the sampling.

Section 6—References: Cites references used to compile this report.

Figures, tables, and appendices are provided as stand-alone sections following Section 6.

SECTION 2
SITE BACKGROUND

2.1 MIDDLE RIVER COMPLEX BACKGROUND

The Middle River Complex is part of the Chesapeake Industrial Park, at 2323 Eastern Boulevard in Middle River, Maryland, approximately 11.5 miles northeast of downtown Baltimore. It comprises approximately 161 acres, including 12 main buildings, an active industrial area and yard, perimeter parking lots, an athletic field, a vacant concrete lot, trailer and parts storage lot, and numerous grassy spaces along its perimeter. It is bounded by Eastern Boulevard (Route 150) to the north, Martin State Airport to the east, Dark Head Cove to the south, and Cow Pen Creek to the west. Figure 2 is a map showing the Middle River Complex layout.

LMC Properties, Inc., owns the Middle River Complex. LMC Properties, Inc.'s, primary site activities include facility and building management and maintenance. The main tenant at the site, MRA Systems, LLC, designs, manufactures, fabricates, tests, overhauls, repairs, and maintains aeronautical structures, parts, and components for military and commercial applications. Lockheed Martin Rotary and Mission Systems, a division of Lockheed Martin Corporation, conducts engineering activities and fabricates, assembles, tests, and otherwise supports vertical-launch systems.

2.1.1 Middle River Complex History

In 1929, the Glenn L. Martin Company (a predecessor entity of Lockheed Martin Corporation) acquired large parcels of undeveloped land in Middle River, Maryland, to manufacture aircrafts for United States government and commercial clients. In the early 1960s, Glenn L. Martin Company merged with American-Marietta Company to form Martin Marietta Corporation. In 1975, the adjacent eastern airport area (currently Martin State Airport), approximately 750 acres, was transferred to the State of Maryland. In the mid-1990s, Martin Marietta Corporation merged with Lockheed Corporation to form Lockheed Martin Corporation. Shortly after the merger, General Electric Company entities acquired most of Lockheed Martin Corporation's aeronautical business in Middle River and MRA Systems, Inc., began operations.

2.1.2 Middle River Complex Characteristics

The Middle River Complex is an industrial facility surrounded primarily by commercial, industrial, and residential establishments. Six facilities adjacent to the Middle River Complex comprise the remaining portion of the Chesapeake Industrial Park. These include Tilley Chemical Company, Inc., (a food and pharmaceutical-chemical distributor), North American Electric, Inc., (an industrial and commercial electrical contractor), Johnson and Towers (a heavy-duty automotive and boat repair and maintenance company), Ashley Furniture (a furniture warehouse distributor), a gasoline filling station and convenience store, and the Middle River Post Office. Residential developments are on the opposite shores of Cow Pen Creek, Dark Head Cove, and Dark Head Creek, and north of Eastern Boulevard (Route 150).

2.1.2.1 Physiography

The Middle River Complex is in the Western Shore of the Coastal Plain physiographic province, which is generally characterized by low relief. The Middle River Complex's topography slopes gently, ranging from sea level to 32 feet above mean sea level (Cassell, 1977). The topography slopes from Eastern Boulevard to the southwest and south toward Cow Pen Creek and Dark Head Cove.

2.1.2.2 Hydrology

The Middle River Complex is at the junction of Cow Pen Creek and Dark Head Cove. Both surface water bodies discharge into Dark Head Creek, a tributary to Middle River, which is a tributary to Chesapeake Bay. The Middle River Complex is approximately 3.24 miles (17,100 feet) upstream of Chesapeake Bay.

The Middle River Complex has no surface water bodies on-site. Excluding areas immediately adjacent to Cow Pen Creek and Dark Head Cove, surface-water runoff discharges from the facility via storm drains. Middle River Complex is not subject to a general stormwater discharge permit.

2.1.2.3 Historic Use of Per- and Polyfluoroalkyl Substances

Per- and polyfluoroalkyl substances comprise a diverse group of fluorinated chemicals that have been in use since the 1940's in various applications and products. The two most likely potential sources of per- and polyfluoroalkyl substances at the Middle River Complex include:

- Potential use of aqueous film forming foams at a former firefighting training area. Aqueous film forming foams have been documented to be a source of per- and polyfluoroalkyl substances contamination at airports and military bases (ITRC, 2017; 2018).
- Former chrome metal plating and other metal plating operations. Metal plating may have used per- and polyfluoroalkyl substances for corrosion prevention, mechanical wear reduction, aesthetic enhancement, surfactant, wetting agent/fume suppressant chrome, copper, nickel and tin electroplating, and post-plating cleaner (EPA Region 5, 2009; ITRC, 2017).

Block E Fire Training Area (Figure 3) — a long-standing employee who has been employed at the Middle River Complex since the 1980's, was interviewed on December 22, 2016, regarding fire training exercises at the site (Martin, 2016). Per this interview, Tax Block E was used in the early 1980's through the mid 1990's for fire training exercises. The exercises were supposedly conducted approximately once per year just north of the water tower in Block E, a remark supported by the location of a nearby hydrant. It is not known whether other areas at the Middle River Complex were used for fire training activities prior to his arrival in the early 1980's. From his recollection, an accelerant such as gasoline or perhaps lighter fluid was typically used to start the fires. Old pallets were burned and then put out with a variety of extinguishers over the years, ranging from water to various foam fire suppressants. Legacy fluorotelomer aqueous firefighting foams used from the 1970s until 2016, typically contain polyfluorinated precursors (ITRC, 2018).

Electro-Plating Operations (Figure 3) — Historical industrial activities at the Middle River Complex are known or suspected to have included metal plating operations in several locations, including the main floor of Building A, the southeast corner of Building B basement and in the northwest corner of Building B, the Building C basement (Patriot Plating line), and the former Building D basement. Since approximately the 1940s, per- and polyfluoroalkyl substances have generally been applied in metal plating operations (ITRC, 2017), and therefore may have been used in association with historical plating operations at the Middle River Complex.

2.1.2.4 Groundwater Studies and Remedy

The groundwater response action at the Middle River Complex is implemented in accordance with an administrative consent order between the Maryland Department of the Environment and Lockheed Martin Corporation. The groundwater response action uses enhanced anaerobic *in situ* bioremediation to treat three areas exhibiting high groundwater concentrations of trichloroethene

and other chlorinated solvents. The response action addresses, or will address, groundwater contamination in the southeastern trichloroethene area (Block E), the southwestern trichloroethene area (Block G), and the northern trichloroethene area (Block I) (Tetra Tech, Inc., 2012).

Construction of the groundwater treatment remedies in Blocks E, G, and I began in early summer 2013. During remedial action activities in Block E, two underground storage tanks were discovered near the foundation of former Building D. Underground storage tank 1 was nearly empty when discovered, whereas underground storage tank 2 contained high concentrations of trichloroethene. Both underground storage tanks were removed during installation of the *in situ* bioremediation system.

Subsequent investigations indicated that the mass and concentration of trichloroethene near underground storage tank 2 would not be readily addressed by *in situ* bioremediation. With Maryland Department of the Environment approval, Lockheed Martin installed a multi-phase extraction system in Block E in 2014. The multi-phase-extraction-system operation was completed in late 2015.

Sampling for residual groundwater contamination detected a narrow trichloroethene plume extending from underground storage tank 2 to Dark Head Cove. Sampling to determine the nature and extent of contamination was completed and remediation alternatives were defined in *Middle River Complex Groundwater Remedial Action Plan Addendum Number 4* (Tetra Tech, Inc., 2018). The *Remedial Action Plan Amendment 4* was reviewed and approved by Maryland Department of the Environment at the end of July 2018.

Semi-permanent injection wells were installed to inject biological amendments into the subsurface. A tracer study was performed in Blocks G and I (May–July 2014) before the full-scale injection to determine the main injection parameters.

Two injection rounds were completed at Block G in June 2015 and February 2016. The second round included bioaugmentation with Dehalococcoides bacterial culture and was completed in early 2016. Remedial action objectives determined for these actions have been met, and two years of post-injection monitoring have been completed. The Block G injection program completion report was submitted to the Maryland Department of the Environment in October 2018.

Three injection rounds were completed in Block I, with the latest completed in September 2017. Injections in September 2017 incorporated pumping to lower the groundwater table in the injection area to control groundwater mounding, to mitigate the potential for substrate escaping through storm drains to Dark Head Cove. This change was documented in the Maryland Department of the Environment-approved *Groundwater Remedial Action Plan Addendum 4* (Tetra Tech Inc, 2018). Remedial action objectives have been achieved, and a third injection-event completion report has been prepared requesting No Further Action for Block I. Two years of post-injection monitoring are in progress. Groundwater monitoring results are currently evaluated annually, except in groundwater treatment areas, for which results are evaluated more frequently.

SECTION 3
INVESTIGATION APPROACH AND METHODOLOGY

The overall objective of the per- and polyfluoroalkyl substances (PFAS) investigation activities is to sample existing groundwater wells in the vicinity, upgradient, and downgradient of the potential PFAS use areas to evaluate whether groundwater at the Middle River Complex (MRC) has been impacted by PFAS. In addition, a subset of samples was collected and analyzed for petroleum hydrocarbons to further evaluate and potentially confirm the location of the firefighting training area. The results of the October 2019 groundwater monitoring are discussed in Section 4.

3.1 GROUNDWATER SAMPLING AND CHEMICAL ANALYSIS

AECOM personnel sampled 40 on-site monitoring wells from October 21 to 28, 2019. A total of 23 shallow wells, 17 intermediate wells, and four field duplicates were collected. All monitoring well locations that were sampled during the October 2019 sampling event are identified in Table 1 and presented in Figure 3.

3.1.1 Pre-Sampling Preparation

Dedicated sampling equipment was pre-cleaned and wrapped prior to arrival on-site. Field personnel performing the collection procedures wore a new pair of nitrile sampling gloves prior to handling any sampling equipment, between sampling and decontamination procedures, and between sampling locations.

AECOM has developed a set of standardized PFAS sampling guidance documents following the United States Environmental Protection Agency (USEPA) and other applicable standard protocols, for the proposed field sampling and data collection program. The guidance documents the field samplers followed are provided in Appendix A.

3.1.2 Well Purging

Monitoring wells were purged using low-flow sampling procedures (LFSP) before sample collection. A sampling sequence was established from areas where it is expected or known to be

least contaminated to areas anticipated or identified as most contaminated. Groundwater purging utilized a peristaltic pump fitted with dedicated, disposable high-density polyethylene (HDPE) tubing positioned within the center of the well's saturated screen length. The pumping rate during purging ranged between 100 and 500 milliliters per minute and was monitored constantly using a graduated cylinder and stopwatch. The purpose of LFSP is to collect groundwater samples from monitoring wells that represent ambient groundwater conditions in the aquifer. This is accomplished by setting the intake velocity of the sampling pump to a flow rate that limits drawdown inside the well. The purge rate, therefore, was adjusted to minimize drawdown.

During groundwater purging, water level drawdown measurements and groundwater parameters (including pH, temperature, specific conductance, dissolved oxygen [DO], oxygen reduction potential [ORP], and turbidity) were collected every 5 minutes until purging was complete. These data were recorded in the appropriate site-specific logbook and on low-flow groundwater sampling purge logs (Appendix B). Water quality parameters were measured using a Horiba U-52 water quality meter. Upon arrival at each sampling location, and immediately after the well is opened, the headspace in monitoring wells were screened with a 3000 MiniRAE photoionization detector. All air- and water-quality monitoring equipment were calibrated and inspected daily to ensure precise and accurate measurements. Several months prior to sampling, dedicated low density polyethylene tubing, if applicable, was removed from the monitoring wells and replaced with new, PFAS-free high density polyethylene tubing for this sampling event. Sample collection procedures and documentation were in accordance with those outlined in the *2019 Per- and Polyfluoroalkyl Substances Investigation Work Plan* (AECOM, 2019).

All nondedicated equipment was certified PFAS-free, except for the water level meters. For water level meters, a rinsate blank was collected in the field as a reference source for potential cross-contamination. The collection of equipment rinsate blanks in the field utilized certified PFAS-free water that was supplied by the laboratory.

Purging is considered complete when the monitored water quality parameters have stabilized, when three saturated well casing volumes have been removed, when the well is purged dry, or after a 90-minute period, whichever occurs first. Purge stabilization parameters are defined in Table 2. If a monitoring well was purged dry, the water level within the well was allowed to recover to 80 percent of its initial static water level before groundwater sampling occurs. All

purged water was collected in United States Department of Transportation (USDOT)-approved 55-gallon steel drums and stored in a dedicated hazardous staging area.

3.2 LABORATORY ANALYSES

AECOM collected groundwater samples as outlined in the *2019 Per- and Polyfluoroalkyl Substances Investigation Work Plan* (AECOM, 2019). Samples were sent under chain of custody to Eurofins Lancaster Laboratories for analysis of PFAS by USEPA Method 537 Modified and total petroleum hydrocarbons (TPH) by Method SW846 8015D. Eurofins Lancaster Laboratories was able to meet the PFAS detection limits of 1 to 2 nanograms per liter for Method 537. The site-specific PFAS analyte list is as follows:

- Perfluorooctane sulfonate (PFOS)
- Perfluorooctanoic acid (PFOA)
- Perfluorononanoic acid (PFNA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorobutanesulfonic acid (PFBS)
- 6:2 Fluorotelomer sulfonate
- 8:2 Fluorotelomer sulfonate

Groundwater samples collected from the former firefighter training area were also analyzed for TPH by Method SW846 8015D to evaluate and potentially confirm the location of the potential source area in Block E.

3.3 DOCUMENTATION

Site activities and observations, including groundwater level measurements, well purge information, groundwater parameters, time of purging and sampling, and field observations were manually recorded in the appropriate site-specific logbook and on low-flow purge data sheets. Copies of field documentation can be found in Appendix B.

3.4 EQUIPMENT DECONTAMINATION

Alconox, a laboratory-grade glassware detergent, was the standard brand of phosphate-free detergent used for equipment decontamination throughout the duration of the sampling event. Deionized, PFAS-free water provided by Eurofins Lancaster Laboratories was used as the final water rinse.

3.4.1 Field Decontamination Procedures

Non-dedicated sampling equipment and tools were decontaminated prior to each use by scrubbing with laboratory grade glassware detergent and tap water to remove visual contamination followed by a generous tap water rinse and a final deionized, PFAS-free water provided by Eurofins Lancaster Laboratories was used as the final water rinse.

Reusable equipment (e.g., water level meter and water quality meter) was decontaminated before and after each use. Between each sampling location, decontamination of reusable equipment involved the following:

- Alconox® and potable-water wash with PFAS-free deionized water
- PFAS-free deionized water rinse
- air drying

Decontamination fluids were collected for disposal in USDOT approved 55-gallon drums. Rinsate water from sampling downgradient of UST #2 in the hazardous trichloroethene (TCE) plume area was segregated from other decontamination fluids and disposed of as F001-listed hazardous waste. Disposable equipment used in groundwater sampling that did not require decontamination (e.g., bonded tubing, silicon tubing, poly sheeting, gloves) was disposed of as general refuse.

3.5 WASTE MANAGEMENT

All purged water was collected in USDOT-approved 55-gallon steel drums. Waste management and disposal was conducted in compliance with Lockheed Martin Corporation's (Locked Martin's) *Energy, Environment, Safety, and Health (EESH) Remediation Waste Management Procedure Number EROP 03* (Lockheed Martin, 2009), in accordance with the Waste Management Plan outlined in the *2019 Per- and Polyfluoroalkyl Substances Investigation Work Plan* (AECOM,

2019), the federal Resource Conservation and Recovery Act, USDOT, the Occupational Safety and Health Administration regulation 1910.120, and other applicable local, state, and federal statutes and regulations.

Disposable equipment used in groundwater sampling that did not require decontamination (e.g., HDPE tubing, silicon tubing, gloves) was disposed of as general refuse. A final summary waste package pertaining to the PFAS sampling is presented in Appendix C.

3.6 DATA MANAGEMENT

Laboratory data handling procedures meet the requirements set forth in the laboratory subcontract. All analytical and field data are maintained in project files, containing copies of the COC forms, sampling log forms, sampling location maps, and data quality assurance documentation.

3.6.1 Data Tracking and Control

A cradle-to-grave sample tracking system was used from the beginning to the end of sampling. The field operations leader coordinated sample tracking before field mobilization. Sample jar labels were both handwritten in the field and pre-supplied by the laboratory. Labels were reviewed to ensure their accuracy and adherence to work plan requirements. The AECOM laboratory task manager (LTM) coordinated with the analytical laboratory to ensure that they were aware of the number and type of samples and analyses to expect.

During field sampling, the field operations leader forwarded the COC forms to the LTM and the laboratory each day that samples were collected. The LTM confirmed that the COC forms provided the information required by the work plan. This allowed early detection of field errors so that adjustments could be made while the field team was mobilized. The laboratory submitted an electronic deliverable for the sample delivery groups. When all electronic deliverables had been received from the laboratory, the LTM confirmed that the laboratory had performed all analyses requested.

3.6.2 Data Export to EESH Geographic Information System

AECOM coordinated with Lockheed Martin to load analytical data from this sampling event into Lockheed Martin's EESH Geographic Information System enterprise database.

3.7 DATA VALIDATION

Laboratory data were entered into the AECOM sample database and evaluated against USEPA guidelines and MDE Cleanup Standards. AECOM performed a manual data review of all samples. Data validation using the EarthSoft *EQuIS*™ database's *Automated Validation Assistant* tool, which performed a limited data review (evaluating data completeness, holding times, laboratory and field blank contamination, laboratory batch quality control, field duplicate precision, and detection limits), was completed concurrent with the data evaluation. This review is based on the United States Environmental Protection Agency (USEPA) *National Functional Guidelines for Organic Superfund Methods Data Review* (USEPA, 2017a) and the specifics of the analytical method used.

Data validation and usability reports are in Appendix D, full laboratory reports are provided in Appendix E. Validation of these data concluded that they are acceptable for their intended uses (i.e., contaminant trending and risk screening). The data qualifiers (i.e., flags) applied to the chemical results during data validation are consistent with the *National Functional Guidelines for Organic Superfund Methods Data Review* (USEPA, 2017a).

3.8 SUSTAINABILITY APPROACH

As discussed in the *2019 Per- and Polyfluoroalkyl Substances Work Plan,* AECOM incorporated Green and Sustainable Remediation practices into the PFAS Investigation at the MRC to enhance and optimize data collection and to highlight the added values that sustainable practices bring. AECOM used Esri's mobile application *Collector* for ArcGIS as a sustainability measure to help enhances a technician's ability to locate and record accurate data.

Once in the field, if the technician required location services, needed to reference a base map, or needed to add or edit a location, *Collector* for ArcGIS was used. The technician can review historical information about the location, make edits, and take photos with the application, as required.

AECOM implemented sustainable approaches in all aspects of work wherever practical and with prior approval from Lockheed Martin and the Remediation Technical Operations contractor, CDM Smith (remediation oversite contractor for Lockheed Martin). The use of *Collector* for ArcGIS instead of printed paper maps as well as the use of rechargeable batteries for field instruments reduced total waste and provided resource efficiency. The utilization of local field staff,

carpooling, and the use of locally sourced materials wherever possible, contributed to reduced overall mobile emissions.

SECTION 4
GROUNDWATER MONITORING RESULTS

Section 4 presents the results of the 2019 per- and polyfluoroalkyl substances (PFAS) groundwater sampling. Results of groundwater level measurements and analytical results are tabulated and presented in this section, alongside groundwater contour maps and maps of the concentrations and distributions of chemicals of concern. A tabulated summary of all analytical data is presented in Appendix F. The laboratory analytical reports with chain of custody (COC) forms are presented in Appendix E. Monitoring well nomenclature for all wells includes the "MRC-" prefix, so all references to specific wells in Section 4 will be abbreviated to exclude the prefix (e.g., "MRC-MW102B" to "MW102B" and "MRC-SEMW-8S" to "SEMW-8S").

4.1 GROUNDWATER ANALYTICAL RESULTS

The October 2019 PFAS groundwater sampling results are tabulated in Table 3 and depicted on Figure 4. All validated analytical results are summarized in Appendix F. Chemical analytical results were used to generate plume maps estimating the boundaries of contaminants and their distribution within the plume footprint (referenced in their respective sections below).

While no state or federal standards exist for PFAS, the United States Environmental Protection Agency (USEPA) has promulgated a health advisory limit (HAL) for perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) at 70 parts per trillion (ppt) (combined or individually) in drinking water. Interim guidance from the USEPA recommends screening sites using the groundwater screening levels based on a Target Hazard Quotient (THQ) of 0.1 for PFOA and/or PFOS, currently set at 40 ppt individually or combined. This 40 ppt threshold for PFOA and/or PFOS is used as a benchmark to evaluate if further investigation is warranted. Therefore, analytical results are compared against the USEPA recommended HAL and site screening levels for PFOA and PFAS. The 2019 analytical results are organized below according to shallow and intermediate aquifer results in Sections 4.1.1 and 4.1.2, respectively.

4.1.1 Shallow Groundwater Analytical Results

4.1.1.1 Per- and Polyfluoroalkyl Substances

Twenty-three shallow groundwater monitoring wells were analyzed for PFAS, with all 23 wells displaying detections for one or more PFAS compounds. Two wells displayed detections above the USEPA screening level of 40 ppt for PFOS: MW21A (46 ppt) and MW118A (42 ppt). The field duplicate associated with sample MW21A also displayed a detection above the USEPA screening level at 47 ppt. Both wells are located along the west/southwest boundary of Block I (MW118A downgradient from the former plating location in Building A and MW21A downgradient from the former plating location in Building B and upgradient of Tilley Chemical Company). All other groundwater sample results displayed detections for PFOS between 0.63 ppt in well MW42A and 10 ppt in well MW125A. No wells displayed detections above the USEPA screening level of 40 ppt for PFOA, or for PFOS and PFOA combined (except for MW21A and MW118A) (Figure 4). In addition, no shallow wells exceeded the USEPA HAL for PFOA and PFOS at 70 ppt (combined or individually) in drinking water.

Total PFAS concentrations (the summation of perfluorobutanesulfonic acid [PFBS], perfluoroheptanoic acid [PFHpA], perfluorohexanesulfonic acid [PFHxS], PFOA, PFOS, perfluorononanoic acid [PFNA], and 6:2 [FTS] Fluorotelomer sulfonate concentrations) were calculated for each sample location. While the USEPA and state regulatory agencies do not have standards in place for total PFAS concentrations, these values help provide a broader sense of potential overall PFAS contamination.

Total PFAS concentrations in shallow groundwater monitoring wells ranged from 8 ppt in well MW05A to 81 ppt in well MW21A. The two wells that displayed the highest total PFAS concentrations (MW21A at 81 ppt and MW118A at 56 ppt) are located along the west/southwest area of Block I, downgradient of Buildings B and A, respectively (Figure 5). MW56A displayed the next highest concentration of total PFAS of 55 ppt and is located towards the center of Block I, immediately downgradient from Building B former platting operations. Background location MW02A contained the highest total PFAS concentration for the selected background well locations of 46 ppt. MW155A, located in the southeastern corner of Block E displayed a total PFAS concentration of 40 ppt.

4.1.1.2 Total Petroleum Hydrocarbons

Total petroleum hydrocarbon (TPH) analysis consists of diesel range organics (DRO) and gasoline range organics (GRO). Of the three shallow groundwater monitoring wells analyzed for TPH DRO/GRO, all wells displayed non-detect results (Figure 6). Non-detect results range from less than 40 µg/L to less than 100 µg/L.

4.1.2 Intermediate Groundwater Analytical Results

4.1.2.1 Per- and Polyfluoroalkyl Substances

PFAS were detected in 16 of the 17 intermediate-aquifer wells sampled; however, no PFAS concentrations exceeded the USEPA HAL of 70 ppt. Detected total PFAS concentrations (the summation of PFBS, PFHpA, PFHxS, PFOA, PFOS, PFNA, and 6:2 FTS concentrations) were calculated for each sample location and ranged from 3.3 ppt (MW60B) to 54 ppt (EXT-MW03). The highest total PFAS concentration reported (EXT-MW03 at 54 ppt), is located adjacent to MW56A, in the center of Block I. Total PFOA + PFOS concentrations ranged from 0.83 ppt (MW134B) to 38 ppt (EXT-MW06), just below the USEPA screening level of 40 ppt. While the USEPA and state regulatory agencies do not have standards in place for total PFAS concentrations, these values help provide a broader sense of potential overall PFAS contamination.

4.1.2.2 Total Petroleum Hydrocarbons

Eight intermediate groundwater monitoring wells were sampled for TPH DRO/GRO. Two of the eight intermediate wells sampled displayed detections for TPH-DRO, MW74B (72 µg/L) and MR147B (49 µg/L). Four wells sampled for TPH-GRO displayed detections, MW72B (550 µg/L), MW74B (7,800 µg/L), and MW147B (1,900 µg/L). The MW74A and B well cluster is directly downgradient of the former 500-gallon underground storage tank (UST). Total petroleum hydrocarbon impacted-groundwater in this area of the site will be addressed during the Blocks E and F remedial action.

Samples that were collected from the former firefighter training area for PFAS analysis were analyzed for TPH DRO/GRO to evaluate and potentially confirm the location of the potential source area in Block E. Three samples (IWE-10, SEMW-3I, and SEMW-2I) were collected in the immediate vicinity of the former firefighter training area and analyzed for TPH DRO/GRO. All results were non-detect. Non-detect results range from less than 40 µg/L to less than 100 µg/L.

The pattern of elevated detections in intermediate aquifers is seen further downgradient of the former firefighting training area with samples collected in Block F in the vicinity of Dark Head Cove. The one shallow aquifer well collected (MW145A) displayed non-detect results for TPH while the two intermediate wells sampled in the same vicinity both displayed detections: MW146B (TPH-GRO at 27 µg/L) and MW147B (TPH-GRO at 1,900 µg/L and TPH-DRO at 49 µg/L). MW146B has an associated well screen interval of 12 to 17 feet and MW147B of 21 to 26 feet. TPH compounds represented on the VOC 8260B list are not detected in surface water samples and therefore, no risk to receptors from the presence of TPH has been identified.

SECTION 5
SUMMARY AND CONCLUSIONS

The findings of the October 2019 PFAS groundwater site characterization for the Lockheed Martin Corporation Middle River Complex are summarized below.

5.1 GROUNDWATER FINDINGS

The findings of the October 2019 groundwater sampling analyses for the Lockheed Martin Corporation Middle River Complex are summarized as follows:

Per- and polyfluoroalkyl substances

- Detections for seven of the eight analyzed per- and polyfluoroalkyl substances compounds were seen throughout the site, with only two wells displaying detections above the USEPA groundwater screening level (40 parts per trillion) for perfluorooctane sulfonate. Per- and Polyfluoroalkyl substances concentrations detected site-wide, including in designated background wells, are ubiquitous in nature and extent. No correlation was observed between per- and Polyfluoroalkyl substances concentration trends and suspected sources pertaining to former plating operations and fire-fighting training. Therefore, an evaluation of per- and Polyfluoroalkyl substances concentrations in relation to historic hexavalent chromium detections and impacts to groundwater remedial action activities was not performed.

Total petroleum hydrocarbon diesel range organics/gasoline range organic

- Field sample detections were only observed in samples from intermediate wells, with four detections for total petroleum hydrocarbon - gasoline range organics and two for total petroleum hydrocarbon -diesel range organics. Samples collected within the former firefighter training, a suspected source area, were all non-detect; however, all samples were collected from intermediate aquifer wells. The intermediate well sampled closest to this potential source area (MRC-MW74B) showed a total petroleum hydrocarbon - gasoline range organics detection of 7,800 micrograms per liter. The MRC-MW74A and B well cluster is directly downgradient of the former 500-gallon underground storage tank. Total petroleum hydrocarbon impacted-groundwater in this area of the site will be addressed during the Blocks E and F remedial action.

SECTION 6
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FIGURES

Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2013 ESRI and its data suppliers).

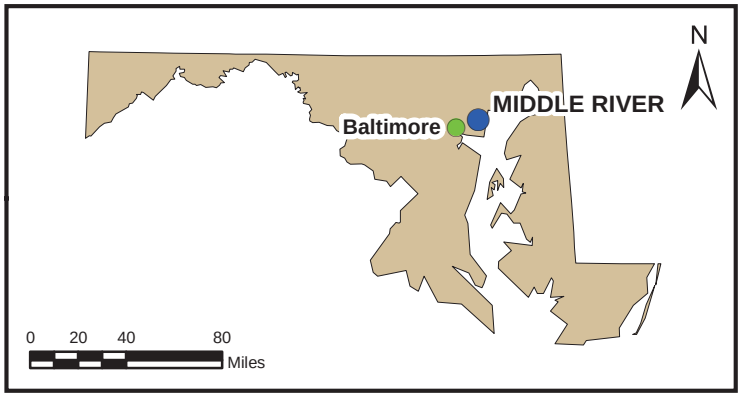

FIGURE 1

MIDDLE RIVER COMPLEX LOCATION MAP

Lockheed Martin Corporation
Middle River Complex, Middle River, Maryland

DATE MODIFIED:	CREATED BY:	SOURCE:
10/29/15	JEE	Tetra Tech 2016-2017 GW & SW Monitoring WP

AECOM

Map Document: (P:\GIS\Middle_River\MapDocs\MXD\mrc_sitemap_may2015.mxd)
10/29/15 -- JEE

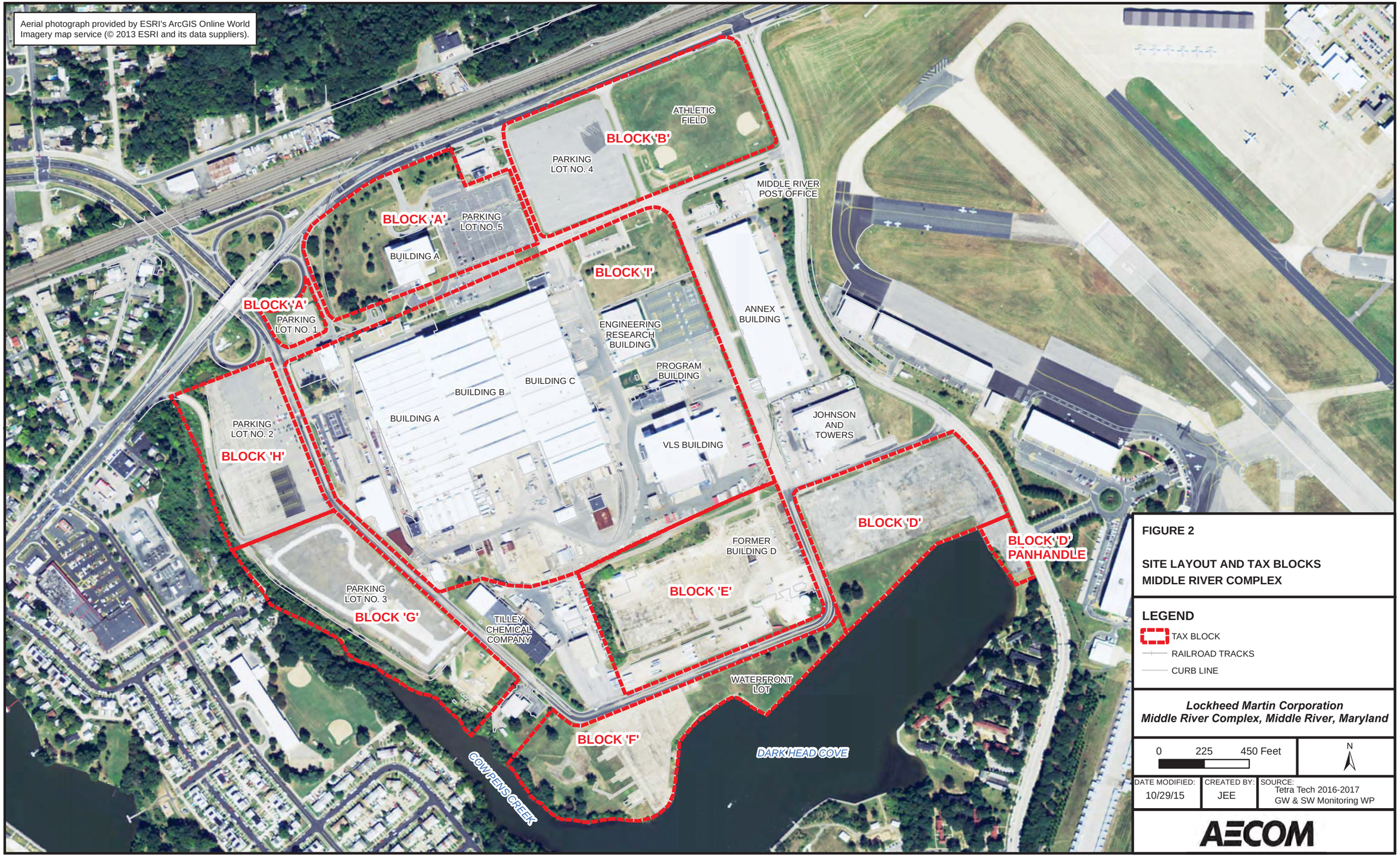

FIGURE 2

SITE LAYOUT AND TAX BLOCKS
MIDDLE RIVER COMPLEX

LEGEND

- TAX BLOCK
- RAILROAD TRACKS
- CURB LINE

Lockheed Martin Corporation
Middle River Complex, Middle River, Maryland

0 225 450 Feet

N

DATE MODIFIED:	CREATED BY:	SOURCE:
10/29/15	JEE	Tetra Tech 2016-2017 GW & SW Monitoring WP

AECOM

Map Document: (P:\GIS\Middle_River\MapDocs\MXD\mrc_tax_blocks_jul2014_aerial.mxd)
10/29/15 -- JEE

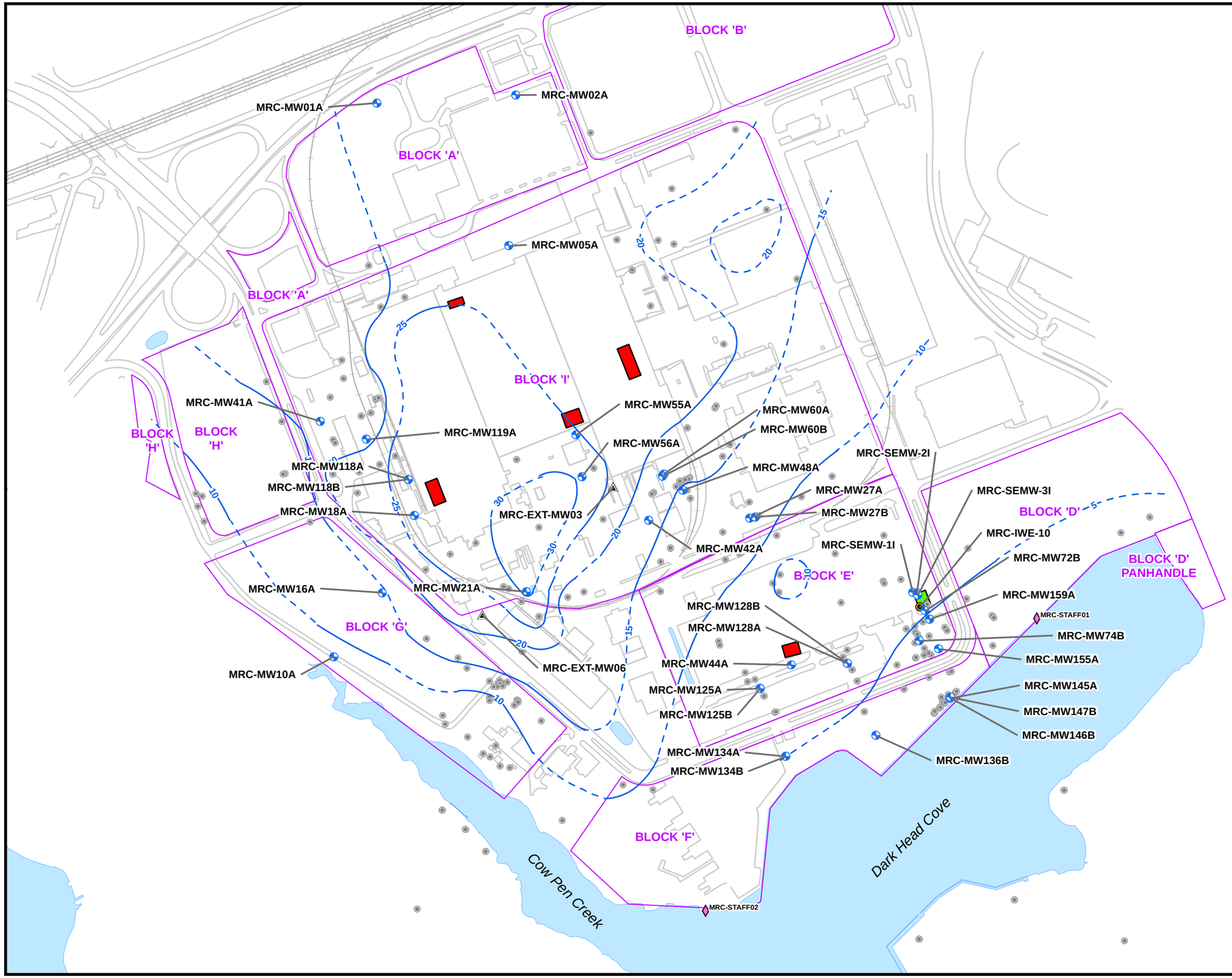

Figure 3
PFAS Groundwater Sampling Locations
2019 PFAS Groundwater Sampling

Legend

- Monitoring Well, sampled
- Extraction Well, sampled
- Injection Well, sampled
- Well Network, not sampled
- Staff Gauge
- Tax Blocks
- Former Plating Locations
- Former Fire Training Area
- Shallow Well Groundwater Elevation contour, feet above Mean Seal Level (Dashed Where Inferred) April 2018

PFAS = Per- and Polyfluoroalkyl Substances

Lockheed Martin Middle River Complex
Middle River, Maryland

0 200 400 Feet

DATE MODIFIED:	GIS BY:	CHECKED BY:
03/06/20	HEO	HAB

AECOM

Map Document: (Q:\Projects\ENV\GEARS\GEO\Lockheed Martin\Middle River\Middle River FY18-20 GW_SW_Mon\900-CAD-GIS\920-GIS\MXDs\PFAS\MRC_PFAS_July2019_GC.mxd)
Credits: Basemap, Tetra Tech, 2017

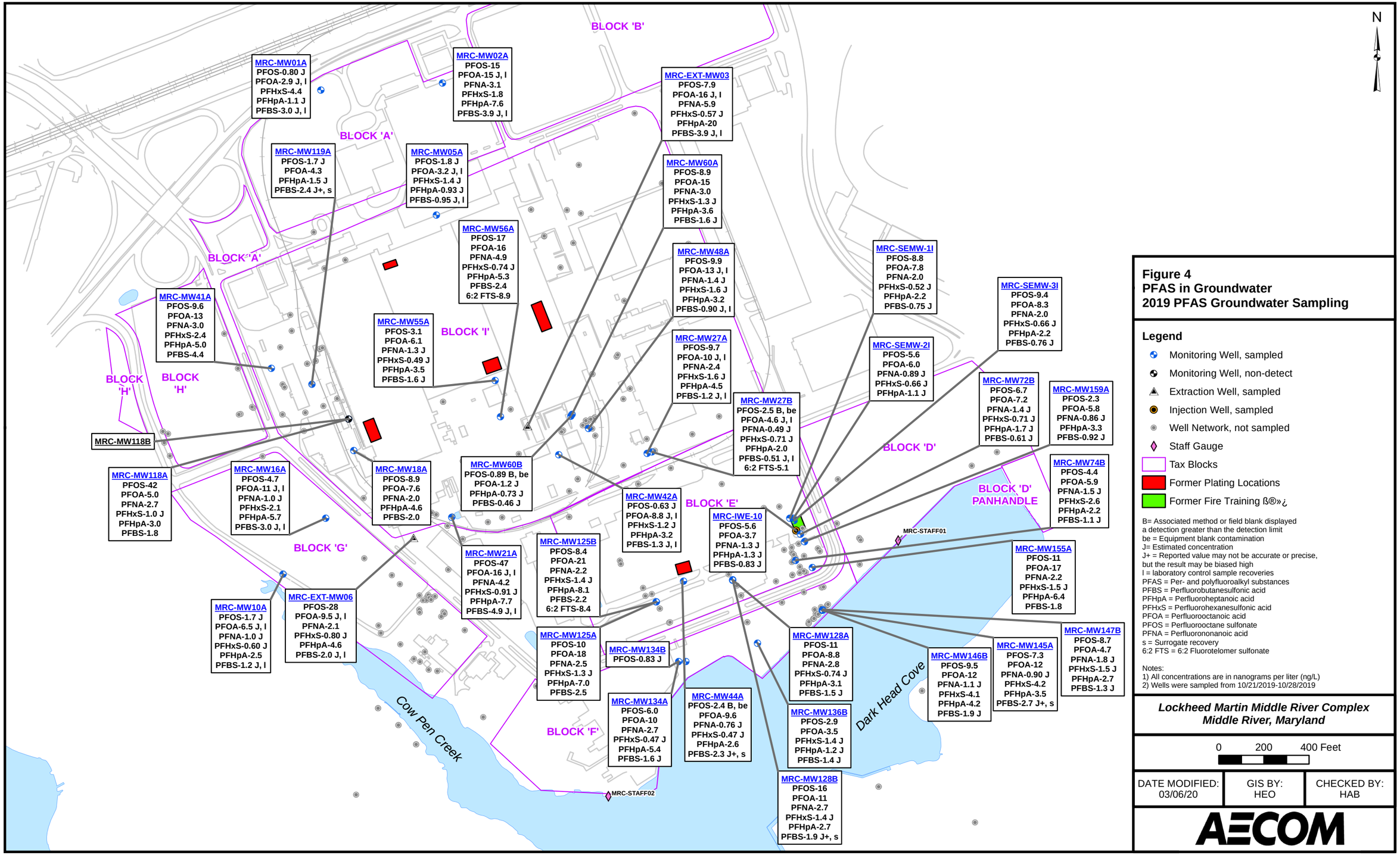

Figure 4
PFAS in Groundwater
2019 PFAS Groundwater Sampling

Legend

- Monitoring Well, sampled
- Monitoring Well, non-detect
- Extraction Well, sampled
- Injection Well, sampled
- Well Network, not sampled
- Staff Gauge
- Tax Blocks
- Former Plating Locations
- Former Fire Training ß®»¿

B= Associated method or field blank displayed
a detection greater than the detection limit
be = Equipment blank contamination
J= Estimated concentration
J+ = Reported value may not be accurate or precise,
but the result may be biased high
l = laboratory control sample recoveries
PFAS = Per- and polyfluoroalkyl substances
PFBS = Perfluorobutanesulfonic acid
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonic acid
PFOA = Perfluorooctanoic acid
PFOS = Perfluorooctane sulfonate
PFNA = Perfluorononanoic acid
s = Surrogate recovery
6:2 FTS = 6:2 Fluorotelomer sulfonate

Notes:
1) All concentrations are in nanograms per liter (ng/L)
2) Wells were sampled from 10/21/2019-10/28/2019

Lockheed Martin Middle River Complex
Middle River, Maryland

0 200 400 Feet

DATE MODIFIED:	GIS BY:	CHECKED BY:
03/06/20	HEO	HAB

AECOM

Map Document: (Q:\Projects\ENV\GEARS\GEO\Lockheed Martin\Middle River\Middle River FY18-20 GW_SW_Mon\900-CAD-GIS\920-GIS\MXDs\PFAS\Summary Map of all Detections.mxd)
Credits: Basemap, Tetra Tech, 2017

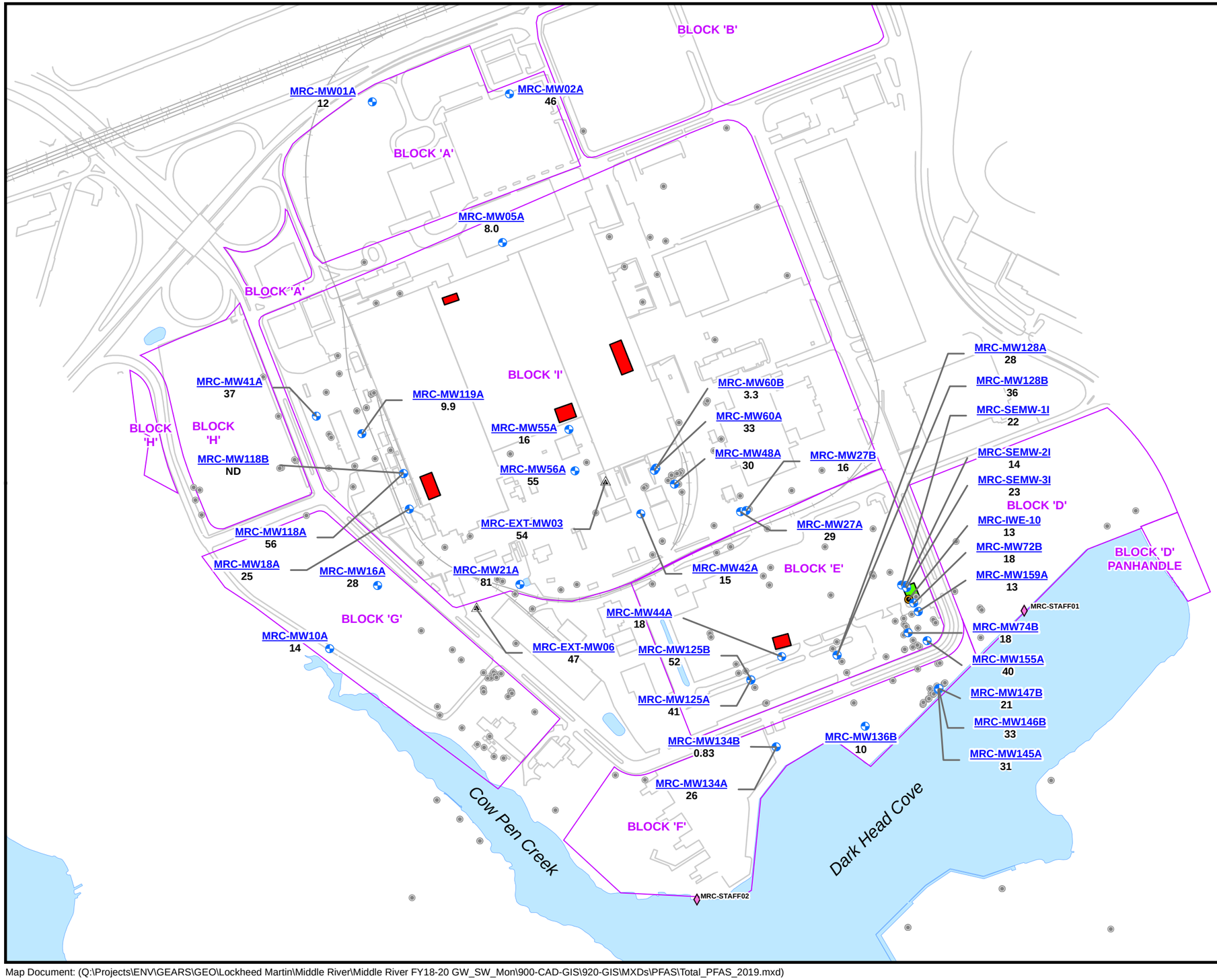

Figure 5
Total PFAS Concentrations in Groundwater
2019 PFAS Groundwater Sampling

Legend

- Monitoring Well, sampled
- Extraction Well, sampled
- Injection Well, sampled
- Well Network, not sampled
- Staff Gauge
- Tax Blocks
- Former Plating Locations
- Former Fire Training Area

ND = Not Detected
PFAS = Per- and Polyfluoroalkyl Substances
PFBS = Perfluorobutanesulfonic acid
PFHpA = Perfluoroheptanoic acid
PFHxS = Perfluorohexanesulfonic acid
PFOA = Perfluorooctanoic acid
PFOS = Perfluorooctane sulfonate
PFNA = Perfluorononanoic acid
Total PFAS = PFBS + PFHpA + PFHxS + PFOA + PFOS + PFNA + 6:2 FTS
6:2 FTS = 6:2 Fluorotelomer sulfonate

Notes:
1) All concentrations are shown in nanograms per liter (ng/L)
2) Wells were sampled from 10/21/2019-10/28/2019

Lockheed Martin Middle River Complex
Middle River, Maryland

0 200 400 Feet

DATE MODIFIED:	GIS BY:	CHECKED BY:
03/06/20	HEO	HAB

AECOM

Map Document: (Q:\Projects\ENV\GEARS\GEO\Lockheed Martin\Middle River\Middle River FY18-20 GW_SW_Mon\900-CAD-GIS\920-GIS\MXDs\PFAS\Total_PFAS_2019.mxd)
Credits: Basemap, Tetra Tech, 2017

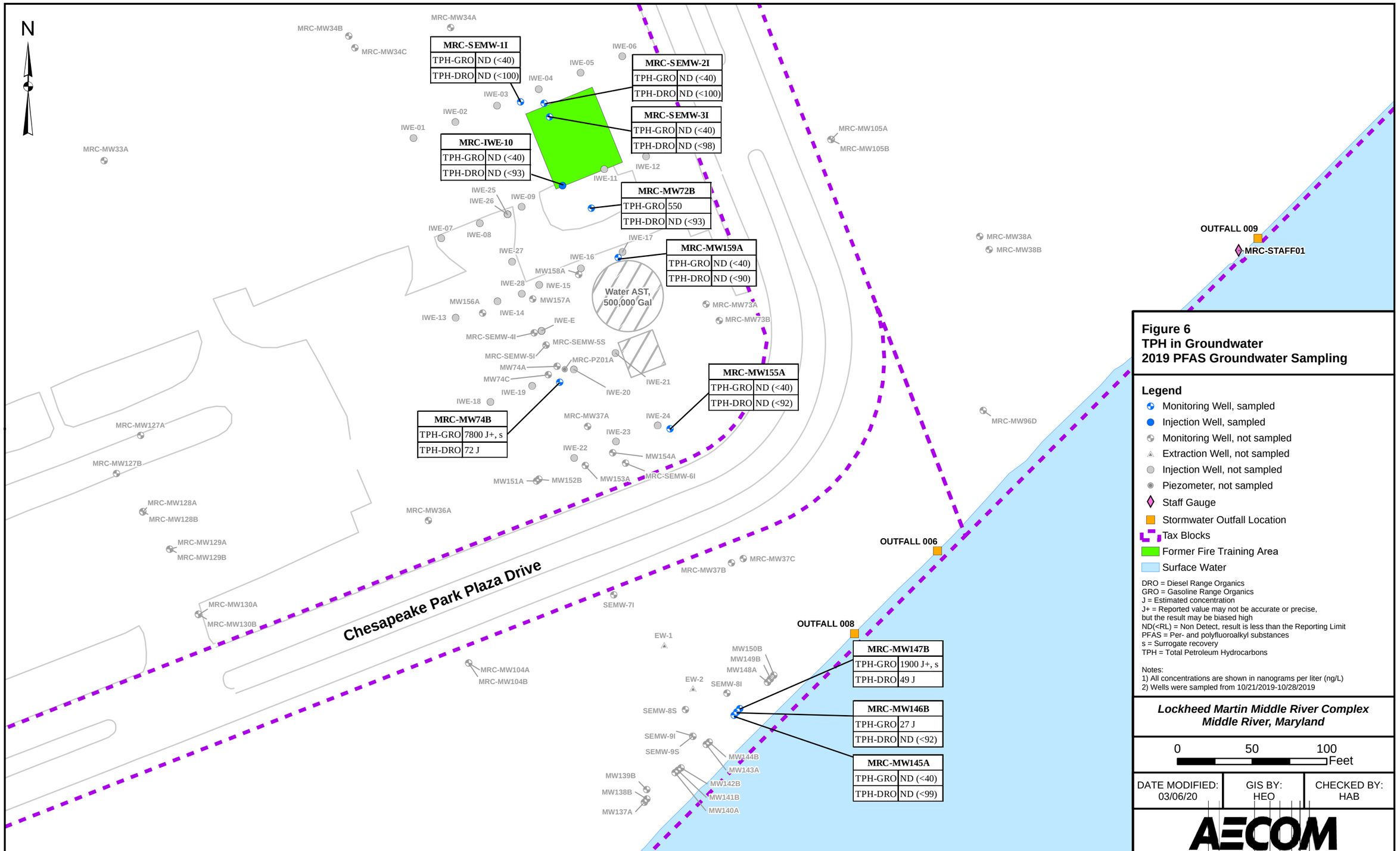

Figure 6
TPH in Groundwater
2019 PFAS Groundwater Sampling

Legend

- Monitoring Well, sampled
- Injection Well, sampled
- Monitoring Well, not sampled
- Extraction Well, not sampled
- Injection Well, not sampled
- Piezometer, not sampled
- Staff Gauge
- Stormwater Outfall Location
- Tax Blocks
- Former Fire Training Area
- Surface Water

DRO = Diesel Range Organics
GRO = Gasoline Range Organics
J = Estimated concentration
J+ = Reported value may not be accurate or precise, but the result may be biased high
ND(<RL) = Non Detect, result is less than the Reporting Limit
PFAS = Per- and polyfluoroalkyl substances
s = Surrogate recovery
TPH = Total Petroleum Hydrocarbons

Notes:
1) All concentrations are shown in nanograms per liter (ng/L)
2) Wells were sampled from 10/21/2019-10/28/2019

Lockheed Martin Middle River Complex
Middle River, Maryland

0 50 100 Feet

DATE MODIFIED:	GIS BY:	CHECKED BY:
03/06/20	HEO	HAB

AECOM

Map Document: (Q:\Projects\ENV\GEARS\GEO\Lockheed Martin\Middle River\Middle River FY18-20 GW_SW_Mon\900-CAD-GIS\920-GIS\Map Packages\v104\TPH.mxd)
CREDITS: Basemap, Tetra Tech, 2017

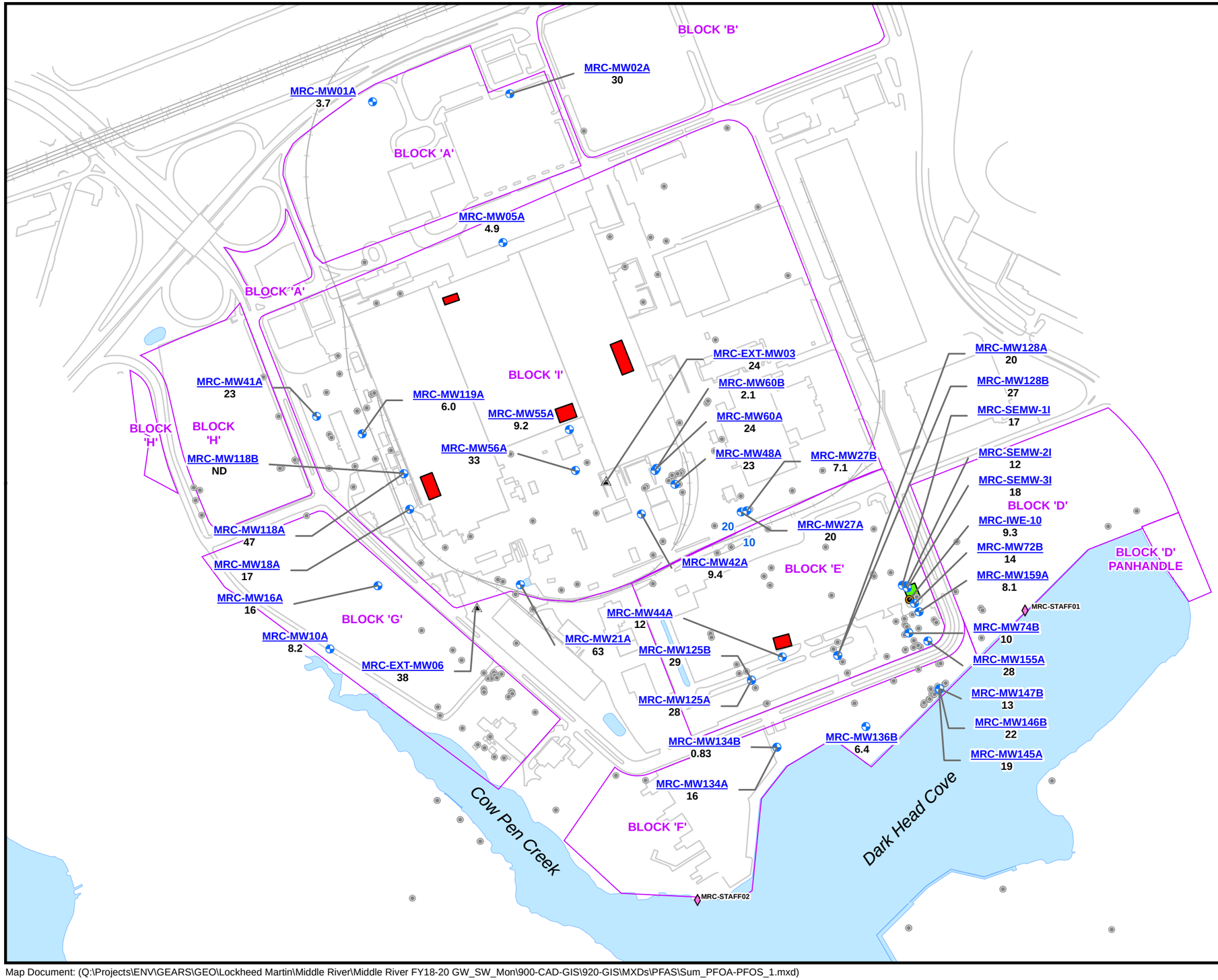

Figure 7
Total PFOA + PFOS in Groundwater
2019 PFAS Groundwater Sampling

Legend

- Monitoring Well, sampled
- Extraction Well, sampled
- Injection Well, sampled
- Well Network, not sampled
- Staff Gauge
- Tax Blocks
- Former Plating Locations
- Former Fire Training Area

ND = Not Detected
PFAS = Per- and polyfluoroalkyl substances
PFOA = Perfluorooctanoic Acid
PFOS = Perfluorooctane Sulfonate

Notes:
1) All concentrations are shown in nanograms per liter (ng/L)
2) Wells were sampled from 10/21/2019-10/28/2019

Lockheed Martin Middle River Complex
Middle River, Maryland

0 200 400 Feet

DATE MODIFIED:	GIS BY:	CHECKED BY:
03/06/20	HEO	HAB

AECOM

Map Document: (Q:\Projects\ENV\GEARS\GEO\Lockheed Martin\Middle River\Middle River FY18-20 GW_SW_Mon\900-CAD-GIS\920-GIS\MXDs\PFAS\Sum_PFOA-PFOS_1.mxd)
Credits: Basemap, Tetra Tech, 2017

TABLES

Table 1
Per- and Polyfluoroalkyl Substances Sampling Locations
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

Well Identification	Sampling Rationale
Building A & Building B Northwest Plating Area	
MRC-MW01A	Upgradient of Buildings A & B
MRC-MW05A	Nearby upgradient of Buildings B & C
MRC-MW10A	Downgradient of WWTP and southern Building A flow path; adjacent to CPC
MRC-MW16A	Downgradient of southern Building A flow path towards CPC
MRC-MW18A	Downgradient of southern Building A former plating area
MRC-MW41A	Downgradient of northern Building B flow path towards CPC
MRC-MW118A	Side-gradient of southern Building A former plating area
MRC-MW118B	Deep side-gradient of southern Building A former plating area
MRC-MW119A	Downgradient of northern Building B flow path towards CPC
Building B Southeast Plating Area	
MRC-EXT-MW03	Downgradient of southern Building B former plating area
MRC-EXT-MW06	Side-gradient of southern Building B flow path towards CPC
MRC-MW21A	Side-gradient of southern Building B flow path towards CPC
MRC-MW42A	Side-gradient of Building C former plating area
MRC-MW55A	Directly downgradient of southern Building B former plating area
MRC-MW56A	Downgradient of southern Building B flow path towards CPC
Building C Plating Area	
MRC-MW02A	Upgradient of Building C
MRC-MW27A	Downgradient of Building C flow path towards DHC
MRC-MW27B	Downgradient of Building C flow path towards DHC
MRC-MW48A	Downgradient of Building C former plating area
MRC-MW 60A	Directly downgradient of Building C former plating area
MRC-MW 60B	Directly downgradient of Building C former plating area
Building D Plating Area	
MRC-MW44A	Directly downgradient of Building D former plating area
MRC-MW125A	Side-gradient (West) of Building D flow path towards DHC
MRC-MW125B	Side-gradient (West) of Building D flow path towards DHC
MRC-MW134A	Side-gradient (West) of Building D flow path, in vicinity of DHC
MRC-MW134B	Side-gradient (West) of Building D flow path, in vicinity of DHC
MRC-MW128A	Side-gradient (East) of Building D flow path towards DHC
MRC-MW128B	Side-gradient (East) of Building D flow path towards DHC
MRC-MW136B	Side-gradient (East) of Building D flow path, in vicinity of DHC
Block E Former Fire Training Area (FFTA)	
MRC-IWE-10	Directly downgradient of the potential source
MRC-MW72B	Directly downgradient of the potential source
MRC-MW159A	Directly downgradient of the potential source
MRC-MW155A	Shallow mid-way between potential source and DHC
MRC-MW74B	Deep mid-way within the trichloroethene plume
MRC-MW145A	In the vicinity of groundwater discharge point to DHC
MRC-MW146B	In the vicinity of groundwater discharge point to DHC
MRC-MW147B	In the vicinity of groundwater discharge point to DHC
MRC-SEMW-1I	Upgradient of the potential source area
MRC-SEMW-2I	Within potential source area
MRC-SEMW-3I	Within potential source area

CPC = Cow Pen Creek
DHC = Dark Head Cove
FFTA = Former Fire Training Area

Table 2
Monitoring Well Purge Completion Criteria
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

Parameter	Completion Parameter
pH	±0.1 standard units
Temperature	± 3 percent (°C)
Specific Conductivity	± 3 percent (mS/cm)
Dissolved Oxygen (DO)	± 10 percent (mg/L)
Oxidation-Reduction Potential (ORP)	± 10 percent (mV)
Turbidity	± 10 percent (NTU)
Time	90 minutes of continuous purging
Volume	Three saturated well casing volumes, OR Well purged dry; allowed to recover 80% of initial static water level

Notes:
°C - degrees Celsius
DO - Dissolved oxygen
mg/L - milligrams per liter
mS/cm - milliSiemens per centimeter
mV - millivolts
NTU - nephelometric turbidity unit
ORP - oxidation-reduction potential

Table 3 – October 2019 PFAS Groundwater Sampling Event Detections - All Analyses
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID			MRC-MW01A	MRC-MW02A	MRC-MW05A	MRC-MW05A	MRC-MW10A	MRC-MW16A	MRC-MW18A
	Screen Interval (feet bgs)			18-28	17-27	24-34	24-34	3-13	3-13	16-26
	Sample Type			N	N	N	FD	N	N	N
	Collection Date			10/21/2019	10/21/2019	10/21/2019	10/21/2019	10/21/2019	10/21/2019	10/23/2019
	Block ID			A	A	I	I	G	G	I
Analyte	CAS Number	SL[a]	Units	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result
Per- and Polyfluoroalkyl Substances (PFAS) - E537M										
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	0.8 J	15	1.2 J	1.8 J	1.7 J	4.7	8.9
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	2.9 J, l	15 J, l	3.2 J, l	3.1 J, l	6.5 J, l	11 J, l	7.6
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	-	3.1	-	-	1 J	1 J	2
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	1.1 J	7.6	0.93 J	0.91 J	2.5	5.7	4.6
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	4.4	1.8	1.4 J	1.3 J	0.6 J	2.1	-
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	3 J, l	3.9 J, l	0.95 J, l	0.93 J, l	1.2 J, l	3 J, l	2
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	-	-	-	-	-	-	-
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	-	-	-	-	-	-	-
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	4	26	4.1	4	10	18	14
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	8.2	21	3.6	4	3.5	9.8	11
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	3.7	30	4.4	4.9	8.2	16	17
Total PFAS	Total PFAS	NE	ng/L	12	46	7.7	8	14	28	25
Total Petroleum Hydrocarbons (TPH) - SW8015D										
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	-	-	-	-	-	-	-

Notes:
- = Not Sampled or Not Detected
bgs = below ground surface
CAS = Chemical Abstract Services
HAL = Health Advisory Level
NE = Not Established
SL = Screening Level
ng/L = Nanograms per liter
µg/L = Micrograms per liter

[a] = **For PFOA and PFOS**: USEPA Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS; December 2019
* = **For TPH**: TPH Method SW846 8015D was used to evaluate and potentially confirm the location of the Former Fire Training Area as a potential source area

Result Detected result exceeds EPA HAL of 70 ppt or EPA SL of 40 ppt for PFOA and PFOS, individually or combined

Interpreted Qualifier Definitions:
B = The analyte was analyzed for, but not detected at a level greater than or equal to the level of the adjusted Detection Limit for sample and method
J = Indicates an estimated value (+/- denotes an over/underestimate)
be = Equipment blank detection
l = Laboratory control sample recoveries
s = Surrogate recovery

Table 3 – October 2019 PFAS Groundwater Sampling Event Detections - All Analyses
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

				Location ID	MRC-MW21A	MRC-MW21A	MRC-MW27A	MRC-MW27B	MRC-MW27B	MRC-MW41A	MRC-MW42A
				Screen Interval (feet bgs)	6-16	6-16	8.5-18.5	30-40	30-40	6-16	9-19
				Sample Type	N	FD	N	N	FD	N	N
				Collection Date	10/21/2019	10/21/2019	10/21/2019	10/21/2019	10/21/2019	10/24/2019	10/21/2019
				Block ID	I	I	I	I	I	I	I
Analyte	CAS Number	SL[a]	Units		Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result
Per- and Polyfluoroalkyl Substances (PFAS) - E537M											
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L		**46**	**47**	9.7	2.5 B, be	2.4 B, be	9.6	0.63 J
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L		16 J, l	16 J, l	10 J, l	4.6 J, l	4.4 J, l	13	8.8 J, l
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L		4.1	4.2	2.4	0.44 J	0.49 J	3	-
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L		7.2	7.7	4.5	2	2	5	3.2
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L		0.91 J	0.87 J	1.6 J	0.64 J	0.71 J	2.4	1.2 J
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L		4.9 J, l	4.8 J, l	1.2 J, l	0.51 J, l	-	4.4	1.3 J, l
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L		-	-	-	5.1	5.1	-	-
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L		-	-	-	-	-	-	-
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L		27	28	17	7	6.9	21	12
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L		52	53	13	3.7	3.1	16	3.1
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L		62	63	20	7.1	6.8	23	9.4
Total PFAS	Total PFAS	NE	ng/L		79	81	29	16	15	37	15
Total Petroleum Hydrocarbons (TPH) - SW8015D											
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-		-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-		-	-	-	-	-	-	-

Notes:
- = Not Sampled or Not Detected
bgs = below ground surface
CAS = Chemical Abstract Services
HAL = Health Advisory Level
NE = Not Established
SL = Screening Level
ng/L = Nanograms per liter
µg/L = Micrograms per liter

[a] = **For PFOA and PFOS**: USEPA Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS; December 2019
* = **For TPH**: TPH Method SW846 8015D was used to evaluate and potentially confirm the location of the Former Fire Training Area as a potential source area

Result Detected result exceeds EPA HAL of 70 ppt or EPA SL of 40 ppt for PFOA and PFOS, individually or combined

Interpreted Qualifier Definitions:
B = The analyte was analyzed for, but not detected at a level greater than or equal to th level of the adjusted Detection Limit for sample and method
J = Indicates an estimated value (+/- denotes an over/underestimate)
be = Equipment blank detection
l = Laboratory control sample recoveries
s = Surrogate recovery

Table 3 – October 2019 PFAS Groundwater Sampling Event Detections - All Analyses
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID			MRC-MW44A	MRC-MW48A	MRC-MW55A	MRC-MW56A	MRC-MW60A	MRC-MW60B	MRC-MW72B
	Screen Interval (feet bgs)			3-13	11-21	12-22	2.5-12.5	12-22	22-32	25-35
	Sample Type			N	N	N	N	N	N	N
	Collection Date			10/24/2019	10/21/2019	10/23/2019	10/23/2019	10/23/2019	10/23/2019	10/24/2019
	Block ID			E	I	I	I	I	I	E
Analyte	CAS Number	SL[a]	Units	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result
Per- and Polyfluoroalkyl Substances (PFAS) - E537M										
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	2.4 B, be	9.9	3.1	17	8.9	0.89 B, be	6.7
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	9.6	13 J, l	6.1	16	15	1.2 J	7.2
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	0.76 J	1.4 J	1.3 J	4.9	3	-	1.4 J
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	2.6	3.2	3.5	5.3	3.6	0.73 J	1.7 J
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	0.47 J	1.6 J	0.49 J	0.74 J	1.3 J	-	0.71 J
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	2.3 J+, s	0.9 J, l	1.6 J	2.4	1.6 J	0.46 J	0.61 J
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	-	-	-	8.9	-	-	-
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	-	-	-	-	-	-	-
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	13	18	11	26	22	1.9	10
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	5.2	12	5.2	20	12	1.4	8
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	12	23	9.2	33	24	2.1	14
Total PFAS	Total PFAS	NE	ng/L	18	30	16	55	33	3.3	18
Total Petroleum Hydrocarbons (TPH) - SW8015D										
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	-	-	-	-	-	-	550

Notes:
- = Not Sampled or Not Detected
bgs = below ground surface
CAS = Chemical Abstract Services
HAL = Health Advisory Level
NE = Not Established
SL = Screening Level
ng/L = Nanograms per liter
µg/L = Micrograms per liter

[a] = **For PFOA and PFOS**: USEPA Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS; December 2019
* = **For TPH**: TPH Method SW846 8015D was used to evaluate and potentially confirm the location of the Former Fire Training Area as a potential source area

Result Detected result exceeds EPA HAL of 70 ppt or EPA SL of 40 ppt for PFOA and PFOS, individually or combined

Interpreted Qualifier Definitions:
B = The analyte was analyzed for, but not detected at a level greater than or equal to th level of the adjusted Detection Limit for sample and method
J = Indicates an estimated value (+/- denotes an over/underestimate)
be = Equipment blank detection
l = Laboratory control sample recoveries
s = Surrogate recovery

Table 3 – October 2019 PFAS Groundwater Sampling Event Detections - All Analyses
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID			MRC-MW74B	MRC-MW118A	MRC-MW118B	MRC-MW119A	MRC-MW125A	MRC-MW125B	MRC-MW128A
	Screen Interval (feet bgs)			22-32	8-13	45-55	8-13	5-15	25-35	9-19
	Sample Type			N	N	N	N	N	N	N
	Collection Date			10/25/2019	10/23/2019	10/23/2019	10/24/2019	10/23/2019	10/23/2019	10/23/2019
	Block ID			E	I	I	I	E	E	E
Analyte	CAS Number	SL[a]	Units	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result
Per- and Polyfluoroalkyl Substances (PFAS) - E537M										
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	4.4	**42**	-	1.7 J	10	8.4	11
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	5.9	5	-	4.3	18	21	8.8
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	1.5 J	2.7	-	-	2.5	2.2	2.8
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	2.2	3	-	1.5 J	7	8.1	3.1
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	2.6	1 J	-	-	1.3 J	1.4 J	0.74 J
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	1.1 J	1.8	-	2.4 J+, s	2.5	2.2	1.5 J
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	-	-	-	-	-	8.4	-
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	-	-	-	-	-	-	-
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	9.6	11	-	5.8	28	31	15
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	8.1	45	-	4.1	14	12	13
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	10	47	-	6	28	29	20
Total PFAS	Total PFAS	NE	ng/L	18	56	-	9.9	41	52	28
Total Petroleum Hydrocarbons (TPH) - SW8015D										
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	72 J	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	7800 J+, s	-	-	-	-	-	-

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[a] = **For PFOA and PFOS**: USEPA Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS; December 2019
* = **For TPH**: TPH Method SW846 8015D was used to evaluate and potentially confirm the location of the Former Fire Training Area as a potential source area

Result Detected result exceeds EPA HAL of 70 ppt or EPA SL of 40 ppt for PFOA and PFOS, individually or combined

Interpreted Qualifier Definitions:
B = The analyte was analyzed for, but not detected at a level greater than or equal to th level of the adjusted Detection Limit for sample and method
J = Indicates an estimated value (+/- denotes an over/underestimate)
be = Equipment blank detection
l = Laboratory control sample recoveries
s = Surrogate recovery

Table 3 – October 2019 PFAS Groundwater Sampling Event Detections - All Analyses
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID			MRC-MW128B	MRC-MW134A	MRC-MW134B	MRC-MW136B	MRC-MW145A	MRC-MW146B	MRC-MW146B
	Screen Interval (feet bgs)			24.5-29.5	7.5-12.5	32.5-37.5	14-19	5-10	12-17	12-17
	Sample Type			N	N	N	N	N	N	FD
	Collection Date			10/23/2019	10/24/2019	10/23/2019	10/24/2019	10/28/2019	10/25/2019	10/25/2019
	Block ID			E	F	F	F	F	F	F
Analyte	CAS Number	SL[a]	Units	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result
Per- and Polyfluoroalkyl Substances (PFAS) - E537M										
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	16	6	0.83 J	2.9	7.3	8.4	9.5
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	11	10	-	3.5	12	11	12
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	2.7	2.7	-	-	0.9 J	1.1 J	1.1 J
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	2.7	5.4	-	1.2 J	3.5	3.8	4.2
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	1.4 J	0.47 J	-	1.4 J	4.2	3.7	4.1
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	1.9 J+, s	1.6 J	-	1.4 J	2.7 J+, s	1.8 J	1.9 J
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	-	-	-	-	-	-	-
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	-	-	-	-	-	-	-
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	16	18	-	4.7	16	16	17
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	19	8.1	0.83	5.7	14	14	16
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	27	16	0.83	6.4	19	19	22
Total PFAS	Total PFAS	NE	ng/L	36	26	0.83	10	31	30	33
Total Petroleum Hydrocarbons (TPH) - SW8015D										
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	-	-	-	-	-	27 J	-

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µg/L = Micrograms per liter

[a] = **For PFOA and PFOS**: USEPA Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS; December 2019
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Result Detected result exceeds EPA HAL of 70 ppt or EPA SL of 40 ppt for PFOA and PFOS, individually or combined

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Table 3 – October 2019 PFAS Groundwater Sampling Event Detections - All Analyses
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

				Location ID	MRC-MW147B	MRC-MW155A	MRC-MW159A	MRC-EXT-MW03	MRC-EXT-MW06	MRC-IWE-10	MRC-IWE-10
				Screen Interval (feet bgs)	21-35	4-9	5-10	N/A	N/A	15-30	15-30
				Sample Type	N	N	N	N	N	N	FD
				Collection Date	10/25/2019	10/24/2019	10/24/2019	10/21/2019	10/21/2019	10/25/2019	10/25/2019
				Block ID	F	E	E	I	G	E	E
Analyte	CAS Number	SL[a]	Units		Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result	Detected Result
Per- and Polyfluoroalkyl Substances (PFAS) - E537M											
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L		8.7	11	2.3	7.9	28	5.1	5.6
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L		4.7	17	5.8	16 J, l	9.5 J, l	3.3	3.7
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L		1.8 J	2.2	0.86 J	5.9	2.1	1.1 J	1.3 J
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L		2.7	6.4	3.3	20	4.6	1.1 J	1.3 J
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L		1.5 J	1.5 J	-	0.57 J	0.8 J	-	-
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L		1.3 J	1.8	0.92 J	3.9 J, l	2 J, l	0.75 J	0.83 J
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L		-	-	-	-	-	-	-
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L		-	-	-	-	-	-	-
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L		9.2	26	10	42	16	5.5	6.3
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L		12	14	3.2	12	31	5.9	6.4
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L		13	28	8.1	24	38	8.4	9.3
Total PFAS	Total PFAS	NE	ng/L		21	40	13	54	47	11	13
Total Petroleum Hydrocarbons (TPH) - SW8015D											
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-		49 J	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-		1900 J+, s	-	-	-	-	-	-

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Table 3 – October 2019 PFAS Groundwater Sampling Event Detections - All Analyses
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID			MRC-SEMW-1I	MRC-SEMW-2I	MRC-SEMW-3I
	Screen Interval (feet bgs)			20-30	20-30	20-30
	Sample Type			N	N	N
	Collection Date			10/24/2019	10/24/2019	10/24/2019
	Block ID			E	E	E
Analyte	CAS Number	SL[a]	Units	Detected Result	Detected Result	Detected Result
Per- and Polyfluoroalkyl Substances (PFAS) - E537M						
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	8.8	5.6	9.4
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	7.8	6	8.3
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	2	0.89 J	2
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	2.2	1.1 J	2.2
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	0.52 J	0.66 J	0.66 J
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	0.75 J	-	0.76 J
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	-	-	-
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	-	-	-
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	12	8	13
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	10	6.3	11
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	17	12	18
Total PFAS	Total PFAS	NE	ng/L	22	14	23
Total Petroleum Hydrocarbons (TPH) - SW8015D						
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	-	-	-

Notes:
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[a] = **For PFOA and PFOS**: USEPA Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS; December 2019
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Result Detected result exceeds EPA HAL of 70 ppt or EPA SL of 40 ppt for PFOA and PFOS, individually or combined

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APPENDICES

Appendix A—AECOM PFAS Sampling Guidance Documents

Appendix B—Low-flow Groundwater Sampling Purge Logs

Appendix C—Investigative Derived Waste Documentation

Appendix D—Data Validation and Usability Report

Appendix E—Laboratory Analytical Reports

Appendix F—October 2019 Groundwater Analytical Results

APPENDIX A
AECOM PFAS Sampling Guidance Documents

DRAFT

Per- and Polyfluoroalkyl Substances (PFAS) Sampling Guidance

April 2018

Trademarks

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Tables

1. Introduction

Per- and Polyfluoroalkyl Substances (PFAS) is a class of emerging contaminants composed of more than 3,000 man-made, fluorinated, organic chemicals (Buck et al., 2011, Wang et al., 2017). The actual number of chemicals is constantly changing, as some PFAS are no longer produced due to regulatory and voluntary actions, while new ones are created to be used as alternatives. The carbon-fluorine bond that exists in PFAS is one of the strongest bonds in nature. It is extremely hard to break and is resistant to thermal, chemical, and biological degradation. There are many PFAS composed of entire families that contain an additional carbon chain atom that is not totally fluorinated (i.e., carbon-hydrogen) that can be more easily broken. As a result, some PFAS may partially degrade in the environment into highly stable end products, such as perfluoroalkyl acids (PFAAs). Two of the best known PFAA families are perfluoroalkyl carboxylic acids (PFCAs) and perfluoroalkyl sulfonic acids (PFSAs). Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) are the most studied and frequently detected PFAS, and they belong to the PFCAs and PFSAs families, respectively.

