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TECHNICAL MEMORANDUM

Project No. AS190293A

April 3, 2025

To: Julia Schwarz, Washington State Department of Ecology

cc: Allison Crowley, Seattle City Light
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Re: **South Park Marina – PFAS Groundwater Sampling Plan – FINAL**

In accordance with Agreed Order No. DE 16185 (the AO) between the Washington State Department of Ecology (Ecology) and the Potentially Liable Parties (PLP) Group, which consists of South Park Marina Limited Partnership (SPM), the Port of Seattle (Port), and the City of Seattle (City), a Remedial Investigation (RI) is being conducted for the South Park Marina Site (Site) located at 8604 Dallas Avenue South in Seattle, Washington (the Property).

The purpose of the RI is to provide sufficient data, analysis, and evaluations to support selection of a cleanup alternative for the Site. Following submittal of the draft RI Report (Aspect, 2024) in October 2024, Ecology, in a preliminary comment on the draft RI Report, identified the potential for per- and polyfluoroalkyl substances (PFAS) at the Site and required additional investigation to address this data gap. This PFAS Groundwater Sampling Plan Memorandum (PFAS Sampling Plan) describes groundwater assessment for PFAS at the Site to address this data gap.

Background

The Site is located on the west[1] bank of the Lower Duwamish Waterway (LDW) Superfund Site between River Miles 3.3 and 3.5, to the south of the South Park Bridge, to the east of Dallas Avenue South, and to the north of Duwamish River People's Park, formerly Terminal 117 (T-117).

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[1] For the RI, a project-specific directional reference has been established in which Project North is aligned downriver within the LDW.

The Site includes three King County tax parcels that are collectively referred to in the draft RI Report as the SPM Property. In accordance with the AO, the Site is "defined by where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located."

RI data collection was conducted in three phases between 2021 and 2023, each in accordance with the RI Work Plan (Aspect, 2021), RI Work Plan Addendum (Aspect, 2022), and additional memoranda (Aspect, 2023a and 2023b) approved by Ecology. The draft RI Report was submitted to Ecology on October 2, 2024, and Ecology provided preliminary comments on the draft RI Report on December 4, 2024. In Comment Number #1, Ecology indicated the following:

> *PFAS were not included because we weren't investigating them at the time the work plan was written. However, current and historical site uses could be sources of PFAS, including marine supply, auto repair, boat manufacturing, A&B Barrel, and the off-site dry cleaner. PFAS became common in industrial operations and consumer products beginning in the 1950s. Discuss this data gap and propose ways to address it. PFAS sampling could be conducted during the FS or during pre-design sampling.*

There have not been any documented releases of PFAS at the Site. To address Ecology's PFAS comment, groundwater sampling is proposed as an initial step to evaluate the potential for the presence of PFAS on the SPM Property. Groundwater sampling was selected because if a source of PFAS is present at the Site, it is likely that PFAS in soil would leach to groundwater. Groundwater assessment is also less prone to high spatial variability than soil sampling.

Sampling Objectives and Approach

The overall objective of this work is to collect sufficient data regarding the occurrence and the potential for source(s) of PFAS at the Site to support selection of a cleanup alternative in a future feasibility study. Specific objectives include the following:

- Evaluate the likelihood of a potential source of PFAS on the SPM Property; and
- If a potential source of PFAS is present, evaluate whether PFAS concentrations in groundwater represent a potential concern for human health or the environment.

The approach to achieve these objectives is to collect groundwater samples for laboratory analysis of PFAS in two areas:

1. On the upgradient (western) side of the SPM Property, to evaluate contributions from off-Site sources (including the former dry cleaner), and
2. Along the downgradient (eastern) side of the SPM Property boundary at the shoreline, to assess concentrations potentially discharging to the LDW.

Further details on how the data will be used are described in the Data Analysis and Reporting section, below.

Screening Levels

As described in the draft RI Report, groundwater at the Site is considered non-potable; therefore, groundwater data will be compared to the lowest available screening levels for marine surface water protection when available, as summarized in Table 1. These marine surface water protection values were developed based on a literature review as detailed in Ecology's PFAS guidance document (Ecology, 2023). In accordance with Ecology guidance (2023), PFAS compounds that do not have surface water screening levels will be compared to the lowest available drinking water-based screening levels (Table 1) for preliminary screening purposes. These screening levels will be used to support selection of target compounds, the analytical method, and target method reporting limits and may be used as a line of evidence in evaluating the data.

Scope of Work

This groundwater assessment will focus on shallow groundwater, which is most likely to be impacted by a potential release, and is where the majority of other Site contaminants have been detected. Groundwater samples will be primarily collected from wells screened in the Fill Unit. Where the Tidal Flat Unit is absent in locations along the western Property boundary, groundwater samples will be collected from the Alluvial Unit, which represents the surficial aquifer in this portion of the Site.

Groundwater sampling will be conducted at 7 monitoring wells – 3 upgradient wells (MW-17, MW-18D, and MW-20) and four shoreline wells (MW-6, MW-8, MW-9, and MW-10), as shown on Figure 1. Specific objectives for each well are provided in Table 2. For context, Table 2 also includes a summary of Site chemicals of potential concern that have been detected above Proposed RI Cleanup Levels (as identified in the draft RI Report) at each of these wells.

Groundwater sampling will be conducted using low-flow sampling techniques in accordance with prior groundwater sampling performed for the RI. Shoreline wells will be sampled during an outgoing tide cycle as practicable. Sampling and sample handling procedures, including potential sources of cross-contamination and specific procedures for collection of PFAS groundwater samples, are detailed in the attached Sampling and Analysis Plan / Quality Assurance Project Plan (SAP/QAPP; Attachment A).

Samples will be submitted to Eurofins Environment Testing of Sacramento, California, which is a Washington state-accredited laboratory. Samples will be analyzed by U.S. Environmental Protection Agency Method 1633 for 40 PFAS compounds, including those 10 with applicable screening levels (see Table 1). Laboratory method details, including method reporting limits, are included in the SAP/QAPP.