Note: Emerging Contaminants are chemicals and materials that have pathways to enter the environment and present real or potential unacceptable human health or environmental risks…

And either

Do not have peer reviewed human health standards

Or

Standards/regulations are evolving due to new science, detection capabilities or pathways.

Due to their unique chemical properties, various PFAS can lower surface tension (act as surfactants), are oil-repelling (oleophobic), and are water-repelling (hydrophobic), yet are also relatively water soluble. They have been used extensively in many industries worldwide for a wide variety of applications. PFAS were first invented in the late 1930's and commercially used from the 1940's as non-stick coatings. PFAS continued to be used in many industries and various products as more PFAS were developed with unique chemical properties. Some of the documented PFAS uses are in hydraulic fluids, biocides, construction products, fire-fighting foams, household products, wetting and mist suppressing agents, surfactants for oil and natural gas recovery enhancement, polymerization agents, low-friction bearings and seals, insulators, cables, wires, protective coatings for a wide variety of materials, nonstick coatings, surgical patches, cardiovascular grafts, implants, oil and water repellent coatings for a wide range of materials such as paper and cardboard packaging products, carpets, leather products, and textiles (OECD, 2013). As a result, even the presence of PFAS impurities in these materials are a potential source of environmental concerns and cross contamination. The probability of false positives as the low PFAS concentration is relatively high during PFAS monitoring due to the potential for many sources of cross contamination combined with low laboratory detection limits.

Many of the articles of commerce, out of hundreds that have been documented to use PFAS, may be found in the sampling environment and might even come into contact with the actual environmental samples. Typical commercial laboratory detection limits for PFAS are in the low nanograms per liter (ng/L) or parts per trillion (ppt). The United States Environmental Protection Agency (USEPA) has established a Lifetime Health Advisory (HA) for PFOA and PFOS, separately or combined, of 70 ppt. The Michigan Department of Environmental Quality (MDEQ) is currently proposing criteria for drinking water that equals the HA for PFOA and PFOS of 70 ppt. The MDEQ has also promulgated a standard under Rule 57 for PFOS as low as 11 ppt for surface water that is used as a drinking water source and 12 ppt for surface water that is not used as a drinking water source.

2. Purpose and Objectives

The purpose of this document is to provide guidance and information to all qualified MDEQ personnel that will:

- Collect or handle PFAS environmental samples; and
- Perform subsurface activities such as soil boring and/or well installation or abandonment at PFAS sites.

This document is intended to supplement current MDEQ Standard Operations Procedures (SOPs) and be a resource for the additional considerations that are required when sampling for PFAS. Therefore, the use of this document is intended to be in conjunction with the MDEQ's required SOPs for sampling of environmental medial or performing subsurface activities.

Note: This guidance does not include basic **SOP** information for sampling environmental media and should not be used to replace sampling SOPs required for use by the MDEQ.

The objectives of this document are as follows:

- Provide guidance on avoiding PFAS cross contamination during sampling of various environmental media;
- Improve sampling consistency and data quality; and
- Provide recommendations to MDEQ staff on supervising field sample collection by MDEQ consultants.

3. Safety

Any field planning and mobilization effort should be aware of the physical, chemical, and biological hazards associated with each PFAS site. The mitigation of potential hazards should be documented in site-specific Health and Safety Plans (HASPs) including the selection of PPE. Due to the extensive spread use of PFAS in many industries, personal protective equipment (PPE) may contain PFAS. During PFAS investigation, PPE containing PFAS should be avoided. For instance, when field sampling has to occur during certain weather conditions such as rainfall, snowfall, or extreme heat, recommendations on alternative clothing are made in HASPs to use water and heat resistant PPE that may contain PFAS and can result in cross contamination during PFAS sampling. The development of the HASP and planning phase for sampling programs should take these factors into consideration prior to mobilization in the field.

In Addition to the concern of PFAS cross contamination in samples, the potential exposure of field personnel to PFAS through PPE should also be evaluated. The primary exposure pathways of PFAS for the general population were found to be ingestion of food and/or drinking water (ATSDR, 2015). Inhalation was found to be the primary exposure pathway to PFAS for occupationally exposed individuals employed in fluorochemical plants. The majority of PFAS (particularly PFCAs and PFSAs) are considered not to be volatile; however, exposure to PFAS through inhalation from impregnated materials such as clothes has been documented (ATSDR, 2015). Additional or alternative PPE may be required.

Note: As the understanding of PFAS continues to evolve and future toxicological studies made available, the current Sampling Guidance will be revised in the future.

4. Technical Approach

The following sections discuss issues such as using PFAS-free water, clothing and personal protective equipment (PPE), and laboratory issues that should be considered when sampling media for PFAS.

4.1 PFAS-Free Water

The term PFAS-free water here is defined as water that does not contain significant concentrations of any compound in a specific PFAS analyte list that is being analyzed at a project-defined level. The significant concentrations depend on project data quality objectives and could, for instance, be the laboratory reporting limit or <1/2 the limit of quantitation for the specific PFAS compound of interest (ITRC, 2017). The actual concentrations will likely change from project to project, as different commercial laboratories have various detection limits. The project PFAS analyte list is expected to vary, depending on the project objective and matrices that will be analyzed.

Note: Various laboratories have different detection limits as well as analyte lists. The detection limits continue to drop over time and the PFAS analyte list continues to expand. As a result, it is important to specify what the level of detection and PFAS analyte list were, when PFAS-free certification was determined for any water or material samples.

One important consideration for each project, primarily when the subsurface remedial investigation is performed, is to identify a PFAS-free water source for the decontamination of large equipment parts. The decontamination of sampling tools or small equipment parts can be performed using laboratory- supplied certified PFAS-free water. Site or water from a public water supply can only be used for decontamination purposes if the water has been analyzed and shown to be PFAS-free as defined for the project. Certified PFAS-free water provided by the laboratory can be used as final sampling equipment rinses and to prepare field and equipment blanks during sampling (evaluating the potential for cross contamination).

Note: The confirmation of PFAS-free water of a Site or public water supply should always be performed ahead of time prior to the commencement of work. Site or public water supplies have been identified in many instances to contain detectable PFAS concentrations.

4.2 PFAS Contamination Sources During Field Sampling

There are many potential sources of PFAS cross contamination that exist in the typical sampling environment, sampling equipment, and the environment that are not related to sampling. The actual list of PFAS-containing materials potentially encountered onsite will change based on the specific sampled media and site-specific sampling conditions. While a lot of information about PFAS is still unknown, AECOM has prepared the following sampling guidance based on its almost two decades of consulting experience on PFAS at over 350 US and international PFAS projects, including the collection of tens of thousands of environmental samples. Due to the fact that PFAS are emerging contaminates and a lot of information about their use in various materials is still not available, AECOM has developed a precautionary sampling approach in order to avoid false positive PFAS results.

The materials associated with sampling that have the potential for PFAS cross contamination have been divide into three major categories:

- **Prohibited Materials** (●) are items or materials that should not be used within the sampling environment. These items or materials have been well documented that PFAS were used in their manufacture, or there is analytical data that document the presence of PFAS in them.

- **Acceptable Materials** (■) are items or materials that have been proven not to be sources of PFAS cross contamination and are considered adequate to be used in the sampling environment.

- **Materials That Require Screening** (▲) are items or materials that have the potential for PFAS cross contamination due to a lack of scientific data. These materials are further sub-divided into two categories:

    - **Category 1:** Materials that will come in direct contact with the sample. These materials should not be used unless they are certified PFAS-free, by collecting an equipment blank sample prior to use.

    - **Category 2:** Materials that will not come in direct contact with the sample. These materials should be avoided if possible or be certified PFAS-free by collecting an equipment blank sample prior to use.

All of the materials or items discussed in the following sections will be divided into these three main categories. However, all of those materials or items, as well as considerations that are expected to be applicable to the sampling of multiple environmental media, will be discussed in the current **Technical Approach**.

4.2.1 Materials Screening

The material screening should include a review of Safety Data Sheets (SDSs; formerly Material SDS [MSDSs]) while making sure the review will use a current SDS as the actual composition of a particular item or material may have changed over time without changing the actual item or material name. The material screening should not be done on articles, materials, or manufacturers from the US only; they should also include those internationally produced as well. Text fragments such as “perfluoro” or “fluoro” may identify the use of PFAS in specific items or materials.

Countries have official national lists of industrial chemicals defined by regulations; such as TSCA in the US), EINECS, as well as substances pre-registered under REACH in the European Union or EU, KEMI in Sweden), DSL in Canada, IECSC in China, ENCS in Japan, KECI in South Korea, NZIoC in New Zealand, and the PICCS in the Philippines. However, the lists may not contain a substantial amount of information because regulations give the suppliers of newly developed chemicals the right to not identify these chemicals in order to protect the company from competitors. The information available on these lists includes the chemical names and various identity numbers, which is usually the Chemical Abstracts Service number (CAS Number) (KEMI, 2015). The information is not always sufficient to identify if the items or materials contain PFAS, as many of the PFAS do not have an assigned CAS Number at this time (KEMI, 2015).

A review of the manufacturing of a specific item or material should be performed primarily for those that are expected to come into contact with the samples and defined as Category 1. Sometimes manufacturers provide information about their products online or upon request, which might indicate if PFAS were used in the manufacture of a particular item or material.

Note: Manufactures can change the chemical composition of any product. As a result, all materials that will come into contact with the sample matrices (defined as Category 1) should be tested to confirm they are “PFAS-free”, i.e. will not contaminate samples at detectable levels. There is no guarantee that materials in the ‘Acceptable’ category will always be PFAS-free.

Materials screening should also be performed during the Health and Safety Plan (HASP) development or planning phase of sampling programs. The screening should primarily be performed on all of the items or materials that are expected to come into contact with the samples and defined as Category 1. Please see a list of several examples of prohibited and acceptable materials as well as materials that need screening in **Table 1**.

Table 1. Sampling and Handling Materials[1]

Prohibited Materials	Acceptable Materials	Materials That Need Screening
Field Equipment		
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite	
Waterproof field books (i.e., Rite in the Rain®)	Loose paper (non-waterproof)	Post-It Notes® can also be evaluated using an equipment blank since the presence or absence of PFAS is currently unknown.
Water and dirt resistant leather gloves	Powderless nitrile gloves	Any special required gloves by the HASP
Recycled paper	Cotton cloth or untreated paper towels	
Markers	Ball point pens, pencils, and Fine-point Sharpies® (Please see Note below)	Off-brand markers and Fine-point Sharpies®
Plastic bags	Polyethylene bags (i.e., Ziploc®).	
Decon 90	Alconox® and/or Liquinox®	
Chemical or Blue Ice	Regular Ice	
Sampling Equipment		
Teflon® lined caps	HDPE*, PP, silicone materials, and stainless steel are Acceptable Materials to be used as sampling equipment (e.g., tubing, spoons, or bowls)	Any bottles or materials that will come into direct contact with the samples that have not been verified or certified to be PFAS free based. Do not assume that any sampling materials are PFAS-free based on composition alone.
LDPE, glass jars, and aluminum foil (Please see Note below)		

[1]This table is not considered to be a complete listing of prohibited or acceptable materials. All materials should be evaluated prior to use during sampling.

Note: Items or equipment that contains LDPE parts and that will be in direct contact with the sampling media should not be used. Some laboratories with PFAS experience have allowed the use of amber glass jars with caps that do not contain any Teflon® lining, for biota samples. In addition, some sampling guidance documents allow the use of aluminum foil as long as the shiny side is placed away from the sample. As a precaution, AECOM recommends that aluminum foil not be used unless equipment blank samples confirm it is PFAS-free. ***Cases of PFAS contamination in HPDE materials have been documented, so do not assume that HPDE tubing is PFAS free until tested.**

4.2.2 Field Clothing and PPE

Globally, protective coatings for textiles are estimated to be about 50% of the total use of PFAS (DEPA, 2015). Due to the unique properties of water and oil repellency, PFAS has been used to coat various clothing (i.e., pants, jackets, and t-shirts) and leather (i.e., boots, shoes, and jackets) products. Many of these types of clothing and PPE have the potential to be used in the sampling environment.

While preparing for sampling, particular focus should be made on clothing that has been advertised as having waterproof, water-repellant, or dirt and/or stain resistant characteristics. These types of clothing are the most likely to have had PFAS used in their manufacturing.

Note: The Danish Ministry of the Environment identified alternative polymer technology as being PFAS-free. Products treated with this technology are water-resistant, but not oil and dirt repellent to the same extent as products treated with PFAS-based agents (DEPA, 2015).

The restriction that all water resistant or stain resistant fabrics or coatings cannot be used in the sampling environment may not be possible in some situations. AECOM considers it to be precautionary for products advertised as described above to be carefully evaluated to determine if they do not contain PFAS (i.e., Gore-Tex®) and will not come into contact with the actual samples (defined as Category 2 Materials). It is also recommended that Equipment Blanks be used for evaluating questionable items.

Clothing materials that must be evaluated (▲) prior to wearing within the immediate sampling environment should include the following:

Note: There could be many PPE materials used during various sampling events and minimum PPE requirements include hard hat and safety glasses. All of the clothing and PPE should be evaluated prior to sampling, which should be evaluated.

- ▲ Water resistant or stain-treated clothing and PPE;
- ▲ Tyvek suits and clothing that contains "Tyvek" (USEPA PFAS sampling guidance from Region 2 prohibits the use of Tyvek; consideration of available product information suggests Tyvek may be used if required. Coated Tyvek requires further evaluation; therefore, AECOM recommends a collection of an equipment blank prior to Tyvek use.

Clothing materials that should be avoided (●) in the immediate sampling environment include the following:

- ● Any known fluoropolymers that contain PFAS such as, but not limited to, Polytetrafluoroethylene (PTFE is known as Teflon), Polyvinylidene fluoride (PVDF), Polyvinyl fluoride (PVF), and Fluorinated ethylene propylene (FEP) or Perfluoropolyethers (PFPEs);
- ● Clothing that has been washed with fabric softener which may contain PFAS;
- ● Chemically treated clothing for insect resistance and ultraviolet protection (See **Section 4.0.3** on biological hazards); and

- Clothing or PPE items that have any of the brand or product names that have been found to contain PFAS by the Danish Ministry of the Environment and presented in **Table 2** below (DEPA, 2015).

Note: Equipment blanks should be collected prior to use for the insect repellents and sunscreens that are not listed under the acceptable materials. The spray and/or cream can be applied on a piece of approved field clothing (cotton fabric that has not been washed with a fabric softener and are not advertised as water or stain resistant) that will be intended to be used during sampling. To collect the sample the laboratory-certified PFAS-free or deionized water should be poured over the field clothing.

Clothing materials that are acceptable (■) to wear within the immediate sampling environment include the following:

- PVC or wax-coated fabrics;
- Neoprene;
- Synthetic and natural fibers (preferably cotton);
- Any boots made of polyurethane and PVC. If the HASP requires a specific type of boot such as steel-toed, and PFAS-free cannot be purchased, PFAS-free over boots may be worn. The over boots must be put on, and the hands washed after putting the over boots on prior to the beginning of the sampling activities. Over boots may only be removed in the staging area and after the sampling, activities have been completed;
- Well laundered (and not using fabric softener) clothes and cotton overalls (several times from time of purchase); and
- Powderless nitrile gloves.

Note: Table 2 provides a list of prohibited field clothing and PPE (DEPA, 2015). However, the manufacturer and/or vendor for the field clothing and/or PPE should be contacted to confirm that these Brand or Product Names still contain PFAS. There have been instances where manufactures have kept the same Brand and/or Product Name, but they have changed the chemicals used during the manufacturing of a certain item.

Table 2. Prohibited Field Clothing and PPE

Prohibited Materials[1]	
Brand Name/ Product Name	
Advanced Dual Action Teflon® fabric protector.	Release Teflon®
Repel Teflon® fabric protector	High Performance Release Teflon®
High performance Repel Teflon® fabric protector	Ultra Release Teflon®
Advanced Dual Action Teflon® fabric protector	GreenShield®
Tri-Effects Teflon® fabric protector	Lurotex Protector RL ECO®
Oleo-phobol CP®	Repellan KFC®
Rucostar® EEE6	UnidyneTM
Bionic Finish®	RUCO-GUARD®
RUCOSTAR®	RUCO-COAT®
RUCO-PROTECT®	RUCOTEC®
RUCO®	Resist Spills™
Resists Spills and Releases Stains™	Scotchgard™ Fabric Protector
NK Guard S series	

[1]This list is not considered to be a complete listing of prohibited materials. All materials should be evaluated prior to use during sampling.

4.2.3 Sun and Biological Protection

Biological hazards may be encountered during sampling, and the elimination of specific clothing materials or PPE such as sunscreens and insect repellents (which can contain PFAS) could pose a health and safety hazard to the field personnel. The safety of the field personnel should not be compromised by fear of PFAS containing materials without any scientific basis. Prolonged sun exposure in the summer will also require special sunscreens (which can include PFAS). A number of sampling guidance documents lists a series of various sunscreens and insect repellents as acceptable materials without providing any scientific documentation, such as analytical results to prove that they are PFAS-free. AECOM recommends that those sunscreens and insect repellents be treated as Materials That Require Screening and are presented in **Table 3** below.

Note: The words "Natural" and/or "Organics" for the product name or to describe it, does not necessarily means that it is PFAS-free.

Because the insect repellent products should not come into contact with the sample, AECOM considers the avoidance of such products a precautionary practice. However, the products should not be applied in the vicinity of the sample collection area and hands should be well washed after application or handling of these products. In addition, these products should be evaluated prior to use. For example, AECOM analyzed two insect repellent sprays and found to be PFAS-free. There is no guarantee that these two products will always remain PFAS free, but at this time they should be used as Acceptable Materials. A list of sunscreens and insect repellents can be found in **Table 3** below.

Note: Sunscreens and insect repellants must be evaluated on a case-by-case basis. **Equipment blanks** should be collected prior to use for the insect repellents and sunscreens that are not listed under the acceptable materials. The spray and/or cream can be applied on a piece of approved field clothing (cotton fabric that has not been washed with a fabric softener and are not advertised as water or stain resistant) that will be intended to be used during sampling. To collect the rinsate sample use certified PFAS-free or deionized water poured over the field clothing.

Table 3. Sunscreen and Insect Repellents

Acceptable Materials[1]	
Photos	**Insect Repellent Spray**
	**OFF Deep Woods and Sawyer Permethrin**
Materials That Require Screening[1]	
Sunscreens: Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss My Face, and baby sunscreens that are "free" or "natural."	
Insect Repellents: Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, Baby Ganics.	
Sunscreen and Insect Repellent: Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion.	

[1]This table is not considered to be a complete listing of acceptable materials and materials that require screening. All materials should be evaluated prior to use during sampling.

In order to further protect against specific biological hazards if an insect repellent has not been approved, field personnel is encouraged to follow the suggestions described below:

Note: All personal on site (including all field team members, boat captains or operators, drill rig operators, helpers and visitors) must abide by the PPE requirements for the project.

- Field personnel may tuck pant legs into socks and/or boots and use PFAS-free brand name duct tape to seal the gap between the boots and the pants to reduce the risk of being bitten by ticks.
- Light-colored shirts and pants (well washed cotton overalls) may be worn and easily identify ticks during field activities.
- Light-colored clothing, long sleeves, and large-brimmed hats may also be worn to prevent sunburn.
- Test and verify that preferred insect repellants and sunscreens are PFAS free by using the testing procedures identified above.

4.2.4 Personnel Hygiene and Protective Skin Products

A number of sampling guidance documents recommend that personal care products (PCPs) (e.g., cosmetics, shampoo, sunscreens, dental floss, etc.) not be used prior to and on the day(s) of sampling

because the presence of PFAS in these products has been documented (OECD, 2002, Fujii, 2013, Borg and Ivarsson, 2017). To this date, AECOM has not recorded cross contamination of samples due to the use of PCPs during the collection of many tens of thousands of samples. AECOM considers the avoidance of such products a precautionary practice and recommends that it should be evaluated by each sampling team. However, the hands should be washed well after the use of any PCPs prior to sampling.

Some of the PCPs may contain PFAS, and most guidance documents recommend that these products should not be brought or used on-site. Again, based on AECOM's global PFAS sampling experience, this is considered a precautionary practice, that should be evaluated for each site. The field personnel needs to ensure that these products do not come into contact with the samples and the application of these products is always done in the staging area and away from sampling equipment and sample bottles. The hands should be washed very well after their use.

4.2.5 Food Packaging

PFAS has been used by the paper industry as a special protective coating against grease, oil, and water for paper and paperboards, including food packaging. PFAS application for food packaging includes paper products that come into contact with food such as plates, food containers, bags, and wraps (OECD, 2002). The Food and Drug Administration (FDA) in January 2016 banned the use of PFAS which has eight carbon atoms (such as PFOA and PFOS) or more in food packaging materials. However, PFOA and PFOS or other eight or more carbon chain PFAS may still be detected in food packaging because of the use of recycled paper which may contain PFAS. Various studies have found up to 57% detection frequency in food contact materials such as paper (Trier et al., 2011; Rosenmai et al., 2013; Schaider et al., 2017).

Note: Short-chain PFAS has not been banned to be used in the manufacturing of contact food materials in the United States.

Hands should be thoroughly washed after handling any fast food, carry-out food, or snacks. Pre-wrapped food or snacks (such as candy bars, microwave popcorn, etc.) must not be in possession of field personnel on-site during sampling. Food and drinks may only be brought on-site and consumed as dictated by the HASP. When field personnel requires a break to eat or drink, they should remove their gloves and coveralls, if worn, in the staging area and move to the designated area for food and beverage consumption. When finished, field personnel should wash their hands, and put their coveralls and gloves back on at the staging area, prior to returning to the work area.

4.3 PFAS Sampling Procedures

4.3.1 Sample Containers, Handling, and Collection

Commercial laboratories that have demonstrated awareness and elimination of possible PFAS cross contamination from sample containers and laboratory supplies should be used. Recommended sampling containers will be discussed for each environmental media. Any sampling containers provided by the laboratory should be certified as PFAS-free.

Note: Materials directly contacting samples are the most important, so dedicated or disposable sampling equipment should be verified as PFAS free.

Prior to sampling field personnel will also come into contact with textiles and fabrics treated with PFAS, such as carpets and car interiors. Field personnel should be aware that these materials, and any other surfaces that repel water and/or are stain resistant, have the potential of being treated with PFAS. If possible field personnel should avoid using vehicles with seat covers that are water and stain resistant. However, if unavoidable, the sample containers and equipment that will be used in the sampling environment should not be stored on or come into contact with these materials. In order to further prevent any cross contamination, field personnel is encouraged to place a well-washed cotton blanket or clean HDPE or other PFAS-free sheeting over the materials that are suspected of having a PFAS coating.

For all environmental media, the hands should be well washed prior to sampling. Clean nitrile gloves must be donned previously to sample collection, and handling of sample containers and equipment. The sample container should be kept sealed at all times and only open during the sample collection. The sampling container cap or lid should never be placed on any surface unless it is PFAS-free. A list of various materials used in sampling and handling can be found in **Table 1**.

4.3.2 Sample Shipment

Recommended sampling shipment information will be discussed for each environmental media (See **Section 5** through **10**). In general, for all environmental media sampled for PFAS, it is required that samples be kept on ice from the time of sample collection to arrival at the laboratory. Sample coolers should be packed with regular ice and not chemical or blue ice. The samples, ice, and chain of custody (COC) should always be double bagged in polyethylene (i.e., Ziploc®) bags. Biota samples ideally should be paced on dry ice and frozen prior to the shipment to the lab. The relinquished COC should be taped to the inside of the cooler lid using PFAS-free tape. The cooler should be taped closed with a custody seal and shipped by overnight courier to the appropriate accredited PFAS laboratory.

4.3.3 Preferential Sampling Sequence

A preferred sampling sequence should be established prior to any sampling event in order to reduce the risk of cross contamination. In general, the sampling sequence should be such that samples from areas where is expected or known to be least contaminated to anticipated areas or identified to be most contaminated. If analytical results from past sampling events are available, the sampling sequence can be readily determined. However, for many PFAS investigation sites, no PFAS sampling has been conducted. In these cases, all site information on possible PFAS uses and potential PFAS migration patterns (e.g., upgradient, downgradient) from PFAS sources at the site should be reviewed prior to the sampling event to help establish the sampling sequence. If multiple samples (i.e., monitoring wells) will be collect for an area where a particular or potential PFAS release in the environment might have documented, samples that are known to be upgradient from the impacted area should be sampled first, followed by those that are furthest downgradient from the suspected source. The remaining wells should be progressively sampled from the one most distant downgradient to those closer to the known PFAS source. If no information is available about the site samples are to be collected in the following order: 1) drinking water (e.g., residential wells), 2) surface water, and 3) groundwater.

4.4 Laboratory Considerations

The PFAS analytical target list and detection limits should be developed based on the objectives of the project.

Laboratories should be able to analyze and report PFAS results that will meet the program specific data quality requirements using USEPA Method 537 Rev. 1.1 (Method 537) or equivalent. Method 537 was designed for chlorinated drinking water and recommends the use of chemical preservation using Trizma in order to buffer and remove free chlorine. Non-chlorinated drinking water can also be analyzed using Method 537. The purpose of Trizma on non-chlorinated drinking water is not expected to affect the PFAS results. Until additional information is available, it is recommended that the thermal preservation, shipping, storage, and holding times contained in Method 537 are used for all other sample media, with the exception of biota. In order to limit microbial growth, biota samples such as fish and vegetation are recommended to be kept frozen until the sample is prepared.

Note: Method 537 was developed to only be used for finished and treated drinking water samples and contains specific requirements for sample preservation, shipping, storage, and holding times.

Currently, there are no USEPA methods for the preparation and analysis of other non-drinking water matrices or other sample media. However, different analytical methods have been published:

- ISO Method 25101 (ISO 2009) - Water quality -- Determination of perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) -- Method for unfiltered samples using solid phase extraction and liquid chromatography/mass spectrometry.
- ASTM D7979 (ASTM 2017) - Standard Test Method for Determination of Per- and Polyfluoroalkyl Substances in Water, Sludge, Influent, Effluent and Wastewater by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS).
- ASTM D7968 (ASTM 2017) - Standard Test Method for Determination of Polyfluorinated Compounds in Soil by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS).

Generally, it is recognized within the analytical community that isotope dilution based methods are recommended for the analysis of PFAS in all media, including aqueous ones, to correct for matrix interferences and extraction efficiency limitations. Many of the laboratories referred to the isotope dilution method as 'modified Method 537'; however, USEPA does not regard isotope dilution as an acceptable modification of USEPA Method 537 for drinking water analysis. USEPA drinking water methods are generally prescriptive, and only limited modifications are allowed because the finished treated drinking water is assumed to be free of significant interferences. A project chemist should carefully review the laboratory's analytical procedure as part of the laboratory selection process. In the absence of a standardized isotope dilution based USEPA reference method, there are significant differences between the SOPs from various laboratories for the processing and analysis of the samples. The review of the laboratory's procedure and certifications should ensure that the laboratory is capable of providing data that meets the data quality objective of the project.

4.5 Quality Control Samples

4.5.1 Laboratory Quality Control Samples

The analytical procedure should describe what batch quality control (QC) samples, such as method blank (MB), laboratory control sample (LCS), laboratory control sample duplicate (LCSD), sample duplicate (SD), matrix spike (MS), and matrix spike duplicate (MSD), are prepared for each media type. In some cases depending on the project, additional QC samples may be required. For samples with high concentrations of PFAS, an SD may be warranted.

Currently, the analytical detection method of choice for PFAS analysis is liquid chromatography-mass spectrometry-mass spectrometry (LC/MS/MS), which is suited for analysis of ionic PFAS, such as the PFCAs and PFSAs. Only commercial laboratories that have demonstrated awareness and elimination of possible PFAS cross contamination from sample containers and laboratory supplies should be used.

If the laboratory is requested to filter water samples prior to analysis, the following should be considered:

- If filtering is required, determine the nature of the filters used and verify that filtration will not introduce false positives or false negative results. Field filtration of the sample is generally prohibited unless specifically requested by a client.
- Consider use of a centrifuge in the laboratory to reduce the need for sample filtering.

4.5.2 Field Quality Control Samples

Field QC samples can be used to evaluate the field equipment and supplies as well as to assess the possibility of cross contamination during sampling, transport, and storage of samples. For samples such as equipment rinse blanks (EB), field blanks (FB), field reagent blanks (FRB), and trip blanks (TB) the following is required:

- Equipment rinse blanks should be collected by passing laboratory certified PFAS-free water over or through decontaminated field sampling equipment prior to the collection of samples to assess the adequacy of the decontamination process and/or to evaluate potential contamination from the equipment used during sampling.
- Field blanks should be collected by pouring laboratory certified PFAS-free water into the sampling container in the field, and shipping to the laboratory with field samples. It is used to assess contamination from field conditions during sampling.
- Field reagent blanks are prepared in the laboratory by placing an aliquot of PFAS-free water reagent water in a sample container and treating it as a sample in all respects, including shipment to the sampling site, exposure to sampling site conditions, storage, preservation, and all analytical procedures. The purpose of the FRB is to determine if method analytes or other interferences are present in the field environment
- Trip blanks is a bottle of PFAS-free water that should be prepared in the laboratory, travel from the laboratory to the site and transported back to the laboratory without having been exposed to sampling procedures. Typically, a trip blank is usually used for volatile compounds, but it may be recommended for PFAS sampling to assess cross-contamination introduced from the laboratory and during shipping procedures.

5. Groundwater Sampling

This section discusses processes, decontamination procedures, and acceptable materials for sampling groundwater for PFAS. The guidance will supplement groundwater Standard Operating Procedures (SOP), but will not replace them. In addition, this guidance will be used to support the sampling objectives and procedures based on the site-specific sampling analysis plan (SAP) developed prior to any field activities.

Note: Sections 1 through 4 should be reviewed prior to reviewing the Groundwater Sampling guidance (**Section 5**).

The groundwater sampling requires the use of non-dedicated equipment, such as pumps and water level meters, the field equipment has to be decontamination in order to avoid cross contamination. The non-dedicated equipment has to be certified that it is PFAS free. PFAS has been detected in groundwater in Michigan in concentrations of over 1,000,000 ng/L, and Michigan has promulgated surface water criterion as low as 11 ng/L. Many commercial laboratories have PFAS detection limits below 1 ng/L. There is a high possibility of false positives if decontamination procedures are not followed diligently.

This guidance covers both the collection of samples from monitoring and temporary wells but does not include the collection of vertical aquifer samples. The guidance assumes that the monitoring or temporary wells were installed using PFAS-free materials and no PFAS contamination occurred during the well installation.

The Groundwater Sampling guidance discusses the potential for cross-contamination that can occur from:

- Field Clothing and PPE;
- Groundwater Sampling Equipment;
- Equipment Decontamination;
- Shaker Test;
- Filtering of Groundwater;
- Sample Collection and Handling; and
- Sample Shipment.

5.1 Field Clothing and PPE

A general overview of field clothing and PPE can be found in **Section 4.2.2** from the **General PFAS Sampling** guidance. This Groundwater Sampling guidance assumes that the groundwater samples will be collected in an environment where only Level D protection is required by the HASP. Any additional field clothing and/or PPE items that might be required for the groundwater sampling and are not discussed in the Sampling Guidance should be evaluated as described in **Sections 4.2.1** and **4.2.2**.

Powderless nitrile gloves should frequently be changed any time there is an opportunity for cross-contamination of the sampling, including, but not limited to, the following activities:

- Each time sampling equipment is removed or placed inside the monitoring well (e.g., multi-parameter flow-through cell, turbidity meter, pump, tubing, bailer, etc.);
- Placement of the tubing in the well and pumps;
- Completion of monitor well purging;
- Prior to sample collection;

Note: Both the field clothing and PPE should be kept dust and fiber free. During the sample collection extra care should be taken such that no dust or fibers can fall into the sample bottle.

- Handling of any sample, including QA/QC samples such as field reagent blanks or equipment rinsate blanks;
- After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel;
- During and after decontamination of non-dedicated sampling equipment.

5.2 Groundwater Sampling Equipment

As defined in **Section 4**, groundwater sampling uses equipment that will come into contact with the groundwater (**Category 1**) that may introduce PFAS into the sample and equipment that will not come into direct contact with the sample (**Category 2**). Each category is addressed below.

Category 1: General sampling equipment such as the water level tape or tubing will come into contact with the groundwater sample and are considered to be (**Category 1**; **Section 4.2**). The water level tape and the tubing should be screened and certified as PFAS-free. The tubing should always be kept in the original cardboard or bag in which was shipped. The tubing should ways be held in a clean location free of dust and fibers.

Note: As a precautionary action an equipment rinsate blank should be collected even if the sampling materials are made of materials that are not expected to contain PFAS.

Category 2: Examples of field equipment that do not come into contact with the groundwater samples (**Category 2; Section 4.2**) are multi-parameter flow-through cells and turbidity meters. The surface of these pieces of field equipment or the storage boxes in which they are kept might contain PFAS. To this date, AECOM has not recorded cross contamination of groundwater samples due to the use of various multi-parameter flow-through cells or turbidity meters.

Do not use any equipment that contains any known fluoropolymers such as, but not limited to the following:

- Polytetrafluoroethylene (PTFE) tradename such as Teflon®;
- Polyvinylidene fluoride (PVDF) tradename such as Kynar®;
- Fluorinated ethylene propylene (FEP) tradename such as Neoflon®;
- Ethylene-tetrafluoro-ethylene (ETFE) tradename such as Tefzel®; and
- Do not use low density polyethylene (LDPE); and
- Use materials that are either made of HDPE, silicone, or acetate.
- Post-It Notes® were historically prohibited and should be avoided as the presence or absence of PFAS is currently unknown; and
- Passive diffuse bags should be certified PFAS free before they are used.

Note: Additional information about notes collection can be found in **Section 4**.

Note: Special care and consideration should be given to the field sampling equipment when stored and handled outside the site boundaries or between different sample locations. During the sample collection, extra care should be given, such that no dust or fibers fall into the sample bottle.

Many times the release of PFAS in the environment occurs concurrently with other chemicals. For example, the release of PFAS present in the aqueous film forming foam (AFFF) is generally associated with the release of flammable liquids, such as jet fuels. As a result, sampling groundwater wells for PFAS may occur within plumes of volatile organic compounds (VOCs). The use of a photoionization detector

(PID) is recommended to measure VOCs that might have accumulated inside the well casings. The PID used during PFAS sampling to screen for VOCs may be made of materials that contain PFAS. However, the PID is a **Category 2** field equipment item and will have a very low possibility of cross contamination.

Groundwater Sampling can be collected using:

- Purging (e.g., bladder, peristaltic, and submersible pump);
- Passive samplers (e.g., HydraSleeve™); and
- Bailers.

Note: Many of the sampling products produced and used in the past were made using PFAS (e.g., PTFE, also known as Teflon®)

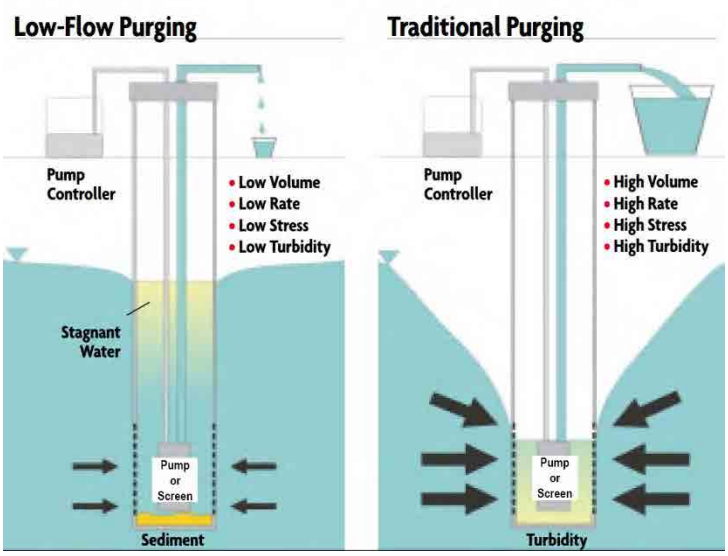
Passive samplers, such as HydraSleeve™, can be used to sample groundwater with no change in water level and only minimal agitation. Passive samplers and bailers are not usually used for PFAS groundwater sampling and will not be discussed in detail further. Bailers and passive samplers, as well as ropes and weights that come into contact with the groundwater samples, must not contain PFAS materials (i.e., PTFE or known as Teflon®). When it is uncertain if the sampling device contains PFAS, rinsate samples should be collected to confirm the sampling device is PFAS free.

5.2.1 Purge Equipment

Note: Equipment rinsate blanks should be collected simulating actual field sampling procedures, similar to collecting a sample. All of the pump components that come into contact with the sample should be PFAS-free.

The most frequently used sampling procedure for PFAS in groundwater is purging. Peristaltic, bladder, and submersible pumps are typically used for groundwater sampling. The potential of cross contamination using these different pumps will be discussed in detail. Regardless of the pump used, low pumping rates (known as low flow) are used to minimize drawdown, prevent turbidity formation, and ensure that the sample is representative of the aquifer sampled. See **Figure 1** for the difference between low-flow purging sampling and traditional purging (Ritchey, 2002).

Figure 1. Low-Flow and Traditional Purge Methods



5.2.1.1 Peristaltic Pump

The peristaltic pump pulls the sample to the surface by decreasing the head, or pressure, over the sample (Schalla et al., 2001). The peristaltic pump is used when the depth to the water table does not exceed 25 ft below grade. The use of peristaltic pump has a low potential of cross contamination, as

none of its components, except disposable tubing, comes into direct contact with the groundwater being sampled.

5.2.1.2 Bladder and Submersible Pumps

When the depth to the water table exceeds 25 ft below grade, suction-lift mechanisms such as peristaltic pumps cannot be used to sample groundwater. A bladder or submersible pump can be used in the case when groundwater is located deeper than 25 ft below grade. Both of these pumps are submerged beneath the water table and will come into contact with the groundwater being sampled.

Bladder pumps operate similarly to the peristaltic pumps using a suction-lift mechanism and being able to pull the sample to the surface by decreasing the head, or pressure, over the sample (Schalla et al., 2001). Many of the bladder pumps are manufactured mostly of stainless steel; however, they might contain various internal parts such as the bladder and O-Rings (i.e., Viton® or FKM) that could be made of PFAS. The pump component that has the highest chance of cross contaminating the groundwater sample and an equipment rinsate blank should be taken prior to use in order to confirm the pump is PFAS free.

Submersible pumps are able to push water to the surface by converting rotary energy to kinetic energy that will result in pressure energy. The majority of submersible pumps use impellers or rotors to create the pressure energy needed to push water to the surface (Schalla et al., 2001). Cross contamination might result from the contact between the pump components (i.e., impellers, rotors) used to push the water to the surface as well as tubing connected to the pump.

- Stainless steel pumps with polyethylene bladders should be used for PFAS sampling. An equipment rinsate blank should be collected in order to certify that the pump is PFAS-free. In the case of dedicated equipment for a well, the equipment needs to evaluate and confirm that it is PFAS-free.

Field rental equipment companies offer “PFAS free” bladder pumps; however, precaution is advised, and an equipment rinsate blank is required. Rental equipment should be treated as being contaminated and only used after proper decontamination has been done.

- In many submersible pumps, the O-Rings do not come into contact with the groundwater sample, and in this case, the O-Rings should be treated as internal pump components. The O-Rings will present a low possibility of cross contamination. Equipment rinsate blanks should be collected simulating actual field sampling procedures and not for individual pump components.

Note: Some rental pumps have been advertised as certified PFAS-free when parts that contain PFAS and come into contact with the groundwater samples were present. A precautionary step, those rental pumps should be avoided. The non-detect PFAS equipment blank results for one or two pumps, do not provide enough assurance that no cross contamination will result from using a pump containing PFAS materials that will come in contact with the groundwater being sampled.

5.3 Equipment Decontamination

Field sampling equipment, either rented or not, that are used at multiple sites or groundwater locations, could become highly contaminated with PFAS. If site specific information is available, sampling should be conducted from the least to the most contaminated locations. Additional guidance on the sampling sequence can be found in **Section 4.3.3**.

Note: Field sampling equipment that will come into contact with the samples should always be thoroughly decontaminated before each sample.

The following materials should be used for decontaminating any equipment that contacts the sampling media:

- ● Do not use Decon 90®;
- ▲ Commercially available deionized water available in HDPE containers may be used for decontamination. However, it is recommended that a water sample should be collected to certify that it is PFAS free. AECOM has sampled multiple deionized water samples commercially sold in Michigan and found it to be PFAS free;
- ▲ Municipal drinking water may be used for decontamination purposes if it is certified to be PFAS free;
- ■ Laboratory certified PFAS-free water should be used for decontamination;
- ■ Alconox®, Liquinox®, and Citranox® can be used for equipment decontamination;
- ■ Sampling equipment can be scrubbed utilizing a polyethylene or PVC brush to get rid of particulates; and
- ■ Decontaminated Sampling equipment should be rinsed three times using PFAS free water.

5.4 Shaker Test

In order to prevent possible false positive samples due to carry over contamination, it is important to inform the laboratory about samples that are expected to contain high PFAS concentrations. Groundwater samples can also be screened in the field for PFAS using a commercially available anionic surfactant test kit called astkCARE™.

Certain families of PFAS, such as PFCAs and PFSAs that are routinely analyzed for are surfactants. Surfactants are capable of reducing the surface water tension of the groundwater, and when enough agitation is produced, air gets mixed with the groundwater resulting in the creation of foam. Groundwater samples were observed to sometimes foam they were agitated in areas where AFFF was release into the environment. AFFF contains both PFAS and hydrocarbon surfactants.

High PFAS levels in the samples can increase the chance of getting false positives due to carry to the next sample in the sequence during the analysis by the laboratory. Screening of groundwater samples in the field can indicate the potential for higher concentration of PFAS, which is useful information to share with the laboratory prior to sample analysis.

The astkCARE™ has the following limitations:

- It can generally only detect PFAS concentrations in the parts per million (ppm) range. However, at most of the sites concentrations are found in low parts per billion (ppb) or parts per trillion (ppt).
- The manufacturer of the kit requires mandatory training of users.

As an alternative, regular sample bottle or small vial could also be agitated in order to observe if foam will be generated. In the case when the foam is observed, it should be noted on the COC that the sample might contain high PFAS concentrations. If groundwater samples are not collected close to source zones, the screening for PFAS is not recommended.

5.5 Filtering of Groundwater

Filtering of the groundwater samples is sometimes necessary. PFAS can adsorb to particulate matter, and unfiltered samples may result in high biased results. However, the filter material should be carefully evaluated. A study between four different filter materials (PTFE, glass, polyethersulfone [PES], and nylon) found that the glass filters adsorbed the least amount of PFAS and nylon adsorbed the most and is not recommended for PFAS sampling (Chandramouli et al., 2015). The following recommendations should be used when considering filtering of the samples:

- Do not use any filters that contain any PFAS such as, PTFE ;
- Do not use nylon filters;
- Field filtration of the sample is generally not advised unless specifically requested by a client;
- If filtering is absolutely necessary, glass filters are recommended to be used; and
- Consider use of a centrifuge in the laboratory to reduce the need for sample filtering.

Note: It is recommended that filtering of the samples should only be performed in the laboratory in order to reduce the possibly of cross contamination.

5.6 Sample Collection and Handling

The following recommendations should be used for the sample collection:

- Do not insert or let the tubing or any materials inside the sample bottle;
- Attention to be given such that no dust or fibers will fall into the sample bottle;
- Do not set the lid down during sample collection;
- Off-brand markers should be certified PFAS free prior to use. Alternatively, use a fine point Sharpie® to label the empty sample bottle while in the staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling;
- Use HDPE sample bottles provided by the laboratory, with Teflon-free lids;
- Ballpoint pen may be used for labeling sample containers. If ball point pens do not write on the sample container labels, preprinted labes in the laboratory can also be used.
- Use polyethylene plastic bags (e.g., Ziploc®) for bagging samples;
- Samplies should be double bagged;
- In the absence of USEPA guidance for groundwater samples storage, thermal preservation, and holding times for Method 537 should be used for groundwater samples. Samples must be chilled during shipment and must not exceed 10°C during the first 48 hours after collection. Samples stored in the laboratory must be held at or below 6°C until extraction, but should not be frozen (USEPA, 2009); and
- Groundwater samples should be extracted as soon as possible but must be extracted within 14 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction (USEPA, 2009).

5.7 Sample Shipment

The following recommendations should be used for the sample shipment:

- Do not use chemical or blue ice;

- Use wet ice that is double bagged in Ziploc® storage bags;
- COC should be double bagged in a Ziploc® storage bags and taped to the inside of the cooler lid; and
- The cooler should be taped closed with a custody seal and shipped by overnight.

6. Soil Sampling

This section discusses processes, decontamination procedures, and acceptable materials for sampling soil for PFAS. The guidance will supplement soil Standard Operating Procedures (SOP), but will not replace them. In addition, this guidance will be used to support the sampling objectives and procedures based on the site-specific sampling analysis plan (SAP) developed prior to any field activities.

Note: Sections 1 through 4 should be reviewed prior to reviewing the Soil Sampling guidance (**Section 6**).

Limited PFAS soil samples have been collected in Michigan to date with the highest detection concentration of over 4,000 µg/Kg or parts per billion (ppb). Michigan has not yet promulgated soil criterion; however, a criterion of 70 ng/L has been established for PFOA/PFOS in groundwater. Based on the groundwater criterion, a soil criterion of 1.4 µg/Kg can be assumed using Michigan Rule 22 (20x rule – R 299.22(2).

Field sampling equipment, either rented or not, that are used at multiple sites or sampling locations, could become highly contaminated with PFAS. If site specific information is available, sampling should be conducted from the least to the most contaminated locations. Additional guidance on the sampling sequence can be found in **Section 4.3.3**.

Soil sampling involves the use of non-dedicated equipment, such as scoops, trowels, shovels, augers and other drilling-related equipment, which may be a source of cross-contamination. Since the soil criterion for PFAS is so conservative, decontamination procedures outline in this guidance and in the SOPs much be followed to avoid cross contamination and the equipment must be certified as PFAS free.

This section describes the procedures specific to collecting surface or subsurface soil samples while conducting PFAS investigation.

The site-specific SAP will generally provide the following information:

- Sample collection objectives;
- Locations, number, and volume of samples;
- Types of chemical analyses;
- Specific quality control procedures; and
- Additional sampling requirements, as necessary.

This Soil Sampling guidance will supplement the SOP and discusses further the potential for cross-contamination that can occur from:

- Field Clothing and PPE;
- Soil Sampling Equipment;
- Equipment Decontamination;
- Sample Collection and Handling; and
- Sample Shipment.

Note: All samples must be collected using HDPE bottles provided by the laboratory, with Teflon-free caps.

6.1 Field Clothing and PPE

A general overview of field clothing and PPE can be found in **Section 4.2.2** from the **General PFAS Sampling** guidance. This Soil Sampling guidance assumes that the soil samples will be collected in an environment where only Level D protection is required by the HASP. As with any field mobilization, it is the responsibility of all personnel to be aware of the physical, chemical and biological hazards associated

with a particular site. Any additional field clothing and/or PPE items that might be required for the soil sampling and are not discussed in the Sampling Guidance should be evaluated as described in **Sections 4.2.1** and **4.2.2**.

Field sampling occuring during wet weather (e.g., rainfall and snow) should be conducted while wearing approriate field clothing that will not pose a risk for cross-contamination.

Note: Special focus should be made on clothing that has been advertised as having waterproof, water-repellant or dirt and/or stain characteristics. They are likely to have PFAS in their manufacturing.

Powderless nitrile gloves should frequently be changed any time there is an opportunity for cross-contamination of the sampling, including, but not limited to, the following activities:

- Each time sampling equipment is handled;
- Prior to sample collection;
- Handling of any sample, including QA/QC samples such as field reagent blanks or equipment rinsate blanks;
- After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel; and
- During and after decontamination of non-dedicated sampling equipment.

Note: Both the field clothing and PPE should be kept dust and fiber free. During the sample collection extra care should be taken such that no dust or fibers can fall into the sample bottle.

6.2 Soil Sampling Equipment

As defined in **Section 4**, soil sampling uses equipment that will come into contact with the soil (**Category 1**) that may introduce PFAS into the sample and equipment that will not come into direct contact with the sample (**Category 2**). Each category is addressed below.

Category 1: General sampling equipment including, but not limited to the list below will come into contact with the soil sample (**Category 1**; **Section 4.2**).

- Shovels, trowels, spoons, and bowls;
- Hand augers buckets and extensions;
- Augers and direct push equipment, including any split spoon or sampling barrels;

Note: As a precautionary action an equipment rinsate blank should be collected even if the sampling materials are made of materials that are not expected to contain PFAS.

Category 2: Examples of field equipment that do not come into contact with the soil samples (**Category 2; Section 4.2**) are field books, Munsell color charts, Post-It Notes®, aluminum foil, and recycled paper towels. The surface of these pieces of field equipment or the storage boxes in which they are kept might contain PFAS. In addition, if the field team is using canopy tents for shelter, the canopy material is likely to be a treated surface. Gloves should be worn when setting up, dismantling and moving the tent, changed immediately afterwards and further contact with the tent should be avoided.

Do not use any equipment that contains any known fluoropolymers such as, but not limited to the following:

- Polytetrafluoroethylene (PTFE) tradename such as Teflon®;
- Polyvinylidene fluoride (PVDF) tradename such as Kynar®;
- Fluorinated ethylene propylene (FEP) tradename such as Neoflon®;
- Ethylene-tetrafluoro-ethylene (ETFE) tradename such as Tefzel®; and

- Do not use low density polyethylene (LDPE); and
- Use materials that are either made of HDPE, silicone, or acetate.
- Post-It Notes® were historically prohibited and should be avoided as the presence or absence of PFAS is currently unknown.

Note: Additional information about notes collection can be found in **Section 4**.

Note: Special care and consideration should be given to the field sampling equipment when stored and handled outside the site boundaries or between different sample locations. During the sample collection, extra care should be given, such that no dust or fibers fall into the sample bottle.

Many times the release of PFAS in the environment occurs concurrently with other chemicals. For example, the release of PFAS present in the aqueous film forming foam (AFFF) is generally associated with the release of flammable liquids, such as jet fuels. As a result, sampling soil for PFAS may occur within plumes of volatile organic compounds (VOCs). The use of a photoionization detector (PID) is recommended to measure VOCs that might be present in the soil. The PID used during PFAS sampling to screen for VOCs may be made of materials that contain PFAS. However, the PID is a **Category 2** field equipment item and will have a very low possibility of cross contamination.

6.3 Equipment Decontamination

The following bullets define what materials should, or should not, be used for decontaminating any equipment that contacts the sampling media:

- Do not use Decon 90®;
- Commercially available deionized water available in HDPE containers may be used for decontamination. However, it is recommended that a water sample should be collected to certify that it is PFAS free;
- Municipal drinking water may be used for decontamination purposes if it is certified to be PFAS free (See **Section 4.1** for the definition of PFAS free drinking water);
- Laboratory certified PFAS-free water should be used for decontamination;
- Alconox®, Liquinox®, and Citranox® can be used for equipment decontamination;
- Sampling equipment can be scrubbed utilizing a polyethylene or PVC brush to get rid of particulates; and
- Decontaminated Sampling equipment should be rinsed three times using PFAS free water.

6.4 Sample Collection and Handling

The following recommendations should be used for the sample collection:

- Do not insert or let any foreign materials inside the sample bottle;
- Attention should be given such that no dust or fibers will fall into the sample bottle;
- Do not set the lid down during sample collection;
- Off-brand markers should be certified PFAS free prior to use. Alternatively, use a fine point Sharpie® to label the empty sample bottle while in the staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling;

- Ballpoint pens may be used for labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory can also be used.
- Use HDPE sample bottles provided by the laboratory, with Teflon-free lids;
- Use polyethylene plastic bags (e.g., Ziploc®) for bagging samples;
- Samples should be double bagged;
- In the absence of USEPA guidance for soil samples storage, thermal preservation, and holding times for Method 537 should be used for soil samples. Samples must be chilled during shipment and must not exceed 10°C during the first 48 hours after collection. Samples stored in the laboratory must be held at or below 6°C until extraction, but should not be frozen (USEPA, 2009); and
- Soil samples should be extracted as soon as possible but must be extracted within 28 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction (USEPA, 2009).

Note: Method 537 was developed for the analysis for finished drinking water. Method 537 was not designed for soil analysis, which may have significant interferences. Many labs provide isotope dilution based methods using liquid chromatography with quadrupole mass spectrometry (LC/MS/MS). These methods are similar to EPA Method 537 in the instrumentation but applicable to other matrices such as soils and sediments.

6.5 Sample Shipment

The following recommendations should be used for the sample shipment:

- Do not use chemical or blue ice;
- Use wet ice that is double bagged in Ziploc® storage bags;
- COC should be double bagged in a Ziploc® storage bags and taped to the inside of the cooler lid; and
- The cooler should be taped closed with a custody seal and shipped by overnight courier.

7. Sediment Sampling

This section discusses processes, decontamination procedures, and acceptable materials for sampling sediment for PFAS. The guidance will supplement sediment SOPs, but will not replace them. In addition, this guidance will be used to support the sampling objectives and procedures based on the site-specific SAP developed prior to any field activities.

Note: Sections 1 through **4** should be reviewed prior to reviewing the Sediment Sampling guidance (**Section 7**).

Sediment sampling involves the use of non-dedicated equipment, such as scoops, trowels, shovels, augers and other dredging or grab samplers, which require decontamination in order to avoid cross contamination. The non-dedicated equipment has to be certified that it is PFAS free. PFAS has been detected in sediment in Michigan in concentrations of over 4,700 µg/Kg. Michigan has not yet promulgated sediment criterion; however, a criterion of 70 ng/L has been established for PFOA/PFOS in groundwater and the surface water criterion is as low as 11 ng/L. Based on the surface water criterion, a sediment criterion of 0.220 µg/Kg can be assumed using Rule 22 (20x rule – R 299.22(2)). In addition, a pore water sample can be compared directly to the surface water criterion

This section describes the procedures specific to sediment samples while conducting a PFAS investigation. The SAP will generally provide the following information -.

- Sample collection objectives;
- Locations, number and volume of samples;
- Types of chemical analyses;
- Specific quality control procedures; and
- Additional sampling requirements, as necessary.

This Sediment Sampling guidance discusses the potential for cross-contamination that can occur from:

- Field Clothing and PPE;
- Sediment Sampling Equipment;
- Equipment Decontamination;
- Sample Collection and Handling; and
- Sample Shipment.

Note: All samples must be collected using HDPE bottles provided by the laboratory, with Teflon-free caps

7.1 Field Clothing and PPE

A general overview of field clothing and PPE can be found in **Section 4.2.2** from the **General PFAS Sampling** guidance. This Sediment Sampling guidance assumes that the sediment samples will be collected in an environment where only Level D protection is required by the HASP. As with any field mobilization, it is the responsibility of all personnel to be aware of the physical, chemical and biological hazards associated with a particular site. Any additional field clothing and/or PPE items that might be required for the sediment sampling and are not discussed in the Sampling Guidance should be evaluated as described in **Sections 4.2.1** and **4.2.2**.

Field sampling occuring during wet weather (e.g. rainfall and snow) should be conducted while wearing approriate field clothing that will not pose a risk for cross-contamination. The coatings

Note: Special focus should be made on clothing that has been advertised as having waterproof, water-repellant or dirt and/or stain characteristics. They are likely to have PFAS in their manufacturing.

used on waders are of particular concern during sediment sampling.

Powderless nitrile gloves should frequently be changed any time there is an opportunity for cross-contamination of the sampling, including, but not limited to, the following activities:

- Each time sampling equipment is handled;
- Prior to sample collection;
- Handling of any sample, including QA/QC samples such as field reagent blanks or equipment rinsate blanks;
- After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel;
- During and after decontamination of non-dedicated sampling equipment.

Note: Both the field clothing and PPE should be kept dust and fiber free. During the sample collection extra care should be taken such that no dust or fibers can fall into the sample bottle.

7.2 Sediment Sampling Equipment

As defined in **Section 4**, sediment sampling uses equipment that will come into contact with the sediment (**Category 1**) that may introduce PFAS into the sample and equipment that will not come into direct contact with the sample (**Category 2**). Each category is addressed below.

Category 1: General sampling equipment including, but not limited to the list below will come into contact with the sediment sample (**Category 1**; **Section 4.2**).

Note: As a precautionary action an equipment rinsate blank should be collected even if the sampling materials are made of materials that are not expected to contain PFAS.

- Shovels, trowels, spoons and bowls;
- Hand augers, hand auger buckets and extensions;
- Ponar or Ekman dredge samplers;
- Core sampler with a wire line;
- Stream sediment sampler;
- Van Veen Grab Samplers and rope;
- Petite ponar grab sampler;
- Water depth recording device;
- Stainless-steel PushPoint Sampler with guard rod;
- MHE Screen-Soks;
- Three way valve with Luer-Lok type fitting; and
- Syringes with Luer-Lok type fitting.

In addition, grease and/or tape used to assemble the sampling equipment could potentially contain PFAS. Pore water samples could be collected using similar sampling equipment described in the Groundwater Sampling section (Section 5).

Category 2: Examples of field equipment that do not come into contact with the sediment samples (**Category 2; Section 4.2**) are field books, Munsell color charts, Post-It Notes®, aluminum foil, and recycled paper towels. The surface of these pieces of field equipment or the storage boxes in which they are kept might contain PFAS. In addition, if the field team is using canopy tents for shelter, the canopy material is likely to be a treated surface. Gloves should be worn when setting up, dismantling and moving the tent, changed immediately afterwards and further contact with the tent should be avoided.

Do not use any equipment that contains any known fluoropolymers such as, but not limited to the following:

- Polytetrafluoroethylene (PTFE) tradename such as Teflon®;
- Polyvinylidene fluoride (PVDF) tradename such as Kynar®;
- Fluorinated ethylene propylene (FEP) tradename such as Neoflon®;
- Ethylene-tetrafluoro-ethylene (ETFE) tradename such as Tefzel®; and
- Do not use low density polyethylene (LDPE); and
- Use materials that are either made of HDPE, silicone, or acetate.
- Post-It Notes® were historically prohibited and should be avoided as the presence or absence of PFAS is currently unknown.

Note: Additional information about notes collection can be found in **Section 4**.

Note: Special care and consideration should be given to the field sampling equipment when stored and handled outside the site boundaries or between different sample locations. During the sample collection, extra care should be given, such that no dust or fibers fall into the sample bottle.

Many times the release of PFAS in the environment occurs concurrently with other chemicals. For example, the release of PFAS present in the aqueous film forming foam (AFFF) is generally associated with the release of flammable liquids, such as jet fuels. As a result, sampling sediment for PFAS may occur within plumes of volatile organic compounds (VOCs). The use of a photoionization detector (PID) is recommended to measure VOCs that might be present in sediment. The PID used during PFAS sampling to screen for VOCs may be made of materials that contain PFAS. However, the PID is a **Category 2** field equipment item and will have a very low possibility of cross contamination.

7.3 Equipment Decontamination

Field sampling equipment, either rented or not, that are used at multiple sites or sampling locations, could become highly contaminated with PFAS. If site specific information is available, sampling should be conducted from the least to the most contaminated locations. Additional guidance on the sampling sequence can be found in **Section 4.3.3**.

The following materials should be used for decontaminating any equipment that contacts the sampling media:

- Do not use Decon 90®;
- Commercially available deionized water available in HDPE containers may be used for decontamination. However, it is recommended that a water sample should be collected to certify that it is PFAS free. AECOM has sampled multiple deionized water samples commercially sold in Michigan and found it to be PFAS free;
- Municipal drinking water may be used for decontamination purposes if it is certified to be PFAS free;
- Laboratory certified PFAS-free water should be used for decontamination;
- Alconox®, Liquinox®, and Citranox® can be used for equipment decontamination;
- Sampling equipment can be scrubbed utilizing a polyethylene or PVC brush to get rid of particulates; and
- Decontaminated Sampling equipment should be rinsed three times using PFAS free water.

7.4 Sample Collection and Handling

The following recommendations should be used for the sample collection:

- Do not insert or let any materials inside the sample bottle;
- Attention should be given such that no dust or fibers will fall into the sample bottle;
- Do not set the lid down during sample collection;
- Off-brand markers should be certified PFAS free prior to use. Alternatively, use a fine point Sharpie® to label the empty sample bottle while in the staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling;
- Use HDPE sample bottles provided by the laboratory, with Teflon-free lids;
- Ballpoint pens may be used for labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory can also be used.
- Use polyethylene plastic bags (e.g., Ziploc®) for bagging samples;
- Samples should be double bagged;
- In the absence of USEPA guidance for sediment samples storage, thermal preservation, and holding times for Method 537 should be used for sediment samples. Samples must be chilled during shipment and must not exceed 10°C during the first 48 hours after collection. Samples stored in the laboratory must be held at or below 6°C until extraction, but should not be frozen (USEPA, 2009); and
- Sediment samples should be extracted as soon as possible but must be extracted within 28 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction (USEPA, 2009).

Note: Method 537 was developed for the analysis for finished drinking water. Method 537 was not designed for sediments, which may have significant interferences. Many labs provide isotope dilution based methods using liquid chromatography with quadrupole mass spectrometry (LC/MS/MS). These methods are similar to EPA Method 537 in the instrumentation but applicable to other matrices such as sediments.

7.5 Sample Shipment

The following recommendations should be used for the sample shipment:

- Do not use chemical or blue ice;
- Use wet ice that is double bagged in Ziploc® storage bags;
- COC should be double bagged in a Ziploc® storage bags and taped to the inside of the cooler lid; and
- The cooler should be taped closed with a custody seal and shipped by overnight courier.

8. Surface Water Sampling

This section discusses processes, decontamination procedures, and acceptable materials for sampling surface water for PFAS. The guidance will supplement surface water sampling Standard Operating Procedures (SOPs), but will not replace them. In addition, this guidance will be used to support the sampling objectives and procedures based on the site-specific sampling analysis plan (SAP) developed prior to any field activities.

Note: Sections 1 through 4 should be reviewed prior to reviewing the Surface Water Sampling guidance (**Section 8**).