Data Analysis and Reporting

Groundwater data will be validated by a third-party data validator, Laboratory Data Consultants, Inc., in accordance with the SAP/QAPP. Validated data will be submitted to Ecology's Environmental Information Management system.

The collected data will be used to assess whether there is potential for sources of PFAS on the SPM Property. Data evaluation will include:

- Concentrations of PFAS compounds with surface water screening levels (identified in Table 1) will be screened against applicable marine surface water screening levels.

- Concentrations of all PFAS compounds at downgradient, shoreline wells will be compared to concentrations at upgradient wells.

If PFAS concentrations in groundwater are higher on the downgradient side of the SPM Property, the following, multiple lines of evidence will be evaluated to assess the data:

- Concentrations of PFAS compounds without surface water screening values will be compared to the potable groundwater values (and will be screened out from further evaluation if they are less than potable groundwater screening levels).
- The relative concentration of PFAS compounds without surface water screening values will be compared to the concentrations of PFAS compounds with surface water screening values.

Prior to producing the data memorandum, preliminary results will be discussed with Ecology to determine next steps. If Ecology agrees the collected data are sufficient for characterizing PFAS at the Site and for evaluating remedial alternatives in the feasibility study, the results will be documented in a data memorandum. The data memorandum will include a description of the work performed, tabulated analytical data compared to potentially applicable screening levels, relevant figures, the laboratory data report, and a data validation report. The data memorandum will serve as an addendum to the RI Report, which is being revised in parallel with this PFAS evaluation.

References

Aspect Consulting, LLC (Aspect), 2021, Remedial Investigation Work Plan, South Park Marina Site, dated February 2, 2021.

Aspect Consulting, LLC (Aspect), 2022, Remedial Investigation Work Plan Addendum, South Park Marina Site, dated August 23, 2022.

Aspect Consulting, LLC (Aspect), 2023a, South Park Marina – Proposed Phase 3 Groundwater Sampling, Spring 2023 Memorandum, dated March 6, 2023.

Aspect Consulting, LLC (Aspect), 2023b, South Park Marina – Tire Factory Vapor Intrusion Assessment Results Memorandum, dated June 27, 2023.

Aspect Consulting (Aspect), 2024, Remedial Investigation Report, South Park Marina Site, Ecology Review Draft, dated October 2, 2024.

Washington State Department of Ecology (Ecology), 2023, Guidance for Investigating and Remediating PFAS Contamination in Washington State, Publication No. 22-09-058, dated June 2023.

Limitations

Work for this project was performed for Seattle City Light, the Port of Seattle, and South Park Marina Limited Partnership (PLP Group), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for this project apply only to the services described in the Contract Agreement(s) with Seattle City Light, contract administrator on behalf of the PLP Group. Any use or reuse by any party other than the PLP Group is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Attachments:	Table 1 – Selected Screening Levels Table 2 – Proposed Sampling Locations and Rationale Figure 1 – Proposed Sampling Locations Attachment A – Sampling and Analysis Plan / Quality Assurance Project Plan (SAP/QAPP)

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TABLES

Table 1. Selected Screening Levels

Project No. AS190293A, South Park Marina, Seattle, Washington

Applicable Media		Surface Water				Potable Groundwater[a]		
Screening Level Basis		Protective Concentrations for Aquatic Life, Marine			Aquatic Life, Marine / Acute	Maximum Contaminant Level	MTCA Method B Noncancer	MTCA Method B Cancer
Units		ug/L			ug/L	ug/L	ug/L	ug/L
Source(s):		Ecology PFAS Guidance, 2023 Ecology PCUL Workbook, 2025			CLARC	CLARC	CLARC	CLARC
Regulation:		[b]			WAC 173-201A	40 CFR 141	WAC 173-340	WAC 173-340
Receptor (if multiple):		Invertebrates	Fish	Other	--	--	--	--
Analyte	Acronym							
Fluorotelomer Sulfonic Acid	6:2 FTS	--	--	--	--	--	**3.2E+00**	--
Hexafluoropropylene Oxide Dimer Acid	GenX / HFPO-DA	--	--	--	--	**1.0E-02**	2.4E-02	--
Perfluorobutanesulfonic Acid	PFBS	**1.3E+05**	--	--	--	--	4.8E+00	--
Perfluorobutanoic Acid	PFBA	--	--	--	--	--	**8.0E+00**	--
Perfluorodecanoic Acid	PFDA	**7.8E+01**	--	--	--	--	3.2E-05	--
Perfluorohexanesulfonic Acid	PFHxS	--	--	--	--	1.0E-02	**6.4E-06**	--
Perfluorohexanoic Acid	PFHxA	--	--	--	--	--	**8.0E+00**	--
Perfluorononanoic Acid	PFNA	**1.0E+01**	--	--	--	1.0E-02	4.0E-02	--
Perfluorooctanesulfonic Acid	PFOS	3.3E+01	1.5E+01	**1.1E+00**	5.5E+02	4.0E-03	1.6E-03	2.2E-03
Perfluorooctanoic Acid	PFOA	5.9E+02	1.5E+03	**1.2E+02**	7.0E+03	4.0E-03	4.8E-04	3.0E-06

Notes:

[a] - Ecology's guidance document (2023) recommends applying potable groundwater cleanup levels for preliminary site screening where surface water is non-potable and there is no available surface water quality criteria.

[b] - From Ecology's 2023 guidance - "Protective concentrations were determined by a review of estimated no adverse effects on the protection and propagation of fish, invertebrates, and other aquatic life found in relevant literature. It is important to note that the documented protective concentration is not necessarily the lowest No Observed Adverse Effects Concentration (NOAEC), but instead a value was chosen that would be protective of the individual class of receptors (fish, invertebrates, other) that is also below a Lowest Observed Adverse Effects Concentration (LOAEC)." These values have not been promulgated in statutes.