Surface water sampling requires the use of non-dedicated equipment, such as stainless steel or glass beakers, dippers, and other specialize surface water sampling equipment (e.g., Kemmerer or Van Dorn samplers), that needs to be decontaminated in order to avoid cross contamination. The non-dedicated equipment has to be certified that it is PFAS free. PFAS has been detected in surface water in Michigan at concentrations of over 19,000 ng/L, and Michigan has promulgated surface water criterion as low as 11 ng/L. Many commercial laboratories have PFAS detection limits below 1 ng/L. Therefore, there is a high possibility of false positives if decontamination procedures are not followed diligently.

This guidance covers both the collection of samples from shallow and deep surface water bodies.

The Surface Water Sampling Guidance discusses the potential for cross-contamination that can occur from:

- Field Clothing and PPE;
- Surface Water Sampling Equipment;
- Equipment Decontamination;
- Shaker Test;
- Filtering of Surface Water;
- Sample Collection and Handling; and
- Sample Shipment.

8.1 Field Clothing and PPE

A general overview of field clothing and PPE can be found in **Section 4.2.2** from the **General PFAS Sampling** Guidance. Depending on the project objectives and SAP the collection of surface water samples could be as simple as a grab sample or complex as a sample collected using a Van Dorn sampler from a boat. For the majority of times approved field clothing discussed in **Section 4.2.2** and Level D protection, as required by the HASP including some type of life jacket, will be used for surface water sampling. Life jackets could be made of materials that contain PFAS. However, life jackets made of PFAS-free materials should be available.

- Life jackets made of polyethylene foam and nylon shell fabric can be used.

Note: Protective coatings that could contain PFAS might still be use in the manufacturing of life jackets.

Any additional field clothing and/or PPE items that might be required for the surface water sampling and are not discussed in the Surface Water Sampling Guidance should be evaluated as described in **Sections 4.2.1** and **4.2.2**.

Powderless nitrile gloves should frequently be changed any time there is an opportunity for cross-contamination during the sampling, including, but not limited to, the following activities:

- Each time sampling equipment is removed or placed in the surface water body (e.g., various surface water samplers, water quality meter, turbidity meter, pump, tubing, bailer, etc.);
- Advancing of the tubing at depth in the surface water;
- Prior to sample collection;
- Handling of any sample, including QA/QC samples such as field reagent blanks or equipment rinsate blanks;
- After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel, and
- During and after decontamination of non-dedicated sampling equipment.

Note: Both the field clothing and PPE should be kept dust and fiber free. During the sample collection extra care should be taken such that no dust or fibers fall into the sample bottle.

8.2 Surface Water Sampling Equipment

As defined in **Section 4**, surface water sampling uses equipment that will come into contact with the surface water (**Category 1**) that may introduce PFAS into the sample and equipment that will not come into direct contact with the sample (**Category 2**). Each category is addressed below.

Category 1: General sampling equipment such as various surface water samplers or tubing that will come into contact with the surface water sample (**Category 1**; **Section 4.2**). Any surface water samplers, tubing, or materials that will come into contact with the surface water samples should be screened and certified as PFAS-free. The tubing should always be kept in the original cardboard or bag in which it was shipped. The tubing should always be stored in a clean location free of dust and fibers.

Note: As a precautionary action an equipment rinsate blank should be collected even if the sampling materials are made of materials that are not expected to contain PFAS.

Category 2: Examples of field equipment that do not come into contact with the surface water samples (**Category 2; Section 4.2**), such as water quality meters, GPS receivers, notebooks, and turbidity meters. The surface of these pieces of field equipment or the storage boxes in which they are kept might contain PFAS.

Do not use any equipment that contains any known fluoropolymers such as, but not limited to the following:

- Polytetrafluoroethylene (PTFE) tradename such as Teflon®;
- Polyvinylidene fluoride (PVDF) tradename such as Kynar®;
- Fluorinated ethylene propylene (FEP) tradename such as Neoflon®;
- Ethylene-tetrafluoro-ethylene (ETFE) tradename such as Tefzel®;
- Do not use low density polyethylene (LDPE);
- Use materials that are either made of HDPE, silicone, or acetate; and
- Post-It Notes® were historically prohibited and should be avoided as the presence or absence of PFAS is currently unknown.

Note: Additional information about notes collection can be found in **Section 4**.

Surface water sampling collection can be divided into two major categories as presented in **Table 4** below.

Table 4 Surface Water Sampling Methods[1]

Depth to Surface Water Sample	Locations	Sampling Method
0-5 ft	Streams, rivers, creeks, tributaries, lakes, lagoons, ponds, and impoundments.	Direct method, swing, telescoping, and Van Dorn samplers.
Up to 21 ft	Large streams, rivers, tributaries, lakes, lagoons, ponds, and impoundments.	Peristaltic pump, swing, telescoping, Van Dorn, Kemmerer, and Bacon Bomb samplers.

[1]This table includes the most frequently used methods for surface water samples.

Note: Depending on the project objectives boats might be required to be used during surface water sampling. Boats might have various parts that may contain PFAS including the protective water repellent coatings. Samples should always be collected on the upgradient side of the boat when used on rivers.

8.2.1 Direct Sampling

For surface water samples collected near the shore (e.g. from streams, rivers, lakes, and other surface waters), the direct method can be used to collect the water samples directly into the sample container.

Note: Unless specifically required by the project objectives, surface water samples should never include the top layer of the water body. PFAS are expected to accumulate at the surface water interface or be present in the surface runoff. The samples will most likely result in high biased results that are not representative of the bulk surface water.

- Do not sample without approved nitrile gloves;
- Sample container and lid should be rinsed with certified PFAS free water at least three times prior to collecting the sample;
- Hands should be well washed; and
- The sample cap should never be placed directly on the ground during sampling.

8.2.2 Container Immersion

Various types of immersion sampling equipment are available for surface water sampling and can be divided in two major categories. The first category includes various types of extension rods that can be used to immerse the actual sample bottle, different types of beakers, or peristaltic pump tubing into the surface water. The second category is made of submersible devices (i.e., Kemmerer Bottle, Van Dorn Sampler, and Bacon Bomb Sampler) that are fully immersed into the surface water using a rope.

8.2.2.1 Extension Rod

The most common extension rods are telescoping or swing samplers. Both types of sampling equipment are very similar in design and concept, which facilitates the immersion of either the sampling bottle or various beakers or scoops. Lists of various extension rod designs are provided below:

- Pendulum or angular beaker;
- Fixed scoop; and
- Fix or rotatable head bottle holder.

A peristaltic pump can also be used with extension rods by attaching the tubing to the extension rods and immersing both the rods and the connected tubing to the desired depth in the surface water.

- Use only sample collection bottles, tubing, beakers, and/or scoop materials that are known to be PFAS-free such as stainless steel, glass, HPDE, PVC, or silicone; and
- Extension rods made of materials, such as aluminum that have been identified as being PFAS-free can be used.

A specialized extension rod which features a telescoping design for the handle could also be used as a subsurface grab sampler. The sample is collected using a cable from the handle which has a ring that can be open for the sample collection after the desired depth has been reached.

8.2.2.1 Submersible Devices

The most common submersible devices being used are Kemmerer Bottle, Van Dorn Sampler, and Bacon Bomb Sampler. These devices are primarily used when the samples are collected at depths greater than 5 ft, from a boat, and/or structure such as a bridge or pier. They are all submerged in the surface water using a rope.

Note: Careful evaluation of all submersible samplers' parts should be done and any parts that might contain PFAS should be replaced with PFAS free materials. Equipment rinsate blank samples should be collected to make certify the sampler PFAS-free.

The Kemmerer Bottle sampler is typically constructed of a stainless steel tube with polyurethane end seals that can collect a total sample volume of 1.2 liters. The Kemmerer Bottle is not ideal for the collection of samples close to the surface, as the tube is immersed vertically in the water.

The Van Dorn Bottle sampler is typically constructed of 1L transparent acrylic tube with two end stoppers. The sampler is suspended horizontally, which is ideal for the sample collection in shallow water bodies as well as sampling at depth.

The Bacon Bomb sampler is typically made of brass and bronze, then nickel plated. The Bacon Bomb sampler can be used to collect a sample at a defined depth. Similar to the Kemmerer Bottle sampler, it is not ideal to be used for the collection of samples close to the surface water as it is suspended vertically. The sample can be activated by the field staff at various depths with the use of a pull line. When the sampler is raised the plunger reseals automatically.

Note: PFAS has been used by the metal plating industry. **An e**quipment rinsate blank sample should be collected in order to certify the Bacon Bomb sampler as PFAS free.

When submersible samplers are used the following recommendations should be followed:

- Do not use a Kemmerer Bottle made of stainless steel with Teflon end seals;
- Use a Kemmerer Bottle made of stainless steel with polyurethane end seals;
- Use a Van Dorn Bottle sampler that uses stoppers made of PFAS free materials;
- Use nylon line, stainless steel cable, or line or wires made of PFAS free materials for sample collection; and
- Use tubing for the sampling ports made of HDPE, PP, silicone, PVC, or other PFC-free materials.

8.3 Equipment Decontamination

Field sampling equipment, either rented or not, that are used at multiple sites or sampling locations, could become highly contaminated with PFAS. If site specific information is available, sampling should be

conducted from the least to the most contaminated locations. Additional guidance on the sampling sequence can be found in **Section 4.3.3**.

The following materials should be used for decontaminating any equipment that contacts the sampling media:

- ● Do not use Decon 90®;
- ▲ Commercially available deionized water available in HDPE containers may be used for decontamination. However, it is recommended that a water sample should be collected to certify that it is PFAS free.
- ▲ Municipal drinking water may be used for decontamination purposes if it is certified to be PFAS free;
- ■ Laboratory certified PFAS-free water should be used for decontamination;
- ■ Alconox®, Liquinox®, and Citranox® can be used for equipment decontamination;
- ■ Sampling equipment can be scrubbed utilizing a polyethylene or PVC brush to get rid of particulates; and
- ■ Decontaminated sampling equipment should be rinsed three times using PFAS free water.

8.4 Shaker Test

Field screening for PFAS using a commercially available anionic surfactant test kit called astkCARE™ is commercially available. However, it can generally only detect PFAS concentrations in the parts per million (ppm) range. At most of the sites PFAS concentrations are found in the low part per billion (ppb) or part per trillion (ppt) range. Currently the commercially available screening test is not recommended to be used for PFAS surface water sampling.

8.5 Filtering of Surface Water

Filtering of the surface water samples is sometimes necessary. PFAS can adsorb to particulate matter, and unfiltered samples may result in high biased results. In order to reduce the need of filtering, samples should be collected with minimal disturbance to sediments as possible.

Note: It is recommended that filtering of the samples should only be performed in the laboratory in order to reduce the possibility of cross contamination.

The filter material should be carefully evaluated. A study between four different filter materials (PTFE, glass, polyethersulfone [PES], and nylon) found that the glass filters adsorbed the least amount of PFAS and nylon adsorbed the most and is not recommended for PFAS sampling (Chandramouli et al., 2015). The following recommendations should be used when considering filtering of the samples:

- ● Do not use any filters that contain any PFAS such as, PTFE ;
- ● Do not use nylon filters;
- ▲ Field filtration of the sample is generally not advised unless specifically requested by a client;
- ▲ If filtering is absolutely necessary, glass filters are recommended to be used; and
- ■ Consider use of a centrifuge in the laboratory to reduce the need for sample filtering.

8.6 Sample Collection and Handling

The following recommendations should be used for the sample collection:

- Do not insert or let the tubing or any materials inside the sample bottle;
- Attention should be given such that no dust or fibers will fall into the sample bottle;
- Do not set the cap down during sample collection;
- Off-brand markers should be certified PFAS free prior to use. Alternatively, use a fine point Sharpie® to label the empty sample bottle while in the staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling;
- Use HDPE sample bottles provided by the laboratory, with Teflon-free caps;
- Ballpoint pen may be used for labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory can also be used.
- Use polyethylene plastic bags (e.g., Ziploc®) for bagging samples;
- Samples should be double bagged;
- In the absence of USEPA guidance for surface water samples storage, thermal preservation, and holding times for Method 537 should be used for groundwater samples. Samples must be chilled during shipment and must not exceed 10°C during the first 48 hours after collection. Samples stored in the laboratory must be held at or below 6°C until extraction, but should not be frozen (USEPA, 2009); and
- Surface water samples should be extracted as soon as possible but must be extracted within 14 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction (USEPA, 2009).

8.7 Sample Shipment

The following recommendations should be used for the sample shipment:

- Do not use chemical or blue ice;
- Use wet ice that is double bagged in Ziploc® storage bags;
- COC should be double bagged in a Ziploc® storage bags and taped to the inside of the cooler lid; and
- The cooler should be taped closed with a custody seal and shipped by overnight courier.

9. Residential Well Sampling

This section discusses processes, decontamination procedures, and acceptable materials used in residential well sampling for PFAS. The guidance is meant to supplement residential well Standard Operating Procedures (SOPs), but not replace them. Also, this guidance will be used to support the sampling objectives and procedures based on the site-specific sampling analysis plan (SAP) developed before starting field activities.

Note: Sections 1 through **4** should be reviewed prior to reviewing the Residential Well Sampling guidance (**Section 9**).

Since residential well sampling may require the use of non-dedicated equipment, such as pumps and tubing, the field equipment must be decontaminated to avoid cross contamination. PFAS has been detected in groundwater in Michigan at concentrations exceeding 1,000,000 ng/L and from residential wells at concentrations over 60,000 ng/L. Michigan has promulgated drinking water criterion of 70 ng/L and many commercial laboratories have PFAS detection limits below one (1) ng/L; therefore, there is a high potential of false positives if decontamination procedures are not followed diligently.

This Residential Well Sampling guidance discusses the potential for cross-contamination that can occur from:

- Field Clothing and PPE;
- Residential Well Sampling Equipment;
- Equipment Decontamination;
- Sample Collection and Handling; and
- Sample Shipment.

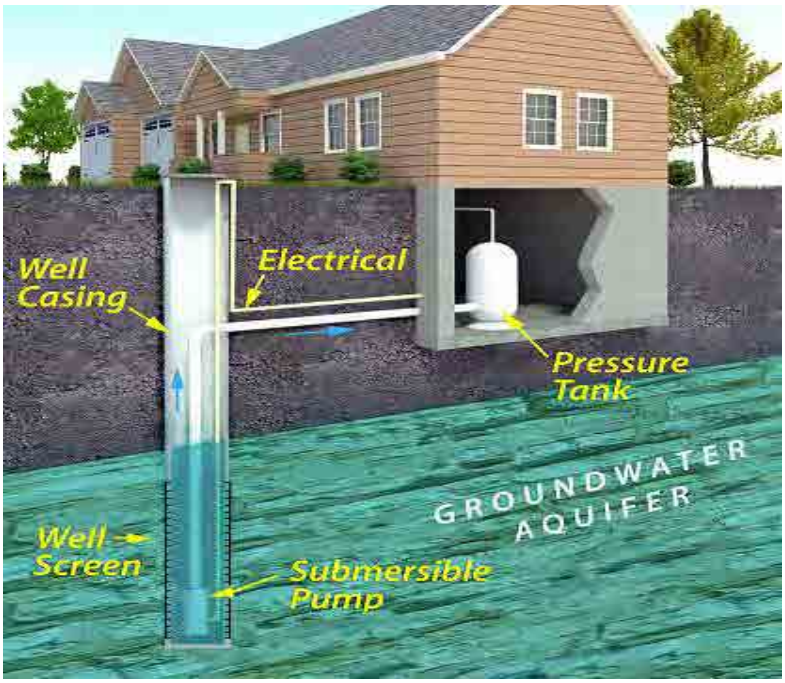
9.1 Typical Well Construction and Sampling Procedures

There are three main types of residential wells. Dug wells are essential hand dug holes created by shovel or backhoe and are typically lined (cased) with stones, brick, tile, or other material to prevent collapse. Dug wells are shallow typically between 5 to 15 feet deep but may be as deep as 30 feet deep. Driven wells use steel casing that is hammered or hydraulically pushed into the ground. Driven wells are also relatively shallow, usually between 30 to 50 feet deep. Drilled wells can either be shallow or as deep as 400 feet or more. Drilled wells typically have metal or some type of plastic casing. Typically wells are equipped with a submersible pump that pulls water from the aquifer into the house. The water is often stored at pressure within a pressure tank for use. The water may or may not be run through filtration or softening systems before distribution to points of use within the home.

Note: The most frequent residential wells that will have to be sampled for PFAS are drilled wells.

A typical residential well configuration is presented in **Figure 1** below**.**

Figure 1. Typical Residential Well



Depending on the project objective there are usually two primary methods for residential well sampling. The specific details of the sampling method will be described in the project specific SAP.

Method 1 – Purge and Stabilize Method: For Method 1 water is collected from a port before treatment systems and as close to the residential well head as possible. For this method, the water in the well is purged for at least 15 minutes generally following the same procedures used for groundwater sampling (**Section 5**). During the well purging, a minimum of three different physical parameters are monitored including temperature, pH and specific conductance. Additional parameters such as dissolved oxygen, oxidation-reduction potential and turbidity may also be recorded. The parameters are monitored and recorded until stabilization is obtained. This procedure attempts to be indicative of aquifer conditions by removing and replacing water from within the pressure tank or well piping with "fresh" water from the aquifer.

Note: For **Method 1** flushing is typically performed for at least 15 minutes until the temperature, pH, and specific conductance will stabilize. Ideally, the final turbidity should be below 10 nephelometric turbidity units (NTU).

Method 2 – Point of Use Method: For Method 2, water is collected before treatment systems and from a location frequently used for water ingestion, such as the kitchen. This method is performed without any significant purging, and no physical parameters are monitored. The objective of this method is to determine the actual concentrations that a resident may be exposed to by consuming the drinking water upon opening the faucet. The sample is typically collected within 1-3 minutes of flushing since residents do not usually flush their taps for an extended period of time before consuming drinking water.

9.1 Field Clothing and PPE

A general overview of field clothing and PPE can be found in **Section 4.2.2** from the **General PFAS Sampling** guidance. This **Residential Well Sampling** guidance assumes that the residential well samples will be collected in an environment where only Level D protection is required by the HASP. Any additional field clothing and/or PPE items that might be necessary for the residential sampling and are not

discussed in this sampling guidance should be evaluated as described in **Sections 4.2.1** and **4.2.2**. The typical residential well sample will be either collected from inside the resident home or an outside spigot. All the necessary guidance on approved screening methods for field clothing and PPE used during the residential well sampling are covered in the **General PFAS Sampling** guidance.

Powderless nitrile gloves should be changed frequently and at any time there is an opportunity for cross-contamination of the sampling, including, but not limited to, the following activities:

- Each time any sampling equipment (e.g., multi-parameter flow-through cell, turbidity meter, pump, tubing, etc.) is handled;
- Before sample collection;
- While handling of any sample, including QA/QC samples, such as field reagent blanks or equipment rinsate blanks;
- After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel; and
- During and after decontamination of non-dedicated sampling equipment.

Note: Both the field clothing and PPE should be kept dust and fiber free. During the sample collection extra care should be taken such that no dust or fibers fall into the sample bottle.

9.2 Residential Well Sampling Equipment

When the Purge and Stabilize Method (**Method 1**) is used for residential well sampling, only a few pieces of sampling equipment, such as flow-through cells and turbidity meters, will be used. However, all of the sampling equipment is considered **Category 2 (Section 4.2)** since it will not come into contact with the actual sample. The residential wells are assumed to have a working pump and piping, and the use of any tubing will only be used for the monitoring of physical parameters.

Even though all of the residential well sampling equipment is considered **Category 2**, with the exception of the certified PFAS free sample bottles, precaution should be taken and only PFAS free sampling materials used if possible. Do not use any equipment that contains any known fluoropolymers such as, but not limited to the following:

- Polytetrafluoroethylene (PTFE) tradename such as Teflon®;
- Polyvinylidene fluoride (PVDF) tradename such as Kynar®;
- Fluorinated ethylene propylene (FEP) tradename such as Neoflon®;
- Ethylene-tetrafluoroethylene (ETFE) tradename such as Tefzel®; and
- Do not use low density polyethylene (LDPE);
- Use materials that are either made of HDPE, silicone, or acetate; and
- Post-It Notes® were historically prohibited and should be avoided as the presence or absence of PFAS is currently unknown.

Note: Additional information about note collection can be found in **Section 4**.

9.3 Equipment Decontamination

The sampling equipment used for the residential well sampling are all **Category 2** and will not come into contact with the actual sample. As a result, no equipment decontamination is needed. As a best practice and precautionary measure, if field staff has site information or reasons to believe that high PFAS concentrations might be present in some residential wells, the **Category 2** sampling equipment should be

decontaminated between each sample collection in order to not carry any PFAS contaminated sampling equipment between locations.

The following materials should be used for decontaminating any equipment that contacts the sampling media:

- ● Do not use Decon 90®;
- ▲ Commercially available deionized water available in HDPE containers may be used for decontamination. However, it is recommended that a water sample be collected to certify that it is PFAS free;
- ▲ Municipal drinking water may be used for decontamination purposes if it is certified to be PFAS free;
- ■ Laboratory certified PFAS free water should be used for decontamination;
- ■ Alconox®, Liquinox®, and Citranox® can be used for equipment decontamination;
- ■ Sampling equipment can be scrubbed utilizing a polyethylene or PVC brush to get rid of particulates; and
- ■ Decontaminated sampling equipment should be rinsed three times using PFAS free water.

9.4 Filtering of Residential Well Samples

Typically residential well samples are not expected to need filtration. (See recommendations presented in **Section 5.5** of the **Groundwater Sampling** guidance).

Note: If filtering of the residential well samples is needed, it should be performed in the laboratory in order to reduce the possibility for cross contamination.

9.5 Sample Collection and Handling

The collection and handling of residential well samples are critical steps during the sampling process as many of the decisions have to be made in the field without prior knowledge of the sampling environment. Cross contamination could be introduced during the sample collection and handling. Careful planning should be done in advance of the sample collection in order to minimize the potential for cross contamination.

Note: Information about the presence of any treatment systems and location of the sampling port should be obtained during the scheduling of the sampling event.

9.5.1 Sampling Port Location

The collection method will be defined in the project specific SAP and will use the following guidance:

Method 1 – Purge and Stabilize Method:

- Samples should always be collected before any treatment system (e.g., granular activated carbon and reverse osmosis), chlorine, or softener, and
- The sample port should be chosen as close as possible to the water source and before the water pipes enter the residence or before any pressurized holding tank, if possible.

Method 2 – Point of Use Method:

- Samples should be collected from the tap that is used the most frequently for water ingestion but before any treatment systems, and
- Swivel faucets or hot and cold mixing faucets with a single lever and leaky or spraying faucets should be avoided.

9.5.2 Sample Collection

The following considerations should be taken during the sample collection:

Note: If the distance between the tap and the bottom of the sink or ground does not allow the sample bottle to be used, a smaller HPDE bottle can be used to transfer the sample to the larger sampling bottle.

- Determine if the sampling tap is protected from exterior contamination and is not too close to the sink bottom or the ground;
- Careful notes should be taken, and the presence of Teflon® tape on the piping should be noted;
- Taps with a constant water flow should be used;
- Sample should be collected from the cold water only;
- Whenever possible, any attachments from the taps, including aerators, screens, washers, hoses, and water filters should be removed;
- The sampling of residential wells in a known PFAS-impacted area should be selected in order from least to most contaminated well;
- Fill the bottle to the neck and never let it overflow;
- Use HDPE sample bottles provided by the laboratory, with Teflon-free caps;

Note: Sampling bottles containing Trizma preservative should only be used on finished drinking water that contains chlorine.

- Attention should be given such that no dust or fibers fall into the sample bottle;
- Never set the cap down, touch any part of the cap that contacts the bottle, or let anything touch the rim of the bottle or inside the cap;
- Care should be given such that no splashed drops of water from the sink or ground enter the sample bottle;
- Markers should be certified PFAS free prior to use. Alternatively, use a fine point Sharpie® to label the empty sample bottle while in the staging area provided the cap is on the sample bottle and gloves are changed following sample bottle labeling;
- Ballpoint pen may be used for labeling sample containers. If ballpoint pens do not write on the sample container labels preprinted labels from the laboratory can also be used.
- Use polyethylene plastic bags (e.g., Ziploc®) for bagging samples;
- Samples should be double bagged;
- In the absence of USEPA guidance for residential well sample storage, thermal preservation, and holding times Method 537 should be used for residential well samples. The Method 537 is intended to be used for finished drinking water samples. Samples must be chilled during shipment and must not exceed 10°C during the first 48 hours after collection. Samples stored in the laboratory must be held at or below 6°C until extraction, but should not be frozen (USEPA, 2009), and

- Residential well samples should be extracted as soon as possible but must be extracted within 14 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction (USEPA, 2009).

9.6 Sample Shipment

The following recommendations should be used for the sample shipment:

- Do not use chemical or blue ice;
- Use wet ice that is double bagged in Ziploc® storage bags;
- COC should be double bagged in a Ziploc® storage bags and taped to the inside of the cooler lid, and
- The cooler should be taped closed with a custody seal and shipped by overnight courier.

10. Deer Sampling

This section discusses processes, decontamination procedures, and acceptable materials for sampling deer for PFAS. This guidance will be used to support the sampling objectives and procedures based on the SAP developed prior to any field activities.

Note: Sections 1 through 4 should be reviewed prior to reviewing the Deer Sampling guidance (**Section 10**).

Limited PFAS biota samples have been collected in Michigan to date with the highest detection concentration of over 9,000 µg/Kg or parts per billion (ppb) in fish filet and over 70,000 µg/Kg in fish liver. PFAS has also been detected in tree swallows and muskrats in Michigan. Michigan has not yet promulgated biota criterion; however, a criterion of 70 ng/L has been established for PFOA/PFOS in groundwater and a surface water criterion of 11 ng/L for PFOS.

10.1 Deer Selection

Deer are known to be fairly mobile and therefore, the sampling sites should be relatively large areas. Prior to sampling, the investigation area should be defined. For statistical reasons the sample size should consist of at least 10 tissue samples from multiple deer and taken from both sexes. It is not recommended that samples be collected from a fawn (<12 months old). Ideally, samples should be collected from yearlings (12-23 month old) which are territorial and stay close to the doe. Sampling yearlings will ensure that all of the deer samples will come from deer that are at least 12 months old and have been exposed to possible PFAS contamination for a year. Samples from deer older than 24 months could also be collected. Ideally, a total of 10 samples from both sexes should be collected from deer without a significant range in the age of the animals.

Samples should only be collected from healthy animals. Tissues should not be collected from deer that exhibit any variations of the normal condition of venison and organs. Any kind of disease alters the physiology of the organisms. Sick animals could be identified prior to shooting by appearances such as; shaggy coat, body mass loss, and/or abnormal behavior. As a result, sampling should only be conducted by experienced hunters, which could distinguish sick animals from healthy ones. Following the shooting during gutting, further evaluation of potential sickness could be identified by abnormal organ size, shape, or color of organs, deposits at organs, increased body fluids, abnormal smell, or extreme ectoparasite and endoparasite infestations. Ectoparasite infestation is a parasitic conditions that is caused by various organisms that live primarily on the surface of the deer and can occur as a result of ticks, lice, fleas, keds, or ear mites. Endoparasite infestation occurs when various organism live inside the deer and common examples includes the presence of round worms, tapeworms, flat worms, and protozoan parasites.

Note: No tissue samples should be collected from non-healthy animals.

10.2 Field Clothing and Personal Protective Equipment (PPE)

While preparing for hunting and sampling deer, be particularly cautious of hunting clothing that has been advertised as having waterproof, water-repellant, or stain resistant characteristics as these properties may actually reflect the use of PFAS in the manufacture of these articles. If there is any question if the material contains PFAS, consult with a PFAS Technical Expert or an analytical chemist with PFAS experience prior to using the item within the sampling environment. An equipment blank may be required prior to using any PPE or equipment in the field.

For products that are not known to contain PFAS, use precaution and do not come into contact with the actual sample. If questionable, these items should be removed from the immediate sampling environment or evaluated carefully to determine if the specific item could be a source of cross-contamination by collecting an equipment blank (See **Section 10.3** for additional information).

Elimination of certain materials, clothing, or hunting equipment during deer hunting may not be possible. For example, not using insect-repellants (which can contain PFAS) can pose a health and safety hazard given the prevalence of biologic hazards (e.g., ticks). The safety of the hunter should not be compromised; therefore, testing the equipment and clothes prior to the sampling event is recommended. See Section 10.3 for information on confirming the presence or absence of PFAS.

If the equipment and PPE is not acceptable, alternatives are provided below:

- Field personnel may tuck pant legs into socks and/or boots and use brand name duct tape to seal the gap between the boots and the pants to reduce the risk of being bitten by ticks.
- Light-colored shirts and pants (well washed cotton overalls) may be worn to easily identify ticks during field activities.
- Light-colored clothing, long sleeves, and large-brimmed hats may also be worn to prevent sunburn.
- Additional details pertaining to acceptable personal care products (e.g., sunscreen, insect repellants) are available in **Section 4.2.3**.

Clothing materials that must be evaluated prior to wearing within the immediate sampling environment include water-resistant, waterproof, or stain-treated clothing. Clothing materials that should be avoided (●) in the immediate sampling environment include the following:

- Any known fluoropolymers that contain PFAS such as but not limited to Polytetrafluoroethylene (PTFE known as Teflon®), Polyvinylidene fluoride (PVDF), Polyvinyl fluoride (PVF), and Fluorinated ethylene propylene (FEP) or Perfluoropolyethers (PFPEs);
- Clothing or boots containing Gore-Tex® ;
- Clothing that has been washed with fabric softener may contain PFAS, and
- Chemically treated clothing for insect resistance and ultraviolet (UV) protection.

Clothing materials that are acceptable to wear within the immediate sampling environment include the following:

- PVC or wax-coated fabrics;
- Neoprene;
- Synthetic and natural fibers (preferably cotton);
- Any boots made with polyurethane and PVC;
- Well laundered clothes (several times from time of purchase), and
- Well washed cotton coveralls (washed several times).

10.3 Equipment Blanks

Since the field equipment and PPE for deer hunting and sampling is different from the PPE used for environmental media, such as soil, sediment, and groundwater, additional information on equipment blanks is provided.

An equipment rinsate blank is defined as a sample that is obtained by running PFAS-free water over the sample material (knifes, sample bags, etc.) after decontamination and placing it in the appropriate sample container for analysis. These samples can also be used to determine if decontamination procedures have been sufficient.

An equipment rinsate blank should also be collected for each item proposed to for use in the sampling environment that is questionable or where the presence or absence of PFAS was not previously documented.

An equipment rinsate blank should be collected prior to use of insect repellents and sunscreens that are not listed under the acceptable materials. Spray and/or cream can be applied on a piece of approved field clothing (cotton fabric that has not been washed with a fabric softener and is not advertised as water or stain resistant) that will be used in the sampling environment. To collect an equipment blank sample certified PFAS-free or deionized water should be poured over the field clothing.

10.4 Sample Containers and Handling

Project-specific objectives such as the complete list of biota tissues (e.g., muscles and various organs) and complete list of PFAS analysis should be defined and established prior to sample collection. Any sampling containers should be able to withstand temperatures as low as -20^{0}C. A list of unacceptable and acceptable sampling containers can be found below.

- Sampling containers and bags that are known to use PFAS during manufacturing or are fluoropolymers such as, but not limited to, polytetrafluoroethylene (PTFE known as Teflon®), polyvinylidene fluoride (PVDF), polyvinyl fluoride (PVF), or fluorinated ethylene propylene (FEP) should not be used during sampling for any purposes and especially tissue collection.
- Markers of any type should not be used in the immediate vicinity of the PFAS sample collection environment with the exception of fine point Sharpies. Plastic clipboards, binders, or spiral hard cover notebooks should not be used especially if they have been advertised as water-proof such as Rite in the Rain®.
- Some sampling guidance documents allow the use of aluminum foil as long as the shiny side is placed away from the tissue sample. Some laboratories with long PFAS experience have allowed the use of amber glass jars and caps that do not contain any Teflon® lining. As a sign of caution, AECOM recommends that neither aluminum foil nor amber glass jars be used unless equipment blank samples confirm that they are PFAS-free. Aluminum foil or containers were historically prohibited and should be avoided as the presence or absence of PFAS is currently unknown.
- ▲ Off-brand markers should be evaluated prior to use.
- ■ Polyethylene plastic freezer bags (e.g. Ziploc® bags) should be used to store any biota tissue samples.
- ■ Powderless nitrile gloves should be used when handling biota samples, QA/QC samples including field blanks and equipment blanks, handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.
- ■ A ballpoint pen should be used for labeling sample containers, field notes, and preparing chains of custody (COC). Preprinted labels could also be used. A fine point Sharpie can be used to label the empty sampling bags while in the staging area. Nitrile gloves should be used and changed following sample bag labeling.
- ■ Notes should be taken on loose paper that is kept in aluminum clipboards.

10.5 Equipment Decontamination

Hunting and sampling equipment that will not come in contact with the tissue samples do not need to be decontaminated. Best practices should be used in order to keep the equipment clean. Any other equipment such as measuring boards, knifes, or any other equipment required for the sampling that comes into contact with the sampled tissue should be decontaminated. If possible, it is recommended that PFAS-free disposable equipment be used. However, when re-use of field sampling equipment is required, decontamination should be performed between each use. Use of PFAS-free certified water provided by an analytical laboratory should be used for decontamination of sampling equipment. Prior to use, all of the equipment should be decontaminated. A list of unacceptable and acceptable materials can be found below.

- Decon 90™ has been analyzed by AECOM and shown to contain PFAS and should not be used.
- AECOM has analyzed various deionized water sold in HDPE containers and found it to be PFAS-free. If laboratory-supplied PFAS-free certified water is not available, deionized water sold in HDPE containers can be used. The deionized water should be sampled prior to use for decontamination in order to confirm that it is PFAS-free.
- Alconox, Liquinox, Citronox, or methanol are acceptable for decontamination. AECOM has analyzed Liquinox and shown it not to contain PFAS.
- Equipment used for sampling should be decontaminated with a solution of Alconox, Liquinox, and Citronox with certified PFAS-free water or deionized water. The sampling equipment should be scrubbed using a polyethylene or PVC plastic scrub brush.
- Decontaminated equipment should be triple rinsed with certified PFAS-free water or deionized water that has been determined to be PFAS-free.

10.6 Sample Collection

All of the biota sample descriptions should be documented using the *Deer Biometric Sample Description* field form. Information about each deer sampled (a minimum of 20g) should include, but not limited to:

- Location of the sample;
- Date and time of the harvested deer;
- Documentation that identifies the animal (e.g. permit tag);
- Position of the bullet/broadhead entry hole, exit wound, and bullet/broadhead type;
- Sex of the animal, and
- Health description of the animal.

During sample collection extreme attention should be given in order to avoid (as much as possible) cross-contamination from other sampling equipment, hair, plants, soil particles, etc. The sampling should occur in the following sequence:

1) After the fatal shot, the deer should be gutted as soon as possible.

2) The tissue collection such as the meat or organs should be collected from uninjured parts of the deer. Hands must be washed prior to commencing the sampling event and clean, powderless, nitrile gloves must be worn before handling sample bags and equipment. Keep the sample bags sealed at all times and only open during sample collection. The tissue samples should be placed in the sampling bags immediately after the collection. In the event that the sample collection has to be performed at an approved sample collection location, the whole corpse should be

immediately transported to the collection location, where the sampled tissues will be removed and placed in the sampling bags.

3) The tissue samples should be placed on ice immediately and should be frozen (< -15^{0}C) in the sampling bag within 24 hours of the kill. Samples should be kept frozen until the analysis.

4) The *Deer Biometric Sample Description* form should be completed with the sample description immediately after the sample collection.

5) During the sampling all of the information about weight, health status, and possible infestation should be documented in the *Deer Biometric Sample Description* form.

10.7 Sample Shipment

The tissue samples should be packed and shipped to ensure that they remain frozen until they reach the laboratory for analysis. The completed and relinquished COC form should be double bagged in a Ziploc® storage bag and taped to the inside of the cooler lid. The cooler should be taped closed with a custody seal and shipped by overnight courier to the appropriately accredited PFAS laboratory.

11. Fish Sampling

This section discusses processes, decontamination procedures, and acceptable materials for PFAS sampling of fish. The guidance will supplement any fish sampling Standard Operating Procedures (SOPs), but will not replace them. Also, this guidance will be used to support the sampling objectives and procedures based on the site-specific sampling analysis plan (SAP) developed before any field activities.

Note: Sections 1 through **4** should be reviewed prior to reviewing the Fish Sampling guidance (**Section 11**).

Limited PFAS biota samples have been collected in Michigan to date with the highest detection concentration of over 9,000 µg/Kg or parts per billion (ppb) in fish filet and over 70,000 µg/Kg in fish liver. PFAS in tree swallows and muskrats have also been detected in Michigan. Michigan Fish Consumption Screening Value (FCSV) advisories range for perfluorooctane sulfonic acid (PFOS) between 9 ppb (16 meals per month category) up to 300 ppb (Do Not Eat) (MDHHS, 2016). Michigan has promulgated a criterion of 70 ng/L for PFOA/PFOS in groundwater and a surface water criterion of 11 ng/L for PFOS.

11.1 Fish Selection

Depending on the sampled surface water body and project objectives, the collection of several different fish species for PFAS analysis can be performed. Some PFAS, such as PFOS, are known to bioaccumulate in fish. PFAS samples can be collected from two main fish categories non-migratory and migratory fish.

One of the exposure routes for PFAS is through the ingestion of fish that live in PFAS-contaminated surface water bodies. Fish samples are collected as part of consumption monitoring programs to evaluate the necessity of possible fish advisories due to PFAS contamination. Most of the fish are fairly mobile and environmental ecosystems are very complex; therefore, for statistical reasons, the sample size should consist of at least ten tissue samples from multiple fish including both sexes. In several studies where a large number of fish samples were collected, there was no strong correlation between PFAS concentrations and fish length. Also, PFAS are proteinphilic (binds to proteins) and not lipophilic (they do not bind to the fat or lipids), therefore, the results cannot be normalized using the lipid percentage (%) as is routinely performed for other legacy organic and inorganic contaminants such as polychlorinated biphenyls (PCBs) or mercury.

Note: No tissue samples should be collected from non-healthy fish.

Fish samples should only be collected from healthy fish. Fish with abnormal deformities and evident health issues should not be sampled.

11.2 Field Clothing and PPE

A general overview of field clothing and PPE can be found in **Section 4.2.2** from the **General PFAS Sampling** guidance. While preparing for fishing and sampling fish, be particularly cautious of fishing clothing that has been advertised as having waterproof, water-repellant, or stain resistant characteristics as these properties may reflect the use of PFAS in the manufacture of these articles. Consult with a PFAS technical expert if there are any questions about a material if it contains PFAS or not, prior to using the item in question. An equipment rinsate blank may be required before using any field clothing or PPE in the field (See **Section 4.5** for additional information on collecting rinsate samples).

Note: Assuring that all of the field clothing and PPE are made of PFAS free materials is considered precautionary. However, these items are not expected to come into contact with the actual fish samples.

Some life jackets will have to be used during fish sampling when accessing freshwater bodies. Life jackets made of PFAS-free materials should be available. Sometimes the field staff will have to enter the surface water to sample the fish; waders will have to be used.

Note: Protective coatings that could contain PFAS might still be use in the manufacturing of life jackets or waders.

Elimination of certain materials, clothing, or fishing equipment during fish sampling may not be possible. The safety of the field staff should not be compromised.

Clothing materials that should be avoided in the immediate sampling environment include the following:

- Any known fluoropolymers that contain PFAS such as but not limited to Polytetrafluoroethylene (PTFE known as Teflon®), Polyvinylidene fluoride (PVDF), Polyvinyl fluoride (PVF), and Fluorinated ethylene propylene (FEP) or Perfluoropolyethers (PFPEs);
- Clothing or boots containing Gore-Tex® ;
- Clothing washed with fabric softener may contain PFAS, and
- Chemically treated clothing for insect resistance and ultraviolet (UV) protection.

Clothing materials that are acceptable to wear within the immediate sampling environment include the following:

- Life jackets made of polyethylene foam and nylon shell fabric can be used.
- Waders made of PVC or neoprene can be used.
- PVC or wax-coated fabrics;
- Neoprene;
- Synthetic and natural fibers (preferably cotton);
- Any boots made of polyurethane and PVC, and
- Well laundered clothes (several times from time of purchase).

11.3 Fish Sampling Equipment

Fish sampling uses equipment that will come into contact with the fish (**Category 1**) that may introduce PFAS into the sample and equipment that will not come into direct contact with the sample (**Category 2**). Each category is addressed below and further explained in **Section 4.**

Category 1: General sampling equipment, such as various knives, sample bag, or processing boards that will come into contact with the fish sample (**Category 1**; **Section 4.2**). Fish samples are collected as skin-off fillet (SFF) since that is the edible part of the fish most often consumed. For SFF samples, the only equipment that will come into contact with the sample are knives and sample bags, as the measuring and weighting of the fish will be performed prior to the sample collection.

Note: As a precautionary action an equipment rinsate blank should be collected even if the sampling materials are made of materials that are not expected to contain PFAS.

When fish samples are collected with the skin on, a larger number of sampling materials might come into contact with the sample. The most important field sampling equipment, in this case, are the processing board, weight scale, knives, sample bags, and measuring boards. However, all of this sampling equipment should be available as PFAS free materials, such as polypropylene or stainless steel. As a

precautionary step, any sampling equipment or materials that will come into contact with the fish samples should be screened and certified as PFAS free.

Category 2: Examples of field equipment that do not come into contact with the fish samples (**Category 2; Section 4.2**), such as the boat, electrofishers, GPS receivers, notebooks, and other sampling equipment used to collect or document the sampling. Approved nitrile gloves should be used whenever any **Category 2** sampling equipment will be used. Frequent change of the gloves should be protective enough to avoid any cross contamination from **Category 2** sampling equipment items.

Note: As precaution, **Category 2** sampling equipment used should be certified PFAS free. Dedicated field staff to only handle the samples could also reduce the potential for cross contamination.

Note: Field equipment such as fish nets, processing boards, or any sampling equipment that would come into contact with the fish skin might be considered **Category 1,** if the samples are analyzed as skin on whole fish or fillets. However, if samples are not analyzed with the skin on the sampling equipment is considered **Category 2**.

11.4 Collection Methods

Fish sampling methods can be divided into two major categories which include active collection and passive collection methods. Active methods are defined as having a team physically collecting the samples, as opposed to a passive method where a team will set up traps or nets and then collect the fish samples.

11.4.1 Active Collection Methods

One of the most frequently used active sampling methods is electrofishing, which uses electricity. Electrofishing enables the field staff to collect fish from various surface water bodies using different equipment such as a backpack, barge, or boat electrofishers, depending on accessibility and depth. Trawls, dredges, surrounding nets, or cast nests can also be used for fish sampling.

11.4.2 Passive Collection Methods

The passive collection methods include entanglement, entrapment, and angling. Passive collection methods are sampling techniques that do not involve the movement of the sampling equipment to collect fish. The sampling equipment is usually anchored and stationary allowing the fish to move into them.

Entanglement sampling equipment includes gill and trammel nets. Entrapment sampling equipment includes hoop nets, fyke nets, and traps such as slat traps and crab pots. Angling with a hook and line such as trotlines can also be used to capture or supplement other sampling methods.

Note: Even if either active or passive collection methods are used, the majority of the sampling equipment used for either active or passive collection methods are considered **Category 2**. Only in the case of fish samples with skin on, some of the sampling materials will be considered **Category 1**. A careful rinse using ambient surface water first followed by certified PFAS free water should be performed in order to reduce possible cross contamination. PFAS free materials should be used if available.

11.5 Equipment Rinsate Blanks

Since the field equipment and PPE for fish sampling are different from the PPE used for environmental media, such as soil, sediment, and groundwater, additional information on equipment rinsate blanks is provided.

An equipment rinsate blank is defined as a sample that is obtained by running PFAS-free water over the sample material (knifes, sample bags, etc.) after decontamination and placing it in the appropriate sample container for analysis. These samples can also be used to determine if decontamination procedures have been sufficient.

An equipment rinsate blank should also be collected for each item proposed for use in the sampling environment that is questionable or where the presence or absence of PFAS was not previously documented.

An equipment rinsate blank should be collected before use of insect repellents and sunscreens that are not listed under the acceptable materials. Spray and/or cream can be applied on a piece of approved field clothing (cotton fabric that has not been washed with a fabric softener and is not advertised as water or stain resistant) that will be used in the sampling environment. To collect an equipment rinsate blank sample certified PFAS free or deionized water should be poured over the field clothing. Additional information can be found in **Section 4**.

11.6 Sample Collection and Handling

Project-specific objectives such as the complete list of biota tissues (e.g., fillets and various organs) and a complete list of PFAS analysis should be defined and established before sample collection. Any sampling containers should be able to withstand temperatures as low as -20^{0}C. A list of unacceptable and acceptable sampling containers can be found below.

- Sampling containers and bags that are known to use PFAS during manufacturing or are fluoropolymers such as, but not limited to, polytetrafluoroethylene (PTFE known as Teflon®), polyvinylidene fluoride (PVDF), polyvinyl fluoride (PVF), or fluorinated ethylene propylene (FEP) should not be used during sampling for any purposes and especially tissue collection.

- Markers of any type should not be used in the immediate vicinity of the PFAS sample collection environment with the exception of fine point Sharpies. Plastic clipboards, binders, or spiral hardcover notebooks should not be used, and especially if they have been advertised as water-proof such as Rite in the Rain®.

- Some sampling guidance documents allow the use of aluminum foil as long as the shiny side is placed away from the tissue sample. Some laboratories with long PFAS experience have allowed the use of amber glass jars and caps that do not contain any Teflon® lining. As a sign of caution, AECOM recommends that neither aluminum foil nor amber glass jars be used unless equipment blank samples confirm that they are PFAS free. Aluminum foil or containers were historically prohibited and should be avoided as the presence or absence of PFAS is currently unknown.

- All markers should be evaluated before use. As noted above, fine point Sharpies have been approved for use in PFAS sampling activities.

- Polyethylene plastic freezer bags (e.g., Ziploc® bags) should be used to store any biota tissue samples.

- Powderless nitrile gloves should be used when handling biota samples, QA/QC samples including field blanks and equipment blanks, handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.

- A ballpoint pen should be used for labeling sample containers, field notes, and preparing chains of custody (COC). Preprinted labels can also be used. A fine point Sharpie can be used to label the empty sampling bags while in the staging area. Nitrile gloves should be used and changed following sample bag labeling.

- Notes should be taken on loose paper that is kept in aluminum clipboards.

All of the biota sample descriptions should be documented on the field forms. Information about each fish sample (a minimum of 20g of fish fillet, or as specified in the SAP) should include, but not limited to:

- Location of the sample;
- Date and time of the sample collected;
- Length and total mass of the fish (mass of the organs should be recorded if sampled);
- Sex of the fish, and
- Health description and photos of the fish.

The sampling should occur in the following sequence:

6) After the fish are caught, the selected individuals of the target species should be rinsed in ambient surface water to remove any foreign materials, sediment, or plants.
7) Fish should be rinsed with certified PFAS free water before sample collection.
8) The tissue collection such as the fillets and/or organs (as specified in the project specific SAP) should be collected from healthy uninjured fish. Hands must be washed before commencing the sampling event, and clean, powderless, nitrile gloves must be worn before handling sample bags and equipment. Keep the sample bags sealed at all times and only open during sample collection.
9) The tissue samples should be placed on dry ice immediately and should be kept frozen (< -20^{0}C) in the sampling bag within 24 hours of the collection. Samples should be kept frozen until the analysis.

11.7 Sample Shipment

The dry ice should be packed and shipped to ensure that they remain frozen until they reach the laboratory for analysis. The completed and relinquished COC form should be double bagged in a Ziploc® storage bag and taped to the inside of the cooler lid. The cooler should be taped closed with a custody seal and shipped by overnight courier to the appropriately accredited PFAS laboratory.

Note: Shipment of dry ice requires special shipping training and labels. Please make sure that shipment of the samples will be performed in accordance with all applicable state and federal regulations.

11.8 Equipment Decontamination

Hunting and sampling equipment that will not come in contact with the tissue samples does not need to be decontaminated. Best practices should be used to keep the equipment clean. Any other equipment such as measuring boards, knives, or any other equipment required for the sampling that comes into contact with the sampled tissue should be decontaminated. If possible, it is recommended that PFAS free disposable equipment is used. However, when re-use of field sampling equipment is required, decontamination should be performed between each use. Use of PFAS free certified water certified by an analytical laboratory should be used for decontamination of sampling equipment. Before use, all of the equipment should be decontaminated. A list of unacceptable and acceptable cleaning materials can be found below.

- Decon 90™ has been analyzed by AECOM and shown to contain PFAS and should not be used.
- AECOM has analyzed various deionized water sold in HDPE containers and found it to be PFAS free. If laboratory-supplied PFAS free certified water is not available, deionized water sold in HDPE containers can be used. The deionized water should be sampled before use for decontamination to confirm that it is PFAS-free.
- Alconox, Liquinox, Citronox, or methanol are acceptable for decontamination. AECOM has analyzed Liquinox and shown it not to contain PFAS.

- Equipment used for sampling should be decontaminated with a solution of Alconox, Liquinox, and Citronox with certified PFAS free water or deionized water. The sampling equipment should be scrubbed using polyethylene or PVC plastic scrub brush.

- Decontaminated equipment should be triple rinsed with certified PFAS free water or deionized water that has been determined to be PFAS free.

12. Wastewater Sampling

This section discusses processes, decontamination procedures, and acceptable materials for sampling wastewater for PFAS. The guidance will supplement wastewater sampling Standard Operating Procedures (SOPs), but will not replace them. In addition, this guidance will be used to support the sampling objectives and procedures based on the site-specific sampling analysis plan (SAP) developed prior to any field activities.

Note: Sections 1 through 4 should be reviewed prior to reviewing this Wastewater Sampling guidance (**Section 12**).

Wastewater sampling requires the use of non-dedicated) equipment (i.e., equipment used for sampling of multiple locations), such as stainless steel or glass beakers and dippers, which must be decontaminated prior to first use and between samples in order to avoid cross contamination. Any disposable equipment must be certified that it is PFAS free. PFAS has been detected in wastewater samples from Michigan wastewater treatment plants (WWTPs) in concentrations of over 5,500 ng/L, and Michigan has promulgated wastewater criteria for PFAS as low as 11 ng/L. Many commercial laboratories have PFAS detection limits below 1 ng/L. Therefore, there is a high possibility of false positives if decontamination procedures are not followed diligently.

This guidance covers the collection of various wastewater samples related to municipal and industrial WWTPs, construction site run-off, storm water run-off, and landfills (i.e., leachate).

The Wastewater Sampling Guidance discusses the methods to prevent cross-contamination that can occur from:

- Field clothing and PPE;
- Wastewater sampling equipment;
- Equipment decontamination;
- Filtering of wastewater;
- Sample collection and handling; and
- Sample shipment.

12.1 Field Clothing and PPE

A general overview of field clothing and PPE can be found in **Section 4.2.2** from the **General PFAS Sampling** Guidance. Depending on the project objectives defined in the SAP the collection of wastewater samples could be as simple as a grab sample or as complex as collecting a sample using an automatic instrument (e.g., discrete and fixed or portable automatic samplers). Most wastewater sampling events call for approved field clothing discussed in **Section 4.2.2 (**Level D protection) or as required by the HASP. Any additional field clothing and/or PPE items that might be required for wastewater sampling and not discussed in **Section 4.2.2** should be evaluated as described in **Sections 4.2.1**.

Powderless nitrile gloves should be changed any time there is an opportunity for cross-contamination during the sampling, including, but not limited to, the following activities:

- Each time sampling equipment is removed or placed in the wastewater body (e.g., various wastewater samplers, water quality meter, turbidity meter, pump, tubing, etc.);
- Advancing of the tubing at depth in the wastewater;
- Prior to sample collection;
- Handling of any sample, including QA/QC samples such

Note: Both the field clothing and PPE should be kept dust and fiber free. During the sample collection extra care should be taken such that no dust or fibers fall into the sample bottle.

as field reagent blanks or equipment rinsate blanks;

– After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel, and

– After decontamination of sampling equipment.

12.2 Wastewater Sampling Equipment

Wastewater sampling equipment should be comprised of materials defined in **Section 4** as **Category 1** and **Category 2**. Materials that will come into contact with the wastewater are defined as **Category 1** and materials that are not expected to come into contact with the wastewater are defined as **Category 2**. Each category is addressed below.

Category 1: Any wastewater samplers, tubing, or materials that will come into contact with the wastewater samples should be screened and certified as PFAS-free. The tubing should always be kept in the original cardboard container or bag in which it was shipped. The tubing should always be stored in a clean location free of dust.

Note: As a precautionary action an equipment rinsate blank could be collected for **Category 1** materials even if the sampling materials are made of materials that are not expected to contain PFAS.

Category 2: Examples of field equipment that does not come into contact with the wastewater samples include water quality meters, turbidity meters (with the exception of the probes associated with this equipment), GPS receivers, and notebooks. The surfaces of this field equipment or the storage boxes in which it is kept might contain PFAS.

Do not use any equipment that contains any known fluoropolymers including, but not limited to, the following:

- Polytetrafluoroethylene (PTFE) tradename such as Teflon®;
- Polyvinylidene fluoride (PVDF) tradename such as Kynar®;
- Fluorinated ethylene propylene (FEP) tradename such as Neoflon®;
- Ethylene-tetrafluoro-ethylene (ETFE) tradename such as Tefzel®; and
- Low density polyethylene (LDPE).

The following materials are acceptable for use:

- High density polyethylene (HDPE);
- Silicone;
- Polyvinyl cloride (PVC); and
- Acetate.
- ▲ Post-It Notes® were historically prohibited and should be avoided as the presence or absence of PFAS is currently unknown.

Note: Additional information about notes collection can be found in **Section 4**.

Wastewater sample collection can be divided into two major categories: grab and automatic composite sampling.

12.3 Sampling Methods

Wastewater sampling collection can be divided into two methods: grab and automatic portable or fixed sampling.

12.3.1 Grab Sampling

Grab sampling is used to collect wastewater samples from locations that are easily accessible (e.g, WWTP effluents) directly into the sample container.

The following guidance should be followed when collecting grab samples:

Note: Be aware that PFAS are expected to accumulate at the air water interface. Unless specifically required in the SAP, it may not be advisable to collect samples from the very top layer of any wastewater.

- Do not sample without approved powderless nitrile gloves.
- Sample container and lid should be rinsed with certified PFAS free water at least three times prior to collecting the sample.
- Hands should be well washed.
- The sample cap should never be placed directly on the ground during sampling.
- Cable ties used to secure the sample bottle should be made of natural rubber or nylon (e.g. Zip-Ties).

Various types of immersion sampling equipment are available for wastewater sampling such as different types of extension rods that can be used to immerse the laboratory sample bottle, different types of beakers, and peristaltic pumps with tubing that extends into the wastewater.

The most common extension rods are telescoping or swing samplers. Both types of sampling equipment are similar in design and concept; the rods facilitate the immersion of either the sampling bottle, beaker, or scoop. Lists of various extension rod designs are provided below:

- Pendulum or angular beaker;
- Fixed scoop; and
- Fixed or rotatable head bottle holder.

A peristaltic pump can also be used with extension rods by attaching the tubing to the extension rods and immersing both the rod and the connected tubing to the desired depth in the wastewater.

- Use only sample collection bottles, tubing, beakers, and/or scoop materials that are known to be PFAS-free such as stainless steel, glass, HPDE, PVC, or silicone.
- Extension rods made of materials such as aluminum that have been identified as being PFAS-free can be used.

A specialized extension rod which features a telescoping design for the handle could also be used to collect wastewater samples from deeper locations, such as manholes. The sample is collected using a cable from the handle which has a ring that can be opened for the sample collection after the desired depth has been reached.

12.3.2 Automatic Sampling

Automatic sampling equipment is used to collect either composite samples during a defined time interval or discrete samples at a defined times without the constant presence of a technician.

Typical automatic sampling equipment includes:

- A strainer used to strain large solids and avoid plugging of the equipment; the strainer is typically weighted to keep the suction line (i.e., tubing) at the desired depth and location;
- Suction line made of a flexible tubing that is run through the peristaltic pump;
- Distribution nozzle made of a flexible tubing that discharges the sample into the sample bottle; and
- Sample bottle which is used for the sample collection.

Note: The strainer should be decontaminated or replaced between each sampling event. The suction line, distribution nozzle and sample bottle should always be replaced between each sampling event.

The materials described above are **Category 1**; the materials will come into contact with the wastewater sample and the following recommendations should be followed:

- Do not use any materials that are known to contain PFAS.
- Use stainless-steel couplings.
- Use sampling materials (i.e., sample bottle, tubing, strainer, etc.) made of HDPE, PP, silicone, PVC, or other PFC-free materials.

12.4 Equipment Decontamination

It is recommended that disposable **Category 1** sampling equipment be used if possible, especially for sample bottles and tubing that are used in automatic samplers where the wastewater sample may be in contact with the sampling equipment for an extended period of time. Field sampling equipment, either rented or not, that is used at multiple sites or sampling locations, could become highly contaminated with PFAS. If site specific information is available, sampling should be conducted from the least to the most contaminated locations. Additional guidance on the sampling sequence can be found in **Section 4.3.3**.

For non-dedicated **Category 1** sampling equipment, the following materials and procedures should be used for decontamination:

- Do not use Decon 90®.
- Commercially available deionized water available in HDPE containers may be used for decontamination. However, it is recommended that a water sample should be collected to certify that it is PFAS-free.
- Municipal drinking water may be used for decontamination purposes if it is certified to be PFAS-free.
- Laboratory certified PFAS-free water is preferred for decontamination.
- Alconox®, Liquinox®, and Citranox® can be used for equipment decontamination.
- Sampling equipment can be scrubbed utilizing a polyethylene or PVC brush to remove particulates.
- Decontaminated sampling equipment should be rinsed three times using PFAS-free water.

12.5 Filtering of Wastewater

Filtering of wastewater samples may be necessary to remove suspended solids and particulates prior to analysis. PFAS can adsorb to particulate matter, and unfiltered samples may result in high biased results. In order to reduce the need for filtering, samples should be collected to minimize the presence of particulate solids.

Note: It is recommended that sample filtration should be performed in the laboratory to reduce the possibility of cross contamination.

The filter material should be carefully evaluated. A study between

four different filter materials (PTFE, glass, polyethersulfone [PES], and nylon) found that the glass filters adsorbed the least amount of PFAS and nylon adsorbed the most and is not recommended for PFAS sampling (Chandramouli et al., 2015). The following recommendations should be used when considering filtering of the samples:

- Do not use any filters that contain any PFAS, such as PTFE .
- Do not use nylon filters.
- Field filtration of the sample is generally not advised.
- If filtering is absolutely necessary, glass filters are recommended.
- Consider use of a centrifuge in the laboratory to reduce the need for sample filtration.

Note: In order to better understand PFAS sources and partition in the wastewater, the sampling of both total and aqueous concentrations of PFAS will have to be performed. Depending on the SAP the filtering might be performed in the field or in the lab.

12.6 Sample Collection and Handling

The following recommendations should be used for sample collection:

- Attention should be given such that no dust or fibers find their way into the sample bottle.
- Do not set the cap down during sample collection.
- Off-brand markers should be certified PFAS free prior to use. Alternatively, use a fine point Sharpie® to label the empty sample bottle while in the staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling.
- Use HDPE sample bottles provided by the laboratory, with Teflon-free caps.
- Commercialy bought sample bottles used for the automatic sampling equipment should be decontaminated prior to sampling and equipment blank samples should be collected using laboratory certified PFAS-free water.
- Ballpoint pen may be used for labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory can also be used.
- Use polyethylene plastic bags (e.g., Ziploc®) for bagging samples.
- Samples should be double bagged.
- In the absence of USEPA guidance for wastewater sample storage, thermal preservation, and holding times for USEPA Method 537 should be used for wastewater samples. Samples must be chilled during shipment and must not exceed 10°C during the first 48 hours after collection. Samples stored in the laboratory must be held at or below 6°C until extraction, but should not be frozen (USEPA, 2009).
- Wastewater samples should be extracted as soon as possible but must be extracted within 14 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction (USEPA, 2009).

12.7 Sample Shipment

The following recommendations should be used for the sample shipment:

- Do not use chemical or blue ice.
- Use wet ice that is double bagged in Ziploc® storage bags.
- COC should be double bagged in a Ziploc® storage bag and taped to the inside of the cooler lid.
- The cooler should be taped closed with a custody seal and shipped by overnight courier.

13. Surface Water Foam Sampling

This section discusses processes, procedures, and acceptable materials used in sampling surface water foam (SW Foam) for PFAS. There are no known SOPs for SW Foam sampling at this time, so this guidance will be used to support the sampling objectives and procedures based on the site-specific sampling analysis plan (SAP) developed prior to any field activities.

Note: Sections 1 through **4** should be reviewed prior to reviewing the Surface Water Foam Sampling guidance (**Section 13**).

Based on limited studies, PFAS have been found to accumulate in the SW Foams. SW Foam is produced when the surface tension of the water is reduced, and air is mixed in from the action of waves. During the degradation of organic matter, such as algae and plants, the release of cellular products (carboxylic fatty acids [surfactant]) into the water like, reduces the surface water tension. By their very nature, PFAS are amphiphilic and are designed to accumulate at interfaces such as the air-water interface. Research is ongoing to better understand how some PFAS that are known surfactants, contribute to the creation of SW Foam.

SW Foam sampling uses dedicated equipment that does not need decontamination, avoiding the possibility of cross-contamination. While Michigan has been sampling SW Foam for PFAS since 2017, there is no information indicating that SW Foam sampling has occurred in other states, as of the publication date. The highest PFAS concentration detected in SW Foam collected in Michigan exceeded 160,000 ng/L or parts per trillion (ppt). Michigan has promulgated drinking water criterion as low as 70 ng/L, surface water criterion of 11 ng/L, and many commercial laboratories have PFAS detection limits below one (1) ng/L.

This guidance covers the collection of SW Foam and discusses the potential for cross-contamination that can occur from:

- Field Clothing and PPE;
- Surface Water Foam Equipment;
- Sample Collection and Handling; and
- Sample Shipment.

13.1 Field Clothing and PPE

A general overview of field clothing and PPE can be found in **Section 4.2.2** from the **General PFAS Sampling** guidance. Depending on the project objectives and SAP the collection of SW Foam samples could be as simple as a grab sample from the surface water shoreline or complex as a sample collected from a boat. For the majority of times approved field clothing discussed in **Section 4.2.2** and Level D protection, as required by the HASP including some type of life jacket, will be used for SW Foam sampling. Life jackets made of PFAS-free materials should be available.

- Life jackets made of polyethylene foam and nylon shell fabric can be used.

Note: Protective coatings that could contain PFAS might still be used in the manufacturing of life jackets.

Any additional field clothing and/or PPE items that might be required for the SW Foam sampling, and are not discussed in below should be evaluated as described in **Sections 4.2.1** and **4.2.2**.

Powderless nitrile gloves should frequently be changed any time there is an opportunity for cross-contamination during the sampling, including, but not limited to, the following activities:

- Prior to sample collection;
- Between the collection of each sample bottle or polyethylene plastic bags (e.g., Ziploc®); and,
- Handling of any sample, including QA/QC samples such as field reagent blanks or equipment rinsate blanks;

Note: Both the field clothing and PPE should be kept dust and fiber free. During the sample collection extra care should be taken such that no dust or fibers fall into the sample bottle.

13.2 Surface Water Foam Sampling Equipment

As defined in **Section 4**, SW Foam sampling uses equipment that will come into contact with the SW Foam (**Category 1**) that may introduce PFAS into the sample and equipment that will not come into direct contact with the sample (**Category 2**). Each category is addressed below.

Category 1: Any SW Foam sample bottle and bag or material that will come into contact with the SW FOAM samples should be screened and certified as PFAS-free.

Category 2: Examples of field equipment that do not come into contact with the SW Foam samples such as GPS receivers, notebooks, and other equipment used on boats. The surface of these pieces of field equipment or the storage boxes in which they are kept might contain PFAS.

Note: As a precautionary action an equipment rinsate blank should be collected for **Category 1** materials even if the sampling materials are made of materials that are not expected to contain PFAS (i.e., polyethylene plastic bags such as Ziploc®).

Do not use any equipment that contains any known fluoropolymers such as, but not limited to the following:

- Polytetrafluoroethylene (PTFE) tradename such as Teflon®;
- Polyvinylidene fluoride (PVDF) tradename such as Kynar®;
- Fluorinated ethylene propylene (FEP) tradename such as Neoflon®;
- Ethylene-tetrafluoroethylene (ETFE) tradename such as Tefzel®;
- Do not use low-density polyethylene (LDPE);
- ▲ Post-It Notes® were historically prohibited and should be avoided as the presence or absence of PFAS is currently unknown; and
- ■ Use materials that are either made of HDPE, silicone, polyvinyl chloride (PVC) or acetate.

Note: Additional information about notes collection can be found in **Section 4**.

Currently, SW Foam has been successfully sampled using various HDPE bottles or polyethylene plastic bags (e.g., Ziploc®), which have wide openings to facilitate the placement of SW Foam.

13.2.1 Direct Sampling

Surface water foam samples streams, rivers, lakes, and other surface waters, can be collected from the shores or from boats. Since boats might use various parts that may contain PFAS including the protective water repellent coatings, SW Foam samples should always be collected on the upstream side of the boat when used on rivers.

- Do not sample without approved nitrile gloves;

- Do not rinse the sampling container, because decon water and/or the surface water will dilute the surface water foam sample, resulting in a low biased result;
- Do not collect any surface water with the surface water foam;
- The sample should be free of insects, plants, and other non-aqueous phases; and
- The sample cap should never be placed on the ground during sampling but kept in a new Ziploc® bag.

13.3 Sample Collection and Handling

The collection and handling of SW Foam samples are critical steps during the sampling process as many of the decisions have to be made in the field without prior knowledge of the sampling environment. Cross contamination could be introduced during the sample collection and handling. Careful planning should be done in advance of the sample collection in order to ensure and exclude any possible cross contamination. SW Foam samples have been successfully collected using the hands while wearing gloves. Duplicate samples might be collected once the SW Foam has condensed into a liquid.

13.3.1 Sample Collection

Samplers should collect enough SW Foam (see Note) so that there is sufficient volume for PFAS analysis after the SW Foam condenses over time into an aqueous phase. A volume between 20 to 50 mL of the liquid phase of SW Foam sample is suffecient for PFAS analyses; however, this quantity should be confirmed with the selected laboratory. The volume of the liquid ratio between various SW Foam samples could vary significantly due to foam composition and percentage of air. Lighter foam will result in less liquid volume.

Note: The collection of 4-250 mL HDPE bottles, 1 gallon or 2 quart size Ziploc® bags, is sufficient to produce enough liquid for the PFAS analysis.

The steps of the SW Foam sampling are as follows:

1) SW Foam sample is collected in the HDPE bottles or Ziploc® bags.
2) The sampling containers should be placed in double Ziploc bags on wet ice in a cooler for a period of 12 hours or until the SW Foam has condensed to a liquid.
3) The condensed liquid should be gently decanted to a new HDPE sample bottle. The sample bottle should be kept on wet ice and shipped to the laboratory.

The following considerations should be taken during the sample collection:

- Do not write on the sample bottle or Ziploc® bag that will be use initially for the collection of the SW Foam;
- Attention should be given such that no dust or fibers fall into the sample bottle or bag;
- Surface water or other non-aqueous matrices (e.g., plants, insects, etc.) should not be collected along with the SW Foam;
- Off-brand markers should be certified PFAS free prior to use. Alternatively, use a fine point Sharpie® to label the final empty sample bottle that will be used to ship the SW Foam sample to the laboratory while in the staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling;
- Use HDPE sample bottles provided by the laboratory with Teflon-free caps or polyethylene plastic bags (e.g., Ziploc®);

- A ballpoint pen may be used for labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory can also be used. During the initial SW Foam sample collection the labeling should be done on the Ziploc® bags used to collect and condense the SW Foam;
- Use polyethylene plastic bags (e.g., Ziploc®) for bagging samples;
- Samples should be double bagged;
- In the absence of USEPA guidance for SW Foam sample storage, thermal preservation, and holding times for Method 537 should be used for the samples. Samples must be chilled during shipment below 6°C until extraction, but should not be frozen (USEPA, 2009); and
- SW Foam samples should be extracted as soon as possible but must be extracted within 14 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction (USEPA, 2009).

13.4 Sample Shipment

The following recommendations should be used for the sample shipment:

- Do not use chemical or blue ice;
- Use wet ice that is double bagged in Ziploc® storage bags;
- COC should be double bagged in a Ziploc® storage bags and taped to the inside of the cooler lid; and
- The cooler should be taped closed with a custody seal and shipped by overnight courier.