Bold = Selected Screening Level

ug/L = micrograms per liter

PFAS = per- and polyfluoroalkyl substances

PCUL Workbook = Preliminary Cleanup Level Workbook for the Lower Duwamish Waterway (Ecology, 2025)

CLARC = Cleanup Levels and Risk Calculation (Ecology, 2025)

WAC = Washington Administrative Code

CFR = Code of Federal Regulations

Table 2. Proposed Sampling Locations and Rationale

Project No. AS190293A, South Park Marina, Seattle, Washington

Monitoring Well	Location	Historical/Current Potential Sources or Other Rationale for Sampling	Groundwater Exceedances of Site COPCs		
			COPC	Number of Events	Max. EF
MW-06	- South Area / Shoreline	- Downgradient of historical A&B Barrel operations / Pond Area - Discharge to surface water	Arsenic	1 out of 3	1.9
			Chromium	1 out of 3	1.2
			Copper	2 out of 3	5.7
			Nickel	1 out of 3	19
			PCB Aroclors	1 out of 3	5.7
			Alpha-BHC	1 out of 3	4.9
			Dieldrin	3 out of 3	55
			PCE	1 out of 2	1.0
MW-08	- Central Area / Shoreline	- Near/downgradient of historical boat manufacturing - Discharge to surface water	Arsenic	2 out of 3	2.6
			Copper	2 out of 3	4.2
			Nickel	2 out of 3	2.9
			Aldrin	1 out of 2	4.3
			Alpha-BHC	1 out of 2	4.3
MW-09	- Central Area / Shoreline	- Presumed pathway for PCE migration from dry cleaner to shoreline - Downgradient of historical and current boat maintenance - Discharge to surface water	Arsenic	1 out of 2	2.6
			Copper	1 out of 2	3.6
			PCE	3 out of 3	9.7
			TCE	3 out of 3	22
MW-10	- Central Area / Shoreline	- Downgradient of historical/current auto repair - Downgradient of current boat repair - Discharge to surface water	Arsenic	1 out of 3	2.8
			Chromium	2 out of 3	213
			Copper	3 out of 3	12
			Nickel	3 out of 3	25
MW-17	- Central Area	- Upgradient of current and historical boat maintenance area - Only one, very slight exceedance of Site COPCs	Copper	1 out of 1	1.1
MW-18D	- South Area	- Very limited exceedances of Site COPCs - Upgradient edge of SPM Property	Copper	1 out of 1	1.1
			BEHP	1 out of 1	13
MW-20	- Northwest Area	- Downgradient of off-Site dry cleaner / upgradient of SPM Property - No exceedances of Site COPCs except for PCE and TCE	PCE	2 out of 2	1,138
			TCE	2 out of 2	14

Notes:

COPC - Chemical of Potential Concern
EF - Exceedance Factor
PCB - Polychlorinated Biphenyls
PCE - Tetrachloroethylene
TCE - Trichloroethylene
BEHP - Bis(2-ethylhexyl) phthalate
SPM - South Park Marina

FIGURE

Data source credits: None || Basemap Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA

Investigation Location

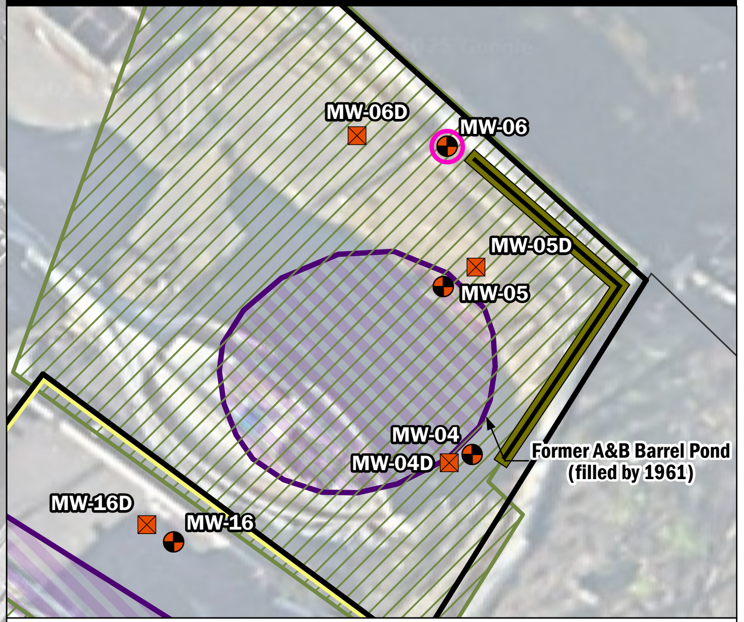
- ☒ Alluvial Unit Monitoring Well
- ● Fill Unit Monitoring Well
- ○ Proposed PFAS Groundwater Sampling Location

Site Features

- ☐ SPM Property Boundary
- Sheet Pile Wall
- ▨ Pervious Surface
- ☐ Historical Structures Destroyed in 2021 Fire
- ▨ Historical Site Feature
- ▨ Historical Off-Property Feature
- ☐ King County Tax Parcel

Note: Site features are approximate

INSET MAP



Proposed Sampling Locations

PFAS Sampling Plan Memorandum
South Park Marina
8604 Dallas Avenue South
Seattle, Washington

Aspect CONSULTING	FEB-2025	BY: JJP / AJY / NLK	FIGURE NO. 1
	PROJECT NO. 190293	REVISED BY: - - - / - - -	

GIS Path: G:\projects\SouthParkMarina_190293\Phase 2 RI Pro\SPM_Phase2_RI.aprx: 01 - Proposed Sampling Locations || User: haley.duran || Print Date: 2/26/2025

ATTACHMENT A

PFAS SAMPLING AND ANALYSIS PLAN / QUALITY ASSURANCE PROJECT PLAN (SAP/QAPP)

Contents – Attachment A

List of Tables

A. Introduction

This PFAS Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP) has been prepared for the South Park Marina Site (Site) on behalf of the Potentially Liable Parties (PLP) Group, which consists of South Park Marina Limited Partnership (SPM), the Port of Seattle (Port), and the City of Seattle (City). This SAP/QAPP is included as Attachment A to the Per- and polyfluoroalkyl substances (PFAS) Groundwater Sampling Plan Memorandum (PFAS Sampling Plan) and meets the requirements of Agreed Order No. DE 16185 between the Washington State Department of Ecology (Ecology) and the PLP Group.