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APPENDIX B
Low-flow Groundwater Sampling Purge Logs

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: ~~MRC~~ LMC MRC
Project No.: 60555202

Sample ID No.: MRC-MW01A
Sample Location:
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[ ] High Concentration

[ ] Domestic Well Data
[X] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

SAMPLING DATA:

Date: 10/21/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	~~Other~~ ORP
Time: 1015								
Method: 537	Clear	5.84	2.86	19.89	51.5	4.92	0.15	55

PURGE DATA:

Date: 10/21/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri pump								
Monitor Reading (ppm): 13.6								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 28.02								
Static Water Level (WL): 15.38								
One Casing Volume(gal/L):								
Start Purge (hrs): 0925								
End Purge (hrs): 1010								
Total Purge Time (min): 45								
Total Vol. Purged (gal/L): 2.5								

SAMPLE COLLECTION INFORMATION: Sample time @ 1015

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250mL PET	2

OBSERVATIONS / NOTES:

None

Circle if Applicable:

MS/MSD | Duplicate ID No.:

Signature(s):

PID: 13.6
DTW: 15.38
DTB: 28.02

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LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER:

WELL ID.: MRC-MW01A
DATE: 10/21/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
0925	16.10	160	5.10	2.61	37.0	4.09	19.87	126	0.14	PD: 26.5 ft.
0930	16.30	160	5.58	2.64	28.2	5.64	19.78	97	0.14	
0935	16.56	150	5.65	2.63	32.7	5.30	19.78	86	0.14	
0940	16.70	150	5.70	2.66	38.2	5.56	19.85	79	0.14	
0945	16.98	150	5.82	2.75	27.6	5.49	19.89	68	0.14	
0950	17.34	130	5.82	2.86	30.0	5.34	19.85	63	0.14	
0955	17.52	130	5.83	2.91	33.8	5.09	19.84	60	0.15	
1000	17.67	130	5.83	2.94	52.2	5.10	19.89	59	0.15	
1005	17.82	130	5.84	2.92	49.0	5.03	19.86	57	0.15	
1010	17.95	130	5.84	2.86	51.5	4.92	19.89	55	0.15	

SIGNATURE(S):

sample time
@ 1015
(MRC-MW01A-102119)

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC LMC PFAS Sampling
Project No.: 60555202.0031

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MW21A
Sample Location: MRC-MW21A
Sampled By: A. Zarrelli
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/21/2019	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1025	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	ORP
Method: Perri Pump	tan	6.40	0.887	19.66	203	0.00	0.50	-23

PURGE DATA:

Date: 10/21/2019	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Perri Pump								
Monitor Reading (ppm): 80.2								
Well Casing Diameter & Material Type: 2in. PVC				See page 2				
Total Well Depth (TD): 15.72								
Static Water Level (WL): 4.78								
One Casing Volume(gal/L): 1.79								
Start Purge (hrs): 0932								
End Purge (hrs): 1023								
Total Purge Time (min): 51								
Total Vol. Purged (gal/L): ~2.0								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
ELLE LL# 173	None	2 250mL plastic bottle	Yes

OBSERVATIONS / NOTES:

MRC-MW21A-20191021 @ 1025

Circle if Applicable:

MS/MSD

Duplicate ID No.: MRC-MW21A-DUP-20191021 @ 1030

Signature(s): Antonio Zarrelli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC LMC
PROJECT NUMBER: 60555202.0031
WELL ID.: MW21A
DATE: 10/21/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
0940	5.78	200	6.25	0.904	883	0.00	18.20	-30	0.35	PD = 14'
0945	6.05	200	6.26	0.899	1000	0.00	18.37	-32	0.35	
0950	6.37	200	6.29	0.894	936	0.00	18.69	-30	0.40	
0955	6.62	200	6.30	0.890	576	0.00	18.82	-27	0.45	
1000	6.96	200	6.31	0.885	349	0.00	19.24	-23	0.50	
1005	7.39	200	6.33	0.873	279	0.00	19.38	-19	0.50	
1010	7.66	200	6.35	0.873	215	0.00	19.50	-20	0.55	
1015	8.02	200	6.37	0.880	195	0.00	19.65	-22	0.50	
1020	8.48	200	6.40	0.887	203	0.00	19.66	-23	0.50	
1025	SAMPLE									

SIGNATURE(S): Antonio Zarrelli

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW02A-20191021
Sample Location: MRC-MW02A
Sampled By: A. Dec
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/21/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(%)~~ PPT	Other ORP (mV)
Time: 1030								
Method: Low Flow / Peri	Clear	4.49	0.626	20.93	9.3	0.00	0.30	417

PURGE DATA:

Date: 10/21/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow / Peri								
Monitor Reading (ppm): 9.6								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 27.20								
Static Water Level (WL): 10.01								
One Casing Volume (gal/L): 2.81								
Start Purge (hrs): 0947								
End Purge (hrs): 1030								
Total Purge Time (min): ~~103~~ 43								
Total Vol. Purged (gal/L): 1.118								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS - ELLE * 173	NONE	Clear, 250 mL	2

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD: N/A
Duplicate ID No.: N/A

Signature(s):

Aden RR

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC - PFAS
PROJECT NUMBER: 60555202
WELL ID.: MRC-MW02A
DATE: 10/21/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
0955	10.60	100	4.44	0.635	16.3	0.45	20.21	415	0.31	17-27', 22'
1000	10.87	100	4.44	0.628	11.5	0.00	20.39	425	0.30	Same
1005	10.92	100	4.45	0.628	5.7	0.00	20.41	424	0.30	Same
1010	10.86	100	4.45	0.626	4.0	0.00	20.52	423	0.30	Same
1015	11.00	100	4.47	0.626	9.4	0.00	20.76	424	0.30	Same
1020	11.08	100	4.49	0.626	9.3	0.00	20.87	421	0.30	Same
1025	11.15	100	4.49	0.626	9.3	0.00	20.93	417	0.30	Same

Sample @ 1030

SIGNATURE(S):

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555202

Sample ID No.: MRC-MW05A
Sample Location:
Sampled By: V. Kirkpatrick
C.O.C. No.:

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity %	Other
Date: 10/21/19								
Time: 1130/1135								
Method: ~~low flow peri pump~~	clear	4.68	0.186	20.39	38.2	5.10	0.01	ORP 199

Method 537

PURGE DATA:

	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 10/21/19								
Method: Low flow peri pump								
Monitor Reading (ppm): 1.5								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 33.65								
Static Water Level (WL): 14.73								
One Casing Volume(gal/L):								
Start Purge (hrs): 1100								
End Purge (hrs): 1125								
Total Purge Time (min): 25								
Total Vol. Purged (gal/L): 1.5								

SAMPLE COLLECTION INFORMATION: sample time @ 1130

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250mL PET	1

OBSERVATIONS / NOTES:

~120 mL/min is the slowest purge rate attainable w/ portable peri pump battery

Circle if Applicable:

MS/MSD

Duplicate ID No.: MRC-MW05A-DUP-102119

(@ 1135)

Signature(s):

AECOM

LOW FLOW PURGE DATA SHEET

PID: 1.5 ppm
DTW: 14.73
DTB: 33.65
22-32
SI: 20 ft

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER:

WELL ID.: MRC-MW05A
DATE: 10/21/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1100	15.71	160	5.14	0.236	31.1	5.42	20.69	153	0.01	PD: 28 ft.
1105	16.78	120	4.78	0.203	28.1	4.95	20.46	180	0.01	
1110	17.55	120	4.68	0.188	39.7	4.91	20.41	194	0.01	
1115	18.02	120	4.76	0.188	39.3	5.16	20.25	193	0.01	
1120	18.70	120	4.64	0.184	36.4	5.05	20.39	203	0.01	
1125	19.22	120	4.68	0.186	38.2	5.10	20.39	199	0.01	

SIGNATURE(S): [signature]

sample time @ 1130
(MRC-MW05A-102119)

DUP collected @ 1135

PAGE 2 OF 2

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC -PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[✓] QA Sample Type: Field Duplicate

Sample ID No.: MRC-MW27B-20191021
Sample Location: MRC-MW27B
Sampled By: A.Dec
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/21/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(ppt)~~ ppt	Other ORP(mV)
Time: 1230								
Method: Low Flow / Peri	Clear	5.35	0.240	23.59	73.6	0.00	0.11	269

PURGE DATA:

Date: 10/21/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow / Peri								
Monitor Reading (ppm): 63.3								
Well Casing Diameter & Material Type: 2inch PVC								
Total Well Depth (TD): 49.50								
Static Water Level (WL): 13.09								
One Casing Volume (gal/L): 5.94								
Start Purge (hrs): 1153								
End Purge (hrs): 1230								
Total Purge Time (min): 37								
Total Vol. Purged (gal/L): 0.96								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS - ELLE #173	NONE	Clear, 250 mL	4

OBSERVATIONS / NOTES:

DUP @ 1235

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	MRC-MW27B-DUP-20191021

Signature(s):

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC- PFAS
PROJECT NUMBER: 60555207
WELL ID.: MRC-MW27B
DATE: 10/21/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1155	14.14	100	5.36	0.248	77.8	0.00	23.10	269	0.12	49.50 - 49.50, 44.50
1200	14.59	100	5.36	0.245	72.3	0.00	23.01	268	0.12	same
1205	14.91	100	5.40	0.244	93.2	0.00	22.80	258	0.12	Same
1210	15.70	100	5.37	0.243	87.9	0.00	23.07	259	0.12	Same
1215	16.96	100	5.36	0.242	78.3	0.00	23.35	261	0.11	Same
1220	17.59	100	5.35	0.242	74.9	0.00	23.43	262	0.11	Same
1225	18.54	100	5.35	0.240	73.6	0.00	23.59	269	0.11	Same

Collected Sampled DUP @ 1230 @ 1235

SIGNATURE(S): Collected

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC LMC PFAS Sampling
Project No.: 60555202.0031

Sample ID No.: EXT-MW06
Sample Location: MRC-EXT-MW06
Sampled By: A. Zarrelli
C.O.C. No.:

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/21/2019 Time: 1255 Method: Perri Pump	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
	Clear	6.22	0.583	22.28	20.1	4.88	0.50	197

PURGE DATA:

Date: 10/21/2019	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Perri Pump								
Monitor Reading (ppm): 257								
Well Casing Diameter & Material Type: 4in PVC			See page 2					
Total Well Depth (TD): 20.23								
Static Water Level (WL): 11.25								
One Casing Volume(gal/L): 5.86								
Start Purge (hrs): 1145								
End Purge (hrs): 1254								
Total Purge Time (min): 69								
Total Vol. Purged (gal/L): ~2.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
ELLE LL# 173	None	2 250mL plastic bottle	Yes

OBSERVATIONS / NOTES:

MRC-EXT-MW06-20191021 @ 1255

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Antonio Zarrelli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC LMC
PROJECT NUMBER: 60555202.0031
WELL ID.: EXT-MW06
DATE: 10/21/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1155	11.32	200	6.32	0.577	80.9	0.82	23.08	178	0.50	PD = 18'
1200	11.33	200	6.28	0.577	90.2	0.51	22.72	174	0.52	
1205	11.33	200	6.26	0.581	94.1	0.43	22.35	175	0.55	
1210	11.35	200	6.24	0.582	82.1	0.37	22.14	184	0.55	
1215	11.36	200	6.27	0.583	67.9	1.82	22.10	183	0.50	
1220	11.37	200	6.28	0.584	55.3	4.60	22.19	182	0.50	
1225	11.38	200	6.30	0.585	27.2	6.15	22.07	181	0.50	
1230	11.39	200	6.28	0.584	22.7	5.78	22.13	186	0.50	
1235	11.40	200	6.25	0.584	21.3	5.39	22.20	189	0.50	
1240	11.40	200	6.23	0.584	21.0	5.06	22.19	193	0.50	
1245	11.43	200	6.22	0.583	20.5	4.90	22.24	195	0.50	
1250	11.43	200	6.22	0.583	20.1	4.88	22.28	197	0.50	
1255	SAMPLE									

SIGNATURE(S): Antonio Zaccarelli

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW27A-20191021
Sample Location: MRC-MW27A
Sampled By: A. DEC
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/21 / Time: 1410 / Method: Low Flow / Peri	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(ppt)~~ PPT	Other ORP (mV)
	Clear	6.24	2.49	27.95	13.1	0.00	1.28	-12

PURGE DATA:

Date: 10/21/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow / Peri								
Monitor Reading (ppm): 15.5								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 18.78								
Static Water Level (WL): 10.11								
One Casing Volume (gal/L): 1.41								
Start Purge (hrs): 1312								
End Purge (hrs): 1406								
Total Purge Time (min): 54								
Total Vol. Purged (gal/L): 4.28								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS - ELLE #173	NONE	Clear, 250 mL	2

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s): Adam RR

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC - PFAS
PROJECT NUMBER: 60555202

WELL ID.: MRC-MW27A
DATE: 10/21/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1315	10.17	300	6.22	2.36	25.9	0.00	28.43	-10	1.21	8.78-18.78, 13.78
1320	10.24	300	6.25	2.45	22.1	0.00	27.65	-18	1.25	Same
13-25	10.26	300	6.25	2.47	19.3	0.00	27.54	-24	1.27	Same
1330	10.28	300	6.26	2.48	14.4	0.00	27.51	-24	1.28	Same
1335	10.29	300	6.24	2.50	12.7	0.00	27.49	-19	1.28	Same
1340	10.30	300	6.24	2.51	11.1	0.00	27.54	-16	1.29	Same
1345	10.31	300	6.24	2.51	9.3	0.00	27.62	-14	1.29	Same
1350	10.32	300	6.24	2.50	7.4	0.00	27.72	-13	1.29	Same
1355	10.32	300	6.24	2.50	8.5	0.00	27.79	-12	1.28	Same
1400	10.32	300	6.24	2.49	11.3	0.00	27.87	-12	1.28	Same
1405	10.33	300	6.24	2.49	13.1	0.00	27.95	-12	1.28	Same
	Sec front, 3 wV									
	Sampled @ 1410									
	Alex R 2									

SIGNATURE(S): Alex R 2

PAGE 2 OF 2

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC LMC PFAS Sampling
Project No.: 60555202.0031

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MW42A
Sample Location: MRC-MW42A
Sampled By: A. Zarrelli
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/21/2019 Time: 1420 Method: Perri Pump	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
	Clear	5.83	2.51	25.90	156	0.00	0.60	-50

PURGE DATA:

Date: 10/21/2019	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Perri Pump								
Monitor Reading (ppm): 147								
Well Casing Diameter & Material Type: 2in PVC			See Page 2					
Total Well Depth (TD): 18.80								
Static Water Level (WL): 11.31								
One Casing Volume(gal/L): 1.22								
Start Purge (hrs): 1340								
End Purge (hrs): 1419								
Total Purge Time (min): 39								
Total Vol. Purged (gal/L): ~1.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
ELLE LL# 173	None	2 250mL plastic bottle	Yes

OBSERVATIONS / NOTES:

MRC-MW42A-20191021 @ 1420

Circle if Applicable:

MS/MSD | Duplicate ID No.:

Signature(s): Antonio Zarrelli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC LMC
PROJECT NUMBER: 60555202.0031
WELL ID.: MW42A
DATE: 10/21/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth	S. Cond
1350	11.71	200	5.68	~~3.6~~	207	1.21	25.40	-36	0.40	PD= 16'	3.67
1355	11.99	200	5.69	~~4.3~~	189	0.00	25.54	-44	0.55		3.21
1400	12.09	200	5.73	~~4.7~~	172	0.00	26.21	-48	0.60		2.78
1405	12.25	200	5.77	~~5.1~~	156	0.00	26.38	-51	0.60		2.70
1410	12.50	200	5.80	~~5.0~~	156	0.00	26.15	-50	0.60		2.68
1415	12.75	200	5.83	~~5.0~~ (DJ)	156	0.00	25.90	-50	0.60		2.51
1420	SAMPLE										

SIGNATURE(S): [signature]

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC LMC PFAS Sampling
Project No.: 60555202.0031

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: EXT-MW03
Sample Location: MRC-EXT-MW03
Sampled By: A. Zarrelli
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/21/2019 Time: 1550 Method: Perri Pump	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
	Clear	6.81	0.301	23.81	15.9	4.68	0.70	14

PURGE DATA:

Date: 10/21/2019	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Perri Pump								
Monitor Reading (ppm): 339								
Well Casing Diameter & Material Type: 4in PVC				See	page 2			
Total Well Depth (TD): 15.82								
Static Water Level (WL): 12.21								
One Casing Volume(gal/L): 2.36								
Start Purge (hrs): 1515								
End Purge (hrs): 1548								
Total Purge Time (min): 33								
Total Vol. Purged (gal/L): 4.0								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
ELLE LL# 173	None	2 250mL plastic bottle	Yes

OBSERVATIONS / NOTES:

MRC-EXT-MW03-20191021 @ 1550

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Antonio Zarrelli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC LMC
PROJECT NUMBER: 60555202.0031

WELL ID.: EXT-MW03
DATE: 10/21/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1525	12.30	200	6.50	0.339	19.8	4.91	26.16	-49	0.70	
1530	12.39	200	6.77	0.318	14.8	4.56	25.05	16	0.70	
1535	12.51	200	6.79	0.312	14.6	4.55	24.20	15	0.70	
1540	12.55	200	6.80	0.309	15.1	4.60	23.99	14	0.70	
1545	12.60	200	6.81	0.301	15.9	4.68	23.81	14	0.70	
1550	SAMPLE									

SIGNATURE(S): Antonio Zarrelli

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC-PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-48A-20191021
Sample Location: MRC-48A
Sampled By: ADec
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/21/19 Time: 1600 Method: Low Flow / Peri	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(ft)~~ ppt	Other ORP (mV)
	Clear	6.24	0.362	25.19	49.0	0.00	0.17	5

PURGE DATA:

Date: 10/21/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow / Peri								
Monitor Reading (ppm): 21.6								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 21.58								
Static Water Level (WL): 7.84								
One Casing Volume(gal/L): 2.24								
Start Purge (hrs): 1528								
End Purge (hrs): 1600								
Total Purge Time (min): 32								
Total Vol. Purged (gal/L): 0.83								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS - ELLE #173	NONE	Clear, 250 mL	2

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s): Adam R

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC-PFAS
PROJECT NUMBER: 60555202
WELL ID.: MRC-MW48A
DATE: 10/21/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1530	9.03	100	6.22	0.365	53.4	0.00	26.32	22	0.17	11.58-21.58, 16.58
1535	9.47	100	6.21	0.349	42.8	0.00	25.48	14	0.17	Same
1540	9.26	100	6.20	0.351	50.7	0.00	25.75	10	0.17	same
1545	9.43	100	6.22	0.356	49.0	0.00	25.27	5	0.17	Same
1550	9.53	100	6.24	0.357	50.7	0.00	25.42	5	0.17	Same
1555	9.62	100	6.24	0.362	49.0	0.00	25.19	5	0.17	Same

Sampled @ 1600

SIGNATURE(S): Adam R R

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555202

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW16A
Sample Location:
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/21/19	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	~~Other~~
Time: 1600	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	% ~~ppt~~ ppt	ORP
Method: 537	clear	3.51	1.27	25.03	0.0	2.50	0.06	352

PURGE DATA:

Date: 10/21/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri pump								
Monitor Reading (ppm): 41.3								
Well Casing Diameter & Material								
Type: 2" PVC								
Total Well Depth (TD): 13.03								
Static Water Level (WL): 3.58								
One Casing Volume(gal/L):								
Start Purge (hrs): 1500								
End Purge (hrs): 1555								
Total Purge Time (min): 55								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION: sample time @ 1600

Analysis	Preservative	Container Requirements	Collected
PFAS by method 537	None	2 x 250 mL PET	1

OBSERVATIONS / NOTES:

None

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	

TD:
DTW: ~~3.58~~
DTB: ~~13.03~~
PD: ~~8.25~~ 8-25

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER:

WELL ID.: MRC-MW16A
DATE: 10/21/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1500 ~~1450~~	~~4.45~~	150	3.64	1.23	24.7	1.09	25.28	307	0.06	PD: 8.25
1505	4.71	150	3.57	1.23	23.6	0.36	25.46	327	0.06	
1510	5.22	150	3.54	1.25	5.5	4.30	25.12	344	0.06	
1515	5.48	150	3.22	1.30	7.8	0.82	25.07	377	0.06	
1520	5.48	150	3.43	1.29	10.1	2.17	25.25	376	0.06	
1525	5.48	150	3.48	1.29	8.7	2.25	25.18	374	0.06	
1530	5.48	150	3.50	1.29	8.4	1.88	25.00	373	0.06	
1535	5.48	150	3.48	1.29	4.8	0.62	25.04	378	0.06	
1540	5.48	150	3.47	1.29	0.0	0.31	25.10	382	0.06	
1545	5.48	150	3.46	1.29	0.0	2.68	24.93	374	0.06	
1550	5.55	150	3.49	1.27	0.0	2.59	25.00	362	0.06	
1555	5.60	150	3.51	1.27	0.0	2.50	25.03	352	0.06	

SIGNATURE(S):

sample time @ 1600
(MRC-MW16A-102119)

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555207

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW10A
Sample Location:
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/21/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
Time: 1325								
Method: 537	cloudy/ dark	6.61	0.474	25.25	541	4.10	0.02	-62

PURGE DATA:

Date: 10/21/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri pump								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 13.25								
Static Water Level (WL): 0.85								
One Casing Volume(gal/L):								
Start Purge (hrs): 1215								
End Purge (hrs): 1320								
Total Purge Time (min): 55								
Total Vol. Purged (gal/L): 3								

SAMPLE COLLECTION INFORMATION: sample time @ 1325

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250mL PET	1

OBSERVATIONS / NOTES:

purge water was dark/milky; high turbidity throughout sampling; sheen present on water

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

PID: --
DTW: 0.85
DTB: 13.25
PD: ~~8.0~~ 8.25 ft

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER:

WELL ID.: MRC-MW10A
DATE: 10/21/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1215	2.98	120	6.19	0.477	11.5	6.06	23.53	-5	0.02	PD: ~~8.0~~ 8.25 ft
1220	3.55	120	6.29	0.480	113	5.27	23.53	-15	0.02	
1225	4.01	120	6.35	0.482	141	5.03	23.71	-22	0.02	
1230	4.60	120	6.38	0.483	442	5.21	23.89	-30	0.02	
1235	5.07	120	6.44	0.487	591	4.81	23.92	-37	0.02	
1240	5.78	120	6.46	0.488	601	4.96	24.16	-42	0.02	
1245	6.52	120	6.46	0.493	659	4.47	24.34	-45	0.02	
1250	6.99	120	6.45	0.499	657	4.18	24.62	-49	0.02	
1255	7.22	120	6.49	0.497	640	4.00	24.65	-60	0.02	
1300	7.40	120	6.54	0.496	638	4.24	24.54	-66	0.02	
1305	7.42	120	6.45	0.491	613	4.18	24.67	-61	0.02	
1310	7.42	120	6.56	0.475	595	4.20	25.28	-64	0.02	
1315	7.42	120	6.55	0.472	561	4.14	25.34	-65	0.02	
1320	7.42	120	6.61	0.474	541	4.10	25.25	-62	0.02	

SIGNATURE(S):

sample time @ 1325

(MRC-MW10A-102119)

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW60B-20191023
Sample Location: MRC-MW60B
Sampled By: A. Dec
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(%)~~ ppt	Other ORP(mV)
Date: 10/23/19								
Time: 0950								
Method: Low Flow / Peri	Clear	6.25	0.133	20.65	42.6	0.00	0.06	22

PURGE DATA:

	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 10/23/19								
Method: Low Flow / Peri								
Monitor Reading (ppm): N/A								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 32.17								
Static Water Level (WL): 13.61								
One Casing Volume (gal/L): 3.03								
Start Purge (hrs): 0845								
End Purge (hrs): 0950								
Total Purge Time (min): 65								
Total Vol. Purged (gal/L): 1.69								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	NONE	Clear, 250 mL PET	2

OBSERVATIONS / NOTES:

PID reading 2000 ppm ambient air → need to send back / troubleshoot

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s): Adec R R

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC-PFAS
PROJECT NUMBER: 60555202
WELL ID.: MRC-MW60B
DATE: 10/23/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or (ppt)	Well Screen Interval & Pump Depth
0850	14.19	100	6.98	0.170	154	0.00	17.55	20	0.08	22.17-32.17, 27.17
0855	14.18	100	6.16	0.164	84.1	0.00	18.72	16	0.08	Same
0900	14.20	100	6.18	0.161	71.5	0.00	19.30	17	0.07	Same
0905	14.22	100	6.20	0.159	63.9	0.00	19.65	18	0.07	Same
0910	14.21	100	6.20	0.156	60.3	0.00	20.01	18	0.07	Same
0915	14.24	100	6.21	0.149	55.6	0.00	20.04	19	0.07	Same
0920	14.29	100	6.22	0.149	40.3	0.00	20.09	19	0.07	Same
0925	14.36	100	6.22	0.142	57.2	0.00	20.30	20	0.07	Same
0930	14.40	100	6.23	0.140	56.8	0.00	20.36	21	0.07	Same
0935	14.41	100	6.25	0.135	43.6	0.00	20.47	22	0.06	Same
0940	14.43	100	6.25	0.134	45.2	0.00	20.51	22	0.06	Same
0945	14.43	100	6.25	0.133	42.6	0.00	20.65	22	0.06	Same

Sampled @ 0950

SIGNATURE(S): Ryan R

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555212

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW18A-20191023
Sample Location: MW18A
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ppt	~~Other~~ ORP
Time: 1010								
Method: 537; Low flow peri	Clear	6.89	0.660	21.88	108	1.15	0.3	149

PURGE DATA:

Date: 10/23/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: 537; Low flow peri								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 25.60								
Static Water Level (WL): 5.73								
One Casing Volume(gal/L):								
Start Purge (hrs): 0900								
End Purge (hrs): 1005								
Total Purge Time (min): 65								
Total Vol. Purged (gal/L): 3.0								

VK

SAMPLE COLLECTION INFORMATION: sampled @ 1010

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250 mL PET	I

OBSERVATIONS / NOTES:

~120 mL/min is slowest rate peri pump will purge @

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

PID: 0.0
DTW: 5.73
DTB: 25.60
PD: 20.0

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER: 60555212
WELL ID.: MRC-MW18A
DATE: 10/23/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
0900	8.33	160	5.15	1.85	202	0.72	21.29	251	0.9	PD = 20.0 ft
0905	9.55	150	5.42	1.84	212	0.34	21.38	237	0.9	
0910	10.65	140	5.65	1.70	196	0.26	21.60	225	0.8	
0915	11.85	120	5.77	1.59	67.5	0.33	21.52	215	0.8	
0920	12.92	120	5.96	1.39	51.1	0.41	21.59	202	0.7	
0925	14.01	120	6.14	1.23	57.5	0.57	21.58	189	0.6	
0930	15.03	120	6.35	0.998	67.7	0.79	21.67	176	0.5	
0935	15.90	120	6.40	0.856	57.5	0.93	21.56	169	0.4	
0940	15.87	120	6.09	1.26	51.2	0.65	21.48	174	0.6	
0945	15.87	120	6.46	0.836	97.5	0.88	21.57	159	0.4	
0950	15.86	120	6.76	0.680	108	1.19	21.72	155	0.3	
0955	15.87	120	6.96	0.658	115	1.10	21.66	156	0.3	
1000	15.87	120	6.94	0.654	113	1.07	21.81	149	0.3	
1005	15.87	120	6.89	0.660	108	1.15	21.88	149	0.3	

sampled @ 1010

SIGNATURE(S): sample time @ 1010

(MRC-MW18A-20191023)

PAGE 2 OF 2

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC LMC PFAS Sampling
Project No.: 60555202.0031

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MW56A
Sample Location: MRC-MW56A
Sampled By: A. Zarrelli
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/2019 Time: 1020 Method: Perri Pump	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
	Clear	6.22	1.32	21.60	13.7	0.00	0.7	-93

PURGE DATA:

Date: 10/23/2019	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Perri Pump								
Monitor Reading (ppm): NA								
Well Casing Diameter & Material Type: PVC 2in								
Total Well Depth (TD): ~~12.40~~ 12.01			see page 2					
Static Water Level (WL): ~~9.24~~ 7.42								
One Casing Volume(gal/L): 0.75								
Start Purge (hrs): 0908								
End Purge (hrs): 1019								
Total Purge Time (min): 71								
Total Vol. Purged (gal/L): ~2.0								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
ELLE LL# 173 PFAS	None	2x 250mL plastic wide mouth	Yes

OBSERVATIONS / NOTES:

MRC-MW56A-20191023 @ 1020

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Antonio Zarrelli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC LMC
PROJECT NUMBER: 60555202.0031

WELL ID.: MW56A
DATE: 10/23/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
0915	7.67	150	6.07	1.34	206	0.00	19.55	-95	0.7	PD = 11'
0920	7.79	150	6.12	1.33	149	0.00	19.97	-98	0.7	
0925	7.95	150	6.18	1.33	95.6	0.00	19.99	-108	0.7	
0930	8.11	150	6.22	1.34	53.1	0.00	20.49	-112	0.7	
0935	8.22	150	6.24	1.35	42.7	0.00	20.64	-113	0.7	
0940	8.45	150	6.25	1.35	37.9	0.00	20.80	-109	0.7	
0945	8.52	150	6.24	1.35	39.9	0.00	21.02	-105	0.7	
0950	8.64	150	6.24	1.35	35.8	0.00	21.10	-100	0.7	
0955	8.71	150	6.23	1.34	24.7	0.00	21.09	-96	0.7	
1000	8.96	150	6.23	1.33	21.1	0.00	21.25	-95	0.7	
1005	9.09	150	6.23	1.32	12.8	0.00	21.42	-95	0.7	
1010	9.17	150	6.23	1.32	14.0	0.00	21.53	-93	0.7	
1015	9.26	150	6.22	1.32	13.7	0.00	21.60	-93	0.7	
1020	SAMPLE									

SIGNATURE(S): Antonio Zorrilla

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[x] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW60A-20191023
Sample Location: MRC-MW60A
Sampled By: A. Dec
C.O.C. No.:
Type of Sample:
[x] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/19	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1125	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%) ~~PPT~~	ORP (mV)
Method: Low Flow/Peri	Clear	6.07	0.304	23.42	3.1	0.00	0.14	-1

PURGE DATA:

Date: 10/23/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow/Peri								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 22.57								
Static Water Level (WL): 14.58								
One Casing Volume (gal/L): 1.70								
Start Purge (hrs): 1020								
End Purge (hrs): 1125								
Total Purge Time (min): 65								
Total Vol. Purged (gal/L): 1.69								

Clear 2 2

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	NONE	Clear, 250 mL PET	2

OBSERVATIONS / NOTES:

Strong sulfur odor

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s): Adam R 2

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: ~~605~~ AD LM MRC - PFAS
PROJECT NUMBER: 60555202

WELL ID.: MRC-MW60A
DATE: 10/23/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1025	14.79	100	6.14	0.309	37.3	0.00	22.18	22	0.15	12.57-22.57, 17.57
1030	14.86	100	6.11	0.309	31.9	0.00	22.28	16	0.15	Same
1035	15.02	100	6.01	0.304	28.9	0.00	22.61	12	0.14	Same
1040	15.17	100	6.00	0.301	27.4	0.00	22.85	12	0.14	Same
1045	15.26	100	6.00	0.300	19.1	0.00	23.08	11	0.14	Same
1050	15.34	100	6.00	0.300	18.5	0.00	23.13	10	0.14	Same
1055	15.42	100	6.03	0.301	9.9	0.00	23.33	5	0.14	Same
1100	15.48	100	6.02	0.302	7.2	0.00	23.44	5	0.14	Same
1105	15.53	100	6.02	0.303	6.6	0.00	23.42	3	0.14	Same
1110	15.60	100	6.06	0.303	3.3	0.00	23.28	-1	0.14	Same
1115	15.65	100	6.06	0.303	3.1	0.00	23.34	-1	0.14	Same
1120	15.70	100	6.07	0.304	3.1	0.00	23.42	-1	0.14	Same

Sampled @ 1125

SIGNATURE(S): [signature]

PAGE 2 OF 2

MW118B

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555212

Sample ID No.: MRC-MW118B-20910
Sample Location: MW118B
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[ ] High Concentration

[ ] Domestic Well Data
[X] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

SAMPLING DATA:

Date: 10/23/19 Time: 1200	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity PPT	Other ORP
Method: 537; Low flow peri	clear	5.65	0.129	22.39	13.9	0.00	0.1	138

PURGE DATA:

Date: 10/23/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: 537; Low flow peri								
Monitor Reading (ppm): 0.4								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 54.95								
Static Water Level (WL): 18.77								
One Casing Volume(gal/L):								
Start Purge (hrs): 1045								
End Purge (hrs): 1155								
Total Purge Time (min): 70								
Total Vol. Purged (gal/L): 3.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250mL PET	1

OBSERVATIONS / NOTES:

Given large water column + fast recharge, pumped 1 full hour before collecting to ensure representative sample was collected / sampling formational water; high iron apparent (iron precipitate present in horiba + purge water)

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

PID: 0.9
DTW: 18.77
DTB: 54.95
PD: 45

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER: 60555212

WELL ID.: MRC-MW118B-20191023
DATE: 10/23/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1045	19.49	200	6.23	0.216	81.9	1.10	21.94	178	0.1	PD: 45.0 ft
1050	19.51	200	6.02	0.214	63.3	0.23	22.07	176	0.1	
1055	19.51	200	6.00	0.209	57.2	0.09	22.20	172	0.1	
1100	19.51	200	5.94	0.206	59.3	0.00	22.24	172	0.1	
1105	19.59	200	5.95	0.200	66.1	0.00	22.27	146	0.1	
1110	19.60	200	5.93	0.194	69.0	0.00	22.32	138	0.1	
1115	19.62	200	5.90	0.187	54.1	0.00	22.38	129	0.1	
1120	19.64	200	5.88	0.177	48.1	0.00	22.45	128	0.1	
1125	19.64	200	5.86	0.170	40.4	0.00	22.40	129	0.1	
1130	19.64	200	5.73	0.151	30.7	0.00	22.40	131	0.1	
1135	19.64	200	5.73	0.142	30.1	0.00	22.39	131	0.1	
1140	19.64	200	5.69	0.140	22.6	0.00	22.39	135	0.1	
1145	19.65	200	5.64	0.133	14.2	0.00	22.40	136	0.1	
1150	19.65	200	5.68	0.130	14.6	0.00	22.43	134	0.1	
1155	19.66	200	5.65	0.129	13.9	0.00	22.39	138	0.1	

SAMPLED @ 1200
VK

SIGNATURE(S):

sample time @ 1200
(MRC-MW118B-20191023)

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC LMC PFAS Sampling
Project No.: 60555202.0031

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MW55A
Sample Location: MRC-MW55A
Sampled By: A. Zarcilli
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/2019	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
Time: 1300								
Method: Perri Pump	Clear	4.61	0.337	22.41	8.1	0.88	0.2	339

PURGE DATA:

Date: 10/23/2019	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Perri Pump								
Monitor Reading (ppm): N/A								
Well Casing Diameter & Material Type: 2in PVC			see page 2					
Total Well Depth (TD): 22.05								
Static Water Level (WL): 12.98								
One Casing Volume(gal/L): 1.48								
Start Purge (hrs): 1118								
End Purge (hrs): 1259								
Total Purge Time (min): 101								
Total Vol. Purged (gal/L): ~2.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
ELLE LL# 173 PFAS	None	2x 250mL Plastic	Yes

OBSERVATIONS / NOTES:

MRC-MW55A-20191023 @ 1300

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Antonio Zarcilli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC LMG
PROJECT NUMBER: 60555202.0031
WELL ID.: MW55A
DATE: 10/23/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1125	13.38	100	6.08	0.000	587	2.12	22.18	11	0.0	PD = 19'
1130	13.42	100	6.00	0.398	131	1.62	21.83	87	0.2	
1135	13.55	100	5.01	0.394	108	1.22	21.85	91	0.2	
1140	13.69	100	4.89	0.378	83.6	1.30	21.94	127	0.2	
1145	13.84	100	4.81	0.353	84.3	1.41	22.01	200	0.2	
1150	14.02	100	4.70	0.326	92.5	1.70	22.20	230	0.2	
1155	14.16	100	4.68	0.323	90.3	1.63	22.19	255	0.2	
1200	14.29	100	4.54	0.308	52.2	1.38	22.28	268	0.2	
1205	14.41	100	4.52	0.306	30.6	1.20	22.34	280	0.2	
1210	14.55	100	4.51	0.304	16.3	0.87	22.38	299	0.2	
1215	14.60	100	4.52	0.303	8.7	0.87	22.38	299	0.2	
1220	14.69	100	4.79	0.347	56.4	0.86	22.11	282	0.2	
1225	14.78	100	4.70	0.342	41.4	0.85	22.22	299	0.2	
1230	14.92	100	4.64	0.339	20.5	0.83	22.31	307	0.2	
1235	15.01	100	4.63	0.331	12.9	0.80	22.33	310	0.2	
1240	15.19	100	4.62	0.330	8.2	0.78	22.34	318	0.2	
1245	15.28	100	4.61	0.334	8.3	0.89	22.42	327	0.2	
1250	15.44	100	4.61	0.336	7.8	0.85	22.44	339	0.2	
1255	15.51	100	4.61	0.337	8.1	0.88	22.41	339	0.2	
1300	SAMPLE									

SIGNATURE(S): Andrew Zarnetti

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC LMC PFAS Sampling
Project No.: 60555202.0031

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MW134B
Sample Location: MRC-MW134B
Sampled By: A. Zarrelli
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/2019	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1540	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	ORP
Method: Perri Pump	Clear	5.95	0.135	19.63	19.2	0.00	0.1	-93

PURGE DATA:

Date: 10/23/2019	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Perri Pump								
Monitor Reading (ppm): 0.2								
Well Casing Diameter & Material			See	Page	2			
Type: 2in PVC								
Total Well Depth (TD): 35.25								
Static Water Level (WL): 4.80								
One Casing Volume(gal/L): 4.97								
Start Purge (hrs): 1409								
End Purge (hrs): 1532								
Total Purge Time (min): 83								
Total Vol. Purged (gal/L): ~2.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
ELLE LL# 173 PFAS	None	2x 250mL Plastic w/mouth	Yes

OBSERVATIONS / NOTES:

MRC-MW134B-20191023 @ 1540

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Antonio Zarrelli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC LMC
PROJECT NUMBER: 60555202.0031

WELL ID.: MW 134B
DATE: 10/23/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1415	5.63	100	5.92	0.137	28.4	0.00	20.60	-65	0.1	PD = 28'
1420	6.33	100	5.93	0.136	25.0	0.00	20.59	-74	0.1	
1425	6.79	100	5.93	0.136	23.2	0.00	20.48	-78	0.1	
1430	7.22	100	5.93	0.135	21.6	0.00	20.40	-80	0.1	
1435	7.89	100	5.93	0.135	20.8	0.00	20.33	-84	0.1	
1440	8.21	100	5.92	0.134	20.2	0.00	20.40	-86	0.1	
1445	8.88	100	5.92	0.134	21.0	0.00	0.49	-86	0.1	
1450	9.11	100	5.91	0.134	21.8	0.00	20.52	-88	0.1	
1455	9.43	100	5.95	0.133	19.9	0.00	20.81	-90	0.1	
1400	9.99	150	5.95	0.133	19.4	0.00	20.95	-91	0.1	
1505	10.45	150	5.95	0.134	19.4	0.00	20.10	-91	0.1	
1510	10.92	150	5.95	0.134	19.3	0.00	19.99	-92	0.1	
1515	11.38	100	5.95	0.135	19.3	0.00	19.74	-92	0.1	
1520	11.79	100	5.95	0.135	19.3	0.00	19.72	-93	0.1	
1525	12.08	100	5.95	0.135	19.2	0.00	19.68	-93	0.1	
1530	12.61	100	5.95	0.135	19.2	0.00	19.63	-93	0.1	
1540	SAMPLE									

SIGNATURE(S): Antonio Zarrelli

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555212

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW118A-20191023
Sample Location: MW118A
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity PPT	Other
Time: 1300								
Method: Low flow peri	clear	4.28	4.22	25.55	0.0	0.47	2.2	ORP 160

PURGE DATA:

Date: 10/23/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri								
Monitor Reading (ppm): 0.3								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 12.95								
Static Water Level (WL): 7.34								
One Casing Volume(gal/L):								
Start Purge (hrs): 1235								
End Purge (hrs): 1255								
Total Purge Time (min): 20								
Total Vol. Purged (gal/L): 1.0								

VK

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250 mL PET	]

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

PID: 0.3
DTW: 7.54
DTB: 12.95
PD: 12.0

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER: 60555212

WELL ID.: MRC-MW118A-20191023
DATE: 10/23/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1235	7.65	140	6.10	4.27	1.1	1.33	25.31	171	2.3	PD: 12 ft.
1240	7.70	140	6.21	4.38	0.0	0.57	25.43	167	2.3	
1245	7.81	140	6.26	4.32	0.0	0.43	25.57	163	2.3	
1250	7.84	140	6.28	4.18	0.0	0.49	25.56	161	2.2	
1255	7.89	140	6.28	4.22	0.0	0.47	25.55	160	2.2	

SAMPLED @ 1300

SIGNATURE(S):

sample time @ 1300

(MRC-MW118A-20191023)

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW125B-2019 1023
Sample Location: MRC-MW125B
Sampled By: A. Dec
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(%)~~ ppt	Other ORP(mV)
Time: 1420								
Method: Low Flow/Peri.	Clear	6.19	0.219	20.31	25.7	0.00	0.11	26

PURGE DATA:

Date: 10/23/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow/Peri.								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 34.87								
Static Water Level (WL): 4.87								
One Casing Volume (gal/L): ~~34.87~~ AP 4.90								
Start Purge (hrs): 1255								
End Purge (hrs): 1420								
Total Purge Time (min): 85								
Total Vol. Purged (gal/L): 2.21								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	NONE	Clear, 250 mL PET	2

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s):

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC - PFAS
PROJECT NUMBER: 60555202
WELL ID.: MRC-MW125B
DATE: 10/23/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1300	5.81	100	6.24	0.226	49.6	0.00	23.03	18	0.11	24.87-34.87, 29.87
1305	6.45	100	6.24	0.228	52.3	0.00	22.22	18	0.11	Same
1310	7.19	100	6.23	0.228	59.3	0.00	21.84	18	0.11	Same
1315	7.78	100	6.22	0.228	63.4	0.00	21.80	18	0.11	Same
1320	8.31	100	6.22	0.228	64.7	0.00	21.58	18	0.11	Same
1325	8.88	100	6.21	0.229	61.0	0.00	21.34	18	0.11	Same
1330	9.38	100	6.23	0.228	64.9	0.00	21.33	18	0.11	Same
1335	9.87	100	6.22	0.228	55.6	0.00	21.05	19	0.11	Same
1340	10.20	100	6.22	0.228	46.8	0.00	20.98	20	0.11	Same
1345	10.49	100	6.23	0.227	43.7	0.00	20.88	20	0.11	Same
1350	10.73	100	6.21	0.226	40.9	0.00	20.71	22	0.11	Same
1355	10.93	100	6.21	0.225	35.5	0.00	20.59	22	0.11	Same
1400	11.13	100	6.20	0.223	32.1	0.00	20.45	23	0.11	Same
1405	11.23	100	6.20	0.222	26.8	0.00	20.41	24	0.11	Same
1410	11.31	100	6.20	0.221	25.7	0.00	20.30	25	0.11	Same
1415	11.33	100	6.19	0.219	25.1	0.00	20.31	26	0.11	Same

Sampled @ 1420

SIGNATURE(S):

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC LMC PFAS Sampling
Project No.: 60555202.0031

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: SEMW-3I
Sample Location: MRC-SEMW-3I
Sampled By: A. Zorrelli
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/2019	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Time: 1520								
Method: Perri Pump								

PURGE DATA:

Date: 10/23/2019	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Perri Pump								
Monitor Reading (ppm): 0.2								
Well Casing Diameter & Material Type: 2in. PVC		See page 2						
Total Well Depth (TD): 29.55								
Static Water Level (WL): 4.50								
One Casing Volume(gal/L): 4.09								
Start Purge (hrs): 1359								
End Purge (hrs): 1513								
Total Purge Time (min): 74								
Total Vol. Purged (gal/L): ~4								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
ELLE LL # 173 PFAS	None	2x 250mL clear plastic	Yes
ELLE LL # 30 DRO	HCL	2x 250mL amber glass	Yes
GRO	HCL	3x 40mL voa vial	Yes

chg

OBSERVATIONS / NOTES:

MRC-SEMW-3I-20191024 @ 1520

Circle if Applicable:
MS/MSD | Duplicate ID No.:

Signature(s): Antonio Zorrelli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC LMC
PROJECT NUMBER: 60555202.0031
WELL ID.: SEMW-3I
DATE: 10/24/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
~~1415~~ 1515	5.25	150	4.83	0.064	31.5	1.87	22.50	314	0.0	
1420 1520	5.29	150	4.76	0.064	30.9	1.23	22.32	322	0.0	
1425 1525	5.32	150	4.61	0.063	30.1	0.99	22.08	333	0.0	
1430 1530	5.35	150	4.53	0.063	29.5	0.74	21.94	346	0.0	
1435 1535	5.35	150	4.50	0.063	29.2	0.72	21.80	350	0.0	
1440 1540	5.35	150	4.48	0.063	29.1	0.70	21.70	354	0.0	
1445 1545	5.35	150	4.48	0.063	27.5	0.71	21.63	355	0.0	
1450 1550	5.35	150	4.47	0.064	26.1	0.74	21.60	357	0.0	
1455 1555	5.35	150	4.47	0.064	24.2	0.76	21.57	358	0.0	
1500	5.36	150	4.48	0.065	22.1	0.69	21.50	350	0.0	
1505	5.36	150	4.48	0.065	19.4	0.65	21.47	346	0.0	
1510	5.37	150	4.49	0.065	19.0	0.63	21.40	340	0.0	
1515	5.37	150	4.49	0.066	18.8	0.61	21.33	341	0.0	
1520	SAMPLE									

SIGNATURE(S): Antonio Zaccelli

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555212

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW119A-20191024
Sample Location: MW119A
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/24/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
Time: 0845								
Method: Low flow peri	clear	6.48	4.24	18.59	136	2.72	2.25	-57

PURGE DATA:

Date: 10/24/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri								
Monitor Reading (ppm): 0.7								
Well Casing Diameter & Material Type: 2" PVC			See page 2					
Total Well Depth (TD): 12.80								
Static Water Level (WL): 11.93								
One Casing Volume(gal/L): ~0.07								
Start Purge (hrs): 0930								
End Purge (hrs): 0934								
Total Purge Time (min): 4								
Total Vol. Purged (gal/L): ~0.07								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250 mL PET	1

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

DTW: 11.75
DTB: 12.80
PD: 12.50

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER: 60555212

WELL ID.: MRC-MW119A-20191023
DATE: 10/23/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
10/23/19 0835	12.45	Water	column	to shallow to purge.	Go straight to	sampling.				PD: 12.50
10/23/19 0840										
10/28/19 0930	12.38	100	6.22	4.32	98.8	2.76	19.65	-75	2.28	
10/28/19 0933	12.79	100	6.48	4.24	136	2.72	18.59	-57	2.25	

Antoine Zamelle

SIGNATURE(S):

Sample time @ 0845

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC LMC PFAS Sampling
Project No.: 60555202.003i

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: SEMW-1I
Sample Location: MRC-SEMW-1I
Sampled By: A. Zarrelli
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/24/2019	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
Time: 1040								
Method: Perri Pump	Clear	9.96	0.077	19.57	20.1	0.33	0.0	212

PURGE DATA:

Date: 10/24/2019	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Perri Pump								
Monitor Reading (ppm): 0.3								
Well Casing Diameter & Material Type: 2in. PVC		See page 2						
Total Well Depth (TD): 30.13								
Static Water Level (WL): 4.22								
One Casing Volume(gal/L): 4.23								
Start Purge (hrs): 0930								
End Purge (hrs): 1038								
Total Purge Time (min): 68								
Total Vol. Purged (gal/L): ~2.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	None	2x 250mL clear plastic	Yes
DRO	HCL	2x 250mL amber glass	Yes
GRO	HCL	3x 40mL voa vial	Yes

AZ

OBSERVATIONS / NOTES:

MRC-SEMW-1I-20191024 @ 1040

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Antonio Zarrelli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC-LMC
PROJECT NUMBER: 60555202.0031
WELL ID.: SEMW-1I
DATE: 10/23/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
0935	5.25	150	5.07	0.098	191	1.08	16.69	179	0.0	PD = 26'
0940	5.39	150	5.15	0.094	90.2	0.00	17.22	160	0.0	
0945	5.49	150	5.15	0.092	67.0	0.00	17.67	156	0.0	
0950	5.49	150	5.13	0.089	60.3	0.01	17.96	159	0.0	
0955	5.50	150	5.12	0.087	54.6	0.05	18.22	163	0.0	
1000	5.50	150	5.10	0.085	51.5	0.11	18.54	175	0.0	
1005	5.52	150	5.06	0.083	38.9	0.58	18.88	186	0.0	
1010	5.54	150	5.01	0.081	22.0	1.01	19.11	199	0.0	
1015	5.55	150	5.01	0.081	22.5	0.68	19.33	198	0.0	
1020	5.56	150	5.01	0.080	23.3	0.30	19.42	198	0.0	
1025	5.58	150	5.00	0.079	22.2	0.31	19.48	205	0.0	
1030	5.60	150	4.98	0.078	21.2	0.31	19.51	210	0.0	
1035	5.62	150	4.96	0.077	20.1	0.33	19.57	212	0.0	
1040	SAMPLE									

SIGNATURE(S): Antonio Zarrelli

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC-LMC PFAS sampling
Project No.: 60555202.0031

Sample ID No.: SEMW-2I
Sample Location: MRC-SEMW-2I
Sampled By: A. Zarrelli
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[ ] High Concentration

[ ] Domestic Well Data
[X] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other ORP
Date: 10/24/2019 Time: 1250 Method: Perri Pump	Clear	4.61	0.041	25.70	25.60	0.07	0.0	276

PURGE DATA:

	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 10/24/2019								
Method: Perri Pump								
Monitor Reading (ppm): 0.1								
Well Casing Diameter & Material Type: 2in. PVC			See page 2					
Total Well Depth (TD): 29.92								
Static Water Level (WL): 5.00								
One Casing Volume(gal/L): 4.07								
Start Purge (hrs): 1134								
End Purge (hrs): 1249								
Total Purge Time (min): 75								
Total Vol. Purged (gal/L): ~3.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
ELLE LL# 173 PFAS	None	2x 250mL clear plastic	Yes
ELLE LL# 30 DRO	HCL	2x 250mL amber glass	Yes
GRO	HCL	3x 40mL VOA vial	Yes

OBSERVATIONS / NOTES:

MRC-SEMW-2I-20191024 @ 1250

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Antonio Zarrelli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC LMC
PROJECT NUMBER: 60555202.0031

WELL ID.: SEMW-2I
DATE: 10/24/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1150	6.69	300	4.60	0.043	51.1	0.20	24.47	268	0.0	PD = 26'
1155	6.77	300	4.64	0.044	50.5	0.24	24.48	250	0.0	
1200	6.95	250	4.68	0.044	48.6	0.23	24.49	235	0.0	
1205	7.01	250	4.67	0.044	42.1	0.22	25.01	230	0.0	
1200	7.09	250	4.44	0.044	39.2	0.20	24.88	230	0.0	
1205	7.15	200	4.35	0.043	36.6	0.19	24.78	231	0.0	
1210	7.20	200	4.20	0.043	33.7	0.13	24.62	233	0.0	
1215	7.23	200	4.33	0.043	31.3	0.22	24.77	250	0.0	
1220	7.26	150	4.69	0.043	29.9	0.44	24.80	238	0.0	
1225	7.27	150	4.67	0.043	28.5	0.34	24.92	244	0.0	
1230	7.30	150	4.65	0.042	27.3	0.22	25.17	251	0.0	
1235	7.31	150	4.64	0.042	26.2	0.11	25.33	265	0.0	
1240	7.28	150	4.63	0.041	25.3	0.08	25.55	270	0.0	
1245	7.29	150	4.61	0.041	25.0	0.07	25.70	276	0.0	
1250	SAMPLE									

SIGNATURE(S): Antonio Zorrilla

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555212

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW72B-20191023
Sample Location: MW72B
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/24/19 Time: 1430	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ppt	Other ORP
Method: Low flow peri	clear	5.09	0.076	23.00	0.0	0.48	0.0	231

PURGE DATA:

Date: 10/24/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri								
Monitor Reading (ppm): 106.7								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 33.94								
Static Water Level (WL): 5.73								
One Casing Volume(gal/L):								
Start Purge (hrs): 1320								
End Purge (hrs): 1420								
Total Purge Time (min): 60								
Total Vol. Purged (gal/L): 2.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250 mL PET	1
TPH-DRO	HCl	2 x 250 ml amber glass	
TPH-GRO	HCl	3 x 40 mL glass vial	

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

PID: 106.7

DTW: 5.73
DTB: 33.94
PD: 29.0ft

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER: 60555212

WELL ID.: MRC-MW72B-20191024
DATE: 10/24/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1320	6.12	140	6.25	0.108	28.9	1.45	22.88	162	0.0	PD: 29.0
1325	6.14	140	5.69	0.101	28.8	0.75	22.85	174	0.0	
1330	6.14	140	5.37	0.103	27.4	0.66	22.95	182	0.0	
1335	6.14	140	5.33	0.096	34.7	0.60	23.03	196	0.0	
1340	6.14	140	5.24	0.092	26.8	0.55	23.07	204	0.0	
1345	6.14	140	5.25	0.084	21.9	0.49	23.06	208	0.0	
1350	6.18	140	5.21	0.078	15.5	0.52	23.02	213	0.0	
1355	6.18	140	5.15	0.074	18.9	0.47	23.02	219	0.0	
1400	6.18	140	5.14	0.073	9.6	0.51	23.01	221	0.0	
1405	6.18	140	5.12	0.072	1.6	0.49	23.06	224	0.0	
1410	6.18	140	5.10	0.073	0.0	0.52	22.97	226	0.0	
1415	6.19	140	5.11	0.073	0.0	0.49	23.01	228	0.0	
1420	6.19	140	5.09	0.076	0.0	0.48	23.00	231	0.0	

SAMPLED @ 1430

SIGNATURE(S):

sample time @ 1430
(MRC-MW72B-20191024)

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW44A-20191024
Sample Location: MRC-MW44A
Sampled By: A. DeC
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/24/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(%)~~ ppt	Other ORP (mV)
Time: 0935								
Method: Low Flow / Peri	Clear	6.80	0.883	18.43	13.4	0.00	0.43	-114

PURGE DATA:

Date: 10/24/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow / Peri								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 13.28								
Static Water Level (WL): 1.18								
One Casing Volume (gal/L): 1.97								
Start Purge (hrs): 0857								
End Purge (hrs): 0935								
Total Purge Time (min): 38								
Total Vol. Purged (gal/L): 0.99								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	NONE	Clear, 250 mL PET	2

OBSERVATIONS / NOTES:

Sulfur odor

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s): Aden R N

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC - PFAS
PROJECT NUMBER: 60555202

WELL ID.: MRC-MW44A
DATE: 10/29/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
0900	1.49	100	6.66	0.927	22.9	0.00	16.60	-128	0.46	3.28-13.28, 8.28
0905	1.63	100	6.70	0.918	18.0	0.00	16.98	-127	0.45	Same
0910	1.53	100	6.77	0.896	19.0	0.00	17.61	-120	0.44	Same
0915	1.55	100	6.79	0.890	15.2	0.00	17.78	-118	0.44	Same
0920	1.58	100	6.80	0.883	13.8	0.00	18.09	-116	0.43	Same
0925	1.62	100	6.81	0.880	14.4	0.00	18.38	-115	0.43	Same
0930	1.64	100	6.80	0.883	13.4	0.00	18.43	-114	0.43	Same

Adam R

Sampled @ 0935

SIGNATURE(S): Adam R

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555212

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW128B-20191023
Sample Location: MW128B
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (ppt)	Other
Time: 1455								ORP
Method: 537; Low flow Peri	cloudy/ murky	6.37	0.377	24.11	358	0.33	0.2	33

PURGE DATA:

Date: 10/23/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: 537; Low flow Peri								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 28.96								
Static Water Level (WL): 6.22								
One Casing Volume(gal/L):								
Start Purge (hrs): 1405								
End Purge (hrs): 1450								
Total Purge Time (min): 45								
Total Vol. Purged (gal/L): 1.25								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250 mL PET	1

OBSERVATIONS / NOTES:

very soft bottom so tubing was placed ~~slightly~~ ~24 ft.

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):

AECOM

LOW FLOW PURGE DATA SHEET

DTW: 6.22
DTB: 28.96
PD: 24.00

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER: 60555212

WELL ID.: MRC-MW128B-20191023
DATE: 10/23/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or (ppt)	Well Screen Interval & Pump Depth
1405	7.78	160	6.57	0.427	215	0.83	24.26	36	0.2	PD: 24.0 ft
1410	8.75	160	6.33	0.392	279	0.19	24.21	50	0.2	
1415	9.93	130	6.45	0.373	348	0.11	24.23	44	0.2	
1420	10.71	120	6.27	0.369	368	0.09	24.16	57	0.2	
1425	11.50	120	6.29	0.367	374	0.17	24.20	58	0.2	
1430	12.28	120	6.33	0.368	353	0.20	24.23	55	0.2	
1435	13.00	120	6.41	0.369	348	0.22	24.24	48	0.2	
1440	13.67	120	6.47	0.370	342	0.30	24.19	37	0.2	
1445	14.38	120	6.39	0.375	350	0.32	24.12	36	0.2	
1450	14.92	120	6.37	0.377	358	0.33	24.11	33	0.2	

SIGNATURE(S):

sample time @ 1455
(MRC-MW128B-20191023)

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW125A-20191023
Sample Location: MRC-MW125A
Sampled By: A. Dec
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(g/L)~~ PPT	Other ORP (mV)
Time: 1520								
Method: Low Flow / Peri	Clear	6.41	0.295	22.91	5.3	0.47	0.14	159

PURGE DATA:

Date: 10/23/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow / Peri								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 14.80								
Static Water Level (WL): 3.90								
One Casing Volume (gal/L): 1.78								
Start Purge (hrs): 1445								
End Purge (hrs): 1520								
Total Purge Time (min): 35								
Total Vol. Purged (gal/L): 0.91								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	NONE	Clear, 250 mL PET	MD 2

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s):

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC - PFAS
PROJECT NUMBER: 60555202

WELL ID.: MRC-MW125A ~~-20~~
DATE: 10/23/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1450	4.69	100	6.36	0.276	10.1	0.69	23.12	124	0.13	4.80-14.80, 9.80
1455	5.02	100	6.36	0.285	8.6	0.53	22.54	142	0.13	same
1500	4.99	100	6.37	0.288	4.8	0.55	22.62	148	0.14	Same
1505	4.99	100	6.40	0.292	5.7	0.50	22.69	149	0.14	Same
1510	5.00	100	6.41	0.295	5.6	0.50	22.80	154	0.14	Same
1515	4.99	100	6.41	0.295	5.3	0.47	22.91	159	0.14	Same

Sampled @ 1520

SIGNATURE(S): [signature]

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555212

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW128A-20191023
Sample Location: MW128A
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/23/19 Time: 1605	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity PPT	Other ORP
Method: Low flow peri	clear	4.79	0.379	24.81	26.9	0.0	0.2	217

PURGE DATA:

Date: 10/23/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri								
Monitor Reading (ppm): 0.4								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 19.68								
Static Water Level (WL): 3.80								
One Casing Volume(gal/L):								
Start Purge (hrs): 1515								
End Purge (hrs): 1600								
Total Purge Time (min): 45								
Total Vol. Purged (gal/L): 1.0								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250 mL PET	1

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

PID: 0.4

DTW: 3.80
DTB: 19.68
PD: 14.68

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMK MRC
PROJECT NUMBER: 60555212
WELL ID.: MRC-MW128A-20191023
DATE: 10/23/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1515	4.03	200	5.51	0.474	71.1	0.45	25.15	136	0.2	PD: 14.68
1520	4.05	200	5.33	0.453	67.9	0.12	25.06	151	0.2	
1525	4.03	200	5.23	0.430	70.2	0.00	25.07	167	0.2	
1530	4.03	200	5.19	0.418	65.3	0.00	24.96	176	0.2	
1535	4.03	200	5.20	0.410	61.5	0.00	25.01	182	0.2	
1540	4.03	200	4.87	0.392	52.2	0.00	24.94	201	0.2	
1545	4.05	200	4.84	0.389	39.8	0.00	24.79	203	0.2	
1550	4.04	200	4.82	0.382	29.0	0.00	24.85	212	0.2	
1555	4.04	200	4.80	0.381	27.9	0.00	24.86	214	0.2	
1600	4.03	200	4.79	0.379	26.9	0.00	24.81	217	0.2	

SAMPLED @ 1605

VK

SIGNATURE(S):

sample time @ 1605
(MRC-MW128A-20191023)

AECOM

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: LMC MRC
Project No.: 60555212

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW41A-201910
Sample Location: MW41A
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/24/19 Time: 1010	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ppt	Other ORP
Method: Low flow peri	clear	6.53	4.70	23.69	0.0	3.20	2.5	-28

PURGE DATA:

Date: 10/24/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri								
Monitor Reading (ppm): 1.7								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 16.30								
Static Water Level (WL): 10.35								
One Casing Volume(gal/L):								
Start Purge (hrs): 0925								
End Purge (hrs): 1000								
Total Purge Time (min): 35								
Total Vol. Purged (gal/L): 1.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250 mL PET	1

OBSERVATIONS / NOTES:

Bolts won't screw in bolt house

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

PID; 17 ppm

DTW: 10.35
DTB: 16.30
PD: 15.50

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER: 60555212

WELL ID.: MRC-MW41A-20191024
DATE: 10/24/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or (ppt)	Well Screen Interval & Pump Depth
0925	10.70	100	6.18	4.63	44.0	1.20	19.61	25	2.5	PD: 15.5 ft.
0930	11.05	100	6.37	4.64	~~40~~ 38.0	~~0.89~~	21.28	-11	2.5	
0935	11.40	100	6.44	4.68	15.1	0.87	22.08	-22	2.5	
0940	11.65	100	6.48	4.71	4.9	4.80	22.85	-26	2.5	
0945	11.98	100	6.50	~~3.52~~ 4.70	0.0	3.49	23.32	-25	2.5	
0950	12.12	100	6.51	4.71	0.0	3.46	23.42	-26	2.5	
0955	12.30	100	6.52	4.72	0.0	~~3.33~~	23.64	-28	2.5	
1000	12.55	100	6.53	4.70	0.0	3.2	23.69	-28	2.5	
~~1005~~ 1010										

SAMPLED @ 1010

VK

SIGNATURE(S): [signature]

sample time @ 1010

(MRC-MW41A-20191024)

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[x] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW136B-20191024
Sample Location: MRC-MW136B
Sampled By: A. Dec
C.O.C. No.:
Type of Sample:
[x] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/24/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~ppt~~	Other ORP (mV)
Time: 1150								
Method: Low Flow/Peri	Clear	4.51	0.350	18.72	0.0	0.00	0.17	159

PURGE DATA:

Date: 10/24/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow/Peri								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 18.68								
Static Water Level (WL): 4.52								
One Casing Volume (gal/L): 2.31								
Start Purge (hrs): 1041								
End Purge (hrs): 1150								
Total Purge Time (min): 69								
Total Vol. Purged (gal/L): 1.79								

Clear 2 2

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	NONE	Clear, 250 mL PET	2

OBSERVATIONS / NOTES:

Slight sulfur odor

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s): Aden 2 2

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC - PFAS
PROJECT NUMBER: 60555207

WELL ID.: MRC-MW136B
DATE: 10/24/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or (ppt)	Well Screen Interval & Pump Depth
1045	4.79	100	5.42	0.267	1.5	0.00	18.66	207	0.13	8.68 - 18.68, 13.68
1050	4.82	100	5.02	0.266	0.0	0.00	18.46	259	0.13	Same
1055	4.85	100	4.65	0.283	0.0	0.00	18.44	289	0.13	Same
1100	4.87	100	4.54	0.300	0.0	0.00	18.46	228	0.14	Same
1105	4.90	100	4.51	0.310	0.0	0.00	18.50	208	0.15	Same
1110	4.91	100	4.49	0.317	0.0	0.00	18.54	203	0.15	Same
1115	4.92	100	4.47	0.323	0.0	0.00	18.47	194	0.15	Same
1120	4.95	100	4.48	0.329	0.0	0.00	18.45	185	0.16	Same
1125	4.98	100	4.48	0.335	0.0	0.00	18.46	175	0.16	Same
1130	4.98	100	4.49	0.342	0.0	0.00	18.52	169	0.16	Same
1135	4.99	100	4.49	0.343	0.0	0.00	18.56	165	0.16	Same
1140	4.99	100	4.50	0.350	0.0	0.00	18.60	157	0.17	Same
1145	5.03	100	4.51	0.350	0.0	0.00	18.72	159	0.17	Same

Adam R N

Sampled @ 1150

SIGNATURE(S): Adam R N

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555212

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW159A-20191024
Sample Location: MW159A
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/24/19 Time: 1220	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ppt (‰)	Other
Method: Low flow peri	Clear	7.05	0.811	20.98	9.6	1.60	0.4	ORP 90

PURGE DATA:

Date: 10/24/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri								
Monitor Reading (ppm): 0.1								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 9.65								
Static Water Level (WL): 6.68								
One Casing Volume(gal/L):								
Start Purge (hrs): 1110								
End Purge (hrs): 1215								
Total Purge Time (min): 65								
Total Vol. Purged (gal/L): 1.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250 mL PET	1
TPH-DRO	HCl	2 x 250 mL G.A.	1
TPH-GRO	HCl	3 x 40 mL G.V.	1

OBSERVATIONS / NOTES:

GA = glass amber
GV = glass vial

Circle if Applicable:

MS/MSD | Duplicate ID No.:

Signature(s):

PID: 0.1

DTW: 6.68
DTB: 9.65
PD: 9.50

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMCMRC
PROJECT NUMBER: 60555212
WELL ID.: MRC-MW159A-20191024
DATE: 10/24/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or (ppt)	Well Screen Interval & Pump Depth
1110	7.18	100	7.19	1.01	240	1.60	22.21	14	0.5	PD: 9.50
1115	7.28	100	7.14	0.884	193	1.34	21.69	26	0.4	
1120	7.38	100	7.13	0.853	128	1.44	21.50	34	0.4	
1125	7.48	100	7.16	0.843	87.8	1.33	21.31	39	0.4	
1130	7.52	100	7.14	0.829	86.5	1.48	21.26	45	0.4	
1135	7.55	100	7.11	0.822	61.4	1.47	21.17	55	0.4	
1140	7.53	100	7.11	0.822	52.3	1.44	21.08	59	0.4	
1145	7.51	100	7.12	0.820	49.8	1.43	21.00	64	0.4	
1150	7.48	100	7.12	0.820	32.8	1.45	20.98	68	0.4	
1155	7.49	100	7.13	0.819	20.7	1.52	20.90	73	0.4	
1200	7.47	100	7.10	0.820	21.5	1.60	20.73	80	0.4	
1205	7.45	100	7.07	0.815	10.5	1.60	20.90	84	0.4	
1210	7.45	100	7.05	0.811	10.1	1.58	21.06	89	0.4	
1215	7.43	100	7.05	0.811	9.6	1.60	20.98	90	0.4	

SAMPLED @ 1220 VK

SIGNATURE(S):

sample time @ 1220

(MRC-MW159A-20191024)

PAGE 2 OF 2

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW134A-20191024
Sample Location: MRC-MW134A
Sampled By: A. Dec
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/24/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(%)~~ ppt	Other ORP (mV)
Time: 1405								
Method: Low Flow / Peri								

PURGE DATA:

Date: 10/24/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow / Peri								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 12.08								
Static Water Level (WL): 3.47								
One Casing Volume (gal/L): 1.41								
Start Purge (hrs): 1226								
End Purge (hrs): 1405								
Total Purge Time (min): 99								
Total Vol. Purged (gal/L): 2.57								

Clean

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	NONE	Clear, 250 mL PET	2

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s): Adam RD

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC-PFAS
PROJECT NUMBER: 60555202

WELL ID.: MRC-MW134A
DATE: 10/24/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1230	3.54	100	6.88	0.384	56.4	0.00	20.50	-84	0.18	2.08-12.08; 7.08
1235	3.54	100	7.12	0.388	50.8	0.00	20.37	-98	0.18	Same
1240	3.54	100	7.18	0.396	35.9	0.00	20.36	-108	0.19	Same
1245	3.54	100	7.20	0.406	27.0	0.00	20.36	-113	0.19	Same
1250	3.54	100	7.23	0.410	20.1	0.00	20.34	-118	0.20	Same
1255	3.54	100	7.24	0.414	10.4	0.00	20.40	-121	0.20	Same
1300	3.54	100	7.24	0.417	8.5	0.00	20.43	-124	0.20	Same
1305	3.54	100	7.25	0.423	4.7	0.00	20.47	-126	0.20	Same
1310	3.54	100	7.25	0.417	13.2	0.00	20.46	-124	0.20	Same
1315	3.54	100	7.25	0.419	8.5	0.00	20.47	-125	0.20	Same
1320	3.54	100	7.25	0.427	0.0	0.00	20.46	-127	0.20	Same
1325	3.54	100	7.25	0.424	3.9	0.00	20.43	-127	0.20	Same
1330	3.54	100	7.25	0.422	5.2	0.00	20.44	-127	0.20	Same
1335	3.54	100	7.26	0.425	1.8	0.00	20.44	-128	0.20	Same
1340	3.52	100	7.26	0.426	1.3	0.00	20.45	-128	0.20	Same
1345	3.52	100	7.26	0.426	0.0	0.00	20.45	-128	0.20	Same
1350	3.52	100	7.26	0.425	1.2	0.00	20.44	-128	0.20	Same
1355	3.52	100	7.26	0.426	0.0	0.00	20.47	-128	0.20	Same
1400	3.52	100	7.26	0.428	0.0	0.00	20.53	-128	0.21	Same

Sampled @ 1405 [signature]

SIGNATURE(S): [signature]

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW155A-20191024
Sample Location: MRC-MW155A
Sampled By: A.Dec
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/24/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(%)~~ ppt	Other ORP (mV)
Time: 1530								
Method: Low Flow/Peri								

PURGE DATA:

Date: 10/24/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow/Peri								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 9.10								
Static Water Level (WL): 4.02								
One Casing Volume (gal/L): 0.83								
Start Purge (hrs): 1505								
End Purge (hrs): 1530								
Total Purge Time (min): 25								
Total Vol. Purged (gal/L): 0.65								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	NONE	Clear, 250 mL PET	2
GRO	HCl	Clear, 40 mL VOA	3
DRO	HCL	Amber, 250mL glass	2

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s): A. Dec

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC - PFAS
PROJECT NUMBER: 60555202

WELL ID.: MRC-MW155A
DATE: 10/24/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1510	4.46	100	6.69	0.845	5.0	1.27	22.01	145	0.42	0.00 - 9.10 ; 7.10
1515	5.05	100	6.51	0.854	5.1	1.09	21.46	131	0.42	same
1520	5.60	100	6.49	0.862	5.4	1.08	21.26	136	0.42	same
1525	5.98	100	6.48	0.863	5.0	1.01	21.15	135	0.42	same

Sample @ 1530

SIGNATURE(S):

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRS
Project No.: 60555202

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-IWE-10-20191025
Sample Location: IWE-10
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/25/19 Time: 0950	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity PPT	Other ORP
Method: Low flow peri	clear	6.83	0.202	21.20	0.0	1.27	0.1	189

PURGE DATA:

Date: 10/25/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri								
Monitor Reading (ppm): 0.3								
Well Casing Diameter & Material Type: 4" PVC								
Total Well Depth (TD): 29.20								
Static Water Level (WL): 4.98					VK			
One Casing Volume(gal/L):								
Start Purge (hrs): 0915								
End Purge (hrs): 0945								
Total Purge Time (min): 30								
Total Vol. Purged (gal/L): 1.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250 mL PET	4
TPH-DRO	HCl	2x 250 mL amber glass	4
TPH-GRO	HCl	3 x 40 mL glass VIAL	6

OBSERVATIONS / NOTES:

GW remediation system from ~~PP~~ TT located inside Well

Circle if Applicable:
~~MS/MSD~~ Duplicate ID No.: MRC-IWE-10-DUP-20191025
@ 0955

Signature(s):

PID: 0.3

DTW: 4.98
DTB: 29.20
PD: 24.2

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER: 60555202

WELL ID.: MRC-IWE-10-20191025
DATE: 10/25/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or (ppt)	Well Screen Interval & Pump Depth
0915	5.22	160	6.16	0.287	21.2	2.38	19.19	229	0.1	PD: 24.20
0920	5.46	160	6.77	0.218	31.2	1.60	20.70	174	0.1	
0925	5.65	160	6.80	0.205	24.4	1.45	20.86	176	0.1	
0930	5.81	160	6.81	0.201	4.7	1.38	21.07	182	0.1	
0935	5.92	160	6.81	0.200	0.0	1.33	21.19	185	0.1	
0940	6.03	160	6.83	0.200	0.0	1.28	21.27	188	0.1	
0945	6.09	160	6.83	0.202	0.0	1.27	21.20	189	0.1	

SAMPLED @ 0950

SIGNATURE(S):

sample time @ 0950
(MRC-~~IWW~~IWE-10-20191025)

DUP collected @ 0955

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: MRC-LMC PFAS
Project No.: 60555202.0031

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MW146B
Sample Location: MRC-MW146B
Sampled By: A. Zarrelli
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 10/25/2019	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	ORP
Time: 1040								
Method: Perri Pump	Clear	5.12	1.63	18.00	38.8	0.00	0.8	30

PURGE DATA:

Date: 10/25/2019	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Perri Pump								
Monitor Reading (ppm): 0.3			See page 2					
Well Casing Diameter & Material Type: 2in PVC								
Total Well Depth (TD): 17.09								
Static Water Level (WL): 3.64								
One Casing Volume(gal/L): 2.19								
Start Purge (hrs): 0858								
End Purge (hrs): 1039								
Total Purge Time (min): 91								
Total Vol. Purged (gal/L): ~4.0								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	None	4 x 250mL clear plastic	Yes
DRO	HCL	4 x 250mL amber glass	Yes
GRO	HCL	6 x 40mL VOA vial	Yes

OBSERVATIONS / NOTES:

MRC-MW146B-20191025 @ 1040

Circle if Applicable:

MS/MSD

Duplicate ID No.: MRC-MW146B-DUP-20191025 @ 1050

Signature(s):

Antonio Zarrelli

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MRC LMC PFAs
PROJECT NUMBER: 60555202.0031
WELL ID.: MW146B
DATE: 10/25/2019

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
0905	4.59	100	5.81	1.59	330	0.00	12.94	-6	0.8	PD = 14'
0910	4.79	100	5.77	1.62	260	0.00	13.70	-9	0.8	sulfur odor strong
0915	4.90	100	5.69	1.67	191	0.00	14.34	-12	0.8	
0920	5.01	100	5.65	1.66	162	0.00	14.71	-12	0.8	
0925	5.08	100	5.59	1.68	146	0.00	15.00	-11	0.8	
0930	5.14	100	5.57	1.69	132	0.00	15.34	-11	0.8	
0935	5.22	100	5.53	1.69	124	0.00	15.66	-9	0.8	
0940	5.30	100	5.49	1.68	117	0.00	15.91	-7	0.8	
0945	5.37	100	5.45	1.68	110	0.00	16.02	-4	0.8	
0950	5.42	100	5.42	1.68	102	0.00	16.26	-2	0.8	
0955	5.46	100	5.38	1.66	90.9	0.00	16.55	1	0.8	
1000	5.49	100	5.34	1.65	81.5	0.00	16.81	5	0.8	
1005	5.50	100	5.30	1.64	73.4	0.00	16.94	8	0.8	
1010	5.52	100	5.28	1.64	72.3	0.00	17.07	10	0.8	
1015	5.51	100	5.23	1.64	62.3	0.00	17.33	15	0.8	
1020	5.53	100	5.20	1.63	59.4	0.00	17.53	18	0.8	
1025	5.55	100	5.18	1.62	53.7	0.00	17.68	21	0.8	
1030	5.56	100	5.17	1.63	41.7	0.00	17.83	24	0.8	
1035	5.58	100	5.12	1.63	38.8	0.00	18.00	30	0.8	
1040	SAMPLE									

SIGNATURE(S): Antonio Zarrelli

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LMC MRC
Project No.: 60555202

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW74B-20191025
Sample Location: MW74B
Sampled By: V. Kirkpatrick
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/25/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~ppt~~	~~Other~~ ORP
Time: 1145								
Method: Low flow peri	clear	6.70	0.251	20.75	75.2	1.49	0.1	-61

PURGE DATA:

Date: 10/25/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low flow peri								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material								
Type: 2" PVC Stick up								
Total Well Depth (TD): 34.47								
Static Water Level (WL): 9.85								
One Casing Volume(gal/L):								
Start Purge (hrs): 1035								
End Purge (hrs): 1140								
Total Purge Time (min): 65								
Total Vol. Purged (gal/L): 2.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS by Method 537	None	2 x 250 mL PET	
TPH-DRO	HCl	2 x 250 mL amber glass	
TPH-GRO	HCl	3 x 40 mL glass vial	

OBSERVATIONS / NOTES:

stick-up well w/ transducer previously deployed

Circle if Applicable:
MS/MSD
Duplicate ID No.:

Signature(s):

DTW: 9.85
DTB: 34.47
PD: 29.50

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LMC MRC
PROJECT NUMBER: 60555202

WELL ID.: MRC-MW74B-20191025
DATE: 10/25/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or (ppt)	Well Screen Interval & Pump Depth
1035	10.22	160	6.79	0.253	118	1.10	20.31	-5	0.1	PD: 29.50
1040	10.53	160	6.74	0.253	109	0.00	20.29	-21	0.1	
1045	10.78	140	6.69	0.250	98.2	0.00	20.31	-30	0.1	
1050	10.95	140	6.62	0.248	97.1	0.00	20.37	-30	0.1	
1055	11.02	140	6.63	0.247	101	0.00	20.42	-38	0.1	
1100	11.26	140	6.69	0.246	101	0.00	20.51	-45	0.1	
1105	11.40	140	6.69	0.250	102	0.00	20.53	-50	0.1	
1110	11.53	140	6.72	0.250	94.3	0.72	20.66	-54	0.1	
1115	11.65	140	6.72	0.250	99.5	0.62	20.68	-57	0.1	
1120	11.73	140	6.72	0.251	94.4	0.60	20.50	-60	0.1	
1125	11.83	140	6.67	0.251	85.2	0.59	20.57	-60	0.1	
1130	11.90	140	6.73	0.251	82.7	1.49	20.75	-61	0.1	
1135	11.93	140	6.65	0.251	78.0	1.52	20.65	-59	0.1	
1140	11.97	140	6.70	0.251	75.2	1.49	20.75	-61	0.1	
1145										

SAMPLED @ 1145

SIGNATURE(S):

sample time @ 1145

(MRC-MW74B-20191025)

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRL - PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[✓] QA Sample Type: MS/MSD

Sample ID No.: MRC-MW147B-20191025
Sample Location: MRL-MW147B
Sampled By: A. Dec
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/25/19	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (~~%~~ ppt)	Other ORP (mV)
Time: 1210								
Method: Low Flow / Peri	Clear	5.61	0.185	18.26	11.5	0.00	0.09	28

PURGE DATA:

Date: 10/25/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow / Peri								
Monitor Reading (ppm): 454								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 28.15								
Static Water Level (WL): 5.65								
One Casing Volume (gal/L): 3.67								
Start Purge (hrs): 1036								
End Purge (hrs): 1210								
Total Purge Time (min): 94								
Total Vol. Purged (gal/L): 2.44								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	NONE	Clear, 250 mL PET	6
GRO	HCl	Clear, 40 mL VOA	9
DRO	HCl	Amber, 250mL glass	6

OBSERVATIONS / NOTES:

Circle if Applicable:
MS/MSD ~~AD~~ AD
Duplicate ID No.: N/A

Signature(s):

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC - PFAS
PROJECT NUMBER: 60555202
WELL ID.: MRC-MW147B
DATE: 10/25/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
1040	6.18	100	5.65	0.202	235	0.29	17.99	-9	0.09	18.15-28.15, 23.15
1045	6.23	100	5.68	0.198	291	0.00	18.09	-21	0.09	Same
1050	6.27	100	5.69	0.195	303	0.00	18.10	-23	0.09	Same
1055	6.31	100	5.71	0.195	292	0.00	18.07	-26	0.09	Same
1100	6.33	100	5.73	0.195	271	0.00	18.04	-23	0.09	Same
1105	6.35	100	5.71	0.195	237	0.00	18.03	-17	0.09	Same
1110	6.38	100	5.67	0.194	188	0.00	18.04	-5	0.09	Same
1115	6.41	100	5.65	0.192	156	0.00	18.06	-1	0.09	Same
1120	6.45	100	5.64	0.191	119	0.00	18.10	7	0.09	Same
1125	6.47	100	5.61	0.190	91.5	0.00	18.08	9	0.09	Same
1130	6.49	100	5.59	0.189	82.9	0.00	18.11	12	0.09	Same
1135	6.50	100	5.58	0.189	65.9	0.00	18.12	12	0.09	Same
1140	6.51	100	5.58	0.188	55.8	0.00	18.17	16	0.09	Same
1145	6.52	100	5.56	0.187	42.0	0.00	18.19	19	0.09	Same
1150	6.54	100	5.55	0.188	31.2	0.00	18.10	21	0.09	Same
1155	6.55	100	5.53	0.186	21.3	0.00	18.21	26	0.09	Same
1200	6.57	100	5.52	0.185	17.5	0.00	18.23	28	0.09	Same
1205	6.59	100	5.51	0.185	11.5	0.00	18.26	28	0.09	Same
~~1210~~ AD		~~100~~ AD								~~Same~~ AD

Sampled @ 1240

SIGNATURE(S):

AECOM

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: LM MRC - PFAS
Project No.: 60555202

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: MRC-MW145A-20191025
Sample Location: MRC-MW145A
Sampled By: A. Dec
C.O.C. No.:
Type of Sample:
[✓] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 10/28/19	★Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity ~~(%)~~ ppt	Other ORP (mV)
Time: 1010								
Method: Low Flow / Peri	Pink/tan	3.51	3.04	16.64	79.1	0.00	1.58	349

PURGE DATA:

Date: 10/25/19	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow / Peri								
Monitor Reading (ppm): 15.2								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 9.81								
Static Water Level (WL): 3.97								
One Casing Volume (gal/L): 0.95								
Start Purge (hrs): 0901								
End Purge (hrs): 0948								
Total Purge Time (min): ~~0~~ 47								
Total Vol. Purged (gal/L): 1.22								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PFAS	NONE	Clear, 250mL PET	2
GRO	HCl	Clear, 40mL VOA	3
DRO	HCl	Amber, 250mL glass	2

10/28/19 ag

OBSERVATIONS / NOTES:

Sulfur odor

★ Last reading before purging dry

MRC-MW145A-20191028 @ 1010 on 10/28/19 ag

Circle if Applicable:

MS/MSD	Duplicate ID No.:
N/A	N/A

Signature(s):

AECOM

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: LM MRC - PFAS
PROJECT NUMBER: 60555202
WELL ID.: MRC-MW145A
DATE: 10/25/19

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Well Screen Interval & Pump Depth
0905	4.55	100	3.43	3.04	34.1	0.47	13.77	423	1.57	0.00 - 9.80', 7.50
0910	5.11	100	3.38	2.98	18.3	0.14	14.68	440	1.54	Same
0915	5.77	100	3.36	2.96	7.5	0.18	15.39	470	1.53	Same
0920	6.28	100	3.38	2.94	3.9	0.00	15.63	474	1.52	Same
0925	6.81	100	3.38	2.94	3.4	0.00	15.85	466	1.52	Same
0930	7.48	100	3.44	2.89	74.8	0.00	16.08	429	1.50	@ ~~Same~~ & lowered 1ft
0935	8.22	100	3.68	3.14	88.9	0.00	16.24	329	1.63	~~Same~~ and lowered 1ft
0940	8.54	100	3.59	3.12	91.2	0.00	16.29	311	1.63	@ 9.50 ft
0945	9.28	100	3.51	3.04	79.1	0.00	16.64	349	1.58	Same
* 0948	Purged	dry								
10/28/19 1008	4.17	Recharge								
1010	SAMPLE									

Antonio Zabrelli

SIGNATURE(S): Antonio Zabrelli

* 80% recharge when DTW = 5.14 ft

APPENDIX C
Investigation Derived Waste Documentation

AECOM - F001 PFAS - GWS

2000011033 SC MA PPW 12/9/2008

Please print or type. Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
MDR000524413	1	(800) 483-3718	014230163 FLE

GENERATOR

5. Generator's Name and Mailing Address
Middle River Complex
195 Chesapeake Park Plaza Rd
Middle River, MD 21220
Generator's Phone: (301) 674-3199 ATTN:HollyBrown

Generator's Site Address (if different than mailing address)

6. Transporter 1 Company Name: Clean Harbors Environmental Services, Inc. — U.S. EPA ID Number: MAD039322250

7. Transporter 2 Company Name — U.S. EPA ID Number:

8. Designated Facility Name and Site Address
Clean Harbors El Dorado LLC
309 American Circle
El Dorado, AR 71730
Facility's Phone: 8708637173

U.S. EPA ID Number: ARD069748192

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
	1. NA3082, HAZARDOUS WASTE, LIQUID, N.O.S. MIXTURE, (TRICHLOROETHENE AND PFAS), 9, PG III	1	DM	300	P	F001		
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1. [illegible]
2.
3.
4.

1) 1 x 55

Authority on initial transporter to add or substitute additional transporters on generator's behalf for purposes of transportation efficiency, convenience, or safety

Contract retained by generator confers agency

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: X THOMAS D. BLACKMAN — Signature: [signature] — Month: 01 Day: 03 Year: 2020

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: COREY JOYNER — Signature: [signature] — Month: 1 Day: 3 Year: 2020

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H040			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name: Dana Tucker — Signature: [signature] — Month: 1 Day: 15 Year: 20

EPA Form 8700-22 (Rev. 12-17) Previous editions are obsolete.

Clean Harbors has the appropriate permits for and will accept the waste the generator is shipping.

DESIGNATED FACILITY TO EPA's e-MANIFEST SYSTEM

CleanHarbors
ENVIRONMENTAL SERVICES®

Land Disposal Restriction Notification Form

Printed Date :Jan 3, 2020

MANIFEST INFORMATION

Generator : Middle River Complex

Address: 195 Chesapeake Park Plaza Rd
Middle River,MD 21220

EPA ID #: M D R 0 0 0 5 2 4 4 1 3

Manifest Tracking Info.

014230163FLE

Sales Order No: 2000011033

LINE ITEM INFORMATION

Line Item:	Page No:	Profile No:	Treatability Group:	LDR Disposal Category
1.	1	CH1956669	WASTEWATER	2 (This is subject to LDR.)

EPA Waste Code
D001

EPA Waste SubCategory
NONE

LDR Chemical Data

Chemical	Underlying Hazardous Constituents	Constituents of Concern	Contaminants Subject to Treatment
TRICHLOROETHYLENE	N	Y	N

Certification

	Applies to Manifest Line Items
Pursuant to 40 CFR 268.7(a), I hereby notify that this shipment contains waste restricted under 40 CFR Part 268.	1.
This waste is not restricted as specified in 40 CFR 268 Subpart D.	2.

Waste analysis data, where available, is attached.

Signature : X [signature]

Print Name : THOMAS D. BLACKMAN

Title : PROJECT LEAD

Date : JANUARY 3, 2020

Waste Listing Assessmet Form

LMC Remediation Project	GWS PFAS Event	**State Generated**	MD
Description of Waste			
Generic Name	Hazardous Purge Water	**Solid, Liquid, Gas**	Liquid
		Additional Info.	
Date of Waste Generation	10/24/2019	**Ongoing (Y/N)?**	N

Description of Process Generating Waste

Purge water generating during sampling event for PFAS.

Listed Waste ? (Y/N)	Y	**F,K, P or U Codes, if applicable**	F001

Justification for Waste Classification (attach support documentation)

Waste code based on historical generator knowledge of TCE from historical degreasing operations.

Completed by	Aimee Schuppin
Company	AECOM
Date	1/16/2020

WASTE MATERIAL PROFILE SHEET

Clean Harbors Profile No. CH1956669

A. GENERAL INFORMATION

GENERATOR EPA ID #/REGISTRATION # ***MDR000524413*** GENERATOR NAME: ***Middle River Complex***

GENERATOR CODE (Assigned by Clean Harbors) ***MI48414*** CITY ***Middle River*** STATE/PROVINCE ***MD*** ZIP/POSTAL CODE ***21220***

ADDRESS ***195 Chesapeake Park Plaza Rd*** PHONE: **(301) 674-3199**

CUSTOMER CODE (Assigned by Clean Harbors) ***AE12881*** CUSTOMER NAME: ***AECOM***

ADDRESS ***12420 Milestone Dr Ste 150*** CITY ***Germantown*** STATE/PROVINCE ***MD*** ZIP/POSTAL CODE ***20876***

B. WASTE DESCRIPTION

WASTE DESCRIPTION: ***Purge Water***

PROCESS GENERATING WASTE: **Purge Water generated during well sampling (09-2019)**

IS THIS WASTE CONTAINED IN SMALL PACKAGING CONTAINED WITHIN A LARGER SHIPPING CONTAINER ? **No**

C. PHYSICAL PROPERTIES (at 25C or 77F)

PHYSICAL STATE
- SOLID WITHOUT FREE LIQUID
- POWDER
- MONOLITHIC SOLID
- ✔ LIQUID WITH NO SOLIDS
- LIQUID/SOLID MIXTURE
- % FREE LIQUID
- % SETTLED SOLID
- % TOTAL SUSPENDED SOLID
- SLUDGE
- GAS/AEROSOL

NUMBER OF PHASES/LAYERS

✔ 1 2 3

% BY VOLUME (Approx.)

TOP ***0.00***

MIDDLE ***0.00***

BOTTOM ***0.00***

VISCOSITY (If liquid present)
- ✔ 1 - 100 (e.g. Water)
- 101 - 500 (e.g. Motor Oil)
- 501 - 10,000 (e.g. Molasses)
- > 10,000

COLOR

clear

ODOR
- ✔ NONE
- MILD
- STRONG

Describe:

BOILING POINT °F (°C)
- <= 95 (<=35)
- 95 - 100 (35-38)
- 101 - 129 (38-54)
- ✔ >= 130 (>54)

MELTING POINT °F (°C)
- < 140 (<60)
- 140-200 (60-93)
- > 200 (>93)

TOTAL ORGANIC CARBON
- ✔ <= 1%
- 1-9%
- >= 10%

FLASH POINT °F (°C)
- < 73 (<23)
- 73 - 100 (23-38)
- 101 -140 (38-60)
- 141 -200 (60-93)
- ✔ > 200 (>93)

pH
- <= 2
- 2.1 - 6.9
- ✔ 7 (Neutral)
- 7.1 - 12.4
- >= 12.5

SPECIFIC GRAVITY
- < 0.8 (e.g. Gasoline)
- 0.8-1.0 (e.g. Ethanol)
- ✔ 1.0 (e.g. Water)
- 1.0-1.2 (e.g. Antifreeze)
- > 1.2 (e.g. Methylene Chloride)

ASH
- < 0.1
- 0.1 - 1.0
- 1.1 - 5.0
- 5.1 - 20.0
- > 20
- ✔ Unknown

BTU/LB (MJ/kg)
- ✔ < 2,000 (<4.6)
- 2,000-5,000 (4.6-11.6)
- 5,000-10,000 (11.6-23.2)
- > 10,000 (>23.2)

Actual:

D. COMPOSITION (List the complete composition of the waste, include any inert components and/or debris. Ranges for individual components are acceptable. If a trade name is used, please supply an MSDS. Please do not use abbreviations.)

CHEMICAL	MIN	--	MAX	UOM
BARIUM	0.0000000	--	0.1280000	PPM
CHROMIUM	0.0000000	--	0.0020000	PPM
PFAS (<100 PPT)		--		Trace
TRICHLOROETHENE	1.0000000	--	62.0000000	PPB
WATER	100.0000000	--	100.0000000	%

DOES THIS WASTE CONTAIN ANY HEAVY GAUGE METAL DEBRIS OR OTHER LARGE OBJECTS (EX., METAL PLATE OR PIPING >1/4" THICK OR >12" LONG, METAL REINFORCED HOSE >12" LONG, METAL WIRE >12" LONG, METAL VALVES, PIPE FITTINGS, CONCRETE REINFORCING BAR OR PIECES OF CONCRETE >3")? YES NO

If yes, describe, including dimensions:

DOES THIS WASTE CONTAIN ANY METALS IN POWDERED OR OTHER FINELY DIVIDED FORM? YES ✔ NO

DOES THIS WASTE CONTAIN OR HAS IT CONTACTED ANY OF THE FOLLOWING; ANIMAL WASTES, HUMAN BLOOD, BLOOD PRODUCTS, BODY FLUIDS, MICROBIOLOGICAL WASTE, PATHOLOGICAL WASTE, HUMAN OR ANIMAL DERIVED SERUMS OR PROTEINS OR ANY OTHER POTENTIALLY INFECTIOUS MATERIAL? YES ✔ NO

I acknowledge that this waste material is neither infectious nor does it contain any organism known to be a threat to human health. This certification is based on my knowledge of the material. Select the answer below that applies:

The waste was never exposed to potentially infectious material. YES NO

Chemical disinfection or some other form of sterilization has been applied to the waste. YES NO

I ACKNOWLEDGE THAT THIS PROFILE MEETS THE CLEAN HARBORS BATTERY PACKAGING REQUIREMENTS. YES NO

I ACKNOWLEDGE THAT MY FRIABLE ASBESTOS WASTE IS DOUBLE BAGGED AND WETTED. YES NO

SPECIFY THE SOURCE CODE ASSOCIATED WITH THE WASTE. ***G44*** SPECIFY THE FORM CODE ASSOCIATED WITH THE WASTE. ***W113***

E. CONSTITUENTS

Are these values based on testing or knowledge? Knowledge ✔ Testing

If constituent concentrations are based on analytical testing, analysis must be provided. Please attach document(s) using the link on the Submit tab.

Please indicate which constituents below apply. Concentrations must be entered when applicable to assist in accurate review and expedited approval of your waste profile. Please note that the total regulated metals and other constituents sections require answers.

RCRA	REGULATED METALS	REGULATORY LEVEL (mg/l)	TCLP mg/l	TOTAL	UOM	NOT APPLICABLE
D004	ARSENIC	5.0				✔
D005	BARIUM	100.0	*0.1280*	*0.1280000*	*PPM*	
D006	CADMIUM	1.0				✔
D007	CHROMIUM	5.0	*0.0024*	*0.0020000*	*PPM*	
D008	LEAD	5.0				✔
D009	MERCURY	0.2				✔
D010	SELENIUM	1.0				✔
D011	SILVER	5.0				✔

	VOLATILE COMPOUNDS		
D018	BENZENE	0.5	
D019	CARBON TETRACHLORIDE	0.5	
D021	CHLOROBENZENE	100.0	
D022	CHLOROFORM	6.0	
D028	1,2-DICHLOROETHANE	0.5	
D029	1,1-DICHLOROETHYLENE	0.7	
D035	METHYL ETHYL KETONE	200.0	
D039	TETRACHLOROETHYLENE	0.7	
D040	TRICHLOROETHYLENE	0.5	*0.0620*
D043	VINYL CHLORIDE	0.2	
	SEMI-VOLATILE COMPOUNDS		
D023	o-CRESOL	200.0	
D024	m-CRESOL	200.0	
D025	p-CRESOL	200.0	
D026	CRESOL (TOTAL)	200.0	
D027	1,4-DICHLOROBENZENE	7.5	
D030	2,4-DINITROTOLUENE	0.13	
D032	HEXACHLOROBENZENE	0.13	
D033	HEXACHLOROBUTADIENE	0.5	
D034	HEXACHLOROETHANE	3.0	
D036	NITROBENZENE	2.0	
D037	PENTACHLOROPHENOL	100.0	
D038	PYRIDINE	5.0	
D041	2,4,5-TRICHLOROPHENOL	400.0	
D042	2,4,6-TRICHLOROPHENOL	2.0	
	PESTICIDES AND HERBICIDES		
D012	ENDRIN	0.02	
D013	LINDANE	0.4	
D014	METHOXYCHLOR	10.0	
D015	TOXAPHENE	0.5	
D016	2,4-D	10.0	
D017	2,4,5-TP (SILVEX)	1.0	
D020	CHLORDANE	0.03	
D031	HEPTACHLOR (AND ITS EPOXIDE)	0.008	

OTHER CONSTITUENTS	MAX	UOM	NOT APPLICABLE
BROMINE			✔
CHLORINE			✔
FLUORINE			✔
IODINE			✔
SULFUR			✔
POTASSIUM			✔
SODIUM			✔
AMMONIA			✔
CYANIDE AMENABLE			✔
CYANIDE REACTIVE			✔
CYANIDE TOTAL			✔
SULFIDE REACTIVE			✔

HOCs

✔ NONE

< 1000 PPM

>= 1000 PPM

PCBs

✔ NONE

< 50 PPM

>=50 PPM

IF PCBS ARE PRESENT, IS THE WASTE REGULATED BY TSCA 40 CFR 761?

YES ✔ NO

ADDITIONAL HAZARDS

DOES THIS WASTE HAVE ANY UNDISCLOSED HAZARDS OR PRIOR INCIDENTS ASSOCIATED WITH IT, WHICH COULD AFFECT THE WAY IT SHOULD BE HANDLED?

YES ✔ NO (If yes, explain)

CHOOSE ALL THAT APPLY

DEA REGULATED SUBSTANCES	EXPLOSIVE	FUMING	OSHA REGULATED CARCINOGENS
POLYMERIZABLE	RADIOACTIVE	REACTIVE MATERIAL	✔ NONE OF THE ABOVE

F. REGULATORY STATUS

- [x] YES [ ] NO USEPA HAZARDOUS WASTE?
  F001
- [ ] YES [x] NO DO ANY STATE WASTE CODES APPLY?
  Texas Waste Code
- [ ] YES [x] NO DO ANY CANADIAN PROVINCIAL WASTE CODES APPLY?
- [x] YES [ ] NO IS THIS WASTE PROHIBITED FROM LAND DISPOSAL WITHOUT FURTHER TREATMENT PER 40 CFR PART 268?
  LDR CATEGORY: *This is subject to LDR.*
  VARIANCE INFO:
- [ ] YES [x] NO IS THIS A UNIVERSAL WASTE?
- [ ] YES [ ] NO IS THE GENERATOR OF THE WASTE CLASSIFIED AS A VERY SMALL QUANTITY GENERATOR (VSQG) OR A STATE EQUIVALENT DESIGNATION?
- [ ] YES [ ] NO IS THIS MATERIAL GOING TO BE MANAGED AS A RCRA EXEMPT COMMERCIAL PRODUCT, WHICH IS FUEL (40 CFR 261.2 (C)(2)(II))?
- [ ] YES [x] NO DOES TREATMENT OF THIS WASTE GENERATE A F006 OR F019 SLUDGE?
- [ ] YES [ ] NO IS THIS WASTE STREAM SUBJECT TO THE INORGANIC METAL BEARING WASTE PROHIBITION FOUND AT 40 CFR 268.3(C)?
- [ ] YES [x] NO DOES THIS WASTE CONTAIN VOC'S IN CONCENTRATIONS >=500 PPM?
- [ ] YES [ ] NO DOES THE WASTE CONTAIN GREATER THAN 20% OF ORGANIC CONSTITUENTS WITH A VAPOR PRESSURE >= .3KPA (.044 PSIA)?
- [ ] YES [x] NO DOES THIS WASTE CONTAIN AN ORGANIC CONSTITUENT WHICH IN ITS PURE FORM HAS A VAPOR PRESSURE > 76.6 KPA (11.1 PSIA)?
- [ ] YES [x] NO IS THIS CERCLA REGULATED (SUPERFUND) WASTE ?
- [ ] YES [x] NO IS THE WASTE SUBJECT TO ONE OF THE FOLLOWING NESHAP RULES?
  Hazardous Organic NESHAP (HON) rule (subpart G) Pharmaceuticals production (subpart GGG)
- [ ] YES [x] NO IF THIS IS A US EPA HAZARDOUS WASTE, DOES THIS WASTE STREAM CONTAIN BENZENE?
  - [ ] YES [ ] NO Does the waste stream come from a facility with one of the SIC codes listed under benzene NESHAP or is this waste regulated under the benzene NESHAP rules because the original source of the waste is from a chemical manufacturing, coke by-product recovery, or petroleum refinery process?
  - [ ] YES [ ] NO Is the generating source of this waste stream a facility with Total Annual Benzene (TAB) >10 Mg/year?

  What is the TAB quantity for your facility? _____ Megagram/year (1 Mg = 2,200 lbs)

  The basis for this determination is: Knowledge of the Waste Or Test Data Knowledge Testing

  Describe the knowledge :

G. DOT/TDG INFORMATION

DOT/TDG PROPER SHIPPING NAME:

NA3082, HAZARDOUS WASTE, LIQUID, N.O.S. MIXTURE, (TRICHLOROETHENE AND PFAS), 9, PG III

H. TRANSPORTATION REQUIREMENTS

ESTIMATED SHIPMENT FREQUENCY [x] ONE TIME WEEKLY MONTHLY QUARTERLY YEARLY OTHER

[x] **CONTAINERIZED**

0-1 CONTAINERS/SHIPMENT

STORAGE CAPACITY: *100*

CONTAINER TYPE:

PORTABLE TOTE TANK BOX|CARTON|CASE

CUBIC YARD BOX [x] DRUM

OTHER: DRUM SIZE: *55*

BULK LIQUID

GALLONS/SHIPMENT: *0 Min -0 Max* GAL.

BULK SOLID

SHIPMENT UOM: TON YARD

TONS/YARDS/SHIPMENT: *0 Min - 0 Max*

I. SPECIAL REQUEST

COMMENTS OR REQUESTS:

GENERATOR'S CERTIFICATION

I certify that I am authorized to execute this document as an authorized agent. I hereby certify that all information submitted in this and attached documents is correct to the best of my knowledge.I also certify that any samples submitted are representative of the actual waste.If Clean Harbors discovers a discrepancy during the approval process, Generator grants Clean Harbors the authority to amend the profile, as Clean Harbors deems necessary, to reflect the discrepancy.

AUTHORIZED SIGNATURE	NAME (PRINT)	TITLE	DATE
~~aimee.schuppin@aecom.com~~	THOMAS A. BLACKMAN	PROJECT LEAD	DEC. 20, 2019

This waste profile has been submitted using Clean Harbors' electronic signature system.

Site Address: AECOM - PFAS GWS - 60555202

SC MA PPW 12/9/2008

1177681

WORK ORDER NO. 200001103

DOCUMENT NO.

STRAIGHT BILL OF LADING

TRANSPORTER 1 Clean Harbors Environmental Services, Inc. VEHICLE ID #

EPA ID # MAD039322250 TRANS. 1 PHONE (781) 792-5000

TRANSPORTER 2 VEHICLE ID #

EPA ID # TRANS. 2 PHONE

DESIGNATED FACILITY				SHIPPER ATTN: Holly Brown			
Clean Harbors El Dorado LLC				Middle River Complex			
FACILITY EPA ID #				SHIPPER EPA ID #			
ARD069748192				MDR000524413			
ADDRESS				ADDRESS			
309 American Circle				195 Chesapeake Park Plaza Rd			
CITY		STATE	ZIP	CITY		STATE	ZIP
El Dorado		AR	71730	Middle River		MD	21220

CONTAINERS NO. & SIZE	TYPE	HM	DESCRIPTION OF MATERIALS	TOTAL QUANTITY	UNIT WT/VOL
55	DM		A. NONE, NON-REGULATED LIQUID, N/A	2	600P
			B.		
			C.		
			D.		
			E.		
			F.		
			G.		
			H.		

SPECIAL HANDLING INSTRUCTIONS EMERGENCY PHONE #: (800) 483-3718 GENERATOR: Middle River Complex
A.CH1958457 A) 2 x 55

SHIPPERS CERTIFICATION: This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

	PRINT	SIGN	DATE
SHIPPER	THOMAS D. BLACKMAN		1/3/2020
TRANSPORTER 1	Corey Joyner		1/3/2020
TRANSPORTER 2			
RECEIVED BY	Dana Tucker	Dana Tucker	1/15/20

1

CHI 107

Waste Listing Assessmet Form

LMC Remediation Project	GWS PFAS Event	**State Generated**	MD
Description of Waste			
Generic Name	Purge Water	**Solid, Liquid, Gas**	Liquid
		Additional Info.	
Date of Waste Generation	10/21/2019	**Ongoing (Y/N)?**	N

Description of Process Generating Waste

Purge water generating during sampling event for PFAS.

Listed Waste ? (Y/N)	N	**F,K, P or U Codes, if applicable**	

Justification for Waste Classification (attach support documentation)

Completed by	Aimee Schuppin
Company	AECOM
Date	1/16/2020

WASTE MATERIAL PROFILE SHEET

Clean Harbors Profile No. CH1958457

A. GENERAL INFORMATION

GENERATOR EPA ID #/REGISTRATION # ***MDR000524413*** GENERATOR NAME: ***Middle River Complex***

GENERATOR CODE (Assigned by Clean Harbors) ***MI48414*** CITY ***Middle River*** STATE/PROVINCE ***MD*** ZIP/POSTAL CODE ***21220***

ADDRESS ***195 Chesapeake Park Plaza Rd*** PHONE: **(301) 674-3199**

CUSTOMER CODE (Assigned by Clean Harbors) ***AE12881*** CUSTOMER NAME: ***AECOM***

ADDRESS ***12420 Milestone Dr Ste 150*** CITY ***Germantown*** STATE/PROVINCE ***MD*** ZIP/POSTAL CODE ***20876***

B. WASTE DESCRIPTION

WASTE DESCRIPTION: ***Purge Water***

PROCESS GENERATING WASTE: **Purge Water generated during well sampling (09-2019)**

IS THIS WASTE CONTAINED IN SMALL PACKAGING CONTAINED WITHIN A LARGER SHIPPING CONTAINER ? **No**

C. PHYSICAL PROPERTIES (at 25C or 77F)

PHYSICAL STATE
- SOLID WITHOUT FREE LIQUID
- POWDER
- MONOLITHIC SOLID
- ✔ LIQUID WITH NO SOLIDS
- LIQUID/SOLID MIXTURE
- % FREE LIQUID
- % SETTLED SOLID
- % TOTAL SUSPENDED SOLID
- SLUDGE
- GAS/AEROSOL

NUMBER OF PHASES/LAYERS

✔ 1 2 3

% BY VOLUME (Approx.)

TOP ***0.00***

MIDDLE ***0.00***

BOTTOM ***0.00***

VISCOSITY (If liquid present)
- ✔ 1 - 100 (e.g. Water)
- 101 - 500 (e.g. Motor Oil)
- 501 - 10,000 (e.g. Molasses)
- > 10,000

COLOR

clear

ODOR
- ✔ NONE
- MILD
- STRONG

Describe:

BOILING POINT °F (°C)
- <= 95 (<=35)
- 95 - 100 (35-38)
- 101 - 129 (38-54)
- ✔ >= 130 (>54)

MELTING POINT °F (°C)
- < 140 (<60)
- 140-200 (60-93)
- > 200 (>93)

TOTAL ORGANIC CARBON
- ✔ <= 1%
- 1-9%
- >= 10%

FLASH POINT °F (°C)
- < 73 (<23)
- 73 - 100 (23-38)
- 101 -140 (38-60)
- 141 -200 (60-93)
- ✔ > 200 (>93)

pH
- <= 2
- 2.1 - 6.9
- ✔ 7 (Neutral)
- 7.1 - 12.4
- >= 12.5

SPECIFIC GRAVITY
- < 0.8 (e.g. Gasoline)
- 0.8-1.0 (e.g. Ethanol)
- ✔ 1.0 (e.g. Water)
- 1.0-1.2 (e.g. Antifreeze)
- > 1.2 (e.g. Methylene Chloride)

ASH
- < 0.1
- 0.1 - 1.0
- 1.1 - 5.0
- 5.1 - 20.0
- > 20
- ✔ Unknown

BTU/LB (MJ/kg)
- ✔ < 2,000 (<4.6)
- 2,000-5,000 (4.6-11.6)
- 5,000-10,000 (11.6-23.2)
- > 10,000 (>23.2)

Actual:

D. COMPOSITION (List the complete composition of the waste, include any inert components and/or debris. Ranges for individual components are acceptable. If a trade name is used, please supply an MSDS. Please do not use abbreviations.)

CHEMICAL	MIN	--	MAX	UOM
BARIUM	0.0000000	--	0.1280000	PPM
CHROMIUM	0.0000000	--	0.0020000	PPM
PFAS (<100PPT)		--		Trace
TRICHLOROETHENE	1.0000000	--	62.0000000	PPB
WATER	100.0000000	--	100.0000000	%

DOES THIS WASTE CONTAIN ANY HEAVY GAUGE METAL DEBRIS OR OTHER LARGE OBJECTS (EX., METAL PLATE OR PIPING >1/4" THICK OR >12" LONG, METAL REINFORCED HOSE >12" LONG, METAL WIRE >12" LONG, METAL VALVES, PIPE FITTINGS, CONCRETE REINFORCING BAR OR PIECES OF CONCRETE >3")? YES NO

If yes, describe, including dimensions:

DOES THIS WASTE CONTAIN ANY METALS IN POWDERED OR OTHER FINELY DIVIDED FORM? YES ✔ NO

DOES THIS WASTE CONTAIN OR HAS IT CONTACTED ANY OF THE FOLLOWING; ANIMAL WASTES, HUMAN BLOOD, BLOOD PRODUCTS, BODY FLUIDS, MICROBIOLOGICAL WASTE, PATHOLOGICAL WASTE, HUMAN OR ANIMAL DERIVED SERUMS OR PROTEINS OR ANY OTHER POTENTIALLY INFECTIOUS MATERIAL? YES ✔ NO

I acknowledge that this waste material is neither infectious nor does it contain any organism known to be a threat to human health. This certification is based on my knowledge of the material. Select the answer below that applies:

The waste was never exposed to potentially infectious material. YES NO

Chemical disinfection or some other form of sterilization has been applied to the waste. YES NO

I ACKNOWLEDGE THAT THIS PROFILE MEETS THE CLEAN HARBORS BATTERY PACKAGING REQUIREMENTS. YES NO

I ACKNOWLEDGE THAT MY FRIABLE ASBESTOS WASTE IS DOUBLE BAGGED AND WETTED. YES NO

SPECIFY THE SOURCE CODE ASSOCIATED WITH THE WASTE. ***G44*** SPECIFY THE FORM CODE ASSOCIATED WITH THE WASTE. ***W113***

E. CONSTITUENTS

Are these values based on testing or knowledge? Knowledge ☑ Testing

If constituent concentrations are based on analytical testing, analysis must be provided. Please attach document(s) using the link on the Submit tab.

Please indicate which constituents below apply. Concentrations must be entered when applicable to assist in accurate review and expedited approval of your waste profile. Please note that the total regulated metals and other constituents sections require answers.

RCRA	REGULATED METALS	REGULATORY LEVEL (mg/l)	TCLP mg/l	TOTAL	UOM	NOT APPLICABLE
D004	ARSENIC	5.0				☑
D005	BARIUM	100.0	*0.1280*	*0.1280000*	*PPM*	
D006	CADMIUM	1.0				☑
D007	CHROMIUM	5.0	*0.0024*	*0.0020000*	*PPM*	
D008	LEAD	5.0				☑
D009	MERCURY	0.2				☑
D010	SELENIUM	1.0				☑
D011	SILVER	5.0				☑

	VOLATILE COMPOUNDS		
D018	BENZENE	0.5	
D019	CARBON TETRACHLORIDE	0.5	
D021	CHLOROBENZENE	100.0	
D022	CHLOROFORM	6.0	
D028	1,2-DICHLOROETHANE	0.5	
D029	1,1-DICHLOROETHYLENE	0.7	
D035	METHYL ETHYL KETONE	200.0	
D039	TETRACHLOROETHYLENE	0.7	
D040	TRICHLOROETHYLENE	0.5	*0.0620*
D043	VINYL CHLORIDE	0.2	

	SEMI-VOLATILE COMPOUNDS	
D023	o-CRESOL	200.0
D024	m-CRESOL	200.0
D025	p-CRESOL	200.0
D026	CRESOL (TOTAL)	200.0
D027	1,4-DICHLOROBENZENE	7.5
D030	2,4-DINITROTOLUENE	0.13
D032	HEXACHLOROBENZENE	0.13
D033	HEXACHLOROBUTADIENE	0.5
D034	HEXACHLOROETHANE	3.0
D036	NITROBENZENE	2.0
D037	PENTACHLOROPHENOL	100.0
D038	PYRIDINE	5.0
D041	2,4,5-TRICHLOROPHENOL	400.0
D042	2,4,6-TRICHLOROPHENOL	2.0

	PESTICIDES AND HERBICIDES	
D012	ENDRIN	0.02
D013	LINDANE	0.4
D014	METHOXYCHLOR	10.0
D015	TOXAPHENE	0.5
D016	2,4-D	10.0
D017	2,4,5-TP (SILVEX)	1.0
D020	CHLORDANE	0.03
D031	HEPTACHLOR (AND ITS EPOXIDE)	0.008

OTHER CONSTITUENTS	MAX	UOM	NOT APPLICABLE
BROMINE			☑
CHLORINE			☑
FLUORINE			☑
IODINE			☑
SULFUR			☑
POTASSIUM			☑
SODIUM			☑
AMMONIA			☑
CYANIDE AMENABLE			☑
CYANIDE REACTIVE			☑
CYANIDE TOTAL			☑
SULFIDE REACTIVE			☑

HOCs

☑ NONE
< 1000 PPM
>= 1000 PPM

PCBs

☑ NONE
< 50 PPM
>=50 PPM

IF PCBS ARE PRESENT, IS THE WASTE REGULATED BY TSCA 40 CFR 761?

YES ☑ NO

ADDITIONAL HAZARDS

DOES THIS WASTE HAVE ANY UNDISCLOSED HAZARDS OR PRIOR INCIDENTS ASSOCIATED WITH IT, WHICH COULD AFFECT THE WAY IT SHOULD BE HANDLED?

YES ☑ NO (If yes, explain)

CHOOSE ALL THAT APPLY

DEA REGULATED SUBSTANCES	EXPLOSIVE	FUMING	OSHA REGULATED CARCINOGENS
POLYMERIZABLE	RADIOACTIVE	REACTIVE MATERIAL	☑ NONE OF THE ABOVE

F. REGULATORY STATUS

YES ✔ NO USEPA HAZARDOUS WASTE?

YES ✔ NO DO ANY STATE WASTE CODES APPLY?

Texas Waste Code

YES ✔ NO DO ANY CANADIAN PROVINCIAL WASTE CODES APPLY?

YES ✔ NO IS THIS WASTE PROHIBITED FROM LAND DISPOSAL WITHOUT FURTHER TREATMENT PER 40 CFR PART 268?

LDR CATEGORY: ***Not subject to LDR***
VARIANCE INFO:

YES ✔ NO IS THIS A UNIVERSAL WASTE?

YES ✔ NO IS THE GENERATOR OF THE WASTE CLASSIFIED AS A VERY SMALL QUANTITY GENERATOR (VSQG) OR A STATE EQUIVALENT DESIGNATION?

YES NO IS THIS MATERIAL GOING TO BE MANAGED AS A RCRA EXEMPT COMMERCIAL PRODUCT, WHICH IS FUEL (40 CFR 261.2 (C)(2)(II))?

YES ✔ NO DOES TREATMENT OF THIS WASTE GENERATE A F006 OR F019 SLUDGE?

YES NO IS THIS WASTE STREAM SUBJECT TO THE INORGANIC METAL BEARING WASTE PROHIBITION FOUND AT 40 CFR 268.3(C)?

YES ✔ NO DOES THIS WASTE CONTAIN VOC'S IN CONCENTRATIONS >=500 PPM?

YES NO DOES THE WASTE CONTAIN GREATER THAN 20% OF ORGANIC CONSTITUENTS WITH A VAPOR PRESSURE >= .3KPA (.044 PSIA)?

YES ✔ NO DOES THIS WASTE CONTAIN AN ORGANIC CONSTITUENT WHICH IN ITS PURE FORM HAS A VAPOR PRESSURE > 76.6 KPA (11.1 PSIA)?

YES ✔ NO IS THIS CERCLA REGULATED (SUPERFUND) WASTE ?

YES ✔ NO IS THE WASTE SUBJECT TO ONE OF THE FOLLOWING NESHAP RULES?

Hazardous Organic NESHAP (HON) rule (subpart G) Pharmaceuticals production (subpart GGG)

YES NO IF THIS IS A US EPA HAZARDOUS WASTE, DOES THIS WASTE STREAM CONTAIN BENZENE?

YES NO Does the waste stream come from a facility with one of the SIC codes listed under benzene NESHAP or is this waste regulated under the benzene NESHAP rules because the original source of the waste is from a chemical manufacturing, coke by-product recovery, or petroleum refinery process?

YES NO Is the generating source of this waste stream a facility with Total Annual Benzene (TAB) >10 Mg/year?

What is the TAB quantity for your facility? Megagram/year (1 Mg = 2,200 lbs)

The basis for this determination is: Knowledge of the Waste Or Test Data Knowledge Testing

Describe the knowledge :

G. DOT/TDG INFORMATION

DOT/TDG PROPER SHIPPING NAME:

NON-REGULATED LIQUID

H. TRANSPORTATION REQUIREMENTS

ESTIMATED SHIPMENT FREQUENCY ✔ ONE TIME WEEKLY MONTHLY QUARTERLY YEARLY OTHER

✔ **CONTAINERIZED**

0-2 CONTAINERS/SHIPMENT

STORAGE CAPACITY: ***100***

CONTAINER TYPE:

PORTABLE TOTE TANK BOX|CARTON|CASE

CUBIC YARD BOX ✔ DRUM

OTHER: DRUM SIZE ***55***

BULK LIQUID

GALLONS/SHIPMENT: ***0 Min -0 Max*** GAL

BULK SOLID

SHIPMENT UOM: TON YARD

TONS/YARDS/SHIPMENT: ***0 Min - 0 Max***

I. SPECIAL REQUEST

COMMENTS OR REQUESTS:

GENERATOR'S CERTIFICATION

I certify that I am authorized to execute this document as an authorized agent. I hereby certify that all information submitted in this and attached documents is correct to the best of my knowledge.I also certify that any samples submitted are representative of the actual waste.If Clean Harbors discovers a discrepancy during the approval process, Generator grants Clean Harbors the authority to amend the profile, as Clean Harbors deems necessary, to reflect the discrepancy.

AUTHORIZED SIGNATURE	NAME (PRINT)	TITLE	DATE
~~aimee.schuppin@aecom.com~~	THOMAS D. BLAKMAN	PROJECT MGR	Dec 20, 2019

This waste profile has been submitted using Clean Harbors' electronic signature system.

LM MRC Drum Tracking Table
2019 MW Repairs and Stage 2 PFM Sub-Sampling

Date: 10/21/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Scheduled T&D	Contents
DM-3	Spent Carbon	Hazardous Waste	10/23/2019	10/16/2019	10/21/2019	A	5	TBD	PFM spent carbon
DM-4	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	TBD	10/21/2019	N/A	A	0	TBD	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A
DM-1	Fill	Hazardous Waste	8/20/2019	7/30/2019	9/16/2019, 9/23/19, 9/30/19, 10/7/19, 10/14/19, 10/21/19	B	83	10/22/2019	MW01A, MW115A, MW95B, NMW-1I, MW24A, MW29A, MW40A, MW34A, SEMW-3I, MW25A, MW26A, MW58A, MW90B, MW17A, MW50A, MW69B, MW110A, MW53B
DM-2	Fill	Hazardous Waste	8/20/2019	8/5/2019	9/16/2019, 9/23/19, 9/30/19, 10/7/19, 10/14/19, 10/21/19	B	77	10/22/2019	MW01A, MW115A, MW95B, NMW-1I, MW24A, MW29A, MW40A, MW34A, SEMW-3I, MW25A, MW26A, MW58A, MW90B, MW17A, MW50A, MW69B, MW110A, MW53B

A = Excellent Condition

B = Some rust present on drum lid

AECOM

LM MRC Drum Tracking Table
Stage 2 PFM Sub-Sampling and PFAS GWS

Date: 10/28/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Not-to-Exceed	Scheduled T&D	Contents
DM-3	Spent Carbon	Hazardous Waste	10/23/2019	10/16/2019	10/21/2019, 10/28/2019	A	12	12/30/2019	TBD	PFM spent carbon
DM-2	Purged GW	Hazardous Waste	N/A	10/24/2019	10/28/2019	A	4	1/7/2020	TBD	Purged GW from PFAS Sampling - MW155A, MW72B, MW159A, IWE-10, MW146B, MW74B, MW147B, MW145A
DM-1	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/23/2019	10/28/2019	A	5	1/6/2020	TBD	Purged GW from PFAS Sampling - MW18A, MW118A, MW118B, MW128B, MW60A, MW60B, MW125A, MW125B, MW55A, MW56A, MW134B, MW128A, MW44A, MW134A, MW136B
DM-4	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/21/2019	10/28/2019	A	7	1/4/2020	TBD	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A, SEMW-1I, SEMW-2I, SEMW-3I, MW41A, MW119A

A = Excellent Condition

AECOM

LM MRC Drum Tracking Table
Stage 2 PFM Sub-Sampling and PFAS GWS

Date: 11/4/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Not-to-Exceed	Scheduled T&D	Contents
DM-3	Spent Carbon	Hazardous Waste	10/23/2019	10/16/2019	10/21/2019, 10/28/2019, 11/4/2019	A	19	12/30/2019	TBD	PFM spent carbon
DM-2	Purged GW	Hazardous Waste	N/A	10/24/2019	10/28/2019, 11/4/2019	A	11	1/7/2020	TBD	Purged GW from PFAS Sampling - MW155A, MW72B, MW159A, IWE-10, MW146B, MW74B, MW147B, MW145A
DM-1	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/23/2019	10/28/2019, 11/4/2019	A	12	1/6/2020	TBD	Purged GW from PFAS Sampling - MW18A, MW118A, MW118B, MW128B, MW60A, MW60B, MW125A, MW125B, MW55A, MW56A, MW134B, MW128A, MW44A, MW134A, MW136B
DM-4	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/21/2019	10/28/2019, 11/4/2019	A	14	1/4/2020	TBD	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A, SEMW-1I, SEMW-2I, SEMW-3I, MW41A, MW119A

A = Excellent Condition

AECOM

LM MRC Drum Tracking Table
Stage 2 PFM Sub-Sampling and PFAS GWS

Date: 11/11/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Not-to-Exceed	Scheduled T&D	Contents
DM-3	Spent Carbon	Hazardous Waste	10/23/2019	10/16/2019	10/21/2019, 10/28/2019, 11/4/2019, 11/11/2019	A	26	12/30/2019	TBD	PFM spent carbon
DM-2	Purged GW	Hazardous Waste	N/A	10/24/2019	10/28/2019, 11/4/2019, 11/11/2019	A	18	1/7/2020	TBD	Purged GW from PFAS Sampling - MW155A, MW72B, MW159A, IWE-10, MW146B, MW74B, MW147B, MW145A
DM-1	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/23/2019	10/28/2019, 11/4/2019, 11/11/2019	A	19	1/6/2020	TBD	Purged GW from PFAS Sampling - MW18A, MW118A, MW118B, MW128B, MW60A, MW60B, MW125A, MW125B, MW55A, MW56A, MW134B, MW128A, MW44A, MW134A, MW136B
DM-4	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/21/2019	10/28/2019, 11/4/2019, 11/11/2019	A	21	1/4/2020	TBD	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A, SEMW-1I, SEMW-2I, SEMW-3I, MW41A, MW119A

A = Excellent Condition

AECOM

LM MRC Drum Tracking Table
Stage 2 PFM Sub-Sampling and PFAS GWS

Date: 11/18/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Not-to-Exceed	Scheduled T&D	Contents
DM-3	Spent Carbon	Hazardous Waste	10/23/2019	10/16/2019	10/21/2019, 10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019	A	33	12/30/2019	TBD	PFM spent carbon
DM-2	Purged GW	Hazardous Waste	N/A	10/24/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019	A	25	1/7/2020	TBD	Purged GW from PFAS Sampling - MW155A, MW72B, MW159A, IWE-10, MW146B, MW74B, MW147B, MW145A
DM-1	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/23/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019	A	26	1/6/2020	TBD	Purged GW from PFAS Sampling - MW18A, MW118A, MW118B, MW128B, MW60A, MW60B, MW125A, MW125B, MW55A, MW56A, MW134B, MW128A, MW44A, MW134A, MW136B
DM-4	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/21/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019	A	28	1/4/2020	TBD	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A, SEMW-1I, SEMW-2I, SEMW-3I, MW41A, MW119A

A = Excellent Condition

AECOM

LM MRC Drum Tracking Table
Stage 2 PFM Sub-Sampling and PFAS GWS

Date: 11/25/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Not-to-Exceed	Scheduled T&D	Contents
DM-3	Spent Carbon	Hazardous Waste	10/23/2019	10/16/2019	10/21/2019, 10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019	A	40	12/30/2019	TBD	PFM spent carbon
DM-2	Purged GW	Hazardous Waste	N/A	10/24/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019	A	32	1/7/2020	TBD	Purged GW from PFAS Sampling - MW155A, MW72B, MW159A, IWE-10, MW146B, MW74B, MW147B, MW145A
DM-1	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/23/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019	A	33	1/6/2020	TBD	Purged GW from PFAS Sampling - MW18A, MW118A, MW118B, MW128B, MW60A, MW60B, MW125A, MW125B, MW55A, MW56A, MW134B, MW128A, MW44A, MW134A, MW136B
DM-4	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/21/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019	A	35	1/4/2020	TBD	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A, SEMW-1I, SEMW-2I, SEMW-3I, MW41A, MW119A

A = Excellent Condition

AECOM

LM MRC Drum Tracking Table
Stage 2 PFM Sub-Sampling and PFAS GWS

Date: 12/2/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Not-to-Exceed	Scheduled T&D	Contents
DM-3	Spent Carbon	Hazardous Waste	10/23/2019	10/16/2019	10/21/2019, 10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019	A	47	12/30/2019	TBD	PFM spent carbon
DM-2	Purged GW	Hazardous Waste	N/A	10/24/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019	A	39	1/7/2020	TBD	Purged GW from PFAS Sampling - MW155A, MW72B, MW159A, IWE-10, MW146B, MW74B, MW147B, MW145A
DM-1	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/23/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019	A	40	1/6/2020	TBD	Purged GW from PFAS Sampling - MW18A, MW118A, MW118B, MW128B, MW60A, MW60B, MW125A, MW125B, MW55A, MW56A, MW134B, MW128A, MW44A, MW134A, MW136B
DM-4	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/21/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019	A	42	1/4/2020	TBD	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A, SEMW-1I, SEMW-2I, SEMW-3I, MW41A, MW119A

A = Excellent Condition

AECOM

LM MRC Drum Tracking Table
Stage 2 PFM Sub-Sampling and PFAS GWS

Date: 12/9/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Not-to-Exceed	Scheduled T&D	Contents
DM-3	Spent Carbon	Hazardous Waste	10/23/2019	10/16/2019	10/21/2019, 10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019	A	54	12/30/2019	TBD	PFM spent carbon
DM-2	Purged GW	Hazardous Waste	N/A	10/24/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019	A	46	1/7/2020	TBD	Purged GW from PFAS Sampling - MW155A, MW72B, MW159A, IWE-10, MW146B, MW74B, MW147B, MW145A
DM-1	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/23/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019	A	47	1/6/2020	TBD	Purged GW from PFAS Sampling - MW18A, MW118A, MW118B, MW128B, MW60A, MW60B, MW125A, MW125B, MW55A, MW56A, MW134B, MW128A, MW44A, MW134A, MW136B
DM-4	Purged GW	Non-Classified Waste - Pending Laboratory Analysis	10/25/2019	10/21/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019	A	49	1/4/2020	TBD	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A, SEMW-1I, SEMW-2I, SEMW-3I, MW41A, MW119A

A = Excellent Condition

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LM MRC Drum Tracking Table
Stage 2 PFM Sub-Sampling and PFAS GWS

Date: 12/16/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Not-to-Exceed	Scheduled T&D	Contents
DM-3	Spent Carbon	Hazardous Waste	10/23/2019	10/16/2019	10/21/2019, 10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019	A	61	12/30/2019	TBD	PFM spent carbon
DM-2	Purged GW	Hazardous Waste	N/A	10/24/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019	A	53	1/7/2020	TBD	Purged GW from PFAS Sampling - MW155A, MW72B, MW159A, IWE-10, MW146B, MW74B, MW147B, MW145A
DM-1	Purged GW	Non-Hazardous Waste	10/25/2019	10/23/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019	A	54	1/6/2020	TBD	Purged GW from PFAS Sampling - MW18A, MW118A, MW118B, MW128B, MW60A, MW60B, MW125A, MW125B, MW55A, MW56A, MW134B, MW128A, MW44A, MW134A, MW136B
DM-4	Purged GW	Non-Hazardous Waste	10/25/2019	10/21/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019	A	56	1/4/2020	TBD	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A, SEMW-1I, SEMW-2I, SEMW-3I, MW41A, MW119A

A = Excellent Condition

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LM MRC Drum Tracking Table
Stage 2 PFM Sub-Sampling and PFAS GWS

Date: 12/23/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Not-to-Exceed	Scheduled T&D	Contents
DM-3	Spent Carbon	Non-Hazardous Waste	10/23/2019	10/16/2019	10/21/2019, 10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019, 12/23/2019	A	68	12/30/2019	TBD	PFM spent carbon
DM-2	Purged GW	Hazardous Waste	N/A	10/24/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019, 12/23/2019	A	60	1/7/2020	TBD	Purged GW from PFAS Sampling - MW155A, MW72B, MW159A, IWE-10, MW146B, MW74B, MW147B, MW145A
DM-1	Purged GW	Non-Hazardous Waste	10/25/2019	10/23/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019, 12/23/2019	A	61	1/6/2020	TBD	Purged GW from PFAS Sampling - MW18A, MW118A, MW118B, MW128B, MW60A, MW60B, MW125A, MW125B, MW55A, MW56A, MW134B, MW128A, MW44A, MW134A, MW136B
DM-4	Purged GW	Non-Hazardous Waste	10/25/2019	10/21/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019, 12/23/2019	A	63	1/4/2020	TBD	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A, SEMW-1I, SEMW-2I, SEMW-3I, MW41A, MW119A

A = Excellent Condition

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LM MRC Drum Tracking Table
Stage 2 PFM Sub-Sampling and PFAS GWS

Date: 12/30/2019

Drum ID	Contents	Label Type	Sampled	Accumulation Date	Weekly Inspection	Condition	Days On-site	Not-to-Exceed	Scheduled T&D	Contents
DM-3	Spent Carbon	Non-Hazardous Waste	10/23/2019	10/16/2019	10/21/2019, 10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019, 12/23/2019, 12/30/2019	A	75	12/30/2019	1/3/2020	PFM spent carbon
DM-2	Purged GW	Hazardous Waste	N/A	10/24/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019, 12/23/2019, 12/30/2019	A	67	1/7/2020	1/3/2020	Purged GW from PFAS Sampling - MW155A, MW72B, MW159A, IWE-10, MW146B, MW74B, MW147B, MW145A
DM-1	Purged GW	Non-Hazardous Waste	10/25/2019	10/23/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019, 12/23/2019, 12/30/2019	A	68	1/6/2020	1/3/2020	Purged GW from PFAS Sampling - MW18A, MW118A, MW118B, MW128B, MW60A, MW60B, MW125A, MW125B, MW55A, MW56A, MW134B, MW128A, MW44A, MW134A, MW136B
DM-4	Purged GW	Non-Hazardous Waste	10/25/2019	10/21/2019	10/28/2019, 11/4/2019, 11/11/2019, 11/18/2019, 11/25/2019, 12/2/2019, 12/9/2019, 12/16/2019, 12/23/2019, 12/30/2019	A	70	1/4/2020	1/3/2020	Purged GW from PFAS Sampling - MW01A, MW16A, MW10A, MW02A, MW42A, MW27A, MW48A, MW27B, EXT-MW03, EXT-MW06, MW21A, MW05A, SEMW-1I, SEMW-2I, SEMW-3I, MW41A, MW119A

A = Excellent Condition

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Analysis Report

Partial Report

Sample Description: PFAS-IDW-20191025 Composite Groundwater
LM MRC PFAS GWS

Project Name: LM MRC PFAS GWS

AECOM
ELLE Sample #: WW 1187258
ELLE Group #: 2071644
Matrix: Groundwater

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-01

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
PCBs	**SW-846 8082A**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10591	PCB-1016	12674-11-2	N.D. D1	0.11	0.32	0.53	1
10591	PCB-1221	11104-28-2	N.D. D1	0.11	0.32	0.53	1
10591	PCB-1232	11141-16-5	N.D. D1	0.21	0.42	0.53	1
10591	PCB-1242	53469-21-9	N.D. D1	0.11	0.32	0.53	1
10591	PCB-1248	12672-29-6	N.D. D1	0.11	0.32	0.53	1
10591	PCB-1254	11097-69-1	N.D. D1	0.11	0.32	0.53	1
10591	PCB-1260	11096-82-5	N.D. D1	0.16	0.32	0.53	1
Wet Chemistry	**SW-846 Chapter 7.3**		**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	
01123	Cyanide (Reactivity)	n.a.	N.D.	19.6	49.1	58.9	1
	SM 2550 B-2010		**Degrees C**	**Degrees C**	**Degrees C**	**Degrees C**	
12151	Temperature of pH	n.a.	19.5	0.010	0.010	0.010	1
	SW-846 1010A		**Degrees F**	**Degrees F**	**Degrees F**	**Degrees F**	
00430	Flash Point	n.a.	No Flash Observed	50	50	50	1
	No flash observed below 188F. Test flame extinguished at 168F. Flash point was determined using Pensky Martens closed cup apparatus.						
	SW-846 9040C		**Std. Units**	**Std. Units**	**Std. Units**	**Std. Units**	
12152	pH	n.a.	7.0	0.010	0.010	0.010	1
	SW-846 Chapter 7						
00496	Corrosivity	n.a.	See Below	0	0	0	1
	The pH of the sample is 6.97 indicating that the sample is not corrosive. A sample is corrosive if it exhibits a pH equal to or less than 2 or equal to or greater than 12.5.						
	SW-846 Chapter 7.3		**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	
01122	Sulfide (Reactivity)	n.a.	N.D.	53.6	143	160	1
	SW-846 Chapter 7.3		**see below**	**see below**	**see below**	**see below**	
01121	Reactivity	n.a.	See Below	0	0	0	1

*=This limit was used in the evaluation of the final result

Reference ID:
2071644131119112650

Partial Report

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

AECOM
ELLE Sample #: WW 1187258
ELLE Group #: 2071644
Matrix: Groundwater

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-01

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
Wet Chemistry	**SW-846 Chapter 7.3**		**see below**	**see below**	**see below**	**see below**	

Reactivity:
This sample was extracted and analyzed by the interim method described in SW-846 Revision 3, December 1996 - Chapter 7.3. The Interim Guidance for Reactive Cyanide and Reactive Sulfide (SW-846 Sections 7.3.3 and 7.3.4 of Chapter 7 - December 1996) identifies a reactive material as generating more than 250 mg/kg of hydrogen cyanide or 500 mg/kg of hydrogen sulfide. This waste is not considered hazardous due to reactivity based on that standard. These results do not reflect total cyanide or total sulfide. On July 14, 2005, EPA published a rule in the Federal Register that removed the Interim Guidance and the method referenced above. At this time there is no specific guidance or a method to be used to evaluate "Reactivity".

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10591	PCBs in Water by 8082A	SW-846 8082A	1	193040021A	11/01/2019 21:12	Covenant Mutuku	1
01123	Cyanide (Reactivity)	SW-846 Chapter 7.3	1	19308104201A	11/04/2019 11:06	Jonathan Saul	1
12151	Temperature of pH	SM 2550 B-2010	1	19303121521A	10/30/2019 14:10	Jeremy L Bolf	1
00430	Flash Point	SW-846 1010A	1	19308043001A	11/04/2019 09:45	Susan A Engle	1
12152	pH	SW-846 9040C	1	19303121521A	10/30/2019 14:10	Jeremy L Bolf	1
00496	Corrosivity	SW-846 Chapter 7	1	19303121521A	10/30/2019 14:10	Jeremy L Bolf	1
01121	Reactivity	SW-846 Chapter 7.3	1	19304112101A	10/31/2019 09:00	Nicole Munsell	1
01122	Sulfide (Reactivity)	SW-846 Chapter 7.3	1	19304112101A	10/31/2019 09:00	Nicole Munsell	1

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
TCLP NVE
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

AECOM
ELLE Sample #: TL 1187259
ELLE Group #: 2071644
Matrix: Groundwater

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-02

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC/MS Semivolatiles	**SW-846 8270D**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
14252	1,4-Dichlorobenzene	106-46-7	N.D.	0.003	0.005	0.010	1
14252	2,4-Dinitrotoluene	121-14-2	N.D.	0.005	0.010	0.025	1

*=This limit was used in the evaluation of the final result

Reference ID:
2071644131119112650

Partial Report

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
TCLP NVE
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-02

AECOM
ELLE Sample #: TL 1187259
ELLE Group #: 2071644
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC/MS Semivolatiles	**SW-846 8270D**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
14252	Hexachlorobenzene	118-74-1	N.D.	0.0005	0.001	0.003	1
14252	Hexachlorobutadiene	87-68-3	N.D.	0.003	0.005	0.010	1
14252	Hexachloroethane	67-72-1	N.D.	0.005	0.010	0.025	1
14252	2-Methylphenol	95-48-7	N.D.	0.003	0.005	0.010	1
14252	4-Methylphenol	106-44-5	N.D.	0.003	0.005	0.010	1
	3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.						
14252	Nitrobenzene	98-95-3	N.D.	0.003	0.005	0.010	1
14252	Pentachlorophenol	87-86-5	N.D.	0.005	0.010	0.025	1
14252	Pyridine	110-86-1	N.D.	0.010	0.020	0.025	1
14252	2,4,5-Trichlorophenol	95-95-4	N.D.	0.003	0.005	0.010	1
14252	2,4,6-Trichlorophenol	88-06-2	N.D.	0.003	0.005	0.010	1
	The response for Pyridine in the initial calibration verification standard is outside the DoD acceptance limits. Due to the decreased response indicating a low bias, a standard was prepared at the method detection limit and was analyzed to verify the instrument?s sensitivity for this compound prior to analyzing the sample. Since Pyridine was recovered in the MDL standard and there is no detection for this compound in the sample, the data is reported.						
Herbicides	**SW-846 8151A**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
00952	2,4-D	94-75-7	N.D. D1	0.016	0.032	0.050	1
00952	2,4,5-TP	93-72-1	N.D. D2	0.0010	0.0020	0.0050	1
Pesticides	**SW-846 8081B**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
10647	Gamma BHC - Lindane	58-89-9	N.D. D1	0.00010	0.00020	0.00050	10
10647	Chlordane	57-74-9	N.D. D1	0.0080	0.016	0.025	10
10647	Endrin	72-20-8	N.D. D1	0.00040	0.0010	0.0010	10
10647	Heptachlor	76-44-8	N.D. D1	0.00020	0.00040	0.00050	10
10647	Heptachlor Epoxide	1024-57-3	N.D. D1	0.00012	0.00036	0.00050	10
10647	Methoxychlor	72-43-5	N.D. D1	0.0015	0.0040	0.0050	10
10647	Toxaphene	8001-35-2	N.D. D1	0.050	0.10	0.15	10
	The recovery for the method blank surrogate(s) is outside the QC acceptance limits as noted on the QC Summary.						
Metals	**SW-846 6010C**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
07035	Arsenic	7440-38-2	N.D.	0.0160	0.0250	0.0300	1
07046	Barium	7440-39-3	0.128	0.0010	0.0025	0.0050	1
07049	Cadmium	7440-43-9	N.D.	0.0010	0.0025	0.0050	1
07051	Chromium	7440-47-3	0.0024 J	0.0016	0.0038	0.0150	1
07055	Lead	7439-92-1	N.D.	0.0071	0.0113	0.0150	1
07036	Selenium	7782-49-2	N.D.	0.0160	0.0375	0.0500	1

*=This limit was used in the evaluation of the final result

Reference ID:
207164413119112650

Partial Report

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
TCLP NVE
LM MRC PFAS GWS

AECOM
ELLE Sample #: TL 1187259
ELLE Group #: 2071644
Matrix: Groundwater

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-02

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
Metals	**SW-846 6010C**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
07066	Silver	7440-22-4	N.D.	0.0050	0.0075	0.0100	1
Metals	**SW-846 7470A**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00010	0.00020	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

If the analysis is for determination of Hazardous Waste Characteristics, see Table 1 in EPA Code of Federal Regulations 40 CFR 261.24.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14252	TCLP 8270D MINI	SW-846 8270D	1	19308WAF026	11/05/2019 14:06	Joseph M Gambler	1
00952	TCLP Herbicides	SW-846 8151A	1	193050015A	11/05/2019 00:14	Rachel Umberger	1
10647	TCLP Pesticides by 8081B	SW-846 8081B	1	193050003A	11/04/2019 17:37	Lisa A Reinert	10
07035	Arsenic	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07046	Barium	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07049	Cadmium	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07051	Chromium	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07055	Lead	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07036	Selenium	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07066	Silver	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	193030571304	10/31/2019 11:15	Damary Valentin	1

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
TCLP ZHE
LM MRC PFAS GWS

AECOM
ELLE Sample #: TL 1187260
ELLE Group #: 2071644
Matrix: Groundwater

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-03

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC/MS Volatiles	**SW-846 8260C**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
11997	Benzene	71-43-2	N.D.	4	10	20	20

*=This limit was used in the evaluation of the final result

Reference ID:
2071644131119112650

Partial Report

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
TCLP ZHE
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

AECOM
ELLE Sample #: TL 1187260
ELLE Group #: 2071644
Matrix: Groundwater

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-03

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC/MS Volatiles	**SW-846 8260C**		ug/l	ug/l	ug/l	ug/l	
11997	2-Butanone	78-93-3	N.D.	6	20	200	20
11997	Carbon Tetrachloride	56-23-5	N.D.	4	10	20	20
11997	Chlorobenzene	108-90-7	N.D.	4	10	20	20
11997	Chloroform	67-66-3	N.D.	4	10	20	20
11997	1,2-Dichloroethane	107-06-2	N.D.	6	10	20	20
11997	1,1-Dichloroethene	75-35-4	N.D.	4	10	20	20
11997	Tetrachloroethene	127-18-4	N.D.	4	10	20	20
11997	Trichloroethene	79-01-6	62	4	10	20	20
11997	Vinyl Chloride	75-01-4	N.D.	4	10	20	20

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

If the analysis is for determination of Hazardous Waste Characteristics, see Table 1 in EPA Code of Federal Regulations 40 CFR 261.24.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11997	VOCs- 5ml Water by 8260C/D	SW-846 8260C	1	Y193103AA	11/07/2019 04:54	Miranda Campbell	20

Sample Description: **TB-20191028 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

AECOM
ELLE Sample #: WW 1187261
ELLE Group #: 2071644
Matrix: Water

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/28/2019 11:00
SDG#: FSB55-04TB

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		ug/l	ug/l	ug/l	ug/l	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

*=This limit was used in the evaluation of the final result

Reference ID:
2071644131119112650

Partial Report

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 14:34	Jeremy C Giffin	1

Sample Description: **MRC-MW145A-20191028 Grab Groundwater LM MRC PFAS GWS**

Project Name: **LM MRC PFAS GWS**

AECOM
ELLE Sample #: WW 1187262
ELLE Group #: 2071644
Matrix: Groundwater

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/28/2019 10:10
SDG#: FSB55-05

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	49	99	110	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 15:51	Jeremy C Giffin	1
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193050033A	11/06/2019 10:35	Heather E Williams	1

*=This limit was used in the evaluation of the final result

Reference ID:
207164413119112650

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only
Acct. # 42343 Group # 207644 Sample # 1187258-63

COC # 594734

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Parciesa	P.O. #:
Sampler: Holly Braun	Quote #:

State where samples were collected: MD
For Compliance: Yes ☐ No ☒

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix: Soil	Sediment	Tissue	Water: Potable	Ground	Surface	NPDES	Other:	Total # of Containers	pH/Temperature of pH	Reactivity	Flash Point	PCBs in Water by 8020A	Aqueous - Full TCLP	Aqueous - TCLP VOCs	H	TPH-GRO	TPH-DRO	PFAS	Remarks
PFAS-IDW-20191025	10/25/19	1400		X				X					11	1	1	1	2	3	3					
TB-20191028	10/28/19	1100	X					WQ					2								2			trip blank Water Quality
MRC-MW145A-20191028	10/28/19	1010	X					GW					4								3	2	2	
FB-20191028	10/28/19	1040	X					WQ					2										2	field blank

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: 12

E-mail address: holly.braun@aecom.com & laura.fountzis@aecom.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-28-19	1310		10/28/19	13:10
	10/28/19	16:54			
				10-28-19	1737

EDD Required? Yes No
If yes, format: EQUIS & .CSV

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS _____ FedEx _____ Other _____

Temperature upon receipt -2.1 - 4.5 °C

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Sample Administration Receipt Documentation Log

Doc Log ID: 264240

Group Number(s): 2071644

Client: DynCorp

Delivery and Receipt Information

Delivery Method:	Fed Ex	Arrival Date:	10/26/2019
Number of Packages:	1	Number of Projects:	1

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	No
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	Total Trip Blank Qty:	0
Paperwork Enclosed:	Yes	Air Quality Samples Present:	No
Samples Intact:	Yes		
Missing Samples:	Yes		
Extra Samples:	Yes		
Discrepancy in Container Qty on COC:	Yes		

Unpacked by Shalynn Ponzo

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle)* *IR = Infrared (Surface Temp)* *All Temperatures in °C.*

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	192099059	4.1	IR	Wet	Y	Loose	N

Missing Sample Details

Sample ID on COC	Comments
M1WW01 MS	
M1WW01 MSD	

Extra Sample Details

Sample ID on Label	Number of Extra Containers	Date on Label	Comments
KDIWW MS	3	10/19/2019 12:15	
KDIWW MSD	3	10/19/2019 12:15	

Container Quantity Discrepancy Details

Sample ID on COC	Container Qty. Received	Container Qty. on COC	Comments
RDWW01 DUP	4	3	
RDWW01	2	3	

Sample ID Discrepancy Details

Sample ID on COC	Sample ID on Label	Comments
KDWW01	KIWW01	

2425 New Holland Pike
Lancaster, PA 17605-2425
T | 717-656-2300
F | 717-656-2681
www.LancasterLabs.com

Client: DynCorp

2425 New Holland Pike
Lancaster, PA 17605-2425

T | 717-656-2300
F | 717-656-2681
www.LancasterLabs.com

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

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ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

AECOM
Suite 150
12420 Milestone Center Drive
Germantown MD 20876

Report Date: November 19, 2019 10:02

Project: LM MRC PFAS GWS

Account #: 42343
Group Number: 2070940
SDG: FSB50
PO Number: 118990
State of Sample Origin: MD

Electronic Copy To AECOM — Attn: Naoum Tavantzis
Electronic Copy To AECOM — Attn: Holly Brown

Respectfully Submitted,

Kay Hower

(717) 556-7364

To view our laboratory's current scopes of accreditation please go to https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/ . Historical copies may be requested through your project manager.