The purpose of this SAP/QAPP is to ensure that field sample collection, handling, and laboratory analysis conducted during implementation of the PFAS Sampling Plan will generate data that meet the project-specific data needs defined in the PFAS Sampling Plan, and in accordance with the Model Toxics Control Act (MTCA) requirements (Washington Administrative Code [WAC] 173-340-350). The SAP identifies the proposed number and location of groundwater samples and defines field protocols for sample collection. The QAPP defines analytical laboratory methods and field and laboratory quality assurance (QA) protocols for the samples' chemical analysis. It is the responsibility of the Aspect Consulting (Aspect) personnel, the subcontracted analytical laboratory, and the subcontracted data validation personnel performing the sampling and analysis activities to adhere to the requirements of the SAP/QAPP.

PFAS have been extensively used in a variety of consumer products, commercial applications, and industries resulting in trace levels of PFAS in most environmental media throughout the world. Also, procedures for sampling and analysis of PFAS are still evolving as further research is conducted. This SAP/QAPP was developed to meet the data quality objectives of this limited groundwater assessment for PFAS at the Site using the latest guidance available from Ecology (2023) and the Interstate Technology and Regulatory Council (2025).

A.1. Sampling and Analysis Plan

The following sections describe the appropriate equipment, materials, and products to be used; groundwater sampling procedures; sample nomenclature; sample custody and field documents; personnel and equipment decontamination procedures; and management of investigation-derived waste (IDW) to be followed during implementation of the Sampling Plan.

A.1.1. Equipment, Materials, and Products

Many common groundwater sampling equipment and materials can potentially contain PFAS, biasing sampling results high, or can potentially sorb PFAS, biasing sampling results low (Field et al., 2021). However, only a limited number of studies have been performed to determine whether use of these materials in typical low-flow groundwater sampling procedures could cross-contaminate groundwater samples (ITRC, 2023). Out of an abundance of caution, steps will be taken to eliminate or limit materials that could potentially cross-contaminate samples.

Generally, there are two categories of equipment and materials to consider: those that come into direct contact with groundwater and/or groundwater samples and those that are not expected to come into direct contact with the groundwater or sample. The equipment and materials that come into direct contact with the sample should be documented to be free from PFAS-containing substances. For the equipment and materials that do not come into direct contact with samples, care should be taken to limit known PFAS-containing materials to the extent practicable. For the purposes of this SAP, the following field materials and equipment that come into direct contact with the groundwater and/or groundwater samples have been deemed acceptable to use:

- Dedicated silicon and/or high-density polyethylene (HDPE) tubing (existing low-density polyethylene tubing will be removed from the monitoring wells at least two weeks prior to the groundwater sampling event).
- Sampling containers, screw caps, and other equipment made from HDPE
- Water level probes[1]

The following field materials and equipment that do not come into direct contact with the groundwater and/or groundwater samples have been deemed acceptable to use:

- Peristaltic pumps
- Disposable powder-free nitrile gloves
- Low-density polythene (LDPE) materials (e.g., Ziploc® bags or plastic sheeting)
- Materials made of polyvinyl chloride (PVC), rubber, HDPE, silicone, nitrile, or stainless steel

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[1] It should be noted that most oil-water interface probes are not PFAS-free; however, oil-water interface probes will only be used to measure depth-to-product and depth-to-water at MW-04 and MW-05, which are not included in the locations selected for collection of groundwater samples for PFAS.

- Sampling forms, loose paper, field notebooks, chain-of-custody (COC) forms, and sample container labels
- Ballpoint pens
- Alconox® detergent
- Paper towels
- Trash bags
- Coolers
- Regular (wet) ice
- Bubble wrap
- Duct tape and/or packing tape
- Water quality meters used during low-flow purging

The following materials are not recommended for use and will not be used:

- Glass sample containers
- Water-resistant paper, notebooks, and labels (e.g., certain Rite in the Rain® products)
- Sticky notes
- Plastic clipboards, binders, and spiral hardcover notebooks
- Pens with water-resistant ink
- Felt pens and markers (e.g., certain Sharpie® products)[2]
- Aluminum foil
- Materials containing polytetrafluoroethylene (PTFE) including Teflon™ and Hostflon® (e.g., tubing, tape)
- Stain- or water-resistant materials
- Materials containing "fluoro" in their name (e.g., fluorinated ethylene propylene [FEP])

Similarly, certain clothing, personal protective equipment, and consumer products have been documented to contain PFAS. While the potential for cross-contamination under typical sampling handling procedures is not expected from these sources, the following lists are provided out of an abundance of caution to limit any such potential cross-contamination.

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[2] Some PFAS sampling guidance (e.g., Michigan, 2024) specifically allow Fine or Ultra-Fine Point Sharpies®, and Eurofins Environment Testing routinely uses Sharpies® in the laboratory following unpublished analytical tests that reportedly showed no impact on PFAS sample results; however, under an abundance of caution, felt pens and markers are not recommended for use during PFAS sampling.