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SAMPLE INFORMATION

Client Sample Description	Sample Collection Date/Time	ELLE#
MRC-MW01A-20191021 Grab Groundwater	10/21/2019 10:15	1183575
MRC-MW16A-20191021 Grab Groundwater	10/21/2019 16:00	1183576
MRC-MW10A-20191021 Grab Groundwater	10/21/2019 13:25	1183577
MRC-EXT-MW03-20191021 Grab Groundwater	10/21/2019 15:50	1183578
MRC-EXT-MW06-20191021 Grab Groundwater	10/21/2019 12:55	1183579
MRC-MW02A-20191021 Grab Groundwater	10/21/2019 10:30	1183580
MRC-MW42A-20191021 Grab Groundwater	10/21/2019 14:20	1183581
MRC-MW27A-20191021 Grab Groundwater	10/21/2019 14:10	1183582
MRC-MW48A-20191021 Grab Groundwater	10/21/2019 16:00	1183583
MRC-MW27B-20191021 Grab Groundwater	10/21/2019 12:30	1183584
MRC-MW27B-DUP-20191021 Grab Groundwater	10/21/2019 12:35	1183585
MRC-MW21A-20191021 Grab Groundwater	10/21/2019 10:25	1183586
MRC-MW21A-DUP-20191021 Grab Groundwater	10/21/2019 10:30	1183587
MRC-MW05A-20191021 Grab Groundwater	10/21/2019 11:30	1183588
MRC-MW05A-DUP-20191021 Grab Groundwater	10/21/2019 11:35	1183589
FB-20191021 Grab Water	10/21/2019 16:00	1183590

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

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Project Name: LM MRC PFAS GWS
ELLE Group #: 2070940

General Comments:

All analyses have been performed in accordance with DOD QSM Version 5.1.1 unless otherwise noted below.

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.
Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

EPA 537 mod QSM 5.1 table B-15, LC/MS/MS Miscellaneous

Sample #s: 1183579, 1183585, 1183590

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Sample #s: 1183584

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The following analytes were manually integrated:
Perfluorobutanesulfonic acid

Sample #s: 1183576, 1183578, 1183586

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control

Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

Sample #s: 1183588

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

The following analytes were manually integrated:
Perfluoroheptanoic acid, Perfluorobutanesulfonic acid

Sample #s: 1183580, 1183582, 1183583, 1183587

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample #s: 1183589

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

The following analytes were manually integrated:
Perfluoroheptanoic acid

Sample #s: 1183577, 1183581

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported

from the initial trial and both sets of data are included in the data package.

The recovery for injection and extraction standards is outside of the QC acceptance limits in the initial extraction and the re-extracted sample. The values here are from the initial extraction of the sample.

Sample #s: 1183575

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for injection and extraction standards is outside of the QC acceptance limits in the initial extraction and the re-extracted sample. The values here are from the initial extraction of the sample.

The following analytes were manually integrated:
Perfluoroheptanoic acid

Batch #: 19305004 (Sample number(s): 1183575-1183590)

The recovery(ies) for the following analyte(s) in the LCS and/or LCSD were below the acceptance window:
Perfluorooctanoic acid, Perfluorobutanesulfonic acid

The recovery(ies) for one or more surrogates exceeded the acceptance window indicating a positive bias for sample(s) 1183575, 1183576, 1183577, 1183578, 1183580, 1183581, 1183582, 1183583, 1183586, 1183587, 1183588, 1183589

The recovery(ies) for one or more surrogates were below the acceptance window for sample(s) 1183575, 1183580, 1183582, 1183583, 1183589

Sample Description: **MRC-MW01A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 10:15
SDG#: FSB50-01

AECOM
ELLE Sample #: GW 1183575
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	3.0	0.45	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	1.1 J	0.45	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	4.4	0.45	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.45	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	0.80 J	0.45	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	2.9	0.45	0.89	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for injection and extraction standards is outside of the QC acceptance limits in the initial extraction and the re-extracted sample. The values here are from the initial extraction of the sample.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:00	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW16A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 16:00
SDG#: FSB50-02

AECOM
ELLE Sample #: GW 1183576
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.90	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	3.0		0.45	0.90	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	5.7		0.45	0.90	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	2.1		0.45	0.90	1.8	1
14434	Perfluorononanoic acid	375-95-1	1.0	J	0.45	0.90	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	4.7		0.45	0.90	1.8	1
14434	Perfluorooctanoic acid	335-67-1	11		0.45	0.90	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:09	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW10A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 13:25
SDG#: FSB50-03

AECOM
ELLE Sample #: GW 1183577
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.91	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.2 J	0.45	0.91	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	2.5	0.45	0.91	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.60 J	0.45	0.91	1.8	1
14434	Perfluorononanoic acid	375-95-1	1.0 J	0.45	0.91	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	1.7 J	0.45	0.91	1.8	1
14434	Perfluorooctanoic acid	335-67-1	6.5	0.45	0.91	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for injection and extraction standards is outside of the QC acceptance limits in the initial extraction and the re-extracted sample. The values here are from the initial extraction of the sample.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:18	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-EXT-MW03-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 15:50
SDG#: FSB50-04

AECOM
ELLE Sample #: GW 1183578
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.7	4.7	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	3.9	0.47	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	20	0.47	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.57 J	0.47	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	5.9	0.47	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	7.9	0.47	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	16	0.47	0.93	1.9	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:27	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-EXT-MW06-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 12:55
SDG#: FSB50-05

AECOM
ELLE Sample #: GW 1183579
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.92	1.8	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	2.0	0.46	0.92	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	4.6	0.46	0.92	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.80 J	0.46	0.92	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.1	0.46	0.92	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	28	0.46	0.92	1.8	1
14434	Perfluorooctanoic acid	335-67-1	9.5	0.46	0.92	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:36	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW02A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 10:30
SDG#: FSB50-06

AECOM
ELLE Sample #: GW 1183580
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.7	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.87	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	3.9	0.44	0.87	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	7.6	0.44	0.87	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.8	0.44	0.87	1.7	1
14434	Perfluorononanoic acid	375-95-1	3.1	0.44	0.87	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	15	0.44	0.87	1.7	1
14434	Perfluorooctanoic acid	335-67-1	15	0.44	0.87	1.7	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:45	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW42A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 14:20
SDG#: FSB50-07

AECOM
ELLE Sample #: GW 1183581
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.3 J	0.46	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	3.2	0.46	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.2 J	0.46	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.46	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	0.63 J	0.46	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	8.8	0.46	0.93	1.9	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for injection and extraction standards is outside of the QC acceptance limits in the initial extraction and the re-extracted sample. The values here are from the initial extraction of the sample.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:54	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW27A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 14:10
SDG#: FSB50-08

AECOM
ELLE Sample #: GW 1183582
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.88	1.8	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.2	J	0.44	0.88	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	4.5		0.44	0.88	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.6	J	0.44	0.88	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.4		0.44	0.88	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	9.7		0.44	0.88	1.8	1
14434	Perfluorooctanoic acid	335-67-1	10		0.44	0.88	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:12	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW48A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 16:00
SDG#: FSB50-09

AECOM
ELLE Sample #: GW 1183583
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.7	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.87	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.90 J	0.44	0.87	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	3.2	0.44	0.87	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.6 J	0.44	0.87	1.7	1
14434	Perfluorononanoic acid	375-95-1	1.4 J	0.44	0.87	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	9.9	0.44	0.87	1.7	1
14434	Perfluorooctanoic acid	335-67-1	13	0.44	0.87	1.7	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:21	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW27B-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 12:30
SDG#: FSB50-10

AECOM
ELLE Sample #: GW 1183584
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	5.1		1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.88	1.8	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.51	J	0.44	0.88	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	2.0		0.44	0.88	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.64	J	0.44	0.88	1.8	1
14434	Perfluorononanoic acid	375-95-1	0.44	J	0.44	0.88	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	2.5		0.44	0.88	1.8	1
14434	Perfluorooctanoic acid	335-67-1	4.6		0.44	0.88	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:30	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW27B-DUP-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 12:35
SDG#: FSB50-11FD

AECOM
ELLE Sample #: GW 1183585
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	5.1	1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.88	1.8	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.44	0.88	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	2.0	0.44	0.88	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.71 J	0.44	0.88	1.8	1
14434	Perfluorononanoic acid	375-95-1	0.49 J	0.44	0.88	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	2.4	0.44	0.88	1.8	1
14434	Perfluorooctanoic acid	335-67-1	4.4	0.44	0.88	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:39	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW21A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 10:25
SDG#: FSB50-12

AECOM
ELLE Sample #: GW 1183586
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.92	1.8	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	4.9	0.46	0.92	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	7.2	0.46	0.92	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.91 J	0.46	0.92	1.8	1
14434	Perfluorononanoic acid	375-95-1	4.1	0.46	0.92	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	46	0.46	0.92	1.8	1
14434	Perfluorooctanoic acid	335-67-1	16	0.46	0.92	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:48	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW21A-DUP-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 10:30
SDG#: FSB50-13FD

AECOM
ELLE Sample #: GW 1183587
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.7	4.7	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	4.8	0.47	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	7.7	0.47	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.87 J	0.47	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	4.2	0.47	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	47	0.47	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	16	0.47	0.93	1.9	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:58	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW05A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 11:30
SDG#: FSB50-14

AECOM
ELLE Sample #: GW 1183588
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.90	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.95 J	0.45	0.90	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	0.93 J	0.45	0.90	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.4 J	0.45	0.90	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.45	0.90	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	1.2 J	0.45	0.90	1.8	1
14434	Perfluorooctanoic acid	335-67-1	3.2	0.45	0.90	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 23:07	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW05A-DUP-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 11:35
SDG#: FSB50-15FD

AECOM
ELLE Sample #: GW 1183589
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.93 J	0.44	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	0.91 J	0.44	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.3 J	0.44	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.44	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	1.8 J	0.44	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	3.1	0.44	0.89	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 23:16	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **FB-20191021 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 16:00
SDG#: FSB50-16FB

AECOM
ELLE Sample #: GW 1183590
ELLE Group #: 2070940
Matrix: Water

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.44	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.44	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.44	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.44	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	N.D.	0.44	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.44	0.89	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 23:25	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

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Quality Control Summary

Client Name: AECOM
Reported: 11/19/2019 10:02

Group Number: 2070940

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	DL**	LOD	LOQ
	ng/l	ng/l	ng/l	ng/l
Batch number: 19305004	Sample number(s): 1183575-1183590			
6:2-Fluorotelomersulfonic acid	N.D.	2.0	4.0	5.0
8:2-Fluorotelomersulfonic acid	N.D.	1.0	2.0	3.0
Perfluorobutanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluoroheptanoic acid	N.D.	0.50	1.0	2.0
Perfluorohexanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorononanoic acid	N.D.	0.50	1.0	2.0
Perfluorooctanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorooctanoic acid	N.D.	0.50	1.0	2.0

LCS/LCSD

Analysis Name	LCS Spike Added ng/l	LCS Conc ng/l	LCSD Spike Added ng/l	LCSD Conc ng/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 19305004	Sample number(s): 1183575-1183590								
6:2-Fluorotelomersulfonic acid	24.28	19.3	24.28	21.22	80	87	51-155	9	30
8:2-Fluorotelomersulfonic acid	24.52	20.19	24.52	22.07	82	90	62-133	9	30
Perfluorobutanesulfonic acid	22.64	17.71	22.64	18.24	78*	81	81-133	3	30
Perfluoroheptanoic acid	25.6	21.06	25.6	21.6	82	84	80-140	3	30
Perfluorohexanesulfonic acid	24.2	18.14	24.2	18.64	75	77	71-131	3	30
Perfluorononanoic acid	25.6	19.91	25.6	22.65	78	88	73-140	13	30
Perfluorooctanesulfonic acid	24.48	17.45	24.48	17.91	71	73	54-139	3	30
Perfluorooctanoic acid	25.6	20.94	25.6	21.33	82*	83	83-138	2	30

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/19/2019 10:02

Group Number: 2070940

Labeled Isotope Quality Control

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19305004

	13C3-PFBS		13C3-PFHxS		13C4-PFHpA		13C2-6:2-FTS		13C8-PFOA		13C8-PFOS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
1183575	233*	8.9	108	8.9	103	1.8	101	8.9	92	1.8	66	8.9
1183576	170*	9.0	100	9.0	101	1.8	107	9.0	93	1.8	78	9.0
1183577	196*	9.1	97	9.1	106	1.8	138	9.1	99	1.8	85	9.1
1183578	151*	9.3	110	9.3	114	1.9	147	9.3	108	1.9	109	9.3
1183579	133	9.2	112	9.2	107	1.8	106	9.2	101	1.8	97	9.2
1183580	156*	8.7	93	8.7	97	1.7	91	8.7	89	1.7	60	8.7
1183581	203*	9.3	103	9.3	115	1.9	174*	9.3	102	1.9	93	9.3
1183582	159*	8.8	92	8.8	98	1.8	92	8.8	84	1.8	58	8.8
1183583	196*	8.7	102	8.7	113	1.7	94	8.7	85	1.7	53	8.7
1183584	141	8.8	107	8.8	109	1.8	120	8.8	103	1.8	93	8.8
1183585	148	8.8	104	8.8	111	1.8	110	8.8	102	1.8	97	8.8
1183586	151*	9.2	108	9.2	121	1.8	141	9.2	99	1.8	90	9.2
1183587	168*	9.3	113	9.3	120	1.9	190*	9.3	106	1.9	107	9.3
1183588	203*	9.0	105	9.0	107	1.8	119	9.0	102	1.8	99	9.0
1183589	187*	8.9	100	8.9	102	1.8	90	8.9	91	1.8	58	8.9
1183590	107	8.9	106	8.9	104	1.8	108	8.9	106	1.8	91	8.9
Blank	120	10	132	10	129	2.0	130	10	136	2.0	124	10
LCS	110	10	105	10	110	2.0	106	10	103	2.0	104	10
LCSD	107	10	106	10	109	2.0	102	10	101	2.0	103	10
Limits:	50-150		50-150		50-150		50-150		50-150		50-150	

	13C9-PFNA		13C2-8:2-FTS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
1183575	77	1.8	42*	5.4
1183576	84	1.8	70	5.4
1183577	96	1.8	82	5.5
1183578	126	1.9	122	5.6
1183579	97	1.8	88	5.5
1183580	68	1.7	46*	5.2
1183581	105	1.9	98	5.6
1183582	65	1.8	47*	5.3
1183583	66	1.7	42*	5.2
1183584	104	1.8	86	5.3
1183585	99	1.8	84	5.3
1183586	109	1.8	83	5.5
1183587	132	1.9	106	5.6
1183588	102	1.8	88	5.4

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/19/2019 10:02

Group Number: 2070940

Labeled Isotope Quality Control (continued)

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19305004

	13C9-PFNA %Rec	LOD (ng/l)	13C2-8:2-FTS %Rec	LOD (ng/l)
1183589	70	1.8	44*	5.3
1183590	93	1.8	75	5.3
Blank	128	2.0	117	6.0
LCS	104	2.0	96	6.0
LCSD	103	2.0	96	6.0
Limits:	50-150		50-150	

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only
Acct. # 42343 Group # 2070940 Sample # 11B3575-90

COC # 593594

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

For Lab Use Only
FSC:
SCR#: 250699

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix	Total # of Containers	Analysis Requested: PFAS by LC/MS/MS-000	Remarks
MRC-MW01A-20191021	10-21-19	1015	X		GW	2	X	
MRC-MW16A-20191021		1600	X					
MRC-MW10A-20191021		1325	X					
MRC-EXT-MW03-20191021		1550	X					
MRC-EXT-MW06-20191021		1255	X					
MRC-MW02A-20191021		1030	X					
MRC-MW42A-20191021		1420	X					
MRC-MW27A-20191021		1410	X					
MRC-MW48A-20191021		1600	X					
MRC-MW27B-20191021	↓	1230	↓		↓	↓	↓	

Matrix: Soil ☐ Sediment ☐ Tissue ☐ | Water: Potable ☐ Ground ☒ NPDES ☐ Surface ☐ | Other:

Turnaround Time (TAT) Requested (please circle)
Standard Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days:

E-mail address: holly.brown@aecom.com & maum.tountzis@aecom.com

Data Package Options (circle if required)
Type I (EPA Level 3 Equivalent/non-CLP) MB
Type III (Reduced non-CLP)
NYSDEC Category A or B
Type VI (Raw Data Only)
NJ DKQP TX TRRP-13
MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-22-19	1340		10/22/19	13:40
				10/23/19	1737

EDD Required? Yes No
If yes, format: EQuIS 4.CSV

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS ____ FedEx ____ Other X

Temperature upon receipt 1.4 °C

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only
Acct. # 42343 Group # 2070910 Sample # 1183575-90

COC #594739

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

Matrix

Soil ☐ Sediment ☐ Tissue ☐ | Water: Potable ☐ Ground ☒ NPDES ☐ Surface ☐ | Other: ____

Analysis Requested

Preservation and Filtration Codes

For Lab Use Only

FSC:
SCR#: 250613

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil	Sediment	Tissue	Water	Potable	Ground	NPDES	Surface	Other	Total # of Containers	PFAS by LC/MS/MS-000	Remarks
MRC-MW27B-DUP-20191021	10-21-19	1235	X					GW						2	X	field duplicate
MRC-MW21A-20191021	↓	1025	X					↓						↓	↓	
MRC-MW21A-DUP-20191021		1030	X													field duplicate
MRC-MW05A-20191021		1130	X													
MRC-MW05A-DUP-20191021		1135	X													field duplicate
FB-20191021	↓	1600	X					WQ						↓	↓	water quality field blank

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: holly.brown@aecom.com & maun.tauntzis@aecom.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) HB
Type III (Reduced non-CLP)
NYSDEC Category A or B
Type VI (Raw Data Only)
NJ DKQP
MA MCP
TX TRRP-13
CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-22-19	1340		10/22/19	13:40
				10-22-19	1757

EDD Required? Yes No
If yes, format: EQuIS & .CSV

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS _____ FedEx _____ Other ✓

Temperature upon receipt 1.4 °C

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Sample Administration Receipt Documentation Log

Doc Log ID: 263778

Group Number(s): 2070940

Client: Aecom

Delivery and Receipt Information

Delivery Method:	ELLE Courier	Arrival Date:	10/22/2019
Number of Packages:	1	Number of Projects:	1
State/Province of Origin:	MD		

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	Total Trip Blank Qty:	0
Paperwork Enclosed:	Yes	Air Quality Samples Present:	No
Samples Intact:	Yes		
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Tamara Lugardo

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle)* *IR = Infrared (Surface Temp)* *All Temperatures in °C.*

Cooler #	Matrix	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	Water	DT42-03	1.4	DT	Wet	Y	Loose	N

2425 New Holland Pike
Lancaster, PA 17605-2425
T 717-656-2300
F 717-656-2681
www.LancasterLabs.com

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

APPENDIX D
Data Validation and Usability Report

Data Validation and Usability Report

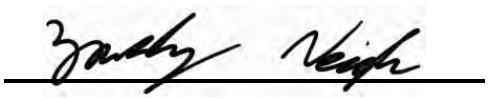
Revision 2: October 2019 – PFAS Groundwater Sampling

Lockheed Martin Corporation
Middle River Complex
Middle River, Maryland

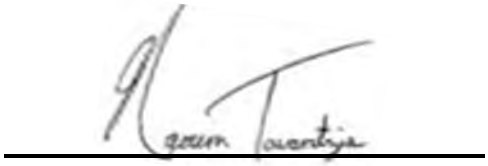
December 2019

IDENTIFICATION FORM

Data Validation and Data Usability Review



Zachary Neigh
Data Validator
AECOM
12/16/2019



Naoum Tavantzis
Project Chemist
AECOM
12/16/2019

Table of Contents

I. Executive Summary

This report has been revised to reflect that PFOS was detected in one rinsate blank taken from a Solinst water level meter, corresponding to one field sampler associated with a particular set of wells. Due to stringent AECOM tracking of field samplers and equipment, the report has been revised to reflect the reduced number of 'B' flagged results from twelve to four. The following are now the remaining field sample results flagged 'B' for PFOS:

a. MRC-MW27B-20191021
b. MRC-MW27B-DUP-20191021
c. MRC-MW44A-20191024
d. MRC-MW60B-20191023

AECOM performed data validation on 100% of the investigative groundwater field samples collected from October 21st, 2019 through October 28th, 2019 at the Lockheed Martin Middle River Complex located in Middle River, Maryland. The validation was performed to a United States Environmental Protection Agency (USEPA) Region III Inorganic Level I and Organic Level I based on the specifics of the analytical methods referenced and qualified according to the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic/Inorganic (January 2017) Superfund Data Review, with the exception of blank detections which were qualified according to the USEPA Region III modifications to the National Functional Guidelines defining the use of the "B" flag (equivalent to a USEPA Stage 2A Electronic Data Validation).

The review was assisted through the use of an electronic data management tool that compiles batch-level quality control (QC) data submitted with the laboratory deliverables and identifies anomalies for verification and qualification by the data reviewer. This information is provided in the form of a structured workbook that includes field sample analytical results, QC sample results, batch associations, and QC criteria. Prior to validation, the quality assurance procedures applied to the process itself consist of reviewing the output for data completeness based on laboratory deliverables and chain of custody reports; verification of QC criteria based on the aforementioned data validation guidelines and project-specific Quality Assurance Project Plan (QAPP); and strict control of data management permissions. The resulting data validation workbooks were evaluated and validated using the AECOM automated validation assistant (AVA) tool. The specific data elements that were reviewed include:

- Holding times and sample preservation
- Blanks (Method, Trip, Field, and Equipment)
- Matrix spike (MS) and/or matrix spike duplicate (MSD) results
- Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) results
- Surrogate spike results (labeled PFAS isotopes)
- Field duplicates
- Laboratory duplicates

- Sensitivity

Data validation qualifiers were applied to results where a QC nonconformance required qualification per USEPA guidance. All QC anomalies were assessed for their impact on data quality in regards to precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) as discussed in **II: PARCCS Data Quality**. A detailed list of the QC non-conformances can be found in **III: Data Validation Findings**. The associated field sample results that required qualification are listed in **IV: Qualified Field Sample Results**.

II. PARCCS Data Quality

Precision

Precision is the degree of agreement among repeated measurements of the same characteristic on the same sample or on separate samples collected as close as possible in time and place. Field sampling precision is measured using the field duplicate relative percent differences; laboratory precision is measured using laboratory duplicate relative percent differences and/or laboratory control spike and matrix spike duplicate relative percent differences. All quality control criteria impacting precision were met for the data reviewed.

Accuracy

Accuracy is a measure of confidence in a measurement. The smaller the difference between the measurement of a parameter and its "true" or expected value, the more accurate the measurement. Analytical accuracy was assessed through the measurement of percent recoveries in the surrogate spikes, laboratory control spike pairs (LCS/LCSD) and the matrix spike pairs (MS/MSD).

During the per- and polyfluoroalkyl substance (PFAS) analysis, the LCS analyzed in QC batch 19305004YPREP displayed percent recoveries less the QC limits of 81% for PFBS and 83% PFOA at 78% and 82%, respectively. The positive associated field sample results were qualified J,l, while non-detects were qualified UJ,l. These anomalies are considered minor and the qualified field sample results should be considered usable as estimated values with a negative bias.

During the PFAS analysis, several field samples displayed labeled isotope percent recoveries outside the QC limits. The affected analytes in the associated field samples were 6:2 FTS, 8:2 FTS, and PFBS. The positive field sample results associated with percent recoveries greater than the upper QC limits were qualified J+,s, unless previously qualified due to LCS percent recovery anomalies. These anomalies are considered minor and the qualified field sample results should be considered usable as estimated values with a positive bias. The field sample results associated with percent recoveries less than the lower QC limits were non-detect and were qualified UJ,s. These anomalies are considered minor and the qualified field sample results should be considered usable as estimated values with a negative bias.

During the gasoline range organics (GRO) analysis, field samples MRC-MW74B-20191025 and MRC-MW147B-20191025 displayed percent recoveries greater than the upper QC limit of 135% for surrogate trifluorotoluene at 219% and 209%, respectively. The associated field sample results were positive and were qualified J+,s. These anomalies are considered minor and the qualified field sample results should be considered usable as estimated values with a positive bias.

Representativeness

Representativeness is the qualitative expression of the degree to which data accurately reflect site conditions. Factors that affect the representativeness of analytical data include appropriate sample

population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences. Representativeness is also monitored using negative controls such as trip blanks, field blanks, and equipment blanks, along with adherence to the standard operating procedures and sampling plans.

Method blanks were prepared at a frequency of one per laboratory QC batch. A total of two (2) trip blanks were analyzed, at a rate of one per GRO sample cooler. Additionally, five (5) field blanks and four (4) equipment blanks were analyzed for PFAS. These blanks were used as negative controls to assess data quality. Equipment blank RB-AD-20191025 displayed a detection for PFOS greater than the method detection limit of 0.43 ng/L at 0.57 ng/L. The positive field sample results, collected from wells associated with the affected equipment, that were within five times the concentration of the equipment blank were qualified B,be. In total, four field sample results for PFOS were qualified due to the equipment blank detection (MRC-MW27B-20191021, MRC-MW27B-DUP-20191021, MRC-MW44A-20191024, and MRC-MW60B-20191023). The qualified field sample results should be considered potential false positives. All method blank, trip blank, and field blank results were non-detect.

Comparability

Comparability is the extent to which data from one study can be compared directly to either past data from the current project or data from another study. Using standardized sampling and analytical methods, units of reporting, and site selection procedures helps ensure comparability. Standard field sampling methods and current CLP analytical methods by an accredited laboratory were used in this investigation.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data expected under normal conditions. It is expected that laboratories will provide data meeting system quality control acceptance criteria for all samples tested. Project completeness is determined by evaluating the planned versus actual quantities of usable data. A total of 56 field samples were validated, including 40 investigative groundwater samples, five (5) field duplicates, two (2) trip blanks, five (5) field blanks, and four (4) equipment blanks. All data are usable, as qualified, for their intended purpose based on the data reviewed.

Sensitivity

Sensitivity reflects the ability of the analytical method to detect analytes of interest below the level of concern. This goal is achieved by identifying the level of concern, choosing a method with appropriate method detection limits, and ensuring that the laboratory analyzes calibration standards at or below the level of concern. The laboratory was able to achieve the lowest reporting limits based on the analytical methods employed and the variety of matrices encountered. No field sample results were reported from dilutions, with the exception of one field sample result for GRO

which was reported at a dilution of five times in order to bring the elevated concentration within the linear range of the instrument. Any analytes detected below the reporting limit and above the method detection limit were reported and qualified "J" as estimated values by the laboratory.

Overall Impact on Data Usability

Overall data usability met the completeness requirement outlined in the QAPP at 100%. During the course of the data validation, several minor anomalies were noted which is to be anticipated based on statistical predictability of standard analytical procedures. Several field sample results were qualified due to these minor anomalies. All data are considered usable as qualified, for their intended purpose based on the data reviewed.

III. Data Validation Findings

PFAS

EPA 537 Modified	Description	Sample ID	Analyte	Value (Control Limit)
Holding Times	No Anomalies			
Method Blank	No Anomalies			
Field/Equipment Blank	Detection > MDL	RB-AD-20191025	PFOS	0.57 ng/L (0.43 ng/L)
LCS/LCSD	% Recovery	LCS19305004	PFBS	82% (83-138%)
			PFOA	78% (81-133%)
MS/MSD	No Anomalies			
Labeled Isotope Spike	% Recovery	MRC-EXT-MW03-20191021	13C3-PFBS	151% (50-150%)
		MRC-MW01A-20191021	13C2-8:2 FTS	42% (50-150%)
			13C3-PFBS	233% (50-150%)
		MRC-MW02A-20191021	13C2-8:2 FTS	46% (50-150%)
			13C3-PFBS	156% (50-150%)
		MRC-MW05A-20191021	13C3-PFBS	203% (50-150%)
		MRC-MW05A-DUP-20191021	13C2-8:2 FTS	44% (50-150%)
			13C3-PFBS	187% (50-150%)
		MRC-MW10A-20191021	13C3-PFBS	196% (50-150%)
		MRC-MW119A-20191024	13C2-6:2 FTS	194% (50-150%)
			13C3-PFBS	334% (50-150%)
		MRC-MW128B-20191023	13C2-6:2 FTS	239% (50-150%)
		MRC-MW145A-20191028	13C3-PFBS	198% (50-150%)
		MRC-MW146B-DUP-20191025	13C2-8:2 FTS	45% (50-150%)
		MRC-MW16A-20191021	13C3-PFBS	170% (50-150%)
		MRC-MW18A-20191023	13C2-6:2 FTS	158% (50-150%)
		MRC-MW21A-20191021	13C3-PFBS	151% (50-150%)
		MRC-MW21A-DUP-20191021	13C2-6:2 FTS	190% (50-150%)
			13C3-PFBS	168% (50-150%)
		MRC-MW27A-20191021	13C2-8:2 FTS	47% (50-150%)
			13C3-PFBS	159% (50-150%)
		MRC-MW42A-20191021	13C2-6:2 FTS	174% (50-150%)
			13C3-PFBS	203% (50-150%)
		MRC-MW44A-20191024	13C2-6:2 FTS	186% (50-150%)
			13C3-PFBS	255% (50-150%)
		MRC-MW48A-20191021	13C2-8:2 FTS	42% (50-150%)
			13C3-PFBS	196% (50-150%)
		MRC-MW60A-20191023	13C2-6:2 FTS	164% (50-150%)
Field Duplicates	No Anomalies			

GRO/DRO

SW846-8015D	Description	Sample ID	Analyte	Value (Control Limit)
Holding Times	No Anomalies			
Method Blanks	No Anomalies			
Trip Blanks	No Anomalies			
LCS/LCSD	No Anomalies			
MS/MSD	No Anomalies			
Surrogate Spike	% Recovery	MRC-MW147B-20191025	Trifluorotoluene	209% (63-135%)
		MRC-MW74B-20191025	Trifluorotoluene	219% (63-135%)
Laboratory Duplicates	No Anomalies			
Field Duplicates	No Anomalies			

IV. Qualified Field Sample Results

Field Sample ID	Analytical Method	Analyte	Result	Units	Qualifier	Reason Code
FB-20191021	E537M	PFBS	0.89 U	ng/l	UJ	l
FB-20191021	E537M	PFOA	0.89 U	ng/l	UJ	l
MRC-EXT-MW03-20191021	E537M	PFBS	3.9	ng/l	J	l
MRC-EXT-MW03-20191021	E537M	PFOA	16	ng/l	J	l
MRC-EXT-MW06-20191021	E537M	PFBS	2.0	ng/l	J	l
MRC-EXT-MW06-20191021	E537M	PFOA	9.5	ng/l	J	l
MRC-MW01A-20191021	E537M	8:2 FTS	1.8 U	ng/l	UJ	s
MRC-MW01A-20191021	E537M	PFBS	3.0	ng/l	J	l
MRC-MW01A-20191021	E537M	PFOA	2.9	ng/l	J	l
MRC-MW02A-20191021	E537M	8:2 FTS	1.7 U	ng/l	UJ	s
MRC-MW02A-20191021	E537M	PFBS	3.9	ng/l	J	l
MRC-MW02A-20191021	E537M	PFOA	15	ng/l	J	l
MRC-MW05A-20191021	E537M	PFBS	0.95	ng/l	J	l
MRC-MW05A-20191021	E537M	PFOA	3.2	ng/l	J	l
MRC-MW05A-DUP-20191021	E537M	8:2 FTS	1.8 U	ng/l	UJ	s
MRC-MW05A-DUP-20191021	E537M	PFBS	0.93	ng/l	J	l
MRC-MW05A-DUP-20191021	E537M	PFOA	3.1	ng/l	J	l
MRC-MW10A-20191021	E537M	PFBS	1.2	ng/l	J	l
MRC-MW10A-20191021	E537M	PFOA	6.5	ng/l	J	l
MRC-MW119A-20191024	E537M	PFBS	2.4	ng/l	J+	s
MRC-MW128B-20191023	E537M	PFBS	1.9	ng/l	J+	s
MRC-MW145A-20191028	E537M	PFBS	2.7	ng/l	J+	s
MRC-MW146B-DUP-20191025	E537M	6:2 FTS	3.9 U	ng/l	UJ	s
MRC-MW147B-20191025	SW8015D	TPH-GRO C6-C10	1900	ug/l	J+	s
MRC-MW16A-20191021	E537M	PFBS	3.0	ng/l	J	l
MRC-MW16A-20191021	E537M	PFOA	11	ng/l	J	l
MRC-MW21A-20191021	E537M	PFBS	4.9	ng/l	J	l
MRC-MW21A-20191021	E537M	PFOA	16	ng/l	J	l
MRC-MW21A-DUP-20191021	E537M	PFBS	4.8	ng/l	J	l
MRC-MW21A-DUP-20191021	E537M	PFOA	16	ng/l	J	l
MRC-MW27A-20191021	E537M	8:2 FTS	1.8 U	ng/l	UJ	s
MRC-MW27A-20191021	E537M	PFBS	1.2	ng/l	J	l
MRC-MW27A-20191021	E537M	PFOA	10	ng/l	J	l

Field Sample ID	Analytical Method	Analyte	Result	Units	Qualifier	Reason Code
MRC-MW27B-20191021	E537M	PFBS	0.51	ng/l	J	l
MRC-MW27B-20191021	E537M	PFOA	4.6	ng/l	J	l
MRC-MW27B-20191021	E537M	PFOS	2.5	ng/l	B	be
MRC-MW27B-DUP-20191021	E537M	PFBS	0.88 U	ng/l	UJ	l
MRC-MW27B-DUP-20191021	E537M	PFOA	4.4	ng/l	J	l
MRC-MW27B-DUP-20191021	E537M	PFOS	2.4	ng/l	B	be
MRC-MW42A-20191021	E537M	PFBS	1.3	ng/l	J	l
MRC-MW42A-20191021	E537M	PFOA	8.8	ng/l	J	l
MRC-MW44A-20191024	E537M	PFBS	2.3	ng/l	J+	s
MRC-MW44A-20191024	E537M	PFOS	2.4	ng/l	B	be
MRC-MW48A-20191021	E537M	8:2 FTS	1.7 U	ng/l	UJ	s
MRC-MW48A-20191021	E537M	PFBS	0.90	ng/l	J	l
MRC-MW48A-20191021	E537M	PFOA	13	ng/l	J	l
MRC-MW60B-20191023	E537M	PFOS	0.89	ng/l	B	be
MRC-MW74B-20191025	SW8015D	TPH-GRO C6-C10	7800	ug/l	J+	s

Appendix A
Data Validation Qualifiers and Reason Codes

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision-making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA Contract Laboratory Program National Functional Guidelines for Organic (August 2014) Data Review and the USEPA Region III Guidelines for Organic (September 1994) for blank qualifications only.

Data Validation Flags

Flag	Interpretation
R	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
B	The analyte was analyzed for, but not detected at a level greater than or equal to the level of the adjusted Detection Limit (DL) for sample and method.
J+	Reported value may not be accurate or precise, but the result may be biased high.
J-	Reported value may not be accurate or precise, but the result may be biased low.
J	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the Limit of Detection (LOD).
NJ	The analysis indicates the presence of an analyte that has been “tentatively identified” and the associated numerical value represents its approximate concentration.
UJ	The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.
C	This qualifier applies to pesticide and Aroclor results when the identification has been confirmed by gas Chromatograph/Mass Spectrometer (GC/MS)
X	This qualifier applies to pesticide and Aroclor results when GC/MS analysis was attempted but was unsuccessful.

The other type of code used by AECOM is a "Reason Code". The reason code indicates the type of quality control failure that led to the application of the data validation flag.

Reason Codes

Code	*Description*	*Code*	*Description*
a	Tracer recovery (radiochemical data only)	**ld**	Laboratory duplicate RPDs (matrix duplicate, MSD, LCSD)
be	Equipment blank contamination	**lp**	Laboratory control sample/laboratory control sample duplicate RPDs
bf	Field blank contamination	**m**	Matrix spike recovery
bi	Bias indeterminate	**md**	Matrix spike/matrix spike duplicate RPD
bl	Laboratory blank contamination	**nb**	Negative laboratory blank contamination
bm	Missing Blank Information	**p**	Chemical preservation issue
bt	Trip Blank	**pe**	Post Extraction Spike
c	Calibration issue	**ps**	Performance Evaluation Sample
cl	Clean-up standard recovery	**q**	Quantitation issue
cp	Insufficient in growth (radiochemical data only)	**r**	Dual column RPD
cr	Chromatographic resolution	**rp**	Re-extraction precision issue [PAHs only]
d	Reporting limit raised due to chromatographic interference	**rt**	SIM ions not within + 2 seconds
dt	Dissolved result > total over limit	**s**	Surrogate recovery
e	Ether interference	**sc**	Sample collection issues
fd	Field duplicate RPDs	**sp**	Sample preparation issue
h	Holding times	**su**	Evidence of ion suppression
hs	Sample headspace did not meet receiving requirements	**t**	Temperature Preservation Issue
i	Internal standard areas	**u**	High combined sample result uncertainty (radiochemical data only)
ii	Injection internal standard area or retention time exceedance	**v**	Compound identification issue
k	Estimated Maximum Possible Concentrations	**x**	Low % solids
l	LCS recoveries	**y**	Serial dilution results
lc	Labeled compound recovery	**z**	ICS results

APPENDIX E
Laboratory Analytical Reports

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ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

AECOM
Suite 150
12420 Milestone Center Drive
Germantown MD 20876

Report Date: November 18, 2019 12:59

Project: LM MRC PFAS GWS

Account #: 42343
Group Number: 2071357
SDG: ESB53
PO Number: 118990
State of Sample Origin: MD

Electronic Copy To AECOM — Attn: Naoum Tavantzis
Electronic Copy To AECOM — Attn: Holly Brown

Respectfully Submitted,

Kay Hower

(717) 556-7364

To view our laboratory's current scopes of accreditation please go to https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/ . Historical copies may be requested through your project manager.

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SAMPLE INFORMATION

Client Sample Description	Sample Collection Date/Time	ELLE#
MRC-MW147B-20191025 Grab Groundwater	10/25/2019 12:10	1185561
MRC-MW147B-20191025 MS Grab Groundwater	10/25/2019 12:10	1185562
MRC-MW147B-20191025 MSD Grab Groundwater	10/25/2019 12:10	1185563
MRC-MW146B-20191025 Grab Groundwater	10/25/2019 10:40	1185564
MRC-MW146B-DUP-20191025 Grab Groundwater	10/25/2019 10:50	1185565
MRC-MW155A-20191024 Grab Groundwater	10/24/2019 15:30	1185566
MRC-MW159A-20191024 Grab Groundwater	10/24/2019 12:20	1185567
MRC-MW72B-20191024 Grab Groundwater	10/24/2019 14:30	1185568
MRC-SEMW-1I-20191024 Grab Groundwater	10/24/2019 10:40	1185569
MRC-SEMW-2I-20191024 Grab Groundwater	10/24/2019 12:50	1185570
MRC-SEMW-3I-20191024 Grab Groundwater	10/24/2019 15:20	1185571
MRC-IWE-10-20191025 Grab Groundwater	10/25/2019 09:50	1185572
MRC-IWE-10-DUP-20191025 Grab Groundwater	10/25/2019 09:55	1185573

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

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Project Name: LM MRC PFAS GWS
ELLE Group #: 2071357

General Comments:

All analyses have been performed in accordance with DOD QSM Version 5.1.1 unless otherwise noted below.

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.

Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

No additional comments are necessary.

Sample Description: **MRC-MW147B-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/25/2019 12:10
SDG#: ESB53-01BKG

AECOM
ELLE Sample #: GW 1185561
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**		**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	49	J	46	92	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193040022A	11/08/2019 04:48	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193040022A	11/01/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW147B-20191025 MS Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/25/2019 12:10
SDG#: ESB53-01MS

AECOM
ELLE Sample #: GW 1185562
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	400	46	93	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193040022A	11/08/2019 05:11	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193040022A	11/01/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW147B-20191025 MSD Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/25/2019 12:10
SDG#: ESB53-01MSD

AECOM
ELLE Sample #: GW 1185563
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	410	46	92	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193040022A	11/08/2019 05:34	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193040022A	11/01/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW146B-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/25/2019 10:40
SDG#: ESB53-02

AECOM
ELLE Sample #: GW 1185564
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	46	92	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193040022A	11/08/2019 05:57	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193040022A	11/01/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW146B-DUP-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/25/2019 10:50
SDG#: ESB53-03

AECOM
ELLE Sample #: GW 1185565
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	48	96	110	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193040022A	11/08/2019 06:19	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193040022A	11/01/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW155A-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/24/2019 15:30
SDG#: ESB53-04

AECOM
ELLE Sample #: GW 1185566
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	46	92	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193030021A	11/08/2019 15:31	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193030021A	10/31/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW159A-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/24/2019 12:20
SDG#: ESB53-05

AECOM
ELLE Sample #: GW 1185567
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	45	90	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193030021A	11/08/2019 15:54	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193030021A	10/31/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW72B-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/24/2019 14:30
SDG#: ESB53-06

AECOM
ELLE Sample #: GW 1185568
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	46	93	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193030021A	11/08/2019 16:17	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193030021A	10/31/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-SEMW-1I-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/24/2019 10:40
SDG#: ESB53-07

AECOM
ELLE Sample #: GW 1185569
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	50	100	110	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193030021A	11/08/2019 16:40	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193030021A	10/31/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-SEMW-2I-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/24/2019 12:50
SDG#: ESB53-08

AECOM
ELLE Sample #: GW 1185570
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	51	100	110	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193030021A	11/08/2019 17:03	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193030021A	10/31/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-SEMW-3I-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/24/2019 15:20
SDG#: ESB53-09

AECOM
ELLE Sample #: GW 1185571
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	49	98	110	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193030021A	11/02/2019 12:49	Bridget Kovacs	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193030021A	10/31/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-IWE-10-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/25/2019 09:50
SDG#: ESB53-10

AECOM
ELLE Sample #: GW 1185572
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	46	92	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193040022A	11/08/2019 06:43	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193040022A	11/01/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-IWE-10-DUP-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/25/2019 09:55
SDG#: ESB53-11

AECOM
ELLE Sample #: GW 1185573
ELLE Group #: 2071357
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	46	93	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193040022A	11/08/2019 07:06	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193040022A	11/01/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: AECOM
Reported: 11/18/2019 12:59

Group Number: 2071357

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	DL**	LOD	LOQ
	ug/l	ug/l	ug/l	ug/l
Batch number: 193030021A	Sample number(s): 1185566-1185571			
DRO C10-C28	N.D.	45	90	100
Batch number: 193040022A	Sample number(s): 1185561-1185565,1185572-1185573			
DRO C10-C28	N.D.	45	90	100

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 193030021A	Sample number(s): 1185566-1185571								
DRO C10-C28	600.05	350.05	600.05	259.18	58	43	36-132	30	30
Batch number: 193040022A	Sample number(s): 1185561-1185565,1185572-1185573								
DRO C10-C28	600.05	415.14			69		36-132		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ug/l	MS Spike Added ug/l	MS Conc ug/l	MSD Spike Added ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 193040022A	Sample number(s): 1185561-1185565,1185572-1185573 UNSPK: 1185561									
DRO C10-C28	49.41	617.33	396.83	614.8	411.45	56	59	36-132	4	30

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/18/2019 12:59

Group Number: 2071357

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: DRO 8015C/D(Mini)
Batch number: 193030021A

	Orthoterphenyl %Rec	LOD (ug/l)
1185566	83	2.4
1185567	88	2.4
1185568	87	2.5
1185569	84	2.7
1185570	86	2.7
1185571	85	2.6
Blank	88	2.4
LCS	80	2.4
LCSD	74	2.4
Limits:	56-125	

Analysis Name: DRO 8015C/D(Mini)
Batch number: 193040022A

	Orthoterphenyl %Rec	LOD (ug/l)
1185561	91	2.5
1185562	74	2.5
1185563	79	2.5
1185564	89	2.5
1185565	90	2.6
1185572	82	2.5
1185573	81	2.5
Blank	76	2.4
LCS	86	2.4
MS	74	2.5
MSD	79	2.5
Limits:	56-125	

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only

Acct. # 42343 Group # 2071357 Sample # 1185561-73

COC #594735

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

Matrix: Soil ☐ Sediment ☐ Tissue ☐ | Water ☒ Potable ☐ Ground ☐ NPDES ☐ Surface ☐ | Other: ____

Analysis Requested — Preservation and Filtration Codes

For Lab Use Only
FSC: ____
SCR#: 250699

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Total # of Containers	30 H DRO-8050D	Remarks
MRC-MW147B-20191025	10/25/19	1210	X		6	X	MS/MSD
MRC-MW74B-20191025	10/25/19	1145	X		6	X	MS/MSD
MRC-MW146B-20191025	10/25/19	1040	X		2	X	
MRC-MW146B-DUP-20191025	10/25/19	1050	X		2	X	
MRC-MW155A-20191024	10/24/19	1530	X		2	X	
MRC-MW159A-20191024	10/24/19	1220	X		2	X	
MRC-MW72B-20191024	10/24/19	1430	X		2	X	
MRC-SEMW-1I-20191024	10/24/19	1040	X		2	X	
MRC-SEMW-2I-20191024	10/24/19	1250	X		2	X	
MRC-SEMW-3I-20191024	10/24/19	1520	X		2	X	

Turnaround Time (TAT) Requested (please circle)
(Standard) Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: 12

E-mail address: holly.brown@aecom.com, naoum.tavantzis@aecom.com

Data Package Options (circle if required)
(Type I (EPA Level 3 Equivalent/non-CLP)) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-25-19	1730			
				10-26-19	1048

EDD Required? (Yes) No
If yes, format: EQUIS & CSV

Site-Specific QC (MS/MSD/Dup)? (Yes) No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS ____ FedEx ____ Other ____

Temperature upon receipt 0.9 °C

301 Fulling Mill Road
Middletown, PA 17057
P. 717-944-5541
F. 717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #: 2 of 2

ALS Quote #:

Client Name:	AECOM
Address:	12420 Milestone Center Drive Germantown, MD 20876
Contact:	Matt Panciera
Phone#:	301-674-3199
Project Name/#:	LM MRC PFAS GWS
Bill To:	Matt Panciera
TAT	[X] Normal-Standard TAT is 10-12 business days. 12 [ ] Rush-Subject to ALS approval and surcharges.
Date Required:	Approved?
Email?	[X] -Y naum.tavantzis@aecom.com
Fax?	[ ] -Y No.: & holly.brown@aecom.com

Receipt Information (completed by Receiving Lab)

W.O. Temp: ____ Therm ID: ____

Analyst Initials: ____

Courier/Tracking #:

Purchase Order #:

Project Comments:

H = HCL perservative

ALS Field Services: □ Pickup □ Labor □ Composite Sampling □ Rental Equipment

Other: ____

ANALYSES/METHOD REQUESTED

	Sample Description/Location (as it will appear on the lab report)	Date Collected mm/dd/yy	Time hh:mm	*G or C	**Matrix	H DRO-8250D	Sample/COC Comments
1	MRC-IWE-10-20191025	10/25/19	0950	G	GW	X	
2	MRC-IWE-10-DUP-20191025	10/25/19	0955	G	GW	X	
3							
4							
5							
6							
7							
8							
9							
10							

Enter Number of Containers Per Sample or Field Results Below.

SAMPLED BY (Please Print): Holly Brown

Sampler Comments:

	Relinquished By / Company Name	Date	Time		Received By / Company Name	Date	Time
1	[signature] / AECOM	10/25/19	1730	2			
3				4			
5				6			
7				8			
9				10	[signature]	10/26/19	1048

Data Deliverables: [X] Standard [ ] CLP-like [ ] USACE/DOD

Special Processing: USACE [ ]

Reportable to PADEP? Yes [ ] No [X]

PWSID #

Sample Disposal: Lab [X] Special [ ]

State Samples Collected In: [ ] NY [ ] NJ [ ] PA [X] MD [ ] other

EDDS: Format Type- EQUIS & CSV

* G=Grab; C=Composite

**Matrix - AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS SHIPPING ADDRESS: 301 Fulling Mill Road, Middletown, PA 17057

D-9

Rev 04/19

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Sample Administration Receipt Documentation Log

Doc Log ID: 264222

Group Number(s): 2071357

Client: AECOM

Delivery and Receipt Information

Delivery Method:	Fed Ex	Arrival Date:	10/26/2019
Number of Packages:	1	Number of Projects:	1

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	Yes	Sample Date/Times match COC:	Yes
Custody Seal Intact:	Yes	Total Trip Blank Qty:	0
Samples Chilled:	Yes	Air Quality Samples Present:	No
Paperwork Enclosed:	Yes		
Samples Intact:	Yes		
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Shalynn Ponzo

Samples Chilled Details

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	192050133	0.9	IR	Wet	Y	Loose	N

2425 New Holland Pike
Lancaster, PA 17605-2425

T | 717-656-2300
F | 717-656-2681
www.LancasterLabs.com

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

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ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

AECOM
Suite 150
12420 Milestone Center Drive
Germantown MD 20876

Report Date: November 19, 2019 10:02

Project: LM MRC PFAS GWS

Account #: 42343
Group Number: 2070940
SDG: FSB50
PO Number: 118990
State of Sample Origin: MD

Electronic Copy To AECOM — Attn: Naoum Tavantzis
Electronic Copy To AECOM — Attn: Holly Brown

Respectfully Submitted,

Kay Hower

(717) 556-7364

To view our laboratory's current scopes of accreditation please go to https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/ . Historical copies may be requested through your project manager.

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SAMPLE INFORMATION

Client Sample Description	Sample Collection Date/Time	ELLE#
MRC-MW01A-20191021 Grab Groundwater	10/21/2019 10:15	1183575
MRC-MW16A-20191021 Grab Groundwater	10/21/2019 16:00	1183576
MRC-MW10A-20191021 Grab Groundwater	10/21/2019 13:25	1183577
MRC-EXT-MW03-20191021 Grab Groundwater	10/21/2019 15:50	1183578
MRC-EXT-MW06-20191021 Grab Groundwater	10/21/2019 12:55	1183579
MRC-MW02A-20191021 Grab Groundwater	10/21/2019 10:30	1183580
MRC-MW42A-20191021 Grab Groundwater	10/21/2019 14:20	1183581
MRC-MW27A-20191021 Grab Groundwater	10/21/2019 14:10	1183582
MRC-MW48A-20191021 Grab Groundwater	10/21/2019 16:00	1183583
MRC-MW27B-20191021 Grab Groundwater	10/21/2019 12:30	1183584
MRC-MW27B-DUP-20191021 Grab Groundwater	10/21/2019 12:35	1183585
MRC-MW21A-20191021 Grab Groundwater	10/21/2019 10:25	1183586
MRC-MW21A-DUP-20191021 Grab Groundwater	10/21/2019 10:30	1183587
MRC-MW05A-20191021 Grab Groundwater	10/21/2019 11:30	1183588
MRC-MW05A-DUP-20191021 Grab Groundwater	10/21/2019 11:35	1183589
FB-20191021 Grab Water	10/21/2019 16:00	1183590

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

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Project Name: LM MRC PFAS GWS
ELLE Group #: 2070940

General Comments:

All analyses have been performed in accordance with DOD QSM Version 5.1.1 unless otherwise noted below.

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.
Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

EPA 537 mod QSM 5.1 table B-15, LC/MS/MS Miscellaneous

Sample #s: 1183579, 1183585, 1183590

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Sample #s: 1183584

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The following analytes were manually integrated:
Perfluorobutanesulfonic acid

Sample #s: 1183576, 1183578, 1183586

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control

Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

Sample #s: 1183588

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

The following analytes were manually integrated:
Perfluoroheptanoic acid, Perfluorobutanesulfonic acid

Sample #s: 1183580, 1183582, 1183583, 1183587

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample #s: 1183589

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

The following analytes were manually integrated:
Perfluoroheptanoic acid

Sample #s: 1183577, 1183581

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported

from the initial trial and both sets of data are included in the data package.

The recovery for injection and extraction standards is outside of the QC acceptance limits in the initial extraction and the re-extracted sample. The values here are from the initial extraction of the sample.

Sample #s: 1183575

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for injection and extraction standards is outside of the QC acceptance limits in the initial extraction and the re-extracted sample. The values here are from the initial extraction of the sample.

The following analytes were manually integrated:
Perfluoroheptanoic acid

Batch #: 19305004 (Sample number(s): 1183575-1183590)

The recovery(ies) for the following analyte(s) in the LCS and/or LCSD were below the acceptance window:
Perfluorooctanoic acid, Perfluorobutanesulfonic acid

The recovery(ies) for one or more surrogates exceeded the acceptance window indicating a positive bias for sample(s) 1183575, 1183576, 1183577, 1183578, 1183580, 1183581, 1183582, 1183583, 1183586, 1183587, 1183588, 1183589

The recovery(ies) for one or more surrogates were below the acceptance window for sample(s) 1183575, 1183580, 1183582, 1183583, 1183589

Sample Description: **MRC-MW01A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 10:15
SDG#: FSB50-01

AECOM
ELLE Sample #: GW 1183575
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	3.0	0.45	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	1.1 J	0.45	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	4.4	0.45	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.45	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	0.80 J	0.45	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	2.9	0.45	0.89	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for injection and extraction standards is outside of the QC acceptance limits in the initial extraction and the re-extracted sample. The values here are from the initial extraction of the sample.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:00	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW16A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 16:00
SDG#: FSB50-02

AECOM
ELLE Sample #: GW 1183576
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.90	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	3.0		0.45	0.90	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	5.7		0.45	0.90	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	2.1		0.45	0.90	1.8	1
14434	Perfluorononanoic acid	375-95-1	1.0	J	0.45	0.90	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	4.7		0.45	0.90	1.8	1
14434	Perfluorooctanoic acid	335-67-1	11		0.45	0.90	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:09	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW10A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 13:25
SDG#: FSB50-03

AECOM
ELLE Sample #: GW 1183577
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.91	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.2 J	0.45	0.91	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	2.5	0.45	0.91	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.60 J	0.45	0.91	1.8	1
14434	Perfluorononanoic acid	375-95-1	1.0 J	0.45	0.91	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	1.7 J	0.45	0.91	1.8	1
14434	Perfluorooctanoic acid	335-67-1	6.5	0.45	0.91	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for injection and extraction standards is outside of the QC acceptance limits in the initial extraction and the re-extracted sample. The values here are from the initial extraction of the sample.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:18	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-EXT-MW03-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 15:50
SDG#: FSB50-04

AECOM
ELLE Sample #: GW 1183578
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.7	4.7	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	3.9	0.47	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	20	0.47	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.57 J	0.47	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	5.9	0.47	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	7.9	0.47	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	16	0.47	0.93	1.9	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:27	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-EXT-MW06-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 12:55
SDG#: FSB50-05

AECOM
ELLE Sample #: GW 1183579
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.92	1.8	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	2.0	0.46	0.92	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	4.6	0.46	0.92	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.80 J	0.46	0.92	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.1	0.46	0.92	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	28	0.46	0.92	1.8	1
14434	Perfluorooctanoic acid	335-67-1	9.5	0.46	0.92	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:36	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW02A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 10:30
SDG#: FSB50-06

AECOM
ELLE Sample #: GW 1183580
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.7	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.87	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	3.9	0.44	0.87	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	7.6	0.44	0.87	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.8	0.44	0.87	1.7	1
14434	Perfluorononanoic acid	375-95-1	3.1	0.44	0.87	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	15	0.44	0.87	1.7	1
14434	Perfluorooctanoic acid	335-67-1	15	0.44	0.87	1.7	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:45	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW42A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 14:20
SDG#: FSB50-07

AECOM
ELLE Sample #: GW 1183581
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.3 J	0.46	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	3.2	0.46	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.2 J	0.46	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.46	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	0.63 J	0.46	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	8.8	0.46	0.93	1.9	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for injection and extraction standards is outside of the QC acceptance limits in the initial extraction and the re-extracted sample. The values here are from the initial extraction of the sample.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 21:54	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW27A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 14:10
SDG#: FSB50-08

AECOM
ELLE Sample #: GW 1183582
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.88	1.8	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.2	J	0.44	0.88	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	4.5		0.44	0.88	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.6	J	0.44	0.88	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.4		0.44	0.88	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	9.7		0.44	0.88	1.8	1
14434	Perfluorooctanoic acid	335-67-1	10		0.44	0.88	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:12	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW48A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 16:00
SDG#: FSB50-09

AECOM
ELLE Sample #: GW 1183583
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.7	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.87	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.90 J	0.44	0.87	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	3.2	0.44	0.87	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.6 J	0.44	0.87	1.7	1
14434	Perfluorononanoic acid	375-95-1	1.4 J	0.44	0.87	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	9.9	0.44	0.87	1.7	1
14434	Perfluorooctanoic acid	335-67-1	13	0.44	0.87	1.7	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:21	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW27B-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 12:30
SDG#: FSB50-10

AECOM
ELLE Sample #: GW 1183584
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	5.1		1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.88	1.8	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.51	J	0.44	0.88	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	2.0		0.44	0.88	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.64	J	0.44	0.88	1.8	1
14434	Perfluorononanoic acid	375-95-1	0.44	J	0.44	0.88	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	2.5		0.44	0.88	1.8	1
14434	Perfluorooctanoic acid	335-67-1	4.6		0.44	0.88	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:30	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW27B-DUP-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 12:35
SDG#: FSB50-11FD

AECOM
ELLE Sample #: GW 1183585
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	5.1	1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.88	1.8	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.44	0.88	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	2.0	0.44	0.88	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.71 J	0.44	0.88	1.8	1
14434	Perfluorononanoic acid	375-95-1	0.49 J	0.44	0.88	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	2.4	0.44	0.88	1.8	1
14434	Perfluorooctanoic acid	335-67-1	4.4	0.44	0.88	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:39	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW21A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 10:25
SDG#: FSB50-12

AECOM
ELLE Sample #: GW 1183586
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.92	1.8	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	4.9	0.46	0.92	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	7.2	0.46	0.92	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.91 J	0.46	0.92	1.8	1
14434	Perfluorononanoic acid	375-95-1	4.1	0.46	0.92	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	46	0.46	0.92	1.8	1
14434	Perfluorooctanoic acid	335-67-1	16	0.46	0.92	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:48	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW21A-DUP-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 10:30
SDG#: FSB50-13FD

AECOM
ELLE Sample #: GW 1183587
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.7	4.7	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	4.8	0.47	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	7.7	0.47	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.87 J	0.47	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	4.2	0.47	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	47	0.47	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	16	0.47	0.93	1.9	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 22:58	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW05A-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 11:30
SDG#: FSB50-14

AECOM
ELLE Sample #: GW 1183588
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.90	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.95 J	0.45	0.90	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	0.93 J	0.45	0.90	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.4 J	0.45	0.90	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.45	0.90	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	1.2 J	0.45	0.90	1.8	1
14434	Perfluorooctanoic acid	335-67-1	3.2	0.45	0.90	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standard 13C3-PFBS is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 23:07	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW05A-DUP-20191021 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 11:35
SDG#: FSB50-15FD

AECOM
ELLE Sample #: GW 1183589
ELLE Group #: 2070940
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.93 J	0.44	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	0.91 J	0.44	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.3 J	0.44	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.44	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	1.8 J	0.44	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	3.1	0.44	0.89	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

The recovery for extraction standards is outside of the QC acceptance limits as noted on the QC Summary.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 23:16	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

Sample Description: **FB-20191021 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/22/2019 17:37
Collection Date/Time: 10/21/2019 16:00
SDG#: FSB50-16FB

AECOM
ELLE Sample #: GW 1183590
ELLE Group #: 2070940
Matrix: Water

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.44	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.44	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.44	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.44	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	N.D.	0.44	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.44	0.89	1.8	1

The recovery for a target analyte(s) in the Laboratory Control Spike(s) is outside the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for a target analyte(s) in the Laboratory Control Spike(s) was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/05/2019 23:25	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19305004	11/01/2019 07:00	Toby Barnhart	1

*=This limit was used in the evaluation of the final result

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Quality Control Summary

Client Name: AECOM
Reported: 11/19/2019 10:02

Group Number: 2070940

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	DL**	LOD	LOQ
	ng/l	ng/l	ng/l	ng/l
Batch number: 19305004	Sample number(s): 1183575-1183590			
6:2-Fluorotelomersulfonic acid	N.D.	2.0	4.0	5.0
8:2-Fluorotelomersulfonic acid	N.D.	1.0	2.0	3.0
Perfluorobutanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluoroheptanoic acid	N.D.	0.50	1.0	2.0
Perfluorohexanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorononanoic acid	N.D.	0.50	1.0	2.0
Perfluorooctanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorooctanoic acid	N.D.	0.50	1.0	2.0

LCS/LCSD

Analysis Name	LCS Spike Added ng/l	LCS Conc ng/l	LCSD Spike Added ng/l	LCSD Conc ng/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 19305004	Sample number(s): 1183575-1183590								
6:2-Fluorotelomersulfonic acid	24.28	19.3	24.28	21.22	80	87	51-155	9	30
8:2-Fluorotelomersulfonic acid	24.52	20.19	24.52	22.07	82	90	62-133	9	30
Perfluorobutanesulfonic acid	22.64	17.71	22.64	18.24	78*	81	81-133	3	30
Perfluoroheptanoic acid	25.6	21.06	25.6	21.6	82	84	80-140	3	30
Perfluorohexanesulfonic acid	24.2	18.14	24.2	18.64	75	77	71-131	3	30
Perfluorononanoic acid	25.6	19.91	25.6	22.65	78	88	73-140	13	30
Perfluorooctanesulfonic acid	24.48	17.45	24.48	17.91	71	73	54-139	3	30
Perfluorooctanoic acid	25.6	20.94	25.6	21.33	82*	83	83-138	2	30

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/19/2019 10:02

Group Number: 2070940

Labeled Isotope Quality Control

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19305004

	13C3-PFBS		13C3-PFHxS		13C4-PFHpA		13C2-6:2-FTS		13C8-PFOA		13C8-PFOS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
1183575	233*	8.9	108	8.9	103	1.8	101	8.9	92	1.8	66	8.9
1183576	170*	9.0	100	9.0	101	1.8	107	9.0	93	1.8	78	9.0
1183577	196*	9.1	97	9.1	106	1.8	138	9.1	99	1.8	85	9.1
1183578	151*	9.3	110	9.3	114	1.9	147	9.3	108	1.9	109	9.3
1183579	133	9.2	112	9.2	107	1.8	106	9.2	101	1.8	97	9.2
1183580	156*	8.7	93	8.7	97	1.7	91	8.7	89	1.7	60	8.7
1183581	203*	9.3	103	9.3	115	1.9	174*	9.3	102	1.9	93	9.3
1183582	159*	8.8	92	8.8	98	1.8	92	8.8	84	1.8	58	8.8
1183583	196*	8.7	102	8.7	113	1.7	94	8.7	85	1.7	53	8.7
1183584	141	8.8	107	8.8	109	1.8	120	8.8	103	1.8	93	8.8
1183585	148	8.8	104	8.8	111	1.8	110	8.8	102	1.8	97	8.8
1183586	151*	9.2	108	9.2	121	1.8	141	9.2	99	1.8	90	9.2
1183587	168*	9.3	113	9.3	120	1.9	190*	9.3	106	1.9	107	9.3
1183588	203*	9.0	105	9.0	107	1.8	119	9.0	102	1.8	99	9.0
1183589	187*	8.9	100	8.9	102	1.8	90	8.9	91	1.8	58	8.9
1183590	107	8.9	106	8.9	104	1.8	108	8.9	106	1.8	91	8.9
Blank	120	10	132	10	129	2.0	130	10	136	2.0	124	10
LCS	110	10	105	10	110	2.0	106	10	103	2.0	104	10
LCSD	107	10	106	10	109	2.0	102	10	101	2.0	103	10
Limits:	50-150		50-150		50-150		50-150		50-150		50-150	

	13C9-PFNA		13C2-8:2-FTS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
1183575	77	1.8	42*	5.4
1183576	84	1.8	70	5.4
1183577	96	1.8	82	5.5
1183578	126	1.9	122	5.6
1183579	97	1.8	88	5.5
1183580	68	1.7	46*	5.2
1183581	105	1.9	98	5.6
1183582	65	1.8	47*	5.3
1183583	66	1.7	42*	5.2
1183584	104	1.8	86	5.3
1183585	99	1.8	84	5.3
1183586	109	1.8	83	5.5
1183587	132	1.9	106	5.6
1183588	102	1.8	88	5.4

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/19/2019 10:02

Group Number: 2070940

Labeled Isotope Quality Control (continued)

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19305004

	13C9-PFNA %Rec	LOD (ng/l)	13C2-8:2-FTS %Rec	LOD (ng/l)
1183589	70	1.8	44*	5.3
1183590	93	1.8	75	5.3
Blank	128	2.0	117	6.0
LCS	104	2.0	96	6.0
LCSD	103	2.0	96	6.0
Limits:	50-150		50-150	

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Environmental Analysis Request/Chain of Custody

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Acct. # 42343 Group # 2070940 Sample # 11B3575-90

COC # 593594

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

For Lab Use Only
FSC:
SCR#: 250699

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix	Total # of Containers	Analysis Requested: PFAS by LC/MS/MS-000	Remarks
MRC-MW01A-20191021	10-21-19	1015	X		GW	2	X	
MRC-MW16A-20191021		1600	X					
MRC-MW10A-20191021		1325	X					
MRC-EXT-MW03-20191021		1550	X					
MRC-EXT-MW06-20191021		1255	X					
MRC-MW02A-20191021		1030	X					
MRC-MW42A-20191021		1420	X					
MRC-MW27A-20191021		1410	X					
MRC-MW48A-20191021		1600	X					
MRC-MW27B-20191021	↓	1230	↓		↓	↓	↓	

Matrix: Soil ☐ Sediment ☐ Tissue ☐ | Water: Potable ☐ Ground ☒ NPDES ☐ Surface ☐ | Other:

Turnaround Time (TAT) Requested (please circle)
Standard Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days:

E-mail address: holly.brown@aecom.com & maum.tountzis@aecom.com

Data Package Options (circle if required)
Type I (EPA Level 3 Equivalent/non-CLP) MB
Type III (Reduced non-CLP)
NYSDEC Category A or B
Type VI (Raw Data Only)
NJ DKQP TX TRRP-13
MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-22-19	1340		10/22/19	13:40
				10/23/19	1737

EDD Required? Yes No
If yes, format: EQuIS 4.CSV

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS ____ FedEx ____ Other X

Temperature upon receipt 1.4 °C

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only
Acct. # 42343 Group # 2070910 Sample # 1183575-90

COC #594739

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

Matrix

Soil ☐ Sediment ☐ Tissue ☐ | Water: Potable ☐ Ground ☒ NPDES ☐ Surface ☐ | Other: ____

Analysis Requested

Preservation and Filtration Codes

For Lab Use Only

FSC:
SCR#: 250613

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil	Sediment	Tissue	Water	Potable	Ground	NPDES	Surface	Other	Total # of Containers	PFAS by LC/MS/MS-000	Remarks
MRC-MW27B-DUP-20191021	10-21-19	1235	X					GW						2	X	field duplicate
MRC-MW21A-20191021	↓	1025	X					↓						↓	↓	
MRC-MW21A-DUP-20191021		1030	X													field duplicate
MRC-MW05A-20191021		1130	X													
MRC-MW05A-DUP-20191021		1135	X													field duplicate
FB-20191021	↓	1600	X					WQ						↓	↓	water quality field blank

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: _____

E-mail address: holly.brown@aecom.com & maun.tauntzis@aecom.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) HB
Type III (Reduced non-CLP)
NYSDEC Category A or B
Type VI (Raw Data Only)
NJ DKQP
MA MCP
TX TRRP-13
CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-22-19	1340		10/22/19	13:40
				10-22-19	1757

EDD Required? Yes No
If yes, format: EQuIS & .CSV

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS _____ FedEx _____ Other ✓

Temperature upon receipt 1.4 °C

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Sample Administration Receipt Documentation Log

Doc Log ID: 263778

Group Number(s): 2070940

Client: Aecom

Delivery and Receipt Information

Delivery Method:	ELLE Courier	Arrival Date:	10/22/2019
Number of Packages:	1	Number of Projects:	1
State/Province of Origin:	MD		

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	Total Trip Blank Qty:	0
Paperwork Enclosed:	Yes	Air Quality Samples Present:	No
Samples Intact:	Yes		
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Tamara Lugardo

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle)* *IR = Infrared (Surface Temp)* *All Temperatures in °C.*

Cooler #	Matrix	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	Water	DT42-03	1.4	DT	Wet	Y	Loose	N

2425 New Holland Pike
Lancaster, PA 17605-2425
T 717-656-2300
F 717-656-2681
www.LancasterLabs.com

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

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Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

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ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

AECOM
Suite 150
12420 Milestone Center Drive
Germantown MD 20876

Report Date: November 21, 2019 14:10

Project: LM MRC PFAS GWS

Account #: 42343
Group Number: 2071352
SDG: FSB51
PO Number: 118990
State of Sample Origin: MD

Electronic Copy To AECOM — Attn: Holly Brown
Electronic Copy To AECOM — Attn: Naoum Tavantzis

Respectfully Submitted,

Kay Hower

(717) 556-7364

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SAMPLE INFORMATION

Client Sample Description	Sample Collection Date/Time	ELLE#
MRC-MW128A-20191023 Grab Groundwater	10/23/2019 16:05	1185535
MRC-MW134B-20191023 Grab Groundwater	10/23/2019 15:40	1185536
MRC-MW125B-20191023 Grab Groundwater	10/23/2019 14:20	1185537
MRC-MW119A-20191024 Grab Groundwater	10/24/2019 08:45	1185538
MRC-MW41A-20191024 Grab Groundwater	10/24/2019 10:10	1185539
MRC-MW44A-20191024 Grab Groundwater	10/24/2019 09:35	1185540
MRC-MW136B-20191024 Grab Groundwater	10/24/2019 11:50	1185541
MRC-MW134A-20191024 Grab Groundwater	10/24/2019 14:05	1185542

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

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Project Name: LM MRC PFAS GWS
ELLE Group #: 2071352

General Comments:

All analyses have been performed in accordance with DOD QSM Version 5.1.1 unless otherwise noted below.

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.
Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

EPA 537 mod QSM 5.1 table B-15, LC/MS/MS Miscellaneous

Sample #s: 1185536

The following analytes were manually integrated:
Perfluorooctanesulfonic acid

Sample #s: 1185538, 1185540

The sample injection internal standard peak areas were outside of the QC limits for both the initial injection and the re-injection. The values here are from the initial injection of the sample.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits as noted on the QC Summary due to the matrix of the sample.

Batch #: 19309008 (Sample number(s): 1185538-1185542)

The recovery(ies) for one or more surrogates exceeded the acceptance window indicating a positive bias for sample(s) 1185538, 1185540

Sample Description: **MRC-MW128A-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 16:05
SDG#: FSB51-01

AECOM
ELLE Sample #: GW 1185535
ELLE Group #: 2071352
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.5 J	0.44	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	3.1	0.44	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.74 J	0.44	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.8	0.44	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	11	0.44	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	8.8	0.44	0.89	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 20:01	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW134B-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 15:40
SDG#: FSB51-02

AECOM
ELLE Sample #: GW 1185536
ELLE Group #: 2071352
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous EPA 537 mod QSM 5.1 table B-15			**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.92	1.8	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.46	0.92	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.46	0.92	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.46	0.92	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.46	0.92	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	0.83 J	0.46	0.92	1.8	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.46	0.92	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 20:10	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW125B-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 14:20
SDG#: FSB51-03

AECOM
ELLE Sample #: GW 1185537
ELLE Group #: 2071352
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	8.4		1.7	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.87	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	2.2		0.44	0.87	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	8.1		0.44	0.87	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.4	J	0.44	0.87	1.7	1
14434	Perfluorononanoic acid	375-95-1	2.2		0.44	0.87	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	8.4		0.44	0.87	1.7	1
14434	Perfluorooctanoic acid	335-67-1	21		0.44	0.87	1.7	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 20:19	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW119A-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/24/2019 08:45
SDG#: FSB51-04

AECOM
ELLE Sample #: GW 1185538
ELLE Group #: 2071352
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.92	1.8	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	2.4	0.46	0.92	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	1.5 J	0.46	0.92	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.46	0.92	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.46	0.92	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	1.7 J	0.46	0.92	1.8	1
14434	Perfluorooctanoic acid	335-67-1	4.3	0.46	0.92	1.8	1

The sample injection internal standard peak areas were outside of the QC limits for both the initial injection and the re-injection. The values here are from the initial injection of the sample.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits as noted on the QC Summary due to the matrix of the sample.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 03:54	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW41A-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/24/2019 10:10
SDG#: FSB51-05

AECOM
ELLE Sample #: GW 1185539
ELLE Group #: 2071352
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.91	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	4.4	0.46	0.91	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	5.0	0.46	0.91	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	2.4	0.46	0.91	1.8	1
14434	Perfluorononanoic acid	375-95-1	3.0	0.46	0.91	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	9.6	0.46	0.91	1.8	1
14434	Perfluorooctanoic acid	335-67-1	13	0.46	0.91	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 04:03	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW44A-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/24/2019 09:35
SDG#: FSB51-06

AECOM
ELLE Sample #: GW 1185540
ELLE Group #: 2071352
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.7	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.87	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	2.3	0.44	0.87	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	2.6	0.44	0.87	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.47 J	0.44	0.87	1.7	1
14434	Perfluorononanoic acid	375-95-1	0.76 J	0.44	0.87	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	2.4	0.44	0.87	1.7	1
14434	Perfluorooctanoic acid	335-67-1	9.6	0.44	0.87	1.7	1

The sample injection internal standard peak areas were outside of the QC limits for both the initial injection and the re-injection. The values here are from the initial injection of the sample.

The recovery for labeled compound used as extraction standards is outside of QC acceptance limits as noted on the QC Summary due to the matrix of the sample.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 04:12	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW136B-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/24/2019 11:50
SDG#: FSB51-07

AECOM
ELLE Sample #: GW 1185541
ELLE Group #: 2071352
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.88	1.8	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.4 J	0.44	0.88	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	1.2 J	0.44	0.88	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.4 J	0.44	0.88	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.44	0.88	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	2.9	0.44	0.88	1.8	1
14434	Perfluorooctanoic acid	335-67-1	3.5	0.44	0.88	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 04:21	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW134A-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/24/2019 14:05
SDG#: FSB51-08

AECOM
ELLE Sample #: GW 1185542
ELLE Group #: 2071352
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.88	1.8	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.6 J	0.44	0.88	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	5.4	0.44	0.88	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.47 J	0.44	0.88	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.7	0.44	0.88	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	6.0	0.44	0.88	1.8	1
14434	Perfluorooctanoic acid	335-67-1	10	0.44	0.88	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 04:30	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: AECOM
Reported: 11/21/2019 14:10

Group Number: 2071352

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	DL**	LOD	LOQ
	ng/l	ng/l	ng/l	ng/l
Batch number: 19308004	Sample number(s): 1185535-1185537			
6:2-Fluorotelomersulfonic acid	N.D.	2.0	4.0	5.0
8:2-Fluorotelomersulfonic acid	N.D.	1.0	2.0	3.0
Perfluorobutanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluoroheptanoic acid	N.D.	0.50	1.0	2.0
Perfluorohexanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorononanoic acid	N.D.	0.50	1.0	2.0
Perfluorooctanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorooctanoic acid	N.D.	0.50	1.0	2.0
Batch number: 19309008	Sample number(s): 1185538-1185542			
6:2-Fluorotelomersulfonic acid	N.D.	2.0	4.0	5.0
8:2-Fluorotelomersulfonic acid	N.D.	1.0	2.0	3.0
Perfluorobutanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluoroheptanoic acid	N.D.	0.50	1.0	2.0
Perfluorohexanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorononanoic acid	N.D.	0.50	1.0	2.0
Perfluorooctanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorooctanoic acid	N.D.	0.50	1.0	2.0

LCS/LCSD

Analysis Name	LCS Spike Added ng/l	LCS Conc ng/l	LCSD Spike Added ng/l	LCSD Conc ng/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 19308004	Sample number(s): 1185535-1185537								
6:2-Fluorotelomersulfonic acid	24.28	21.69	24.28	23.58	89	97	51-155	8	30
8:2-Fluorotelomersulfonic acid	24.52	24.38	24.52	25.89	99	106	62-133	6	30
Perfluorobutanesulfonic acid	22.64	21.04	22.64	21.43	93	95	81-133	2	30
Perfluoroheptanoic acid	25.6	25.68	25.6	25.05	100	98	80-140	2	30
Perfluorohexanesulfonic acid	24.2	21.01	24.2	20.99	87	87	71-131	0	30
Perfluorononanoic acid	25.6	24.8	25.6	22.89	97	89	73-140	8	30
Perfluorooctanesulfonic acid	24.48	20.36	24.48	20.07	83	82	54-139	1	30
Perfluorooctanoic acid	25.6	22.93	25.6	23.69	90	93	83-138	3	30
Batch number: 19309008	Sample number(s): 1185538-1185542								
6:2-Fluorotelomersulfonic acid	24.28	23.96			99		51-155		

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/21/2019 14:10

Group Number: 2071352

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ng/l	LCS Conc ng/l	LCSD Spike Added ng/l	LCSD Conc ng/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
8:2-Fluorotelomersulfonic acid	24.52	20.4			83		62-133		
Perfluorobutanesulfonic acid	22.64	21.6			95		81-133		
Perfluoroheptanoic acid	25.6	24.03			94		80-140		
Perfluorohexanesulfonic acid	24.2	20.26			84		71-131		
Perfluorononanoic acid	25.6	22.83			89		73-140		
Perfluorooctanesulfonic acid	24.48	19.97			82		54-139		
Perfluorooctanoic acid	25.6	22.84			89		83-138		

Labeled Isotope Quality Control

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19308004

	13C3-PFBS %Rec	LOD (ng/l)	13C3-PFHxS %Rec	LOD (ng/l)	13C4-PFHpA %Rec	LOD (ng/l)	13C2-6:2-FTS %Rec	LOD (ng/l)	13C8-PFOA %Rec	LOD (ng/l)	13C8-PFOS %Rec	LOD (ng/l)
1185535	102	8.9	82	8.9	82	1.8	83	8.9	77	1.8	81	8.9
1185536	93	9.2	87	9.2	81	1.8	80	9.2	83	1.8	82	9.2
1185537	94	8.7	81	8.7	77	1.7	81	8.7	77	1.7	78	8.7
Blank	82	10	83	10	78	2.0	77	10	83	2.0	84	10
LCS	91	10	92	10	89	2.0	86	10	89	2.0	84	10
LCSD	84	10	87	10	86	2.0	79	10	83	2.0	85	10
Limits:	50-150		50-150		50-150		50-150		50-150		50-150	

	13C9-PFNA %Rec	LOD (ng/l)	13C2-8:2-FTS %Rec	LOD (ng/l)
1185535	81	1.8	75	5.3
1185536	82	1.8	72	5.5
1185537	78	1.7	72	5.2
Blank	83	2.0	67	6.0
LCS	84	2.0	84	6.0
LCSD	88	2.0	71	6.0
Limits:	50-150		50-150	

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19309008

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/21/2019 14:10

Group Number: 2071352

Labeled Isotope Quality Control (continued)

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19309008

	13C3-PFBS		13C3-PFHxS		13C4-PFHpA		13C2-6:2-FTS		13C8-PFOA		13C8-PFOS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
1185538	334*	9.2	82	9.2	73	1.8	194*	9.2	80	1.8	80	9.2
1185539	132	9.1	67	9.1	82	1.8	114	9.1	66	1.8	56	9.1
1185540	255*	8.7	84	8.7	97	1.7	186*	8.7	89	1.7	85	8.7
1185541	118	8.8	80	8.8	84	1.8	87	8.8	78	1.8	77	8.8
1185542	117	8.8	81	8.8	92	1.8	102	8.8	80	1.8	77	8.8
Blank	84	10	92	10	85	2.0	85	10	82	2.0	86	10
LCS	79	10	84	10	81	2.0	77	10	78	2.0	80	10
Limits:	50-150		50-150		50-150		50-150		50-150		50-150	

	13C9-PFNA		13C2-8:2-FTS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
1185538	106	1.8	111	5.5
1185539	69	1.8	53	5.5
1185540	111	1.7	125	5.2
1185541	83	1.8	83	5.3
1185542	86	1.8	76	5.3
Blank	87	2.0	96	6.0
LCS	76	2.0	82	6.0
Limits:	50-150		50-150	

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

J.A

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only
Acct. # 42343 Group # 2071352 Sample # 11855535-542

COC # 594738

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

Matrix

Soil ☐ Sediment ☐ Tissue ☐ | Water: Potable ☐ Ground ☒ NPDES ☐ Surface ☐ | Other: ____

Analysis Requested

Preservation and Filtration Codes

For Lab Use Only

FSC:
SCR#:

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix	Total # of Containers	PFAS by IC/MS/MS 0.0	Remarks
MRC-MW123A-20191023	10-23-19	1605	G		GW	2	X	
MRC-MW134B-20191023	↓	1540	↓		↓	↓	↓	
MRC-MW125B-20191023	↓	1420						
MRC-MW119A-20191024	10-24-19	0845						collected ~ 375 mL
MRC-MW141A-20191024	↓	1010						
MRC-MW144A-20191024		0935						
MRC-MW136B-20191024		1150						
MRC-MW134A-20191024	↓	1405	↓		↓	↓	↓	

Turnaround Time (TAT) Requested (please circle)
Standard Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: 12

E-mail address: holly.brown@aecom.com & mann.tauntzis@aecom.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-24-19	1435		10/24/19	14:35
	10/25/19	1309		10-25-19	1309
	10-25-19	1648			
				10-25-19	1726

EDD Required? Yes No
If yes, format: EQuIS & .CSV

Site-Specific QC (MS/MSD/Dup)? ~~Yes~~ No
(If yes, indicate QC sample and submit triplicate sample volume.) MS

Relinquished by Commercial Carrier: UPS ____ FedEx ____ Other X

Temperature upon receipt -0.8 °C

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Sample Administration Receipt Documentation Log

Doc Log ID: 264210

Group Number(s): 2071352

Client: AECOM

Delivery and Receipt Information

Delivery Method:	ELLE Courier	Arrival Date:	10/25/2019
Number of Packages:	1	Number of Projects:	1

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	Total Trip Blank Qty:	0
Paperwork Enclosed:	Yes	Air Quality Samples Present:	No
Samples Intact:	Yes		
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Shalynn Ponzo

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle)* *IR = Infrared (Surface Temp)* *All Temperatures in °C.*

Cooler #	Matrix	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	Water	192099059	-0.8	IR	Wet	Y	Loose	N

General Comments: Not frozen

2425 New Holland Pike
Lancaster, PA 17605-2425
T | 717-656-2300
F | 717-656-2681
www.LancasterLabs.com

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

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ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

AECOM
Suite 150
12420 Milestone Center Drive
Germantown MD 20876

Report Date: November 25, 2019 11:25

Project: LM MRC PFAS GWS

Account #: 42343
Group Number: 2071353
SDG: FSB52
PO Number: 118990
State of Sample Origin: MD

Electronic Copy To	AECOM	Attn: Holly Brown
Electronic Copy To	AECOM	Attn: Naoum Tavantzis

Respectfully Submitted,

Kay Hower

(717) 556-7364

To view our laboratory's current scopes of accreditation please go to https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/ . Historical copies may be requested through your project manager.

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SAMPLE INFORMATION

Client Sample Description	Sample Collection Date/Time	ELLE#
MRC-MW18A-20191023 Grab Groundwater	10/23/2019 10:10	1185543
MRC-MW55A-20191023 Grab Groundwater	10/23/2019 13:00	1185544
MRC-MW60B-20191023 Grab Groundwater	10/23/2019 09:50	1185545
MRC-MW118B-20191023 Grab Groundwater	10/23/2019 12:00	1185546
MRC-MW56A-20191023 Grab Groundwater	10/23/2019 10:20	1185547
MRC-MW60A-20191023 Grab Groundwater	10/23/2019 11:25	1185548
MRC-MW125A-20191023 Grab Groundwater	10/23/2019 15:20	1185549
MRC-MW128B-20191023 Grab Groundwater	10/23/2019 14:55	1185550
MRC-MW118A-20191023 Grab Groundwater	10/23/2019 13:00	1185551
FB-20191023 Water	10/23/2019 16:00	1185552

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-6766 • www.EurofinsUS.com/LancLabsEnv

Project Name: LM MRC PFAS GWS
ELLE Group #: 2071353

General Comments:

All analyses have been performed in accordance with DOD QSM Version 5.1.1 unless otherwise noted below.

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.
Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

EPA 537 mod QSM 5.1 table B-15, LC/MS/MS Miscellaneous

Sample #s: 1185547, 1185551

The following analytes were manually integrated:
Perfluorohexanesulfonic acid

Sample #s: 1185548, 1185550

The recovery for extraction standard 13C2-6:2-FTS is outside of QC acceptance limits as noted on the QC Summary.

Sample #s: 1185543

The recovery for extraction standard 13C2-6:2-FTS is outside of QC acceptance limits as noted on the QC Summary.

The following analytes were manually integrated:
Perfluorohexanesulfonic acid

Batch #: 19308004 (Sample number(s): 1185543-1185552)

The recovery(ies) for one or more surrogates exceeded the acceptance window indicating a positive bias for sample(s) 1185543, 1185548, 1185550

Sample Description: **MRC-MW18A-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 10:10
SDG#: FSB52-01

AECOM
ELLE Sample #: GW 1185543
ELLE Group #: 2071353
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	2.0	0.45	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	4.6	0.45	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.45	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.0	0.45	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	8.9	0.45	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	7.6	0.45	0.89	1.8	1

The recovery for extraction standard 13C2-6:2-FTS is outside of QC acceptance limits as noted on the QC Summary.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 20:37	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW55A-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 13:00
SDG#: FSB52-02

AECOM
ELLE Sample #: GW 1185544
ELLE Group #: 2071353
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.7	4.7	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.6 J	0.47	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	3.5	0.47	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.49 J	0.47	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	1.3 J	0.47	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	3.1	0.47	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	6.1	0.47	0.93	1.9	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 20:46	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW60B-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 09:50
SDG#: FSB52-03

AECOM
ELLE Sample #: GW 1185545
ELLE Group #: 2071353
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.7	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.87	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.46 J	0.44	0.87	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	0.73 J	0.44	0.87	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.44	0.87	1.7	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.44	0.87	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	0.89 J	0.44	0.87	1.7	1
14434	Perfluorooctanoic acid	335-67-1	1.2 J	0.44	0.87	1.7	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 20:55	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW118B-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 12:00
SDG#: FSB52-04

AECOM
ELLE Sample #: GW 1185546
ELLE Group #: 2071353
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous EPA 537 mod QSM 5.1 table B-15			**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.90	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.45	0.90	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.45	0.90	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.45	0.90	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.45	0.90	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	N.D.	0.45	0.90	1.8	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.45	0.90	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 21:04	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW56A-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 10:20
SDG#: FSB52-05

AECOM
ELLE Sample #: GW 1185547
ELLE Group #: 2071353
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	8.9	1.9	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	2.4	0.46	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	5.3	0.46	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.74 J	0.46	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	4.9	0.46	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	17	0.46	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	16	0.46	0.93	1.9	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 21:13	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW60A-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 11:25
SDG#: FSB52-06

AECOM
ELLE Sample #: GW 1185548
ELLE Group #: 2071353
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.8	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.88	1.8	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.6	J	0.44	0.88	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	3.6		0.44	0.88	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.3	J	0.44	0.88	1.8	1
14434	Perfluorononanoic acid	375-95-1	3.0		0.44	0.88	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	8.9		0.44	0.88	1.8	1
14434	Perfluorooctanoic acid	335-67-1	15		0.44	0.88	1.8	1

The recovery for extraction standard 13C2-6:2-FTS is outside of QC acceptance limits as noted on the QC Summary.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 21:22	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW125A-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 15:20
SDG#: FSB52-07

AECOM
ELLE Sample #: GW 1185549
ELLE Group #: 2071353
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.7	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.87	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	2.5		0.44	0.87	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	7.0		0.44	0.87	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.3	J	0.44	0.87	1.7	1
14434	Perfluorononanoic acid	375-95-1	2.5		0.44	0.87	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	10		0.44	0.87	1.7	1
14434	Perfluorooctanoic acid	335-67-1	18		0.44	0.87	1.7	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 21:31	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW128B-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 14:55
SDG#: FSB52-08

AECOM
ELLE Sample #: GW 1185550
ELLE Group #: 2071353
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.8	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.92	1.8	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.9		0.46	0.92	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	2.7		0.46	0.92	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.4	J	0.46	0.92	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.7		0.46	0.92	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	16		0.46	0.92	1.8	1
14434	Perfluorooctanoic acid	335-67-1	11		0.46	0.92	1.8	1

The recovery for extraction standard 13C2-6:2-FTS is outside of QC acceptance limits as noted on the QC Summary.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/10/2019 17:42	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW118A-20191023 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 13:00
SDG#: FSB52-09

AECOM
ELLE Sample #: GW 1185551
ELLE Group #: 2071353
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.8	3.6	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.8		0.44	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	3.0		0.44	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.0	J	0.44	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.7		0.44	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	42		0.44	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	5.0		0.44	0.89	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 21:49	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **FB-20191023 Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/25/2019 17:26
Collection Date/Time: 10/23/2019 16:00
SDG#: FSB52-10FB

AECOM
ELLE Sample #: GW 1185552
ELLE Group #: 2071353
Matrix: Water

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.45	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.45	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.45	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.45	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	N.D.	0.45	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.45	0.89	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/06/2019 21:58	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19308004	11/04/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: AECOM
Reported: 11/25/2019 11:25

Group Number: 2071353

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	DL**	LOD	LOQ
	ng/l	ng/l	ng/l	ng/l
Batch number: 19308004	Sample number(s): 1185543-1185552			
6:2-Fluorotelomersulfonic acid	N.D.	2.0	4.0	5.0
8:2-Fluorotelomersulfonic acid	N.D.	1.0	2.0	3.0
Perfluorobutanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluoroheptanoic acid	N.D.	0.50	1.0	2.0
Perfluorohexanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorononanoic acid	N.D.	0.50	1.0	2.0
Perfluorooctanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorooctanoic acid	N.D.	0.50	1.0	2.0

LCS/LCSD

Analysis Name	LCS Spike Added ng/l	LCS Conc ng/l	LCSD Spike Added ng/l	LCSD Conc ng/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 19308004	Sample number(s): 1185543-1185552								
6:2-Fluorotelomersulfonic acid	24.28	21.69	24.28	23.58	89	97	51-155	8	30
8:2-Fluorotelomersulfonic acid	24.52	24.38	24.52	25.89	99	106	62-133	6	30
Perfluorobutanesulfonic acid	22.64	21.04	22.64	21.43	93	95	81-133	2	30
Perfluoroheptanoic acid	25.6	25.68	25.6	25.05	100	98	80-140	2	30
Perfluorohexanesulfonic acid	24.2	21.01	24.2	20.99	87	87	71-131	0	30
Perfluorononanoic acid	25.6	24.8	25.6	22.89	97	89	73-140	8	30
Perfluorooctanesulfonic acid	24.48	20.36	24.48	20.07	83	82	54-139	1	30
Perfluorooctanoic acid	25.6	22.93	25.6	23.69	90	93	83-138	3	30

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/25/2019 11:25

Group Number: 2071353

Labeled Isotope Quality Control

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19308004

	13C3-PFBS		13C3-PFHxS		13C4-PFHpA		13C2-6:2-FTS		13C8-PFOA		13C8-PFOS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
1185543	114	8.9	87	8.9	97	1.8	158*	8.9	84	1.8	79	8.9
1185544	115	9.3	83	9.3	85	1.9	81	9.3	78	1.9	77	9.3
1185545	106	8.7	93	8.7	95	1.7	97	8.7	92	1.7	88	8.7
1185546	91	9.0	79	9.0	77	1.8	75	9.0	81	1.8	79	9.0
1185547	118	9.3	87	9.3	95	1.9	124	9.3	84	1.9	78	9.3
1185548	145	8.8	79	8.8	90	1.8	164*	8.8	81	1.8	82	8.8
1185549	126	8.7	89	8.7	90	1.7	98	8.7	85	1.7	84	8.7
1185550	103	9.2	85	9.2	103	1.8	239*	9.2	92	1.8	97	9.2
1185551	96	8.9	79	8.9	82	1.8	90	8.9	76	1.8	82	8.9
1185552	79	8.9	86	8.9	81	1.8	75	8.9	87	1.8	85	8.9
Blank	82	10	83	10	78	2.0	77	10	83	2.0	84	10
LCS	91	10	92	10	89	2.0	86	10	89	2.0	84	10
LCSD	84	10	87	10	86	2.0	79	10	83	2.0	85	10
Limits:	50-150		50-150		50-150		50-150		50-150		50-150	

	13C9-PFNA		13C2-8:2-FTS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
1185543	98	1.8	107	5.4
1185544	80	1.9	74	5.6
1185545	91	1.7	86	5.2
1185546	81	1.8	77	5.4
1185547	88	1.9	67	5.6
1185548	99	1.8	87	5.3
1185549	86	1.7	86	5.2
1185550	114	1.8	136	5.5
1185551	84	1.8	76	5.3
1185552	83	1.8	81	5.4
Blank	83	2.0	67	6.0
LCS	84	2.0	84	6.0
LCSD	88	2.0	71	6.0
Limits:	50-150		50-150	

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

TA

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only

Acct. # 42343 Group # 2071353 Sample # 1185543-552

COC #593593

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

Matrix: Tissue ☐ Sediment ☐ Soil ☐; Ground ☒ Potable ☐ Water; Surface ☐ NPDES ☐; Other:

Analysis Requested — Preservation and Filtration Codes: PFAS by LC/MS/MS-DoD

For Lab Use Only: FSC: ______ SCR#: ______

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Date	Time	Grab	Composite	Soil	Water	Other	Total # of Containers	PFAS by LC/MS/MS-DoD	Remarks
MRC-MW18A-20191023	10-23-19	1010	G			GW		2	X	
MRC-MW55A-20191023	↓	1300	↓			↓		↓	↓	
MRC-MW60B-20191023	↓	0950	↓			↓		↓	↓	
MRC-MW118B-20191023	↓	1200	↓			↓		↓	↓	
MRC-MW56A-20191023	↓	1020	↓			↓		↓	↓	
MRC-MW60A-20191023	↓	1125	↓			↓		↓	↓	
MRC-MW125A-20191023	↓	1520	↓			↓		↓	↓	
MRC-MW128B-20191023	↓	1455	↓			↓		↓	↓	
MRC-MW118A-20191023	↓	1300	↓			↓		↓	↓	
FB-20191023	↓	1600	↓			↓ Q		↓	↓	field blank, H_2O quality

Turnaround Time (TAT) Requested (please circle)

(Standard) Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: 12

E-mail address: matt.pantzis@aecom.com & holly.brown@aecom.com

Data Package Options (circle if required)

(Type I (EPA Level 3 Equivalent/non-CLP)) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
[signature]	10-24-19	1435	[signature]	10/24/19	1435
[signature]	10/25/19	1309	[signature]	10-25-19	1309
[signature]	10-25-19	1648			
			[signature]	10/25/19	1726

EDD Required? (Yes) No
If yes, format: EQuIS & .CSV

Site-Specific QC (MS/MSD/Dup)? Yes (No)
(If yes, indicate QC sample and submit triplicate sample volume.) HB

Relinquished by Commercial Carrier:
UPS ______ FedEx ______ Other ✓

Temperature upon receipt -0.8 °C

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Sample Administration Receipt Documentation Log

Doc Log ID: 264210

Group Number(s): 2071353

Client: AECOM

Delivery and Receipt Information

Delivery Method:	ELLE Courier	Arrival Date:	10/25/2019
Number of Packages:	1	Number of Projects:	1

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	Total Trip Blank Qty:	0
Paperwork Enclosed:	Yes	Air Quality Samples Present:	No
Samples Intact:	Yes		
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Shalynn Ponzo

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle)* *IR = Infrared (Surface Temp)* *All Temperatures in °C.*

Cooler #	Matrix	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	Water	192099059	-0.8	IR	Wet	Y	Loose	N

General Comments: Not frozen

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Lancaster, PA 17605-2425
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F | 717-656-2681
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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

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Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

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ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

AECOM
Suite 150
12420 Milestone Center Drive
Germantown MD 20876

Report Date: November 22, 2019 15:02

Project: LM MRC PFAS GWS

Account #: 42343
Group Number: 2071362
SDG: FSB53
PO Number: 118990
State of Sample Origin: MD

Electronic Copy To AECOM Attn: Naoum Tavantzis
Electronic Copy To AECOM Attn: Holly Brown

Respectfully Submitted,

Kay Hower

(717) 556-7364

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SAMPLE INFORMATION

Client Sample Description	Sample Collection Date/Time	ELLE#
FB-20191024 Grab Water	10/24/2019 15:35	1185586
FB-20191025 Grab Water	10/25/2019 11:30	1185587
RB-AD-20191025 Grab Water	10/25/2019 13:30	1185588
RB-VK-20191025 Grab Water	10/25/2019 13:25	1185589
RB-AZ-20191025 Grab Water	10/25/2019 13:20	1185590
RB-TRANS-20191025 Grab Water	10/25/2019 13:40	1185591
MW147B-20191025 Grab Groundwater	10/25/2019 12:10	1185592
MW147B-20191025 MS Grab Groundwater	10/25/2019 12:10	1185593
MW147B-20191025 MSD Grab Groundwater	10/25/2019 12:10	1185594
MW74B-20191025 Grab Groundwater	10/25/2019 11:45	1185595
MW74B-20191025 MS Grab Groundwater	10/25/2019 11:45	1185596
MW74B-20191025 MSD Grab Groundwater	10/25/2019 11:45	1185597
MW146B-20191025 Grab Groundwater	10/25/2019 10:40	1185598
MW146B-DUP-20191025 Grab Groundwater	10/25/2019 10:50	1185599
MW72B-20191024 Grab Groundwater	10/24/2019 14:30	1185600
MW159A-20191024 Grab Groundwater	10/24/2019 12:20	1185601
SEMW-1I-20191024 Grab Groundwater	10/24/2019 10:40	1185602
SEMW-3I-20191024 Grab Groundwater	10/24/2019 15:20	1185603
SEMW-2I-20191024 Grab Groundwater	10/24/2019 12:50	1185604
MW155A-20191024 Grab Groundwater	10/24/2019 15:30	1185605
IWE-10-20191025 Grab Groundwater	10/25/2019 09:50	1185606
IWE-10-DUP-20191025 Grab Groundwater	10/25/2019 09:55	1185607

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

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Project Name: LM MRC PFAS GWS
ELLE Group #: 2071362

General Comments:

All analyses have been performed in accordance with DOD QSM Version 5.1.1 unless otherwise noted below.

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.
Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

EPA 537 mod QSM 5.1 table B-15, LC/MS/MS Miscellaneous

Sample #s: 1185598

The following analytes were manually integrated:
Perfluorobutanesulfonic acid

Sample #s: 1185599

The recovery for extraction standard 13C2-8:2-FTS is outside of the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for extraction standards was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Batch #: 19310003 (Sample number(s): 1185595-1185599, 1185606-1185607 UNSPK: 1185595)

The recovery(ies) for one or more surrogates were below the acceptance window for sample(s) 1185599

Sample Description: **FB-20191024 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/24/2019 15:35
SDG#: FSB53-01FB

AECOM
ELLE Sample #: GW 1185586
ELLE Group #: 2071362
Matrix: Water

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.7	3.4	4.3	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.85	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.43	0.85	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.43	0.85	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.43	0.85	1.7	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.43	0.85	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	N.D.	0.43	0.85	1.7	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.43	0.85	1.7	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 04:39	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **FB-20191025 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 11:30
SDG#: FSB53-02FB

AECOM
ELLE Sample #: GW 1185587
ELLE Group #: 2071362
Matrix: Water

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.90	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.45	0.90	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.45	0.90	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.45	0.90	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.45	0.90	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	N.D.	0.45	0.90	1.8	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.45	0.90	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 04:57	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **RB-AD-20191025 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 13:30
SDG#: FSB53-03RB

AECOM
ELLE Sample #: GW 1185588
ELLE Group #: 2071362
Matrix: Water

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.7	3.4	4.3	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.86	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.43	0.86	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.43	0.86	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.43	0.86	1.7	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.43	0.86	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	0.57 J	0.43	0.86	1.7	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.43	0.86	1.7	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 05:06	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **RB-VK-20191025 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 13:25
SDG#: FSB53-04RB

AECOM
ELLE Sample #: GW 1185589
ELLE Group #: 2071362
Matrix: Water

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous EPA 537 mod QSM 5.1 table B-15			ng/l	ng/l	ng/l	ng/l	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.92	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.46	0.92	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.46	0.92	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.46	0.92	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.46	0.92	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	N.D.	0.46	0.92	1.8	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.46	0.92	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 05:15	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **RB-AZ-20191025 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 13:20
SDG#: FSB53-05RB

AECOM
ELLE Sample #: GW 1185590
ELLE Group #: 2071362
Matrix: Water

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.91	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.45	0.91	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.45	0.91	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.45	0.91	1.8	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.45	0.91	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	N.D.	0.45	0.91	1.8	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.45	0.91	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 05:24	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **RB-TRANS-20191025 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 13:40
SDG#: FSB53-06RB

AECOM
ELLE Sample #: GW 1185591
ELLE Group #: 2071362
Matrix: Water

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous EPA 537 mod QSM 5.1 table B-15			**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.7	3.4	4.3	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.86	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.43	0.86	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	N.D.	0.43	0.86	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.43	0.86	1.7	1
14434	Perfluorononanoic acid	375-95-1	N.D.	0.43	0.86	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	N.D.	0.43	0.86	1.7	1
14434	Perfluorooctanoic acid	335-67-1	N.D.	0.43	0.86	1.7	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 05:33	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW147B-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 12:10
SDG#: FSB53-07BKG

AECOM
ELLE Sample #: GW 1185592
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.3	J	0.45	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	2.7		0.45	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.5	J	0.45	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	1.8	J	0.45	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	8.7		0.45	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	4.7		0.45	0.89	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 05:42	Marissa C Drexinger	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW147B-20191025 MS Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 12:10
SDG#: FSB53-07MS

AECOM
ELLE Sample #: GW 1185593
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	20	1.7	3.5	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	16	0.87	1.7	2.6	1
14434	Perfluorobutanesulfonic acid	375-73-5	19	0.44	0.87	1.7	1
14434	Perfluoroheptanoic acid	375-85-9	21	0.44	0.87	1.7	1
14434	Perfluorohexanesulfonic acid	355-46-4	19	0.44	0.87	1.7	1
14434	Perfluorononanoic acid	375-95-1	21	0.44	0.87	1.7	1
14434	Perfluorooctanesulfonic acid	1763-23-1	25	0.44	0.87	1.7	1
14434	Perfluorooctanoic acid	335-67-1	31	0.44	0.87	1.7	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 05:51	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW147B-20191025 MSD Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 12:10
SDG#: FSB53-07MSD

AECOM
ELLE Sample #: GW 1185594
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	20	1.8	3.6	4.4	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	21	0.89	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	20	0.44	0.89	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	22	0.44	0.89	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	20	0.44	0.89	1.8	1
14434	Perfluorononanoic acid	375-95-1	23	0.44	0.89	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	27	0.44	0.89	1.8	1
14434	Perfluorooctanoic acid	335-67-1	32	0.44	0.89	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 06:01	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW74B-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 11:45
SDG#: FSB53-08BKG

AECOM
ELLE Sample #: GW 1185595
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.9	3.7	4.7	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.1	J	0.47	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	2.2		0.47	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	2.6		0.47	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	1.5	J	0.47	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	4.4		0.47	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	5.9		0.47	0.93	1.9	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/07/2019 19:21	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/06/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW74B-20191025 MS Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 11:45
SDG#: FSB53-08MS

AECOM
ELLE Sample #: GW 1185596
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous EPA 537 mod QSM 5.1 table B-15			**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	19	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	22	0.91	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	18	0.45	0.91	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	22	0.45	0.91	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	21	0.45	0.91	1.8	1
14434	Perfluorononanoic acid	375-95-1	21	0.45	0.91	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	22	0.45	0.91	1.8	1
14434	Perfluorooctanoic acid	335-67-1	28	0.45	0.91	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/07/2019 19:30	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/06/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW74B-20191025 MSD Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 11:45
SDG#: FSB53-08MSD

AECOM
ELLE Sample #: GW 1185597
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous EPA 537 mod QSM 5.1 table B-15			**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	20	1.9	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	22	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	20	0.46	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	22	0.46	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	22	0.46	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	24	0.46	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	22	0.46	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	28	0.46	0.93	1.9	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/07/2019 19:39	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/06/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW146B-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 10:40
SDG#: FSB53-09

AECOM
ELLE Sample #: GW 1185598
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.9	3.7	4.7	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.94	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.8	J	0.47	0.94	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	3.8		0.47	0.94	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	3.7		0.47	0.94	1.9	1
14434	Perfluorononanoic acid	375-95-1	1.1	J	0.47	0.94	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	8.4		0.47	0.94	1.9	1
14434	Perfluorooctanoic acid	335-67-1	11		0.47	0.94	1.9	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/07/2019 19:48	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/06/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW146B-DUP-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 10:50
SDG#: FSB53-10FD

AECOM
ELLE Sample #: GW 1185599
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.9	3.9	4.8	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.97	1.9	2.9	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.9	J	0.48	0.97	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	4.2		0.48	0.97	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	4.1		0.48	0.97	1.9	1
14434	Perfluorononanoic acid	375-95-1	1.1	J	0.48	0.97	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	9.5		0.48	0.97	1.9	1
14434	Perfluorooctanoic acid	335-67-1	12		0.48	0.97	1.9	1

The recovery for extraction standard 13C2-8:2-FTS is outside of the QC acceptance limits as noted on the QC Summary. The following action was taken:
The sample was re-extracted outside of the method holding time and the recovery for extraction standards was within the QC acceptance limits. The data is reported from the initial trial and both sets of data are included in the data package.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/07/2019 19:57	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/06/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW72B-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/24/2019 14:30
SDG#: FSB53-11

AECOM
ELLE Sample #: GW 1185600
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.90	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.61 J	0.45	0.90	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	1.7 J	0.45	0.90	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.71 J	0.45	0.90	1.8	1
14434	Perfluorononanoic acid	375-95-1	1.4 J	0.45	0.90	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	6.7	0.45	0.90	1.8	1
14434	Perfluorooctanoic acid	335-67-1	7.2	0.45	0.90	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 06:10	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW159A-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/24/2019 12:20
SDG#: FSB53-12

AECOM
ELLE Sample #: GW 1185601
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous EPA 537 mod QSM 5.1 table B-15			**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.92 J	0.46	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	3.3	0.46	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.46	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	0.86 J	0.46	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	2.3	0.46	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	5.8	0.46	0.93	1.9	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 06:19	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **SEMW-1I-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/24/2019 10:40
SDG#: FSB53-13

AECOM
ELLE Sample #: GW 1185602
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.7	4.7	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.75 J	0.47	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	2.2	0.47	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.52 J	0.47	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	2.0	0.47	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	8.8	0.47	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	7.8	0.47	0.93	1.9	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 06:37	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **SEMW-3I-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/24/2019 15:20
SDG#: FSB53-14

AECOM
ELLE Sample #: GW 1185603
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.90	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.76	J	0.45	0.90	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	2.2		0.45	0.90	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.66	J	0.45	0.90	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.0		0.45	0.90	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	9.4		0.45	0.90	1.8	1
14434	Perfluorooctanoic acid	335-67-1	8.3		0.45	0.90	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 06:46	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

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Sample Description: **SEMW-2I-20191024 Grab Groundwater LM MRC PFAS GWS**

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/24/2019 12:50
SDG#: FSB53-15

AECOM
ELLE Sample #: GW 1185604
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.7	4.6	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.93	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	N.D.	0.46	0.93	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	1.1 J	0.46	0.93	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	0.66 J	0.46	0.93	1.9	1
14434	Perfluorononanoic acid	375-95-1	0.89 J	0.46	0.93	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	5.6	0.46	0.93	1.9	1
14434	Perfluorooctanoic acid	335-67-1	6.0	0.46	0.93	1.9	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 06:55	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **MW155A-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/24/2019 15:30
SDG#: FSB53-16

AECOM
ELLE Sample #: GW 1185605
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**		**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.		1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.		0.90	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	1.8		0.45	0.90	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	6.4		0.45	0.90	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	1.5	J	0.45	0.90	1.8	1
14434	Perfluorononanoic acid	375-95-1	2.2		0.45	0.90	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	11		0.45	0.90	1.8	1
14434	Perfluorooctanoic acid	335-67-1	17		0.45	0.90	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/09/2019 07:04	Devon M Whooley	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19309008	11/05/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **IWE-10-20191025 Grab Groundwater LM MRC PFAS GWS**

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 09:50
SDG#: FSB53-17

AECOM
ELLE Sample #: GW 1185606
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.8	3.6	4.5	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.90	1.8	2.7	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.75 J	0.45	0.90	1.8	1
14434	Perfluoroheptanoic acid	375-85-9	1.1 J	0.45	0.90	1.8	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.45	0.90	1.8	1
14434	Perfluorononanoic acid	375-95-1	1.1 J	0.45	0.90	1.8	1
14434	Perfluorooctanesulfonic acid	1763-23-1	5.1	0.45	0.90	1.8	1
14434	Perfluorooctanoic acid	335-67-1	3.3	0.45	0.90	1.8	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/07/2019 20:06	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/06/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Sample Description: **IWE-10-DUP-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:24
Collection Date/Time: 10/25/2019 09:55
SDG#: FSB53-18FD

AECOM
ELLE Sample #: GW 1185607
ELLE Group #: 2071362
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
LC/MS/MS Miscellaneous	**EPA 537 mod QSM 5.1 table B-15**		**ng/l**	**ng/l**	**ng/l**	**ng/l**	
14434	6:2-Fluorotelomersulfonic acid	27619-97-2	N.D.	1.9	3.8	4.7	1
14434	8:2-Fluorotelomersulfonic acid	39108-34-4	N.D.	0.95	1.9	2.8	1
14434	Perfluorobutanesulfonic acid	375-73-5	0.83 J	0.47	0.95	1.9	1
14434	Perfluoroheptanoic acid	375-85-9	1.3 J	0.47	0.95	1.9	1
14434	Perfluorohexanesulfonic acid	355-46-4	N.D.	0.47	0.95	1.9	1
14434	Perfluorononanoic acid	375-95-1	1.3 J	0.47	0.95	1.9	1
14434	Perfluorooctanesulfonic acid	1763-23-1	5.6	0.47	0.95	1.9	1
14434	Perfluorooctanoic acid	335-67-1	3.7	0.47	0.95	1.9	1

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14434	PFAS in Water by LC/MS/MS-DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/07/2019 20:15	Mark Collare	1
14465	PFAS Water Prep - DoD	EPA 537 mod QSM 5.1 table B-15	1	19310003	11/06/2019 07:00	Austin Prince	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: AECOM
Reported: 11/22/2019 15:02

Group Number: 2071362

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	DL**	LOD	LOQ
	ng/l	ng/l	ng/l	ng/l
Batch number: 19309008	Sample number(s): 1185586-1185594,1185600-1185605			
6:2-Fluorotelomersulfonic acid	N.D.	2.0	4.0	5.0
8:2-Fluorotelomersulfonic acid	N.D.	1.0	2.0	3.0
Perfluorobutanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluoroheptanoic acid	N.D.	0.50	1.0	2.0
Perfluorohexanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorononanoic acid	N.D.	0.50	1.0	2.0
Perfluorooctanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorooctanoic acid	N.D.	0.50	1.0	2.0
Batch number: 19310003	Sample number(s): 1185595-1185599,1185606-1185607			
6:2-Fluorotelomersulfonic acid	N.D.	2.0	4.0	5.0
8:2-Fluorotelomersulfonic acid	N.D.	1.0	2.0	3.0
Perfluorobutanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluoroheptanoic acid	N.D.	0.50	1.0	2.0
Perfluorohexanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorononanoic acid	N.D.	0.50	1.0	2.0
Perfluorooctanesulfonic acid	N.D.	0.50	1.0	2.0
Perfluorooctanoic acid	N.D.	0.50	1.0	2.0

LCS/LCSD

Analysis Name	LCS Spike Added ng/l	LCS Conc ng/l	LCSD Spike Added ng/l	LCSD Conc ng/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 19309008	Sample number(s): 1185586-1185594,1185600-1185605								
6:2-Fluorotelomersulfonic acid	24.28	23.96			99		51-155		
8:2-Fluorotelomersulfonic acid	24.52	20.4			83		62-133		
Perfluorobutanesulfonic acid	22.64	21.6			95		81-133		
Perfluoroheptanoic acid	25.6	24.03			94		80-140		
Perfluorohexanesulfonic acid	24.2	20.26			84		71-131		
Perfluorononanoic acid	25.6	22.83			89		73-140		
Perfluorooctanesulfonic acid	24.48	19.97			82		54-139		
Perfluorooctanoic acid	25.6	22.84			89		83-138		
Batch number: 19310003	Sample number(s): 1185595-1185599,1185606-1185607								
6:2-Fluorotelomersulfonic acid	24.28	21.85			90		51-155		

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/22/2019 15:02

Group Number: 2071362

LCS/LCSD (continued)

Analysis Name	LCS Spike Added ng/l	LCS Conc ng/l	LCSD Spike Added ng/l	LCSD Conc ng/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
8:2-Fluorotelomersulfonic acid	24.52	23.81			97		62-133		
Perfluorobutanesulfonic acid	22.64	18.72			83		81-133		
Perfluoroheptanoic acid	25.6	23.4			91		80-140		
Perfluorohexanesulfonic acid	24.2	19.82			82		71-131		
Perfluorononanoic acid	25.6	22.32			87		73-140		
Perfluorooctanesulfonic acid	24.48	18.59			76		54-139		
Perfluorooctanoic acid	25.6	21.35			83		83-138		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ng/l	MS Spike Added ng/l	MS Conc ng/l	MSD Spike Added ng/l	MSD Conc ng/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 19309008	Sample number(s): 1185586-1185594,1185600-1185605 UNSPK: 1185592									
6:2-Fluorotelomersulfonic acid	N.D.	21.21	20.37	21.59	19.97	96	92	51-155	2	30
8:2-Fluorotelomersulfonic acid	N.D.	21.42	16.17	21.8	21.3	75	98	62-133	27	30
Perfluorobutanesulfonic acid	1.35	19.78	19.01	20.13	19.81	89	92	81-133	4	30
Perfluoroheptanoic acid	2.69	22.37	20.8	22.76	21.97	81	85	80-140	5	30
Perfluorohexanesulfonic acid	1.47	21.14	18.74	21.52	19.75	82	85	71-131	5	30
Perfluorononanoic acid	1.78	22.37	21.5	22.76	22.96	88	93	73-140	7	30
Perfluorooctanesulfonic acid	8.69	21.39	25.19	21.77	26.92	77	84	54-139	7	30
Perfluorooctanoic acid	4.70	22.37	30.85	22.76	32.49	117	122	83-138	5	30
Batch number: 19310003	Sample number(s): 1185595-1185599,1185606-1185607 UNSPK: 1185595									
6:2-Fluorotelomersulfonic acid	N.D.	22.09	19.39	22.53	19.7	88	87	51-155	2	30
8:2-Fluorotelomersulfonic acid	N.D.	22.3	21.57	22.76	21.54	97	95	62-133	0	30
Perfluorobutanesulfonic acid	1.14	20.59	17.91	21.01	19.75	81	89	81-133	10	30
Perfluoroheptanoic acid	2.22	23.29	21.7	23.76	21.89	84	83	80-140	1	30
Perfluorohexanesulfonic acid	2.61	22.01	21.04	22.46	22.04	84	86	71-131	5	30
Perfluorononanoic acid	1.49	23.29	20.92	23.76	23.87	83	94	73-140	13	30
Perfluorooctanesulfonic acid	4.35	22.27	22.46	22.72	22.02	81	78	54-139	2	30
Perfluorooctanoic acid	5.95	23.29	27.93	23.76	28.37	94	94	83-138	2	30

*- Outside of specification
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(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/22/2019 15:02

Group Number: 2071362

Labeled Isotope Quality Control

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19309008

	13C3-PFBS		13C3-PFHxS		13C4-PFHpA		13C2-6:2-FTS		13C8-PFOA		13C8-PFOS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
1185586	82	8.5	78	8.5	77	1.7	76	8.5	80	1.7	86	8.5
1185587	79	9.0	87	9.0	85	1.8	82	9.0	84	1.8	86	9.0
1185588	87	8.6	93	8.6	91	1.7	95	8.6	85	1.7	94	8.6
1185589	81	9.2	85	9.2	85	1.8	85	9.2	82	1.8	86	9.2
1185590	77	9.1	80	9.1	68	1.8	80	9.1	73	1.8	87	9.1
1185591	82	8.6	80	8.6	70	1.7	81	8.6	71	1.7	89	8.6
1185592	97	8.9	90	8.9	104	1.8	94	8.9	88	1.8	83	8.9
1185593	94	8.7	91	8.7	103	1.7	90	8.7	82	1.7	85	8.7
1185594	88	8.9	84	8.9	97	1.8	96	8.9	79	1.8	82	8.9
1185600	91	9.0	85	9.0	84	1.8	82	9.0	82	1.8	90	9.0
1185601	102	9.3	78	9.3	83	1.9	88	9.3	73	1.9	81	9.3
1185602	105	9.3	99	9.3	97	1.9	99	9.3	94	1.9	99	9.3
1185603	93	9.0	80	9.0	82	1.8	78	9.0	79	1.8	81	9.0
1185604	92	9.3	84	9.3	84	1.9	76	9.3	80	1.9	88	9.3
1185605	117	9.0	90	9.0	97	1.8	90	9.0	84	1.8	83	9.0
Blank	84	10	92	10	85	2.0	85	10	82	2.0	86	10
LCS	79	10	84	10	81	2.0	77	10	78	2.0	80	10
MS	94	8.7	91	8.7	103	1.7	90	8.7	82	1.7	85	8.7
MSD	88	8.9	84	8.9	97	1.8	96	8.9	79	1.8	82	8.9
Limits:	50-150		50-150		50-150		50-150		50-150		50-150	

	13C9-PFNA		13C2-8:2-FTS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
1185586	83	1.7	88	5.1
1185587	82	1.8	83	5.4
1185588	99	1.7	117	5.2
1185589	91	1.8	120	5.5
1185590	85	1.8	115	5.5
1185591	84	1.7	91	5.2
1185592	85	1.8	82	5.4
1185593	82	1.7	93	5.2
1185594	85	1.8	82	5.3
1185600	90	1.8	84	5.4
1185601	82	1.9	81	5.6
1185602	101	1.9	90	5.6
1185603	85	1.8	87	5.4
1185604	81	1.9	88	5.6

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/22/2019 15:02

Group Number: 2071362

Labeled Isotope Quality Control (continued)

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19309008

	13C9-PFNA %Rec	13C9-PFNA LOD (ng/l)	13C2-8:2-FTS %Rec	13C2-8:2-FTS LOD (ng/l)
1185605	83	1.8	88	5.4
Blank	87	2.0	96	6.0
LCS	76	2.0	82	6.0
MS	82	1.7	93	5.2
MSD	85	1.8	82	5.3
Limits:	50-150		50-150	

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19310003

	13C3-PFBS %Rec	13C3-PFBS LOD (ng/l)	13C3-PFHxS %Rec	13C3-PFHxS LOD (ng/l)	13C4-PFHpA %Rec	13C4-PFHpA LOD (ng/l)	13C2-6:2-FTS %Rec	13C2-6:2-FTS LOD (ng/l)	13C8-PFOA %Rec	13C8-PFOA LOD (ng/l)	13C8-PFOS %Rec	13C8-PFOS LOD (ng/l)
1185595	139	9.3	104	9.3	109	1.9	137	9.3	103	1.9	92	9.3
1185596	142	9.1	110	9.1	116	1.8	129	9.1	99	1.8	101	9.1
1185597	122	9.3	99	9.3	112	1.9	145	9.3	98	1.9	97	9.3
1185598	139	9.4	105	9.4	109	1.9	109	9.4	97	1.9	93	9.4
1185599	136	9.7	100	9.7	102	1.9	105	9.7	90	1.9	71	9.7
1185606	105	9.0	94	9.0	98	1.8	106	9.0	92	1.8	87	9.0
1185607	111	9.5	100	9.5	94	1.9	101	9.5	92	1.9	101	9.5
Blank	93	10	93	10	91	2.0	86	10	95	2.0	91	10
LCS	95	10	98	10	103	2.0	92	10	99	2.0	99	10
MS	142	9.1	110	9.1	116	1.8	129	9.1	99	1.8	101	9.1
MSD	122	9.3	99	9.3	112	1.9	145	9.3	98	1.9	97	9.3
Limits:	50-150		50-150		50-150		50-150		50-150		50-150	

	13C9-PFNA %Rec	13C9-PFNA LOD (ng/l)	13C2-8:2-FTS %Rec	13C2-8:2-FTS LOD (ng/l)
1185595	102	1.9	100	5.6
1185596	110	1.8	91	5.5
1185597	106	1.9	99	5.6
1185598	100	1.9	85	5.6
1185599	82	1.9	45*	5.8
1185606	92	1.8	92	5.4
1185607	97	1.9	92	5.7
Blank	90	2.0	91	6.0
LCS	100	2.0	89	6.0
MS	110	1.8	91	5.5

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/22/2019 15:02

Group Number: 2071362

Labeled Isotope Quality Control (continued)

Labeled isotope recoveries which are outside of the QC window are confirmed unless otherwise noted on the analysis report.

Analysis Name: PFAS in Water by LC/MS/MS-DoD
Batch number: 19310003

	13C9-PFNA		13C2-8:2-FTS	
	%Rec	LOD (ng/l)	%Rec	LOD (ng/l)
MSD	106	1.9	99	5.6
Limits:	50-150		50-150	

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Environmental Analysis Request/Chain of Custody

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Acct. # 42343 Group # 2071362 Sample # 1185586-607

COC # 594737

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix	Total # of Containers	Analysis Requested: Preservation and Filtration Codes	Remarks
FB-20191024	10-24-19	1535	X		WQ	2	X	water qual field blank
FB-20191025	10-25-19	1130	X		WQ	2		field blank
RB-AD-20191025	10-25-19	1330	X		WQ	2		rinsate blank
RB-VK-20191025	10-25-19	1325	X		WQ	2		rinsate blank
RB-AZ-20191025	10-25-19	1320	X		WQ	2		rinsate blank
RB-TRANS-20191025	10-25-19	1340	X		WQ	2		rinsate blank
MRC-MW147B-20191025	10-25-19	1210	X		GW	6		+MS/MSD
MRC-MW74B-20191025	10-25-19	1145	X		GW	6		+MS/MSD
MRC-MW146B-20191025	10-25-19	1040	X		GW	2		
MRC-MW146B-DUP-20191025	10-25-19	1050	X		GW	2		field duplicate

PFAS by LC/MS/MS-QSM

Turnaround Time (TAT) Requested (please circle)

Standard Rush holly.brown@aecom.com

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: 12

E-mail address: naoum.tavantzis@aecom.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-25-19	1730			
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	10.26.19	1024

EDD Required? (Yes) No

If yes, format: EQuIS ; CSV

Site-Specific QC (MS/MSD/Dup)? (Yes) No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:

UPS ____ FedEx X Other ____

Temperature upon receipt 2.3 °C

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only
Acct. # 42343 Group # 2071362 Sample # 1185586-607

COC # 593592

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

For Lab Use Only
FSC:
SCR#: 250616

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix: Soil ☐ Sediment ☐ Tissue ☐	Water: Potable ☐ Ground ☒ NPDES ☐ Surface ☐	Other:	Total # of Containers	Analysis Requested: Preservation and Filtration Codes (PFAS by 1633 MS/MSD)	Remarks
MRC-MW-72B-20191024	10-24-19	1430	X			GW		2	X	
MRC-MW-59A-20191024	↓	1220	↓			↓		↓	↓	
MRC-SEMW-1I-20191024		1440								
MRC-SEMW-3I-20191024		1520								
MRC-SEMW-2I-20191024		1250								
MRC-MW-55A-20191024	↓	1530								
MRC-IWE-10-20191025	10-25-19	0950								
MRC-IWE-10-DUP-20191025	10-25-19	0955	↓			↓		↓	↓	

Turnaround Time (TAT) Requested (please circle)
Standard Rush
(Rush TAT is subject to laboratory approval and surcharge.) holly.brown@aecom.com

Requested TAT in business days: 12

E-mail address: naoum.tavantzis@aecom.com

Data Package Options (circle if required)
Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-25-19	1730			
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	10-26-19	1024

EDD Required? Yes No
If yes, format: EQUIS ESV

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS _____ FedEx ☒ Other _____

Temperature upon receipt 2.3 °C

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Sample Administration Receipt Documentation Log

Doc Log ID: 264242

Group Number(s): 2071362

Client: AECOM

Delivery and Receipt Information

Delivery Method:	Fed Ex	Arrival Date:	10/26/2019
Number of Packages:	1	Number of Projects:	1

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	Yes	Sample Date/Times match COC:	Yes
Custody Seal Intact:	Yes	Total Trip Blank Qty:	0
Samples Chilled:	Yes	Air Quality Samples Present:	No
Paperwork Enclosed:	Yes		
Samples Intact:	Yes		
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Shalynn Ponzo

Samples Chilled Details

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	192050133	2.3	IR	Wet	Y	Bagged	N

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F 717-656-2681
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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

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Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

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ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

AECOM
Suite 150
12420 Milestone Center Drive
Germantown MD 20876

Report Date: November 11, 2019 12:53

Project: LM MRC PFAS GWS

Account #: 42343
Group Number: 2071358
SDG: FSB54
PO Number: 118990
State of Sample Origin: MD

Electronic Copy To AECOM — Attn: Naoum Tavantzis
Electronic Copy To AECOM — Attn: Holly Brown

Respectfully Submitted,

Kay Hower

(717) 556-7364

To view our laboratory's current scopes of accreditation please go to https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/ . Historical copies may be requested through your project manager.

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SAMPLE INFORMATION

Client Sample Description	Sample Collection Date/Time	ELLE#
MRC-MW74B-20191025 Grab Groundwater	10/25/2019 11:45	1185574
MRC-MW74B-20191025 MS Grab Groundwater	10/25/2019 11:45	1185575
MRC-MW74B-20191025 MSD Grab Groundwater	10/25/2019 11:45	1185576

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

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Project Name: LM MRC PFAS GWS
ELLE Group #: 2071358

General Comments:

All analyses have been performed in accordance with DOD QSM Version 5.1.1 unless otherwise noted below.

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.

Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

No additional comments are necessary.

Sample Description: **MRC-MW74B-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/25/2019 11:45
SDG#: FSB54-01BKG

AECOM
ELLE Sample #: WW 1185574
ELLE Group #: 2071358
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**		**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	72	J	45	90	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193040023A	11/08/2019 20:52	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193040023A	11/01/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW74B-20191025 MS Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/25/2019 11:45
SDG#: FSB54-01MS

AECOM
ELLE Sample #: WW 1185575
ELLE Group #: 2071358
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	480	45	90	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193040023A	11/08/2019 21:14	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193040023A	11/01/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW74B-20191025 MSD Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/26/2019 10:48
Collection Date/Time: 10/25/2019 11:45
SDG#: FSB54-01MSD

AECOM
ELLE Sample #: WW 1185576
ELLE Group #: 2071358
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	480	45	90	100	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193040023A	11/08/2019 21:37	Heather E Williams	1
12906	Mini-extraction DRO (waters)	SW-846 3510C	1	193040023A	11/01/2019 09:30	Joshua S Ruth	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: AECOM
Reported: 11/11/2019 12:53

Group Number: 2071358

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	DL**	LOD	LOQ
	ug/l	ug/l	ug/l	ug/l
Batch number: 193040023A	Sample number(s): 1185574-1185576			
DRO C10-C28	N.D.	45	90	100

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 193040023A	Sample number(s): 1185574-1185576								
DRO C10-C28	600.05	410.58			68		36-132		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ug/l	MS Spike Added ug/l	MS Conc ug/l	MSD Spike Added ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 193040023A	Sample number(s): 1185574-1185576 UNSPK: 1185574									
DRO C10-C28	72.23	600.05	481.95	602.46	479.73	68	68	36-132	0	30

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: DRO 8015C/D(Mini)
Batch number: 193040023A

	Orthoterphenyl %Rec	LOD (ug/l)
1185574	79	2.4

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/11/2019 12:53

Group Number: 2071358

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: DRO 8015C/D(Mini)
Batch number: 193040023A

	Orthoterphenyl %Rec	LOD (ug/l)
1185575	79	2.4
1185576	81	2.4
Blank	88	2.4
LCS	87	2.4
MS	79	2.4
MSD	81	2.4
Limits:	56-125	

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Environmental Analysis Request/Chain of Custody

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Acct. # 42343 Group # 2071358 Sample # 1185574-76

COC #594735

Client Information

Client: AECOM
Acct. #:
Project Name/#: LM MRC PFAS GWS
PWSID #:
Project Manager: Matt Panciera
P.O. #:
Sampler: Holly Brown
Quote #:
State where samples were collected: MD
For Compliance: Yes ☐ No ☒

Matrix

Soil ☐ Sediment ☐ Tissue ☐ | Water ☒ Potable ☐ Ground ☐ NPDES ☐ Surface ☐ | Other: ____

Analysis Requested

Preservation and Filtration Codes

Sample Identification	Collected Date	Collected Time	Grab	Composite	Total # of Containers	30 H DRO-8050D	Remarks
MRC-MW147B-20191025	10/25/19	1210	X		6	X	MS/MSD
MRC-MW74B-20191025	10/25/19	1145	X		6	X	MS/MSD
MRC-MW146B-20191025	10/25/19	1040	X		2	X	
MRC-MW146B-DUP-20191025	10/25/19	1050	X		2	X	
MRC-MW155A-20191024	10/24/19	1530	X		2	X	
MRC-MW159A-20191024	10/24/19	1220	X		2	X	
MRC-MW72B-20191024	10/24/19	1430	X		2	X	
MRC-SEMW-1I-20191024	10/24/19	1040	X		2	X	
MRC-SEMW-2I-20191024	10/24/19	1250	X		2	X	
MRC-SEMW-3I-20191024	10/24/19	1520	X		2	X	

For Lab Use Only

FSC:
SCR#: 250699

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Turnaround Time (TAT) Requested (please circle)

(Standard) Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: 12

E-mail address: holly.brown@aecom.com, naoum.tavantzis@aecom.com

Data Package Options (circle if required)

(Type I (EPA Level 3 Equivalent/non-CLP)) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-25-19	1730			
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	10-26-19	1048

EDD Required? (Yes) No
If yes, format: EQUIS & CSV

Site-Specific QC (MS/MSD/Dup)? (Yes) No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS ____ FedEx ____ Other ____

Temperature upon receipt 0.9 °C

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Sample Administration Receipt Documentation Log

Doc Log ID: 264222

Group Number(s): 2071358

Client: AECOM

Delivery and Receipt Information

Delivery Method:	Fed Ex	Arrival Date:	10/26/2019
Number of Packages:	1	Number of Projects:	1

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	Yes	Sample Date/Times match COC:	Yes
Custody Seal Intact:	Yes	Total Trip Blank Qty:	0
Samples Chilled:	Yes	Air Quality Samples Present:	No
Paperwork Enclosed:	Yes		
Samples Intact:	Yes		
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Shalynn Ponzo

Samples Chilled Details

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	192050133	0.9	IR	Wet	Y	Loose	N

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Lancaster, PA 17605-2425

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F | 717-656-2681
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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

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Analysis Report

Partial Report

Sample Description: PFAS-IDW-20191025 Composite Groundwater
LM MRC PFAS GWS

Project Name: LM MRC PFAS GWS

AECOM
ELLE Sample #: WW 1187258
ELLE Group #: 2071644
Matrix: Groundwater

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-01

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
PCBs	**SW-846 8082A**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10591	PCB-1016	12674-11-2	N.D. D1	0.11	0.32	0.53	1
10591	PCB-1221	11104-28-2	N.D. D1	0.11	0.32	0.53	1
10591	PCB-1232	11141-16-5	N.D. D1	0.21	0.42	0.53	1
10591	PCB-1242	53469-21-9	N.D. D1	0.11	0.32	0.53	1
10591	PCB-1248	12672-29-6	N.D. D1	0.11	0.32	0.53	1
10591	PCB-1254	11097-69-1	N.D. D1	0.11	0.32	0.53	1
10591	PCB-1260	11096-82-5	N.D. D1	0.16	0.32	0.53	1
Wet Chemistry	**SW-846 Chapter 7.3**		**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	
01123	Cyanide (Reactivity)	n.a.	N.D.	19.6	49.1	58.9	1
	SM 2550 B-2010		**Degrees C**	**Degrees C**	**Degrees C**	**Degrees C**	
12151	Temperature of pH	n.a.	19.5	0.010	0.010	0.010	1
	SW-846 1010A		**Degrees F**	**Degrees F**	**Degrees F**	**Degrees F**	
00430	Flash Point	n.a.	No Flash Observed	50	50	50	1
	No flash observed below 188F. Test flame extinguished at 168F. Flash point was determined using Pensky Martens closed cup apparatus.						
	SW-846 9040C		**Std. Units**	**Std. Units**	**Std. Units**	**Std. Units**	
12152	pH	n.a.	7.0	0.010	0.010	0.010	1
	SW-846 Chapter 7						
00496	Corrosivity	n.a.	See Below	0	0	0	1
	The pH of the sample is 6.97 indicating that the sample is not corrosive. A sample is corrosive if it exhibits a pH equal to or less than 2 or equal to or greater than 12.5.						
	SW-846 Chapter 7.3		**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	
01122	Sulfide (Reactivity)	n.a.	N.D.	53.6	143	160	1
	SW-846 Chapter 7.3		**see below**	**see below**	**see below**	**see below**	
01121	Reactivity	n.a.	See Below	0	0	0	1

*=This limit was used in the evaluation of the final result

Reference ID:
2071644131119112650

Partial Report

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

AECOM
ELLE Sample #: WW 1187258
ELLE Group #: 2071644
Matrix: Groundwater

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-01

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
Wet Chemistry	**SW-846 Chapter 7.3**		**see below**	**see below**	**see below**	**see below**	

Reactivity:
This sample was extracted and analyzed by the interim method described in SW-846 Revision 3, December 1996 - Chapter 7.3. The Interim Guidance for Reactive Cyanide and Reactive Sulfide (SW-846 Sections 7.3.3 and 7.3.4 of Chapter 7 - December 1996) identifies a reactive material as generating more than 250 mg/kg of hydrogen cyanide or 500 mg/kg of hydrogen sulfide. This waste is not considered hazardous due to reactivity based on that standard. These results do not reflect total cyanide or total sulfide. On July 14, 2005, EPA published a rule in the Federal Register that removed the Interim Guidance and the method referenced above. At this time there is no specific guidance or a method to be used to evaluate "Reactivity".