These items are acceptable to use when conducting groundwater sampling for PFAS:

- Boots made of polyurethane, PVC, or untreated leather
- Rain gear made of polyurethane, PVC, wax-coatings, vinyl, or rubber
- Clothing made of synthetic (e.g., polyester) or natural (e.g., cotton) fibers
- Safety glasses
- Reflective safety vests
- Hardhats
- Sunscreens and insect repellants that have been tested and found to be PFAS-free
- Bottled water and hydration drinks

Use of the following items will be avoided when conducting groundwater sampling for PFAS:

- Water- or stain-resistant boots and clothing (e.g., products containing GORE-TEX®)
- Clothing coated in water- or stain-resistant protectors
- Clothing recently laundered with a fabric softener or dryer sheets
- Sunscreen and insect repellants containing fluorinated compounds as ingredients, such as polyfluoroalkyl phosphate esters
- Latex gloves
- Cosmetics, moisturizers, hand cream, and other related products
- Food wrappers and packaging
- Food and drinks other than bottled water or hydration drinks

Items used during field sampling (whether equipment/materials for groundwater sample collection and shipment or personal clothing/protective equipment/consumer products) will be documented on the daily checklist included in Attachment A.1. If an item cannot be avoided, additional equipment rinsate blanks will be collected to evaluate the potential impact of sample cross-contamination. Additional details for equipment blanks are provided in Section A.2.6.1.

A.1.2. Groundwater Sampling Procedures

Seven locations were selected to assess PFAS concentrations in groundwater at the Site: shoreline monitoring wells MW-06, MW-08, MW-09, and MW-10, and inland/upgradient monitoring wells MW-17, MW-18D, and MW-20. The locations and the rationale for each sampling location are described in the Sampling Plan. Prior to collection of groundwater samples, water levels will be recorded at each monitoring well Site-wide.

A.1.2.1. Timing

Groundwater at shoreline monitoring wells at the Site is tidally influenced. During Phase 2 of the Remedial Investigation (RI) for the Site, a comprehensive tidal study was conducted, which included measuring pressure (water level) and conductivity at monitoring wells across the Site. The timing of groundwater sample collection will be based on both the Phase 2 tidal study and observations made during groundwater sampling for Phases 1, 2, and 3 of the RI:

- Inland/Upgradient Monitoring Wells – MW-17, MW-18D, and MW-20: These monitoring wells are not tidally influenced or only minimally influenced (i.e., no significant conductivity variation due to tidal stage and less than 0.5 foot of water level variation over a tide cycle), and sampling may be conducted at any time.
- Shoreline Monitoring Wells That Do Not Go Dry – MW-06: This monitoring well is tidally influenced but does not typically go dry during either the high-low or low-low part of each tide cycle. The calculated lag time between the tidal minimums observed at the nearby National Oceanographic and Atmospheric Administration's (NOAA) station number 9447130, located in Elliott Bay, and the water levels in MW-06 was approximately 2 hours and 30 minutes. This calculated lag time will be used to establish the time of minimal tidal influence as predicted by the NOAA station. Groundwater sampling will be conducted within a 3-hour window bracketing the time of minimal tidal influence predicted for MW-06.
- Shoreline Monitoring Wells That Go Dry – MW-08, MW-09, and MW-10: These monitoring wells are tidally influenced and go dry during low tides; therefore, the approximate bottom elevation of each well's screen will be used to determine when each well will go dry during upcoming tides. Groundwater sampling will be conducted starting 2 hours before the predicted time for the groundwater elevation to reach the bottom of each well screen and for the well to become dry, to allow for sufficient time for low-flow purging and collection of water quality parameters prior to sample collection.

A.1.2.2. Sample Collection

Groundwater samples will be collected and handled in accordance with the procedures described below:

- The locking well cap will be removed, and the well will be allowed to equilibrate with atmospheric pressure for at least 15 minutes. Once equilibrated, the depth-to-groundwater will be measured from the surveyed location (marked on the casing with a "V" notch or black mark) to the nearest 0.01 foot using an electronic water level measuring device.

- Each monitoring well will be purged at a low-flow rate using a peristaltic pump and new, clean tubing. The dedicated tubing will consist of HDPE tubing[3] down well with a short length of silicon tubing through the peristaltic pump head. The depth of the tubing intake will be determined by whether the well is tidally influenced or not:
    - For wells that are not tidally influenced, the tubing intake will be placed just below the center of the saturated section of well screen.
    - For wells that are tidally influenced, the tubing intake will be placed approximately 3 inches above the bottom of the well screen to avoid needing to adjust it during low-flow purging and sample collection.
- The flowrate will be adjusted to minimize drawdown; however, a minimum purge flowrate of 100 milliliters per minute (mL/min) will be maintained throughout purging and sampling.
- During well purging, field parameters (temperature, pH, specific electrical conductance, dissolved oxygen [DO], and oxygen reduction potential [ORP]) will be monitored using an In-Situ Aqua TROLL 600 meter and flow-through cell, or equivalent. Additionally, turbidity will be recorded using a turbidimeter and the depth-to-water will be recorded during purging. These field parameters and depth-to-water readings will be recorded at 5-minute intervals on the groundwater sampling form (Attachment A.1) throughout well purging until they stabilize. Stabilization is defined as three successive readings where:
    - the water level is stable (i.e., water level drawdown is less than 0.33 foot below the initial water level reading),
    - temperature varies by less than 0.1 degree Celsius,
    - specific conductivity varies by less than 3 percent,
    - dissolved oxygen varies by less than 10 percent (or 0.5 milligrams per liter [mg/L] if the readings are below 1 mg/L),
    - pH varies by less than 0.1,
    - ORP varies by less than 10 mV, and
    - turbidity varies by less than 10 percent (or if three consecutive readings are less than 10 nephelometric turbidity units [NTU])
- However, groundwater samples will be collected regardless of stabilization parameters if more than three well casing volumes are purged or after one hour of low-flow purging. It is important to note that many of the field parameters, particularly water levels and specific conductivity, are not expected to stabilize at shoreline monitoring wells based on previous experience with groundwater sampling at the Site.

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[3] If verified PFAS-free HDPE tubing is difficult to source, silicon tubing may be used down the well in addition to at the pump head.