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10591	PCBs in Water by 8082A	SW-846 8082A	1	193040021A	11/01/2019 21:12	Covenant Mutuku	1
01123	Cyanide (Reactivity)	SW-846 Chapter 7.3	1	19308104201A	11/04/2019 11:06	Jonathan Saul	1
12151	Temperature of pH	SM 2550 B-2010	1	19303121521A	10/30/2019 14:10	Jeremy L Bolf	1
00430	Flash Point	SW-846 1010A	1	19308043001A	11/04/2019 09:45	Susan A Engle	1
12152	pH	SW-846 9040C	1	19303121521A	10/30/2019 14:10	Jeremy L Bolf	1
00496	Corrosivity	SW-846 Chapter 7	1	19303121521A	10/30/2019 14:10	Jeremy L Bolf	1
01121	Reactivity	SW-846 Chapter 7.3	1	19304112101A	10/31/2019 09:00	Nicole Munsell	1
01122	Sulfide (Reactivity)	SW-846 Chapter 7.3	1	19304112101A	10/31/2019 09:00	Nicole Munsell	1

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
TCLP NVE
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

AECOM
ELLE Sample #: TL 1187259
ELLE Group #: 2071644
Matrix: Groundwater

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-02

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC/MS Semivolatiles	**SW-846 8270D**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
14252	1,4-Dichlorobenzene	106-46-7	N.D.	0.003	0.005	0.010	1
14252	2,4-Dinitrotoluene	121-14-2	N.D.	0.005	0.010	0.025	1

*=This limit was used in the evaluation of the final result

Reference ID:
2071644131119112650

Partial Report

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
TCLP NVE
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-02

AECOM
ELLE Sample #: TL 1187259
ELLE Group #: 2071644
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC/MS Semivolatiles	**SW-846 8270D**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
14252	Hexachlorobenzene	118-74-1	N.D.	0.0005	0.001	0.003	1
14252	Hexachlorobutadiene	87-68-3	N.D.	0.003	0.005	0.010	1
14252	Hexachloroethane	67-72-1	N.D.	0.005	0.010	0.025	1
14252	2-Methylphenol	95-48-7	N.D.	0.003	0.005	0.010	1
14252	4-Methylphenol	106-44-5	N.D.	0.003	0.005	0.010	1
	3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.						
14252	Nitrobenzene	98-95-3	N.D.	0.003	0.005	0.010	1
14252	Pentachlorophenol	87-86-5	N.D.	0.005	0.010	0.025	1
14252	Pyridine	110-86-1	N.D.	0.010	0.020	0.025	1
14252	2,4,5-Trichlorophenol	95-95-4	N.D.	0.003	0.005	0.010	1
14252	2,4,6-Trichlorophenol	88-06-2	N.D.	0.003	0.005	0.010	1
	The response for Pyridine in the initial calibration verification standard is outside the DoD acceptance limits. Due to the decreased response indicating a low bias, a standard was prepared at the method detection limit and was analyzed to verify the instrument?s sensitivity for this compound prior to analyzing the sample. Since Pyridine was recovered in the MDL standard and there is no detection for this compound in the sample, the data is reported.						
Herbicides	**SW-846 8151A**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
00952	2,4-D	94-75-7	N.D. D1	0.016	0.032	0.050	1
00952	2,4,5-TP	93-72-1	N.D. D2	0.0010	0.0020	0.0050	1
Pesticides	**SW-846 8081B**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
10647	Gamma BHC - Lindane	58-89-9	N.D. D1	0.00010	0.00020	0.00050	10
10647	Chlordane	57-74-9	N.D. D1	0.0080	0.016	0.025	10
10647	Endrin	72-20-8	N.D. D1	0.00040	0.0010	0.0010	10
10647	Heptachlor	76-44-8	N.D. D1	0.00020	0.00040	0.00050	10
10647	Heptachlor Epoxide	1024-57-3	N.D. D1	0.00012	0.00036	0.00050	10
10647	Methoxychlor	72-43-5	N.D. D1	0.0015	0.0040	0.0050	10
10647	Toxaphene	8001-35-2	N.D. D1	0.050	0.10	0.15	10
	The recovery for the method blank surrogate(s) is outside the QC acceptance limits as noted on the QC Summary.						
Metals	**SW-846 6010C**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
07035	Arsenic	7440-38-2	N.D.	0.0160	0.0250	0.0300	1
07046	Barium	7440-39-3	0.128	0.0010	0.0025	0.0050	1
07049	Cadmium	7440-43-9	N.D.	0.0010	0.0025	0.0050	1
07051	Chromium	7440-47-3	0.0024 J	0.0016	0.0038	0.0150	1
07055	Lead	7439-92-1	N.D.	0.0071	0.0113	0.0150	1
07036	Selenium	7782-49-2	N.D.	0.0160	0.0375	0.0500	1

*=This limit was used in the evaluation of the final result

Reference ID:
207164413119112650

Partial Report

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
TCLP NVE
LM MRC PFAS GWS

AECOM
ELLE Sample #: TL 1187259
ELLE Group #: 2071644
Matrix: Groundwater

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-02

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
Metals	**SW-846 6010C**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
07066	Silver	7440-22-4	N.D.	0.0050	0.0075	0.0100	1
Metals	**SW-846 7470A**		**mg/l**	**mg/l**	**mg/l**	**mg/l**	
00259	Mercury	7439-97-6	N.D.	0.000050	0.00010	0.00020	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

If the analysis is for determination of Hazardous Waste Characteristics, see Table 1 in EPA Code of Federal Regulations 40 CFR 261.24.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
14252	TCLP 8270D MINI	SW-846 8270D	1	19308WAF026	11/05/2019 14:06	Joseph M Gambler	1
00952	TCLP Herbicides	SW-846 8151A	1	193050015A	11/05/2019 00:14	Rachel Umberger	1
10647	TCLP Pesticides by 8081B	SW-846 8081B	1	193050003A	11/04/2019 17:37	Lisa A Reinert	10
07035	Arsenic	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07046	Barium	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07049	Cadmium	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07051	Chromium	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07055	Lead	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07036	Selenium	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
07066	Silver	SW-846 6010C	1	193031404505	11/01/2019 18:14	Patrick J Engle	1
00259	Mercury	SW-846 7470A	1	193030571304	10/31/2019 11:15	Damary Valentin	1

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
TCLP ZHE
LM MRC PFAS GWS

AECOM
ELLE Sample #: TL 1187260
ELLE Group #: 2071644
Matrix: Groundwater

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-03

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC/MS Volatiles	**SW-846 8260C**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
11997	Benzene	71-43-2	N.D.	4	10	20	20

*=This limit was used in the evaluation of the final result

Reference ID:
2071644131119112650

Partial Report

Sample Description: **PFAS-IDW-20191025 Composite Groundwater**
TCLP ZHE
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

AECOM
ELLE Sample #: TL 1187260
ELLE Group #: 2071644
Matrix: Groundwater

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/25/2019 14:00
SDG#: FSB55-03

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC/MS Volatiles	**SW-846 8260C**		ug/l	ug/l	ug/l	ug/l	
11997	2-Butanone	78-93-3	N.D.	6	20	200	20
11997	Carbon Tetrachloride	56-23-5	N.D.	4	10	20	20
11997	Chlorobenzene	108-90-7	N.D.	4	10	20	20
11997	Chloroform	67-66-3	N.D.	4	10	20	20
11997	1,2-Dichloroethane	107-06-2	N.D.	6	10	20	20
11997	1,1-Dichloroethene	75-35-4	N.D.	4	10	20	20
11997	Tetrachloroethene	127-18-4	N.D.	4	10	20	20
11997	Trichloroethene	79-01-6	62	4	10	20	20
11997	Vinyl Chloride	75-01-4	N.D.	4	10	20	20

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

If the analysis is for determination of Hazardous Waste Characteristics, see Table 1 in EPA Code of Federal Regulations 40 CFR 261.24.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
11997	VOCs- 5ml Water by 8260C/D	SW-846 8260C	1	Y193103AA	11/07/2019 04:54	Miranda Campbell	20

Sample Description: **TB-20191028 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

AECOM
ELLE Sample #: WW 1187261
ELLE Group #: 2071644
Matrix: Water

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/28/2019 11:00
SDG#: FSB55-04TB

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		ug/l	ug/l	ug/l	ug/l	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

*=This limit was used in the evaluation of the final result

Reference ID:
2071644131119112650

Partial Report

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 14:34	Jeremy C Giffin	1

Sample Description: **MRC-MW145A-20191028 Grab Groundwater LM MRC PFAS GWS**

Project Name: **LM MRC PFAS GWS**

AECOM
ELLE Sample #: WW 1187262
ELLE Group #: 2071644
Matrix: Groundwater

Submittal Date/Time: 10/28/2019 17:37
Collection Date/Time: 10/28/2019 10:10
SDG#: FSB55-05

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1
GC Petroleum Hydrocarbons	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
13579	DRO C10-C28	n.a.	N.D.	49	99	110	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 15:51	Jeremy C Giffin	1
13579	DRO 8015C/D(Mini)	SW-846 8015D Rev.4, June 2003	1	193050033A	11/06/2019 10:35	Heather E Williams	1

*=This limit was used in the evaluation of the final result

Reference ID:
207164413119112650

Environmental Analysis Request/Chain of Custody

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Acct. # 42343 Group # 207644 Sample # 1187258-63

COC # 594734

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Parciesa	P.O. #:
Sampler: Holly Braun	Quote #:

State where samples were collected: MD
For Compliance: Yes ☐ No ☒

Sample Identification	Collected Date	Collected Time	Grab	Composite	Matrix: Soil	Sediment	Tissue	Water: Potable	Ground	Surface	NPDES	Other:	Total # of Containers	pH/Temperature of pH	Reactivity	Flash Point	PCBs in Water by 8020A	Aqueous - Full TCLP	Aqueous - TCLP VOCs	H	TPH-GRO	TPH-DRO	PFAS	Remarks
PFAS-IDW-20191025	10/25/19	1400		X				X					11	1	1	1	2	3	3					
TB-20191028	10/28/19	1100	X					WQ					2								2			trip blank Water Quality
MRC-MW145A-20191028	10/28/19	1010	X					GW					4								3	2	2	
FB-20191028	10/28/19	1040	X					WQ					2										2	field blank

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: 12

E-mail address: holly.braun@aecom.com & laura.fountzis@aecom.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-28-19	1310		10/28/19	13:10
	10/28/19	16:54			
				10-28-19	1737

EDD Required? Yes No
If yes, format: EQUIS & .CSV

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS _____ FedEx _____ Other _____

Temperature upon receipt -2.1 - 4.5 °C

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Sample Administration Receipt Documentation Log

Doc Log ID: 264240

Group Number(s): 2071644

Client: DynCorp

Delivery and Receipt Information

Delivery Method:	Fed Ex	Arrival Date:	10/26/2019
Number of Packages:	1	Number of Projects:	1

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	No
Custody Seal Present:	No	Sample Date/Times match COC:	Yes
Samples Chilled:	Yes	Total Trip Blank Qty:	0
Paperwork Enclosed:	Yes	Air Quality Samples Present:	No
Samples Intact:	Yes		
Missing Samples:	Yes		
Extra Samples:	Yes		
Discrepancy in Container Qty on COC:	Yes		

Unpacked by Shalynn Ponzo

Samples Chilled Details

Thermometer Types: *DT = Digital (Temp. Bottle)* *IR = Infrared (Surface Temp)* *All Temperatures in °C.*

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?
1	192099059	4.1	IR	Wet	Y	Loose	N

Missing Sample Details

Sample ID on COC	Comments
M1WW01 MS	
M1WW01 MSD	

Extra Sample Details

Sample ID on Label	Number of Extra Containers	Date on Label	Comments
KDIWW MS	3	10/19/2019 12:15	
KDIWW MSD	3	10/19/2019 12:15	

Container Quantity Discrepancy Details

Sample ID on COC	Container Qty. Received	Container Qty. on COC	Comments
RDWW01 DUP	4	3	
RDWW01	2	3	

Sample ID Discrepancy Details

Sample ID on COC	Sample ID on Label	Comments
KDWW01	KIWW01	

2425 New Holland Pike
Lancaster, PA 17605-2425
T | 717-656-2300
F | 717-656-2681
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Client: DynCorp

2425 New Holland Pike
Lancaster, PA 17605-2425

T | 717-656-2300
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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

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ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

AECOM
Suite 150
12420 Milestone Center Drive
Germantown MD 20876

Report Date: November 04, 2019 20:45

Project: LM MRC PFAS GWS

Account #: 42343
Group Number: 2071863
SDG: FSB56
PO Number: 118990
State of Sample Origin: MD

Electronic Copy To AECOM Attn: Naoum Tavantzis
Electronic Copy To AECOM Attn: Holly Brown

Respectfully Submitted,

Kay Hower

(717) 556-7364

To view our laboratory's current scopes of accreditation please go to https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/ . Historical copies may be requested through your project manager.

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SAMPLE INFORMATION

Client Sample Description	Sample Collection Date/Time	ELLE#
MRC-MW72B-20191024 Grab Groundwater	10/24/2019 14:30	1188251
MRC-MW159A-20191024 Grab Groundwater	10/24/2019 12:20	1188252
MRC-IWE-10-20191024 Grab Groundwater	10/25/2019 09:50	1188253
MRC-SEMW-3I-20191024 Grab Groundwater	10/24/2019 15:20	1188254
MRC-SEMW-2I-20191024 Grab Groundwater	10/24/2019 12:50	1188255
MRC-SEMW-1I-20191024 Grab Groundwater	10/24/2019 10:40	1188256
MRC-MW155A-20191024 Grab Groundwater	10/24/2019 15:30	1188257
MRC-IWE-10-DUP-20191025 Grab Groundwater	10/25/2019 09:55	1188258
MRC-MW146B-20191025 Grab Groundwater	10/25/2019 10:40	1188259
MRC-MW146B-DUP-20191025 Grab Groundwater	10/25/2019 10:50	1188260
MRC-MW74B-20191025 Grab Groundwater	10/25/2019 11:45	1188261
MRC-MW74B-20191025MS Grab Groundwater	10/25/2019 11:45	1188262
MRC-MW74B-20191025MSD Grab Groundwater	10/25/2019 11:45	1188263
TB-20191026 Grab Water	10/26/2019 14:45	1188264

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

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Project Name: LM MRC PFAS GWS
ELLE Group #: 2071863

General Comments:

All analyses have been performed in accordance with DOD QSM Version 5.1.1 unless otherwise noted below.

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.
Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Analysis Specific Comments:

SW-846 8015D Rev.4, June 2003, GC Volatiles

Batch #: 19305A53A (Sample number(s): 1188251-1188260, 1188264 UNSPK: 1188261)

The recovery(ies) for one or more surrogates exceeded the acceptance window indicating a positive bias for sample(s) MS, MSD

Batch #: 19305A53B (Sample number(s): 1188261-1188263 UNSPK: 1188261)

The recovery(ies) for one or more surrogates exceeded the acceptance window indicating a positive bias for sample(s) 1188261, 1188262, 1188263, MS, MSD

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Analysis Report

Sample Description: **MRC-MW72B-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/24/2019 14:30
SDG#: FSB56-01

AECOM
ELLE Sample #: GW 1188251
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	550	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 16:16	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 16:15	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW159A-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/24/2019 12:20
SDG#: FSB56-02

AECOM
ELLE Sample #: GW 1188252
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 16:42	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 16:41	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-IWE-10-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/25/2019 09:50
SDG#: FSB56-03

AECOM
ELLE Sample #: GW 1188253
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 17:07	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 17:06	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-SEMW-3I-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/24/2019 15:20
SDG#: FSB56-04

AECOM
ELLE Sample #: GW 1188254
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 19:15	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 19:14	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-SEMW-2I-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/24/2019 12:50
SDG#: FSB56-05

AECOM
ELLE Sample #: GW 1188255
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 19:41	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 19:40	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-SEMW-1I-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/24/2019 10:40
SDG#: FSB56-06

AECOM
ELLE Sample #: GW 1188256
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 20:07	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 20:06	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW155A-20191024 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/24/2019 15:30
SDG#: FSB56-07

AECOM
ELLE Sample #: GW 1188257
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 20:33	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 20:32	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-IWE-10-DUP-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/25/2019 09:55
SDG#: FSB56-08FD

AECOM
ELLE Sample #: GW 1188258
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 20:58	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 20:57	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW146B-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/25/2019 10:40
SDG#: FSB56-09

AECOM
ELLE Sample #: GW 1188259
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result		Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**		**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	27	J	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 21:24	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 21:23	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW146B-DUP-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/25/2019 10:50
SDG#: FSB56-10FD

AECOM
ELLE Sample #: GW 1188260
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 21:50	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 21:49	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW74B-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/25/2019 11:45
SDG#: FSB56-11BKG

AECOM
ELLE Sample #: GW 1188261
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	7,800	120	200	250	5

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53B	11/04/2019 16:30	Jeremy C Giffin	5
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53B	11/04/2019 16:29	Jeremy C Giffin	5

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW74B-20191025MS Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/25/2019 11:45
SDG#: FSB56-11MS

AECOM
ELLE Sample #: GW 1188262
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	14,000	120	200	250	5

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53B	11/04/2019 16:56	Jeremy C Giffin	5
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53B	11/04/2019 16:55	Jeremy C Giffin	5

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW74B-20191025MSD Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/25/2019 11:45
SDG#: FSB56-11MSD

AECOM
ELLE Sample #: GW 1188263
ELLE Group #: 2071863
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	14,000	120	200	250	5

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53B	11/04/2019 17:21	Jeremy C Giffin	5
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53B	11/04/2019 17:20	Jeremy C Giffin	5

*=This limit was used in the evaluation of the final result

Sample Description: **TB-20191026 Grab Water**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/26/2019 14:45
SDG#: FSB56-12TB

AECOM
ELLE Sample #: GW 1188264
ELLE Group #: 2071863
Matrix: Water

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	N.D.	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19305A53A	11/01/2019 15:00	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19305A53A	11/01/2019 14:59	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: AECOM
Reported: 11/04/2019 20:45

Group Number: 2071863

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	DL**	LOD	LOQ
	ug/l	ug/l	ug/l	ug/l
Batch number: 19305A53A	Sample number(s): 1188251-1188260,1188264			
TPH-GRO water C6-C10	N.D.	23	40	50
Batch number: 19305A53B	Sample number(s): 1188261-1188263			
TPH-GRO water C6-C10	N.D.	23	40	50

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 19305A53A	Sample number(s): 1188251-1188260,1188264								
TPH-GRO water C6-C10	1100	1048.67			95		78-122		
Batch number: 19305A53B	Sample number(s): 1188261-1188263								
TPH-GRO water C6-C10	1100	1048.67			95		78-122		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ug/l	MS Spike Added ug/l	MS Conc ug/l	MSD Spike Added ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 19305A53A	Sample number(s): 1188251-1188260,1188264 UNSPK: 1188261									
TPH-GRO water C6-C10	7762.77	5500	13957.71	5500	13940.48	113	112	78-122	0	30
Batch number: 19305A53B	Sample number(s): 1188261-1188263 UNSPK: 1188261									
TPH-GRO water C6-C10	7762.77	5500	13957.71	5500	13940.48	113	112	78-122	0	30

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Quality Control Summary

Client Name: AECOM
Reported: 11/04/2019 20:45

Group Number: 2071863

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: TPH-GRO water C6-C10
Batch number: 19305A53A

	Trifluorotoluene-F %Rec	LOD (ug/l)
1188251	129	50 (3)
1188252	82	50 (3)
1188253	76	50 (3)
1188254	81	50 (3)
1188255	80	50 (3)
1188256	76	50 (3)
1188257	77	50 (3)
1188258	76	50 (3)
1188259	78	50 (3)
1188260	79	50 (3)
1188264	82	50 (3)
Blank	81	50 (3)
LCS	92	50 (3)
MS	173*	250 (3)
MSD	171*	250 (3)
Limits:	63-135	

Analysis Name: TPH-GRO water C6-C10
Batch number: 19305A53B

	Trifluorotoluene-F %Rec	LOD (ug/l)
1188261	219*	250 (3)
1188262	173*	250 (3)
1188263	171*	250 (3)
Blank	78	50 (3)
LCS	92	50 (3)
MS	173*	250 (3)
MSD	171*	250 (3)
Limits:	63-135	

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only
Acct. # 42343 Group # 2071863 Sample # 1188251-64

COC # 594736

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil	Sediment	Tissue	Water	Potable	Ground	NPDES	Surface	Other:	Total # of Containers	Analysis Requested: TPH-GRO	Remarks
MRC-MW72B-20191024	10-24-19	1430	X					GW						3	X	
MRC-MW159A-20191024	10-24-19	1220	X					GW						3	X	
MRC-IWE-10-20191025	10-25-19	0950	X					GW						3	X	
MRC-SEMW-3I-20191024	10-24-19	1520	X					GW						3	X	
MRC-SEMW-2I-20191024	10-24-19	1250	X					GW						3	X	
MRC-SEMW-1I-20191024	10-24-19	1040	X					GW						3	X	
MRC-MW155A-20191024	10-24-19	1530	X					GW						3	X	
MRC-IWE-10-DUP-20191025	10-25-19	0955	X					GW						3	X	field duplicate
MRC-MW146B-20191025	10-25-19	1040	X					GW						3	X	
MRC-MW146B-DUP-20191025	10-25-19	1050	X					GW						3	X	field duplicate

Preservation and Filtration Codes: H

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Remarks

Turnaround Time (TAT) Requested (please circle)
Standard Rush
(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: 12

E-mail address: holly.brown@aecom.com & matthew.panciera@aecom.com

Data Package Options (circle if required)
Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-26-19	1530			
			Chl Wells	10/24/19	10:57

EDD Required? Yes No
If yes, format: EQuIS & .CSV

Site-Specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS ____ FedEx X Other ____

Temperature upon receipt 8.7-11.6°C

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only
Acct. # 42343 Group # 2071863 Sample # 1188251-64

COC #595189

Client Information		Matrix	Total # of Containers	Analysis Requested	For Lab Use Only
Client: AECOM	Acct. #:	Tissue ☐ / Sediment ☐ / Soil ☐		Preservation and Filtration Codes: H	FSC:
Project Name/#: LM MRC PFAS GWS	PWSID #:	Water: Ground ☒ / Potable ☐ / Surface ☐ / NPDES ☐		TPH-GRO	SCR#: 251170
Project Manager: Matt Parcicsa	P.O. #:	Other:			
Sampler: Holly Brown	Quote #:				
State where samples were collected: MD	For Compliance: Yes ☐ No ☒				

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Soil	Water	Other	Total # of Containers	TPH-GRO										Remarks
MRC-MW74B-20191025	10-25-19	1145	X			GW		9	X										ms/msd
MRC-MW147B-20191025	10-25-19	1210	X			GW		9	X										ms/msd
TB-20191026	10-26-19	1445	X			WQ		2	X										trip blank

Turnaround Time (TAT) Requested (please circle)
(Standard) Rush
(Rush TAT is subject to laboratory approval and surcharge.)
Requested TAT in business days: 12
E-mail address: naoum.tavantzis@aecom.com & holly.brown@aecom.com

Data Package Options (circle if required)
(Type I (EPA Level 3 Equivalent/non-CLP)) Type VI (Raw Data Only)
Type III (Reduced non-CLP) NJ DKQP TX TRRP-13
NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
Edwin Hernandez	10/25/19	1540	[signature]	10-26-19	1200
[signature]	10-26-19	1530			
			CM Webb	10/28/19	1050

EDD Required? (Yes) No
If yes, format: EQuIS & .CSV
Site-Specific QC (MS/MSD/Dup)? (Yes) No
(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:
UPS ____ FedEx X Other ____

Temperature upon receipt 0.7-11.6 °C

2071863

Kay Hower

From: Brown, Holly <holly.brown@aecom.com>
Sent: Thursday, October 31, 2019 10:47 AM
To: Kay Hower; Tavantzis, Naoum
Cc: Neigh, Zachary
Subject: RE: LM MRC PFAS GWS TPG-GRO Received by FedEx on 10/29

EXTERNAL EMAIL*

Please proceed with the analysis.

Holly A. Brown, MS, PG, STS
Geologist, Design & Consulting Services
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M +1-301-674-3199
holly.brown@aecom.com

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From: Kay Hower <KayHower@eurofinsus.com>
Sent: Thursday, October 31, 2019 9:31 AM
To: Brown, Holly <holly.brown@aecom.com>; Tavantzis, Naoum <naoum.tavantzis@aecom.com>
Subject: LM MRC PFAS GWS TPG-GRO Received by FedEx on 10/29

Good morning, I just learned that the samples received by FedEx for TPH-GRO were received above 6C. The temperature blank was 10.4C. We took surface temperatures and they ranged from 8.7-11.6C. Please let me know if we should proceed. I apologize for not notifying you sooner. Regards, Kay

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Sample Administration Receipt Documentation Log

Doc Log ID: 264440

Group Number(s): 2071863

Client: AECOM

Delivery and Receipt Information

Delivery Method:	Fed Ex	Arrival Date:	10/29/2019
Number of Packages:	1	Number of Projects:	1
State/Province of Origin:	MD		

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	Yes	Sample Date/Times match COC:	Yes
Custody Seal Intact:	Yes	Total Trip Blank Qty:	2
Samples Chilled:	Yes	Trip Blank Type:	N/A
Paperwork Enclosed:	Yes	Air Quality Samples Present:	No
Samples Intact:	Yes		
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Julissa Rivera-Santa

Samples Chilled Details

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?	Samples Collected Same Day as Receipt?
1	DT42-03	10.4	DT	Wet	N	Loose	Y	N

Elevated Temperature Details

All Temperatures in °C

Cooler #	Thermometer ID	Top Left Temp	Top Right Temp	Bottom Left Temp	Bottom Right Temp	Center Temp	Factors Contributing to Elevated Temp	Comments
1	192099059	8.7	9.4	9.3	9.8	11.6	ICE MELTED	

General Comments: 1 vial MRC-MW74B-20191025 received unlabeled

2425 New Holland Pike
Lancaster, PA 17605-2425
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F 717-656-2681
www.LancasterLabs.com

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

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ANALYSIS REPORT

Prepared by:

Eurofins Lancaster Laboratories Environmental
2425 New Holland Pike
Lancaster, PA 17601

Prepared for:

AECOM
Suite 150
12420 Milestone Center Drive
Germantown MD 20876

Report Date: November 04, 2019 22:14

Project: LM MRC PFAS GWS

Account #: 42343
Group Number: 2071864
SDG: FSB57
PO Number: 118990
State of Sample Origin: MD

Electronic Copy To AECOM — Attn: Naoum Tavantzis
Electronic Copy To AECOM — Attn: Holly Brown

Respectfully Submitted,

Kay Hower

(717) 556-7364

To view our laboratory's current scopes of accreditation please go to https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/certifications-and-accreditations-eurofins-lancaster-laboratories-environmental/ . Historical copies may be requested through your project manager.

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SAMPLE INFORMATION

Client Sample Description	Sample Collection Date/Time	ELLE#
MRC-MW147B-20191025 Grab Groundwater	10/25/2019 12:10	1188265
MRC-MW147B-20191025MS Grab Groundwater	10/25/2019 12:10	1188266
MRC-MW147B-20191025MSD Grab Groundwater	10/25/2019 12:10	1188267

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

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Project Name: LM MRC PFAS GWS
ELLE Group #: 2071864

General Comments:

All analyses have been performed in accordance with DOD QSM Version 5.1.1 unless otherwise noted below.

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below.

Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are included in this data set.

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Analysis Specific Comments:

SW-846 8015D Rev.4, June 2003, GC Volatiles

Batch #: 19308A94A (Sample number(s): 1188265-1188267 UNSPK: 1188265)

The recovery(ies) for one or more surrogates exceeded the acceptance window indicating a positive bias for sample(s) 1188265, 1188266, MS

Sample Description: **MRC-MW147B-20191025 Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/25/2019 12:10
SDG#: FSB57-01BKG

AECOM
ELLE Sample #: GW 1188265
ELLE Group #: 2071864
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	1,900	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19308A94A	11/04/2019 17:54	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19308A94A	11/04/2019 17:53	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW147B-20191025MS Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/25/2019 12:10
SDG#: FSB57-01MS

AECOM
ELLE Sample #: GW 1188266
ELLE Group #: 2071864
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	3,000	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19308A94A	11/04/2019 18:19	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19308A94A	11/04/2019 18:18	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Sample Description: **MRC-MW147B-20191025MSD Grab Groundwater**
LM MRC PFAS GWS

Project Name: **LM MRC PFAS GWS**

Submittal Date/Time: 10/29/2019 10:57
Collection Date/Time: 10/25/2019 12:10
SDG#: FSB57-01MSD

AECOM
ELLE Sample #: GW 1188267
ELLE Group #: 2071864
Matrix: Groundwater

CAT No.	Analysis Name	CAS Number	Result	Detection Limit*	Limit of Detection	Limit of Quantitation	DF
GC Volatiles	**SW-846 8015D Rev.4, June 2003**		**ug/l**	**ug/l**	**ug/l**	**ug/l**	
10598	TPH-GRO water C6-C10	n.a.	3,000	23	40	50	1

Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/20.
The sample receipt temperature requirement was not met. The temperature of the temperature blank bottle(s) upon receipt at the lab was 10.4 C using a digital thermometer. The sample bottles were then measured using an IR thermometer and were recorded at 8.7-11.6 C.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10598	TPH-GRO water C6-C10	SW-846 8015D Rev.4, June 2003	1	19308A94A	11/04/2019 18:45	Jeremy C Giffin	1
01146	GC VOA Water Prep	SW-846 5030C	1	19308A94A	11/04/2019 18:44	Jeremy C Giffin	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: AECOM
Reported: 11/04/2019 22:14

Group Number: 2071864

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Method Blank

Analysis Name	Result	DL**	LOD	LOQ
	ug/l	ug/l	ug/l	ug/l
Batch number: 19308A94A	Sample number(s): 1188265-1188267			
TPH-GRO water C6-C10	N.D.	23	40	50

LCS/LCSD

Analysis Name	LCS Spike Added ug/l	LCS Conc ug/l	LCSD Spike Added ug/l	LCSD Conc ug/l	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 19308A94A	Sample number(s): 1188265-1188267								
TPH-GRO water C6-C10	1100	995.01			90		78-122		

MS/MSD

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike

Analysis Name	Unspiked Conc ug/l	MS Spike Added ug/l	MS Conc ug/l	MSD Spike Added ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	MS/MSD Limits	RPD	RPD Max
Batch number: 19308A94A	Sample number(s): 1188265-1188267 UNSPK: 1188265									
TPH-GRO water C6-C10	1891.16	1100	3002.02	1100	3022.06	101	103	78-122	1	30

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: TPH-GRO water C6-C10
Batch number: 19308A94A

	Trifluorotoluene-F %Rec	LOD (ug/l)
1188265	209*	50 (3)

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

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Quality Control Summary

Client Name: AECOM
Reported: 11/04/2019 22:14

Group Number: 2071864

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: TPH-GRO water C6-C10
Batch number: 19308A94A

	Trifluorotoluene-F %Rec	LOD (ug/l)
1188266	138*	50 (3)
1188267	135	50 (3)
Blank	76	50 (3)
LCS	82	50 (3)
MS	138*	50 (3)
MSD	135	50 (3)
Limits:	63-135	

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.
(3) The surrogate spike amount was less than the LOD.

Environmental Analysis Request/Chain of Custody

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For Eurofins Lancaster Laboratories Environmental use only

Acct. # 42343 Group # 2071864 Sample # 1188265-67

COC # 594736

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Panciera	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

Matrix

Soil ☐ Sediment ☐ Tissue ☐ Water: Potable ☐ Ground ☒ NPDES ☐ Surface ☐ Other: ____

Analysis Requested

Preservation and Filtration Codes

For Lab Use Only: FSC: ____ SCR#: ____

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Sample Identification	Collected Date	Collected Time	Grab	Composite	Total # of Containers	H	TPH-GRO	Remarks
MRC-MW72B-20191024	10-24-19	1430	X		3	X	X	
MRC-MW159A-20191024	10-24-19	1220	X		3	X	X	
MRC-IWE-10-20191025	10-25-19	0950	X		3	X	X	
MRC-SEMW-3I-20191024	10-24-19	1520	X		3	X	X	
MRC-SEMW-2I-20191024	10-24-19	1250	X		3	X	X	
MRC-SEMW-1I-20191024	10-24-19	1040	X		3	X	X	
MRC-MW155A-20191024	10-24-19	1530	X		3	X	X	
MRC-IWE-10-DUP-20191025	10-25-19	0955	X		3	X	X	field duplicate
MRC-MW146B-20191025	10-25-19	1040	X		3	X	X	
MRC-MW146B-DUP-20191025	10-25-19	1050	X		3	X	X	field duplicate

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: 12

E-mail address: holly.brown@aecom.com & maura.frantzis@aecom.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
	10-26-19	1530			
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by	Date	Time
Relinquished by	Date	Time	Received by Chi Welsh	Date 10/24/19	Time 10:57

EDD Required? (Yes) No

If yes, format: EQUIS & .CSV

Site-Specific QC (MS/MSD/Dup)? (Yes) No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier: UPS ____ FedEx X Other ____

Temperature upon receipt 8.7-11.6 °C

Environmental Analysis Request/Chain of Custody

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Acct. # 42343 Group # 2071864 Sample # 1188265-67

COC #595189

Client Information

Client: AECOM	Acct. #:
Project Name/#: LM MRC PFAS GWS	PWSID #:
Project Manager: Matt Paviesa	P.O. #:
Sampler: Holly Brown	Quote #:
State where samples were collected: MD	For Compliance: Yes ☐ No ☒

Matrix

Soil ☐ Sediment ☐ Tissue ☐ Water: Ground ☒ Potable ☐ Surface ☐ NPDES ☐ Other: ____

Analysis Requested

Preservation and Filtration Codes

Sample Identification	Collected Date	Collected Time	Grab	Composite	Total # of Containers	PFAS-6GD	Remarks
MRC-MW74B-20191025	10-25-19	1145	X		9	X	MS/MSD
MRC-MW147B-20191025	10-25-19	1210	X		9	X	MS/MSD
TB-20191026	10-26-19	1445	X		2	X	triplank

For Lab Use Only

FSC:

SCR#: 251170

Preservation Codes

H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 P=H_3PO_4
F=Field Filtered O=Other

Remarks

Turnaround Time (TAT) Requested (please circle)

Standard Rush

(Rush TAT is subject to laboratory approval and surcharge.)

Requested TAT in business days: 12

E-mail address: holly.brown@aecom.com & naoum.fountzis@aecom.com

Data Package Options (circle if required)

Type I (EPA Level 3 Equivalent/non-CLP) Type VI (Raw Data Only)

Type III (Reduced non-CLP) NJ DKQP TX TRRP-13

NYSDEC Category A or B MA MCP CT RCP

Relinquished by	Date	Time	Received by	Date	Time
Edwin Hernandez	10/25/19	1540		10-26-19	1200
	10-26-19	1530			
			Received by: CM Webb	10/29/19	10:57

EDD Required? (Yes) No

If yes, format: EQuIS & CSV

Site-Specific QC (MS/MSD/Dup)? (Yes) No

(If yes, indicate QC sample and submit triplicate sample volume.)

Relinquished by Commercial Carrier:

UPS ____ FedEx X Other ____

Temperature upon receipt 8.7 11.6 °C

2671864

Kay Hower

From: Brown, Holly <holly.brown@aecom.com>
Sent: Thursday, October 31, 2019 10:47 AM
To: Kay Hower; Tavantzis, Naoum
Cc: Neigh, Zachary
Subject: RE: LM MRC PFAS GWS TPG-GRO Received by FedEx on 10/29

EXTERNAL EMAIL*

Please proceed with the analysis.

Holly A. Brown, MS, PG, STS
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From: Kay Hower <KayHower@eurofinsus.com>
Sent: Thursday, October 31, 2019 9:31 AM
To: Brown, Holly <holly.brown@aecom.com>; Tavantzis, Naoum <naoum.tavantzis@aecom.com>
Subject: LM MRC PFAS GWS TPG-GRO Received by FedEx on 10/29

Good morning, I just learned that the samples received by FedEx for TPH-GRO were received above 6C. The temperature blank was 10.4C. We took surface temperatures and they ranged from 8.7-11.6C. Please let me know if we should proceed. I apologize for not notifying you sooner. Regards, Kay

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Sample Administration Receipt Documentation Log

Doc Log ID: 264440

Group Number(s): 2071864

Client: AECOM

Delivery and Receipt Information

Delivery Method:	Fed Ex	Arrival Date:	10/29/2019
Number of Packages:	1	Number of Projects:	1
State/Province of Origin:	MD		

Arrival Condition Summary

Shipping Container Sealed:	Yes	Sample IDs on COC match Containers:	Yes
Custody Seal Present:	Yes	Sample Date/Times match COC:	Yes
Custody Seal Intact:	Yes	Total Trip Blank Qty:	2
Samples Chilled:	Yes	Trip Blank Type:	N/A
Paperwork Enclosed:	Yes	Air Quality Samples Present:	No
Samples Intact:	Yes		
Missing Samples:	No		
Extra Samples:	No		
Discrepancy in Container Qty on COC:	No		

Unpacked by Julissa Rivera-Santa

Samples Chilled Details

Thermometer Types: DT = Digital (Temp. Bottle) IR = Infrared (Surface Temp) All Temperatures in °C.

Cooler #	Thermometer ID	Corrected Temp	Therm. Type	Ice Type	Ice Present?	Ice Container	Elevated Temp?	Samples Collected Same Day as Receipt?
1	DT42-03	10.4	DT	Wet	N	Loose	Y	N

Elevated Temperature Details

All Temperatures in °C

Cooler #	Thermometer ID	Top Left Temp	Top Right Temp	Bottom Left Temp	Bottom Right Temp	Center Temp	Factors Contributing to Elevated Temp	Comments
1	192099059	8.7	9.4	9.3	9.8	11.6	ICE MELTED	

General Comments: ONE OF THE VIALS DID NOT HAVE CLIENT LABEL , BY PROCESS OF ELIMINATION IT BELONGS TO SAMPLE MRC-MW147B-20191025

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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

BMQL	Below Minimum Quantitation Level	**mL**	milliliter(s)
C	degrees Celsius	**MPN**	Most Probable Number
cfu	colony forming units	**N.D.**	non-detect
CP Units	cobalt-chloroplatinate units	**ng**	nanogram(s)
F	degrees Fahrenheit	**NTU**	nephelometric turbidity units
g	gram(s)	**pg/L**	picogram/liter
IU	International Units	**RL**	Reporting Limit
kg	kilogram(s)	**TNTC**	Too Numerous To Count
L	liter(s)	**µg**	microgram(s)
lb.	pound(s)	**µL**	microliter(s)
m3	cubic meter(s)	**umhos/cm**	micromhos/cm
meq	milliequivalents	**MCL**	Maximum Contamination Limit
mg	milligram(s)		

<	less than
>	greater than
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg) or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter per liter of gas.
ppb	parts per billion
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff.

Times are local to the area of activity. Parameters listed in the 40 CFR Part 136 Table II as “analyze immediately” are not performed within 15 minutes.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL AND (B) WHETHER EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Eurofins Lancaster Laboratories Environmental which includes any conditions that vary from the Standard Terms and Conditions, and Eurofins Lancaster Laboratories Environmental hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

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Data Qualifiers

Qualifier	Definition
C	Result confirmed by reanalysis
D1	Indicates for dual column analyses that the result is reported from column 1
D2	Indicates for dual column analyses that the result is reported from column 2
E	Concentration exceeds the calibration range
K1	Initial Calibration Blank is above the QC limit and the sample result is ND
K2	Continuing Calibration Blank is above the QC limit and the sample result is ND
K3	Initial Calibration Verification is above the QC limit and the sample result is ND
K4	Continuing Calibration Verification is above the QC limit and the sample result is ND
J (or G, I, X)	Estimated value >= the Method Detection Limit (MDL or DL) and < the Limit of Quantitation (LOQ or RL)
P	Concentration difference between the primary and confirmation column >40%. The lower result is reported.
P^	Concentration difference between the primary and confirmation column > 40%. The higher result is reported.
U	Analyte was not detected at the value indicated
V	Concentration difference between the primary and confirmation column >100%. The reporting limit is raised due to this disparity and evident interference.
W	The dissolved oxygen uptake for the unseeded blank is greater than 0.20 mg/L.
Z	Laboratory Defined - see analysis report

Additional Organic and Inorganic CLP qualifiers may be used with Form 1 reports as defined by the CLP methods.
Qualifiers specific to Dioxin/Furans and PCB Congeners are detailed on the individual Analysis Report.

APPENDIX F
October 2019 Groundwater Analytical Results

Appendix F – October 2019 Groundwater Analytical Results
Per- and Polyfluoroalkyl Substances Investigation
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID			MRC-MW01A						MRC-MW02A						MRC-MW05A						MRC-MW05A						MRC-MW10A					
	Sample Type			N						N						N						FD						N					
	Collection Date			10/21/2019						10/21/2019						10/21/2019						10/21/2019						10/21/2019					
	Block ID			A						A						I						I						G					
Analyte	CAS Number	SL[a]	Units	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL
Per- and Polyfluoroalkyl Substances (PFAS) - E537M																																	
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	18-28	**0.8**	J			0.89	17-27	**15**				0.87	24-34	**1.2**	J			0.9	24-34	**1.8**	J			0.89	3-13	**1.7**	J			0.91
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	18-28	**2.9**		J	l	0.89	17-27	**15**		J	l	0.87	24-34	**3.2**		J	l	0.9	24-34	**3.1**		J	l	0.89	3-13	**6.5**		J	l	0.91
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	18-28	< 0.89	U			0.89	17-27	**3.1**				0.87	24-34	< 0.90	U			0.9	24-34	< 0.89	U			0.89	3-13	**1**	J			0.91
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	18-28	**1.1**	J			0.89	17-27	**7.6**				0.87	24-34	**0.93**	J			0.9	24-34	**0.91**	J			0.89	3-13	**2.5**				0.91
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	18-28	**4.4**				0.89	17-27	**1.8**				0.87	24-34	**1.4**	J			0.9	24-34	**1.3**	J			0.89	3-13	**0.6**	J			0.91
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	18-28	**3**		J	l	0.89	17-27	**3.9**		J	l	0.87	24-34	**0.95**	J	J	l	0.9	24-34	**0.93**	J	J	l	0.89	3-13	**1.2**	J	J	l	0.91
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	18-28	< 3.6	U			3.6	17-27	< 3.5	U			3.5	24-34	< 3.6	U			3.6	24-34	< 3.5	U			3.5	3-13	< 3.6	U			3.6
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	18-28	< 1.8	U	UJ	s	1.8	17-27	< 1.7	U	UJ	s	1.7	24-34	< 1.8	U			1.8	24-34	< 1.8	U	UJ	s	1.8	3-13	< 1.8	U			1.8
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	18-28	**4**				0.89	17-27	**26**				0.87	24-34	**4.1**				0.9	24-34	**4**				0.89	3-13	**10**				0.91
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	18-28	**8.2**				0.89	17-27	**21**				0.87	24-34	**3.6**				0.9	24-34	**4**				0.89	3-13	**3.5**				0.91
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	18-28	**3.7**				0.89	17-27	**30**				0.87	24-34	**4.4**				0.9	24-34	**4.9**				0.89	3-13	**8.2**				0.91
Total PFAS	Total PFAS	NE	ng/L	18-28	**12**				3.6	17-27	**46**				3.5	24-34	**7.7**				3.6	24-34	**8**				3.5	3-13	**14**				3.6
Total Petroleum Hydrocarbons (TPH) - SW8015D																																	
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
- = Not Sampled or Not Detected
bgs = below ground surface
CAS = Chemical Abstract Services
NE = Not Established
RL = Reporting Limit
SL = Screening Level
ng/L = Nanograms per liter
µg/L = Micrograms per liter

[a] = **For PFOA and PFOS**: USEPA Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS; December 2019
* = **For TPH**: TPH Method SW846 8015D was used to evaluate and potentially confirm the location of the Former Fire Training Area as a potential source area

Result Detected result exceeds EPA HAL of 70 ppt or EPA SL of 40 ppt for PFOA and PFOS, individually or combined; or exceeds EPA SL of 47 ppb for TPH-DRO/GRO

Laboratory (Lab) and Data Validation (DV) Qualifier (Qual) Definitions:
B = The analyte was analyzed for, but not detected at a level greater than or equal to the level of the adjusted Detection Limit for sample and method
J = Indicates an estimated value (+/- denotes an over/underestimate)
U = Indicates that a compound was analyzed for but not detected
DV Qual Reason Code (RC) Definitions:
be = Equipment blank detection
l = Laboratory control sample recoveries
s = Surrogate recovery

Appendix F – October 2019 Groundwater Analytical Results
Per- and Polyfluoroalkyl Substances Investigation
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID	MRC-MW16A								MRC-MW18A						MRC-MW21A						MRC-MW21A						MRC-MW27A					
	Sample Type	N								N						N						FD						N					
	Collection Date	10/21/2019								10/23/2019						10/21/2019						10/21/2019						10/21/2019					
	Block ID	G								I						I						I						I					
Analyte	CAS Number	SL[a]	Units	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL
Per- and Polyfluoroalkyl Substances (PFAS) - E537M																																	
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	3-13	**4.7**				0.9	16-26	**8.9**				0.89	6-16	**46**				0.92	6-16	**47**				0.93	8.5-18.5	**9.7**				0.88
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	3-13	**11**		J	I	0.9	16-26	**7.6**				0.89	6-16	**16**		J	I	0.92	6-16	**16**		J	I	0.93	8.5-18.5	**10**		J	I	0.88
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	3-13	**1**	J			0.9	16-26	**2**				0.89	6-16	**4.1**				0.92	6-16	**4.2**				0.93	8.5-18.5	**2.4**				0.88
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	3-13	**5.7**				0.9	16-26	**4.6**				0.89	6-16	**7.2**				0.92	6-16	**7.7**				0.93	8.5-18.5	**4.5**				0.88
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	3-13	**2.1**				0.9	16-26	< 0.89	U			0.89	6-16	**0.91**	J			0.92	6-16	**0.87**	J			0.93	8.5-18.5	**1.6**	J			0.88
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	3-13	**3**		J	I	0.9	16-26	**2**				0.89	6-16	**4.9**		J	I	0.92	6-16	**4.8**		J	I	0.93	8.5-18.5	**1.2**	J	J	I	0.88
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	3-13	< 3.6	U			3.6	16-26	< 3.6	U			3.6	6-16	< 3.7	U			3.7	6-16	< 3.7	U			3.7	8.5-18.5	< 3.5	U			3.5
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	3-13	< 1.8	U			1.8	16-26	< 1.8	U			1.8	6-16	< 1.8	U			1.8	6-16	< 1.9	U			1.9	8.5-18.5	< 1.8	U	UJ	s	1.8
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	3-13	**18**				0.9	16-26	**14**				0.89	6-16	**27**				0.92	6-16	**28**				0.93	8.5-18.5	**17**				0.88
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	3-13	**9.8**				0.9	16-26	**11**				0.89	6-16	**52**				0.92	6-16	**53**				0.93	8.5-18.5	**13**				0.88
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	3-13	**16**				0.9	16-26	**17**				0.89	6-16	**62**				0.92	6-16	**63**				0.93	8.5-18.5	**20**				0.88
Total PFAS	Total PFAS	NE	ng/L	3-13	**28**				3.6	16-26	**25**				3.6	6-16	**79**				3.7	6-16	**81**				3.7	8.5-18.5	**29**				3.5
Total Petroleum Hydrocarbons (TPH) - SW8015D																																	
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
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Appendix F – October 2019 Groundwater Analytical Results
Per- and Polyfluoroalkyl Substances Investigation
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID			MRC-MW27B						MRC-MW27B						MRC-MW41A						MRC-MW42A						MRC-MW44A					
	Sample Type			N						FD						N						N						N					
	Collection Date			10/21/2019						10/21/2019						10/24/2019						10/21/2019						10/24/2019					
	Block ID			I						I						I						I						E					
Analyte	CAS Number	SL[a]	Units	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL
Per- and Polyfluoroalkyl Substances (PFAS) - E537M																																	
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	30-40	**2.5**		B	be	0.88	30-40	**2.4**		B	be	0.88	6-16	**9.6**				0.91	9-19	**0.63**	J			0.93	3-13	**2.4**		B	be	0.87
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	30-40	**4.6**		J	I	0.88	30-40	**4.4**		J	I	0.88	6-16	**13**				0.91	9-19	**8.8**		J	I	0.93	3-13	**9.6**				0.87
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	30-40	**0.44**	J			0.88	30-40	**0.49**	J			0.88	6-16	**3**				0.91	9-19	< 0.93	U			0.93	3-13	**0.76**	J			0.87
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	30-40	**2**				0.88	30-40	**2**				0.88	6-16	**5**				0.91	9-19	**3.2**				0.93	3-13	**2.6**				0.87
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	30-40	**0.64**	J			0.88	30-40	**0.71**	J			0.88	6-16	**2.4**				0.91	9-19	**1.2**	J			0.93	3-13	**0.47**	J			0.87
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	30-40	**0.51**	J	J	I	0.88	30-40	< 0.88	U	UJ	I	0.88	6-16	**4.4**				0.91	9-19	**1.3**	J	J	I	0.93	3-13	**2.3**		J+	s	0.87
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	30-40	**5.1**				3.5	30-40	**5.1**				3.5	6-16	< 3.6	U			3.6	9-19	< 3.7	U			3.7	3-13	< 3.5	U			3.5
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	30-40	< 1.8	U			1.8	30-40	< 1.8	U			1.8	6-16	< 1.8	U			1.8	9-19	< 1.9	U			1.9	3-13	< 1.7	U			1.7
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	30-40	**7**				0.88	30-40	**6.9**				0.88	6-16	**21**				0.91	9-19	**12**				0.93	3-13	**13**				0.87
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	30-40	**3.7**				0.88	30-40	**3.1**				0.88	6-16	**16**				0.91	9-19	**3.1**				0.93	3-13	**5.2**				0.87
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	30-40	**7.1**				0.88	30-40	**6.8**				0.88	6-16	**23**				0.91	9-19	**9.4**				0.93	3-13	**12**				0.87
Total PFAS	Total PFAS	NE	ng/L	30-40	**16**				3.5	30-40	**15**				3.5	6-16	**37**				3.6	9-19	**15**				3.7	3-13	**18**				3.5
Total Petroleum Hydrocarbons (TPH) - SW8015D																																	
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Appendix F – October 2019 Groundwater Analytical Results
Per- and Polyfluoroalkyl Substances Investigation
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID			MRC-MW48A						MRC-MW55A						MRC-MW56A						MRC-MW60A						MRC-MW60B					
	Sample Type			N						N						N						N						N					
	Collection Date			10/21/2019						10/23/2019						10/23/2019						10/23/2019						10/23/2019					
	Block ID			I						I						I						I						I					
Analyte	CAS Number	SL[a]	Units	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL
Per- and Polyfluoroalkyl Substances (PFAS) - E537M																																	
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	11-21	**9.9**				0.87	12-22	**3.1**				0.93	2.5-12.5	**17**				0.93	12-22	**8.9**				0.88	22-32	**0.89**	J	B	be	0.87
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	11-21	**13**		J	I	0.87	12-22	**6.1**				0.93	2.5-12.5	**16**				0.93	12-22	**15**				0.88	22-32	**1.2**	J			0.87
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	11-21	**1.4**	J			0.87	12-22	**1.3**	J			0.93	2.5-12.5	**4.9**				0.93	12-22	**3**				0.88	22-32	< 0.87	U			0.87
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	11-21	**3.2**				0.87	12-22	**3.5**				0.93	2.5-12.5	**5.3**				0.93	12-22	**3.6**				0.88	22-32	**0.73**	J			0.87
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	11-21	**1.6**	J			0.87	12-22	**0.49**	J			0.93	2.5-12.5	**0.74**	J			0.93	12-22	**1.3**	J			0.88	22-32	< 0.87	U			0.87
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	11-21	**0.9**	J	J	I	0.87	12-22	**1.6**	J			0.93	2.5-12.5	**2.4**				0.93	12-22	**1.6**	J			0.88	22-32	**0.46**	J			0.87
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	11-21	< 3.5	U			3.5	12-22	< 3.7	U			3.7	2.5-12.5	**8.9**				3.7	12-22	< 3.5	U			3.5	22-32	< 3.5	U			3.5
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	11-21	< 1.7	U	UJ	s	1.7	12-22	< 1.9	U			1.9	2.5-12.5	< 1.9	U			1.9	12-22	< 1.8	U			1.8	22-32	< 1.7	U			1.7
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	11-21	**18**				0.87	12-22	**11**				0.93	2.5-12.5	**26**				0.93	12-22	**22**				0.88	22-32	**1.9**				0.87
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	11-21	**12**				0.87	12-22	**5.2**				0.93	2.5-12.5	**20**				0.93	12-22	**12**				0.88	22-32	**1.4**				0.87
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	11-21	**23**				0.87	12-22	**9.2**				0.93	2.5-12.5	**33**				0.93	12-22	**24**				0.88	22-32	**2.1**				0.87
Total PFAS	Total PFAS	NE	ng/L	11-21	**30**				3.5	12-22	**16**				3.7	2.5-12.5	**55**				3.7	12-22	**33**				3.5	22-32	**3.3**				3.5
Total Petroleum Hydrocarbons (TPH) - SW8015D																																	
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Per- and Polyfluoroalkyl Substances Investigation
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	Location ID			MRC-MW72B						MRC-MW74B						MRC-MW118A						MRC-MW118B						MRC-MW119A					
	Sample Type			N						N						N						N						N					
	Collection Date			10/24/2019						10/25/2019						10/23/2019						10/23/2019						10/24/2019					
	Block ID			E						E						I						I						I					
Analyte	CAS Number	SL[a]	Units	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL
Per- and Polyfluoroalkyl Substances (PFAS) - E537M																																	
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	25-35	**6.7**				0.9	22-32	**4.4**				0.93	8-13	**42**				0.89	45-55	< 0.90	U			0.9	8-13	**1.7**	J			0.92
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	25-35	**7.2**				0.9	22-32	**5.9**				0.93	8-13	**5**				0.89	45-55	< 0.90	U			0.9	8-13	**4.3**				0.92
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	25-35	**1.4**	J			0.9	22-32	**1.5**	J			0.93	8-13	**2.7**				0.89	45-55	< 0.90	U			0.9	8-13	< 0.92	U			0.92
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	25-35	**1.7**	J			0.9	22-32	**2.2**				0.93	8-13	**3**				0.89	45-55	< 0.90	U			0.9	8-13	**1.5**	J			0.92
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	25-35	**0.71**	J			0.9	22-32	**2.6**				0.93	8-13	**1**	J			0.89	45-55	< 0.90	U			0.9	8-13	< 0.92	U			0.92
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	25-35	**0.61**	J			0.9	22-32	**1.1**	J			0.93	8-13	**1.8**				0.89	45-55	< 0.90	U			0.9	8-13	**2.4**		J+	s	0.92
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	25-35	< 3.6	U			3.6	22-32	< 3.7	U			3.7	8-13	< 3.6	U			3.6	45-55	< 3.6	U			3.6	8-13	< 3.7	U			3.7
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	25-35	< 1.8	U			1.8	22-32	< 1.9	U			1.9	8-13	< 1.8	U			1.8	45-55	< 1.8	U			1.8	8-13	< 1.8	U			1.8
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	25-35	**10**				0.9	22-32	**9.6**				0.93	8-13	**11**				0.89	45-55	< 0.9				0.9	8-13	**5.8**				0.92
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	25-35	**8**				0.9	22-32	**8.1**				0.93	8-13	**45**				0.89	45-55	< 0.9				0.9	8-13	**4.1**				0.92
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	25-35	**14**				0.9	22-32	**10**				0.93	8-13	**47**				0.89	45-55	< 0.9				0.9	8-13	**6**				0.92
Total PFAS	Total PFAS	NE	ng/L	25-35	**18**				3.6	22-32	**18**				3.7	8-13	**56**				3.6	45-55	< 3.6				3.6	8-13	**9.9**				3.7
Total Petroleum Hydrocarbons (TPH) - SW8015D																																	
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	25-35	< 93	U			93	22-32	**72**	J			90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	25-35	**550**				40	22-32	**7800**		J+	s	200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Per- and Polyfluoroalkyl Substances Investigation
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	Location ID			MRC-MW125A						MRC-MW125B						MRC-MW128A						MRC-MW128B						MRC-MW134A					
	Sample Type			N						N						N						N						N					
	Collection Date			10/23/2019						10/23/2019						10/23/2019						10/23/2019						10/24/2019					
	Block ID			E						E						E						E						F					
Analyte	CAS Number	SL[a]	Units	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL
Per- and Polyfluoroalkyl Substances (PFAS) - E537M																																	
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	5-15	**10**				0.87	25-35	**8.4**				0.87	9-19	**11**				0.89	24.5-29.5	**16**				0.92	7.5-12.5	**6**				0.88
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	5-15	**18**				0.87	25-35	**21**				0.87	9-19	**8.8**				0.89	24.5-29.5	**11**				0.92	7.5-12.5	**10**				0.88
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	5-15	**2.5**				0.87	25-35	**2.2**				0.87	9-19	**2.8**				0.89	24.5-29.5	**2.7**				0.92	7.5-12.5	**2.7**				0.88
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	5-15	**7**				0.87	25-35	**8.1**				0.87	9-19	**3.1**				0.89	24.5-29.5	**2.7**				0.92	7.5-12.5	**5.4**				0.88
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	5-15	**1.3**	J			0.87	25-35	**1.4**	J			0.87	9-19	**0.74**	J			0.89	24.5-29.5	**1.4**	J			0.92	7.5-12.5	**0.47**	J			0.88
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	5-15	**2.5**				0.87	25-35	**2.2**				0.87	9-19	**1.5**	J			0.89	24.5-29.5	**1.9**		J+	s	0.92	7.5-12.5	**1.6**	J			0.88
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	5-15	< 3.5	U			3.5	25-35	**8.4**				3.5	9-19	< 3.6	U			3.6	24.5-29.5	< 3.7	U			3.7	7.5-12.5	< 3.5	U			3.5
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	5-15	< 1.7	U			1.7	25-35	< 1.7	U			1.7	9-19	< 1.8	U			1.8	24.5-29.5	< 1.8	U			1.8	7.5-12.5	< 1.8	U			1.8
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	5-15	**28**				0.87	25-35	**31**				0.87	9-19	**15**				0.89	24.5-29.5	**16**				0.92	7.5-12.5	**18**				0.88
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	5-15	**14**				0.87	25-35	**12**				0.87	9-19	**13**				0.89	24.5-29.5	**19**				0.92	7.5-12.5	**8.1**				0.88
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	5-15	**28**				0.87	25-35	**29**				0.87	9-19	**20**				0.89	24.5-29.5	**27**				0.92	7.5-12.5	**16**				0.88
Total PFAS	Total PFAS	NE	ng/L	5-15	**41**				3.5	25-35	**52**				3.5	9-19	**28**				3.6	24.5-29.5	**36**				3.7	7.5-12.5	**26**				3.5
Total Petroleum Hydrocarbons (TPH) - SW8015D																																	
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
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CAS = Chemical Abstract Services
NE = Not Established
RL = Reporting Limit
SL = Screening Level
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µg/L = Micrograms per liter

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Result Detected result exceeds EPA HAL of 70 ppt or EPA SL of 40 ppt for PFC and PFOS, individually or combined; or exceeds EPA SL of 47 ppb for T

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Appendix F – October 2019 Groundwater Analytical Results
Per- and Polyfluoroalkyl Substances Investigation
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

					MRC-MW134B N 10/23/2019 F						MRC-MW136B N 10/24/2019 F						MRC-MW145A N 10/28/2019 F						MRC-MW146B N 10/25/2019 F						MRC-MW146B FD 10/25/2019 F					
Analyte	CAS Number	SL[a]	Units	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL
Per- and Polyfluoroalkyl Substances (PFAS) - E537M																																	
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	32.5-37.5	**0.83**	J			0.92	14-19	**2.9**				0.88	5-10	**7.3**				0.93	12-17	**8.4**				0.94	12-17	**9.5**				0.97
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	32.5-37.5	< 0.92	U			0.92	14-19	**3.5**				0.88	5-10	**12**				0.93	12-17	**11**				0.94	12-17	**12**				0.97
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	32.5-37.5	< 0.92	U			0.92	14-19	< 0.88	U			0.88	5-10	**0.9**	J			0.93	12-17	**1.1**	J			0.94	12-17	**1.1**	J			0.97
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	32.5-37.5	< 0.92	U			0.92	14-19	**1.2**	J			0.88	5-10	**3.5**				0.93	12-17	**3.8**				0.94	12-17	**4.2**				0.97
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	32.5-37.5	< 0.92	U			0.92	14-19	**1.4**	J			0.88	5-10	**4.2**				0.93	12-17	**3.7**				0.94	12-17	**4.1**				0.97
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	32.5-37.5	< 0.92	U			0.92	14-19	**1.4**	J			0.88	5-10	**2.7**		J+	s	0.93	12-17	**1.8**	J			0.94	12-17	**1.9**	J			0.97
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	32.5-37.5	< 3.7	U			3.7	14-19	< 3.5	U			3.5	5-10	< 3.7	U			3.7	12-17	< 3.7	U			3.7	12-17	< 3.9	U	UJ	s	3.9
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	32.5-37.5	< 1.8	U			1.8	14-19	< 1.8	U			1.8	5-10	< 1.9	U			1.9	12-17	< 1.9	U			1.9	12-17	< 1.9	U			1.9
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	32.5-37.5	< 0.92				0.92	14-19	**4.7**				0.88	5-10	**16**				0.93	12-17	**16**				0.94	12-17	**17**				0.97
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	32.5-37.5	**0.83**				0.92	14-19	**5.7**				0.88	5-10	**14**				0.93	12-17	**14**				0.94	12-17	**16**				0.97
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	32.5-37.5	**0.83**				0.92	14-19	**6.4**				0.88	5-10	**19**				0.93	12-17	**19**				0.94	12-17	**22**				0.97
Total PFAS	Total PFAS	NE	ng/L	32.5-37.5	**0.83**				3.7	14-19	**10**				3.5	5-10	**31**				3.7	12-17	**30**				3.7	12-17	**33**				3.9
Total Petroleum Hydrocarbons (TPH) - SW8015D																																	
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-	-	-	-	-	-	-	-	-	-	5-10	< 99	U			99	12-17	< 92	U			92	12-17	< 96	U			96
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	-	-	-	-	-	-	-	-	-	-	-	-	5-10	< 40	U			40	12-17	**27**	J			40	12-17	< 40	U			40

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Appendix F – October 2019 Groundwater Analytical Results
Per- and Polyfluoroalkyl Substances Investigation
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID			MRC-MW147B						MRC-MW155A						MRC-MW159A						MRC-EXT-MW03						MRC-EXT-MW06					
	Sample Type			N						N						N						N						N					
	Collection Date			10/25/2019						10/24/2019						10/24/2019						10/21/2019						10/21/2019					
	Block ID			F						E						E						I						G					
Analyte	CAS Number	SL[a]	Units	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL
Per- and Polyfluoroalkyl Substances (PFAS) - E537M																																	
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	21-35	**8.7**				0.89	4-9	**11**				0.9	5-10	**2.3**				0.93	N/A	**7.9**				0.93	N/A	**28**				0.92
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	21-35	**4.7**				0.89	4-9	**17**				0.9	5-10	**5.8**				0.93	N/A	**16**		J	I	0.93	N/A	**9.5**		J	I	0.92
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	21-35	**1.8**	J			0.89	4-9	**2.2**				0.9	5-10	**0.86**	J			0.93	N/A	**5.9**				0.93	N/A	**2.1**				0.92
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	21-35	**2.7**				0.89	4-9	**6.4**				0.9	5-10	**3.3**				0.93	N/A	**20**				0.93	N/A	**4.6**				0.92
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	21-35	**1.5**	J			0.89	4-9	**1.5**	J			0.9	5-10	< 0.93	U			0.93	N/A	**0.57**	J			0.93	N/A	**0.8**	J			0.92
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	21-35	**1.3**	J			0.89	4-9	**1.8**				0.9	5-10	**0.92**	J			0.93	N/A	**3.9**		J	I	0.93	N/A	**2**		J	I	0.92
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	21-35	< 3.6	U			3.6	4-9	< 3.6	U			3.6	5-10	< 3.7	U			3.7	N/A	< 3.7	U			3.7	N/A	< 3.7	U			3.7
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	21-35	< 1.8	U			1.8	4-9	< 1.8	U			1.8	5-10	< 1.9	U			1.9	N/A	< 1.9	U			1.9	N/A	< 1.8	U			1.8
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	21-35	**9.2**				0.89	4-9	**26**				0.9	5-10	**10**				0.93	N/A	**42**				0.93	N/A	**16**				0.92
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	21-35	**12**				0.89	4-9	**14**				0.9	5-10	**3.2**				0.93	N/A	**12**				0.93	N/A	**31**				0.92
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	21-35	**13**				0.89	4-9	**28**				0.9	5-10	**8.1**				0.93	N/A	**24**				0.93	N/A	**38**				0.92
Total PFAS	Total PFAS	NE	ng/L	21-35	**21**				3.6	4-9	**40**				3.6	5-10	**13**				3.7	N/A	**54**				3.7	N/A	**47**				3.7
Total Petroleum Hydrocarbons (TPH) - SW8015D																																	
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	21-35	**49**	J			92	4-9	< 92	U			92	5-10	< 90	U			90	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	21-35	**1900**		J+	s	40	4-9	< 40	U			40	5-10	< 40	U			40	-	-	-	-	-	-	-	-	-	-	-	-

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Appendix F – October 2019 Groundwater Analytical Results
Per- and Polyfluoroalkyl Substances Investigation
Lockheed Martin Corporation, Middle River Complex, Middle River, Maryland

	Location ID			MRC-IWE-10						MRC-IWE-10						MRC-IWE-10						MRC-SEMW-1I						MRC-SEMW-2I					
	Sample Type			N						N						FD						N						N					
	Collection Date			10/24/2019						10/25/2019						10/25/2019						10/24/2019						10/24/2019					
	Block ID			E						E						E						E						E					
Analyte	CAS Number	SL[a]	Units	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL
Per- and Polyfluoroalkyl Substances (PFAS) - E537M																																	
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	-	-	-	-	-	-	15-30	**5.1**				0.9	15-30	**5.6**				0.95	20-30	**8.8**				0.93	20-30	**5.6**				0.93
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	-	-	-	-	-	-	15-30	**3.3**				0.9	15-30	**3.7**				0.95	20-30	**7.8**				0.93	20-30	**6**				0.93
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	-	-	-	-	-	-	15-30	**1.1**	J			0.9	15-30	**1.3**	J			0.95	20-30	**2**				0.93	20-30	**0.89**	J			0.93
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	-	-	-	-	-	-	15-30	**1.1**	J			0.9	15-30	**1.3**	J			0.95	20-30	**2.2**				0.93	20-30	**1.1**	J			0.93
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	-	-	-	-	-	-	15-30	< 0.90	U			0.9	15-30	< 0.95	U			0.95	20-30	**0.52**	J			0.93	20-30	**0.66**	J			0.93
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	-	-	-	-	-	-	15-30	**0.75**	J			0.9	15-30	**0.83**	J			0.95	20-30	**0.75**	J			0.93	20-30	< 0.93	U			0.93
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	-	-	-	-	-	-	15-30	< 3.6	U			3.6	15-30	< 3.8	U			3.8	20-30	< 3.7	U			3.7	20-30	< 3.7	U			3.7
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	-	-	-	-	-	-	15-30	< 1.8	U			1.8	15-30	< 1.9	U			1.9	20-30	< 1.9	U			1.9	20-30	< 1.9	U			1.9
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	-	-	-	-	-	-	15-30	**5.5**				0.9	15-30	**6.3**				0.95	20-30	**12**				0.93	20-30	**8**				0.93
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	-	-	-	-	-	-	15-30	**5.9**				0.9	15-30	**6.4**				0.95	20-30	**10**				0.93	20-30	**6.3**				0.93
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	-	-	-	-	-	-	15-30	**8.4**				0.9	15-30	**9.3**				0.95	20-30	**17**				0.93	20-30	**12**				0.93
Total PFAS	Total PFAS	NE	ng/L	-	-	-	-	-	-	15-30	**11**				3.6	15-30	**13**				3.8	20-30	**22**				3.7	20-30	**14**				3.7
Total Petroleum Hydrocarbons (TPH) - SW8015D																																	
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	-	-	-	-	-	-	15-30	< 92	U			92	15-30	< 93	U			93	20-30	< 100	U			100	20-30	< 100	U			100
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	15-30	< 40	U			40	-	-	-	-	-	-	15-30	< 40	U			40	20-30	< 40	U			40	20-30	< 40	U			40

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	Location ID	MRC-SEMW-31							
	Sample Type	N							
	Collection Date	10/24/2019							
	Block ID	E							
Analyte	CAS Number	SL[a]	Units	Screen Interval feet bgs	Result	Lab Qual	DV Qual	RC	RL
Per- and Polyfluoroalkyl Substances (PFAS) - E537M									
Perfluorooctane sulfonate (PFOS)	1763-23-1	40	ng/L	20-30	**9.4**				0.9
Perfluorooctanoic acid (PFOA)	335-67-1	40	ng/L	20-30	**8.3**				0.9
Perfluorononanoic acid (PFNA)	375-95-1	NE	ng/L	20-30	**2**				0.9
Perfluoroheptanoic acid (PFHpA)	375-85-9	NE	ng/L	20-30	**2.2**				0.9
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NE	ng/L	20-30	**0.66**	J			0.9
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NE	ng/L	20-30	**0.76**	J			0.9
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2	NE	ng/L	20-30	< 3.6	U			3.6
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4	NE	ng/L	20-30	< 1.8	U			1.8
Total Perfluoroalkyl Carboxylates (PFCA)	Total PFCA	NE	ng/L	20-30	**13**				0.9
Total Perfluoroalkyl Sulfonates (PFSA)	Total PFSA	NE	ng/L	20-30	**11**				0.9
Total PFOA+PFOS	Total PFOA+PFOS	70	ng/L	20-30	**18**				0.9
Total PFAS	Total PFAS	NE	ng/L	20-30	**23**				3.6
Total Petroleum Hydrocarbons (TPH) - SW8015D									
Diesel Range Organics (DRO) C10-C28	DROC10C28	*	-	20-30	< 98	U			98
Gasoline Range Organics (GRO) C6-C10	GROC6C10	*	-	20-30	< 40	U			40

Notes:
- = Not Sampled or Not Detected
bgs = below ground surface
CAS = Chemical Abstract Services
NE = Not Established
RL = Reporting Limit
SL = Screening Level
ng/L = Nanograms per liter
µg/L = Micrograms per liter

[a] = **For PFOA and PFOS**: USEPA Interim Recommendations for Addressing Groundwater Contaminated with PFOA and PFOS; December 2019
* = **For TPH**: TPH Method SW846 8015D was used to evaluate and potentially confirm the location of the Former Fire Training Area as a potential source ar

Result Detected result exceeds EPA HAL of 70 ppt or EPA SL of 40 ppt for PFC and PFOS, individually or combined; or exceeds EPA SL of 47 ppb for T

Laboratory (Lab) and Data Validation (DV) Qualifier (Qual) Definitions:
B = The analyte was analyzed for, but not detected at a level greater than or equ level of the adjusted Detection Limit for sample and method
J = Indicates an estimated value (+/- denotes an over/underestimate)
U = Indicates that a compound was analyzed for but not detected
DV Qual Reason Code (RC) Definitions:
be = Equipment blank detection
l = Laboratory control sample recoveries
s = Surrogate recovery