- If the monitoring well is completely dewatered during low-flow purging, samples will be collected when sufficient recharge has occurred to allow filling of all sample containers during an outgoing tide (i.e., following a high tide). Low-flow purging will not be conducted prior to sample collection in this case, but water quality parameters will be recorded prior to sample collection.
- Samples with a field-measured specific electrical conductance greater than 1,000 microsiemens per centimeter (uS/cm) or turbidity greater than 25 NTU will be denoted as such on the chain-of-custody (COC) form, so that the laboratory can employ appropriate sample preparation techniques to avoid analytical interferences (refer to Section A.2.4.1).
- Once purging is complete, the groundwater samples will be collected using the same low-flow rate from the dedicated tubing upstream of the flow-through cell to avoid potential cross-contamination directly into laboratory-supplied sample containers for analysis of the PFAS compounds presented in Table A.1.
- Quality Control (QC) groundwater samples (e.g., field duplicates, and trip blanks) will be collected at the respective frequencies prescribed in Section A.2.6.1.
- After sample collection is complete, the depth to the bottom of the monitoring well will also be measured to evaluate siltation of the monitoring well.
- Following sampling, the well cap and monument cap will be secured. Damaged or defective well caps or monuments will be noted and scheduled for replacement, if necessary.

Low-flow sampling will be documented on the groundwater sampling form contained in Attachment A.1. Groundwater samples will be collected from monitoring wells into laboratory-supplied containers and for analysis of the PFAS compounds presented in Table A.1.

A.1.2.3. Sample Handling

Disposable, powder-free nitrile gloves will be worn at all times during handling of sampling equipment and bottles and during sample collection. General procedures will include the following:

- New, clean nitrile gloves will be worn when handling sampling equipment that will come into contact with groundwater or groundwater samples (e.g., tubing).
- New, clean nitrile gloves will be worn when handling sampling containers.
- Sample bottles will be kept closed unless sampling is actively occurring.
- Sample bottle lids or caps will never be placed on the ground, and if the cap is set down, it must be on a PFAS-free surface.

Additionally, field personnel will don new nitrile gloves immediately prior to sample collection at each monitoring well (e.g., after stabilization during low-flow purging is complete and prior to sample collection).

Following sample collection, the samples will be packed for shipment:

- Sample bottles from each groundwater sampling location will be sealed into an LDPE bag (e.g., Ziploc®).
- Sample containers will be placed upright into the cooler.
- Excess space will be filled with bubble wrap to protect the sample bottles during shipment.
- The remaining space will be filled with wet ice that is double bagged with LDPE bags and sealed to limit leaks and keep the samples from direct contact with melted ice.
- The entire cooler will be sealed with a custody seal and duct tape or packing tape.

A.1.3. Sample Nomenclature and Labeling

Nomenclature for the samples collected as part of the Sampling Plan will be consistent with the data collection conducted during Phases 1, 2, and 3 of the RI. Each groundwater sample will be assigned a unique sample identification number that includes the well number and the six-digit date on which the sample was collected. For example, a groundwater sample collected from monitoring well MW-06 on March 30, 2025, would be identified as MW-06-250330.

Each field quality control sample will be assigned a unique sample identification number that includes the quality control type abbreviation in addition to other identifying information as described below. See Section A.2.6.1 for further information on the field quality control program.

- Field duplicates will be submitted blind to the lab and will include the matrix of the parent sample (i.e., “GW”) with the addition of “FD” indicating this is a field duplicate. Field duplicates will be numbered sequentially and with the six-digit date on which it is collected. For example, the first field duplicate sample, collected on March 30, 2025, would be labeled GW-FD-1-250330.
- Field blanks will be identified by an “FB” and will be numbered sequentially and include the six-digit date on which they are collected. For example, the first field blank sample, collected on March 30, 2025, would be labeled FB-01-250330.
- Equipment rinsate blanks will be identified by an “EB” and will be numbered sequentially and include the six-digit date on which they are collected. For example, the first equipment blank sample, collected on March 30, 2025, would be labeled EB-01-250330.

A.1.4. Sample Custody and Field Documentation

A.1.4.1. Sample Custody

After collection, samples will be maintained in Aspect’s custody until formally transferred to the shipper. When the sample coolers are shipped to the laboratory, the COC form will be placed in a waterproof bag within the cooler for shipment. For purposes of this work, custody of the samples is defined as

- in plain view of the field representatives;
- inside a cooler that is in plain view of the field representative; or
- inside any locked space such as a locker, car, or truck to which the field representative has the only immediately available key(s).

A COC record provided by the laboratory will be initiated at the time of sampling for all samples collected. The record will be signed by the field representative and others who subsequently take custody of the sample. Couriers or other professional shipping representatives are not required to sign the COC form; however, shipping receipts will be collected and maintained in project files as a part of custody documentation. A copy of the COC form with appropriate signatures will be kept by Aspect's project coordinator.

Upon sample receipt, the laboratory will fill out a cooler receipt form to document sample delivery conditions. A designated sample custodian will accept custody of the shipped samples and will verify that the COC form matches the samples received. The laboratory will notify the Aspect project coordinator as soon as possible of any issues noted with the sample shipment or custody.

A.1.4.2. Field Documentation

While conducting field work, the field representative will document pertinent observations and events specific to each activity on field forms (Attachment A.1) and/or in a field notebook, and, when warranted, provide photographic documentation of specific sampling efforts. Field notes will include a description of the field activity, sample descriptions, and associated details such as the date, time, and field conditions.

A.1.5. Decontamination Procedures

Field personnel will thoroughly wash their hands with Alconox® detergent and PFAS-free water[4], dry their hands with paper towels, and don new nitrile gloves after the following activities:

- Contact with a material potentially containing PFAS
- Changes in sampling locations
- Breaks in work and/or restroom breaks
- Exit and entry into the project site exclusion zone
- At the end of each day

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[4] The laboratory will provide verified PFAS-free water for use in decontamination and for field quality control samples (equipment rinsate blanks and field blanks).

All non-disposable sampling equipment that is in contact with groundwater (e.g., water level probes and water quality meters) must be cleaned prior to and between uses at each groundwater sampling location according to the following procedures:

- Wash equipment thoroughly and vigorously with PFAS-free water containing a detergent (Alconox®) and using a bristle brush or similar utensil.
- Rinse equipment thoroughly with PFAS-free water (1st rinse).
- Rinse equipment thoroughly with PFAS-free water (2nd rinse).
- Complete a free-standing (e.g., non-bucket) rinse with PFAS-free water (3rd rinse). This free-standing rinse can be conducted with a spray bottle made from HDPE or by pouring PFAS-free water over the equipment.
- Dry the equipment with a paper towel or leave the equipment to dry in a location away from dust or fugitive emissions. All equipment should be dry before reuse.

A.1.6. Investigation-Derived Waste Management

Investigation-derived waste (IDW) water generated during equipment decontamination and monitoring well sampling will be placed in labeled United States Department of Transportation (DOT) approved drums pending the analytical results to determine appropriate disposal. The drums will be temporarily consolidated onsite, profiled based on available analytical data, and disposed appropriately at a permitted off-site disposal facility. Any liquid IDW, including water drums, will be stored on secondary containment pallets regardless of its classification. Documentation for off-Site disposal of IDW will be maintained in Aspect's project file.

PPE, gloves, paper towels, baggies, and other disposable field supplies will be placed in a garbage bag, sealed, and placed in a municipal dumpster.

A.2. Quality Assurance Project Plan (QAPP)

This QAPP identifies QC procedures and criteria required to ensure that data collected during implementation of the Sampling Plan are of known quality and acceptable to achieve project objectives. Specific protocols and criteria are also set forth in this QAPP for a data quality evaluation, upon the completion of data collection, to determine the level of completeness and usability of the data. It is the responsibility of the project personnel performing or overseeing the sampling and analysis activities to adhere to the requirements of the SAP and this QAPP.

A.2.1. Purpose of the QAPP

As stated in Ecology's *Guidelines for Preparation of Quality Assurance Project Plans for Environmental Studies* (Ecology Publication No. 04-03-030, revised December 2016), the specific goals of this QAPP are as follows:

- Alert the project coordinator and project team to factors affecting data quality during the planning stage of the project.
- Facilitate communication among field, laboratory, and management staff as the project progresses.
- Document the planning, implementation, and assessment procedures for QA/QC activities for the investigation.
- Ensure that the Data Quality Objectives (DQOs) are achieved.
- Provide a record of the project to facilitate final report preparation.

The DQOs for the project are to collect representative samples of groundwater for laboratory analysis of PFAS to meet the objectives described in the PFAS Sampling Plan. The DQOs include both qualitative and quantitative objectives, which define the appropriate type of data and specify the tolerable levels of potential decision errors that will be used as a basis for establishing the quality and quantity of data needed to support the environmental assessment. This QAPP describes both quantitative and qualitative measures of data and details aspects of data collection including analytical methods, QA/QC procedures, and data quality reviews to ensure that the DQOs are achieved. DQOs dictate data collection rationale, sampling and analysis designs that are presented in the main body of the Sampling Plan, and sample collection procedures that are presented in the SAP (Section A.1).

A.2.2. Project Organization and Responsibilities

The project consultant team involved with data generation includes representatives from Aspect and, under subcontract to Aspect, Laboratory Data Consultants, Inc. (LDC; data validation), and Eurofins Environment Testing (Eurofins; laboratory analysis), which is based in Sacramento, California. Key individuals and their roles on this project are as follows, and contact information is listed in Table A.2:

Project Coordinator for PLP Group – Jeremy Porter, PE, Aspect. The project coordinator is responsible for the successful completion of all aspects of this project, including day-to-day management, production of reports, liaison with the PLP Group, and coordination with the project team members. The project coordinator is also responsible for resolution of non-conformance issues, is the lead author on project plans and reports, and will provide regular, up-to-date progress reports and other requested project information to the PLP Group and Ecology.

RI Lead / Field Manager / Site Health & Safety Officer – Andrew Yonkofski, LHG, Aspect. The RI lead and field manager is responsible for overseeing the field sampling program outlined in this plan, including collecting representative samples and ensuring that they are handled properly prior to transfer of custody to the project laboratory. They will also manage procurement of necessary field supplies, assure that monitoring equipment is operational and calibrated in accordance with the specifications provided herein. They will also ensure that the Site-specific Health and Safety Plan is being implemented, that field staff have the appropriate level of training and medical clearance for the tasks assigned, and that field staff have the appropriate equipment required to conduct the work safely.

Project Data Quality Management Lead – Hanna Winter, Aspect. The project data quality management lead is responsible for overseeing the management, validation, and submission of data to Ecology.

Data Validation Manager –Pei Geng, LDC. The data validation manager is responsible for conducting QA validation of the analytical data reports received from the project laboratory.

Laboratory Project Manager – Laura Turpen, Eurofins. The laboratory project manager is responsible for ensuring that all laboratory analytical work for all media complies with project requirements. The laboratory project manager also, while acting as liaison with the project coordinator, field manager, and data quality manager, fulfills project needs on the analytical laboratory work.

Table A.2. Project Personnel Contact Information

Person	Role	Phone Number	E-mail Address
Jeremy Porter	Project Coordinator for PLP Group	206.790.2129	jeremy.porter@aspectconsulting.com
Andrew Yonkofski	RI Lead, Field Manager, and Health & Safety Officer	404.272.3488	andrew.yonkofski@aspectconsulting.com
Hanna Winter	Project Data Quality Manager	206.780.7749	hanna.winter@aspectconsulting.com
Pei Geng	Data Validator	760-827-1100	pgeng@lab-data.com
Laura Turpen	Lab Manager (Eurofins)	916.374.4414	laura.turpen@et.eurofinsus.com

A.2.3. Analytical Method

All samples will be analyzed by EPA Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS (EPA, 2024).

A.2.4. Method Detection Limit and Method Reporting Limit

The method detection limit (MDL) is the minimum concentration of a compound that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero. MDLs are established by the laboratory using prepared samples, not samples of environmental media.

The method reporting limit (MRL) is defined as the lowest concentration at which a chemical can be accurately and reproducibly quantified, within specified limits of precision and accuracy, for a given environmental sample. The MRL can vary from sample to sample depending on sample size, sample dilution, matrix interferences, moisture content, and other sample-specific conditions. MRLs are operationally equivalent to practical quantitation limits (PQLs) as defined in MTCA. As a minimum requirement for analyses, the MRL should be equal to or greater than the concentration of the lowest calibration standard in the initial calibration curve and equal to or, preferably less than, the project screening levels.

The expected MDLs and MRLs are summarized in Table A.3, which also compares the MDLs and MRLs to the screening levels for PFAS in groundwater samples as identified in the Sampling Plan.

A.2.4.1. Sample Preparation for Analysis of Brackish and/or Turbid Water Samples

Turbid water samples may create high bias not representative of groundwater quality for analyses of PFAS compounds. To limit potential for turbidity bias, groundwater samples with field-measured turbidities greater than 25 NTU will be recorded on the corresponding COC and may be centrifuged[5] in the laboratory prior to analysis for PFAS. If the samples are centrifuged, both the uncentrifuged sample and centrifuged sample will be analyzed by the laboratory, and the results will be used to assess the effect of suspended solids on groundwater concentrations.

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[5] EPA Method 1633 allows for centrifuging of samples and analysis of both the supernatant and solid portions of the sample if aqueous samples are too turbid to be extracted effectively. Based on past groundwater sampling events conducted at the Site, turbidities of this magnitude are not expected. If the laboratory deems centrifugation necessary for effective extraction of the samples, the results from the supernatant and solid portions of the samples will be added to quantify the total concentration in the original sample.

To limit potential for salinity and/or matrix interference from turbidity, samples may be diluted, provided the resulting elevated method reporting limits still meet the selected screening levels shown in Table A.4. For example, no more than a 550x dilution for perfluorooctanesulfonic acid (PFOS). Samples with a specific conductance greater than 1,000 uS/cm will be noted on the COC.

A.2.5. Measurement Quality Objectives

Measurement quality objectives (MQOs), including the Measurement Quality Indicators (MQIs)—precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS parameters)—and sample-specific method reporting limits (MRLs) are dictated by the project requirements and intended uses of the data. For this project, the analytical data must be of sufficient technical quality to determine whether contaminants are present and, if present, whether their concentrations are greater than or less than applicable screening levels.

The quality of data generated through this sampling effort will be assessed against the MQIs set forth in this QAPP. Specific QC parameters associated with each of the PARCCS are summarized in Table A.3. Specific MQI goals and evaluation criteria (i.e., percent recovery (%R) for accuracy measurements, relative percent difference (RPD) for precision measurements, are defined in Table A.4 along with the MRLs. Definitions of these parameters and the applicable QC procedures are presented below.

A.2.5.1. Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared with their average values. Analytical precision is measured through laboratory control samples/laboratory control sample duplicates (LCS/LCSD) for organic analysis.

Analytical precision is quantitatively expressed as the RPD between the LCS/LCSD or laboratory duplicate pairs and is calculated with the following formula:

$$RPD\ (\%) = 100 \times \frac{|S - D|}{(S + D)/2}$$

where:
S = analyte concentration in sample
D = analyte concentration in duplicate sample

Analytical precision measurements will be carried out at a minimum frequency of 1 per 20 samples for each matrix sampled, or 1 per laboratory analysis group. Laboratory precision will be evaluated against laboratory quantitative RPD performance criteria provided with the laboratory's analytical data report. If the control criteria are not met, the laboratory will supply a justification of why the limits were exceeded and implement the appropriate corrective actions. The RPD will be evaluated during data review and validation. The data reviewer will note deviations from the specified limits and will comment on the effect of the deviations on reported data.

A.2.5.2. Accuracy

Accuracy measures the closeness of the measured value to the true value. The accuracy of chemical test results is assessed by “spiking” samples with known standards (extracted internal standards, blank spikes, labeled compounds, or matrix spikes) and establishing the recovery. Accuracy is quantified as the %R. The closer the %R is to 100 percent, the more accurate the data.

Extracted internal standard, LCS/LCSD, and labeled compound recovery will be calculated as follows:

$$\text{Recovery}\,(\%) = \frac{MC}{SC} \times 100$$

where:
SC = spiked concentration
MC = measured concentration

Accuracy measurements will be carried out at a minimum frequency of 1 in 20 samples per matrix analyzed, as applicable to the method. A matrix spike / matrix spike duplicate (MS/MSD) analysis is not required if isotope dilution analysis can be used for all the PFAS analytes identified in Table A.1, because the extracted internal standard recoveries account for the influence of matrix interferences in each sample. If extracted internal standards are not available for the PFAS of interest, an MS/MSD may be warranted to assess the effects of matrix interference on that specific PFAS compound. Blank spikes will also be analyzed at a minimum frequency of 1 in 20 samples per matrix analyzed. Extracted internal standard recoveries will be determined for each sample analyzed for respective compounds. Laboratory accuracy will be evaluated against the laboratory’s quantitative LCS and extracted internal standard spike recovery performance criteria as provided with the laboratory’s analytical data report. If the control criteria are not met, the laboratory will supply a justification of why the limits were exceeded and implement the appropriate corrective actions. Percent recoveries will be evaluated during data review and validation, and the data reviewer will comment on the effect of the deviations on the reported data.

A.2.5.3. Representativeness

Representativeness measures how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the matrix sampled. The SAP sampling techniques and sample handling protocols (e.g., storage, use of duplicates and blanks) have been developed to ensure representative samples. The field sampling procedures are described in Section A.1 of this SAP/QAPP.

A.2.5.4. Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. This goal will be achieved through the use of standard techniques to collect samples, EPA-approved standard methods to analyze samples, and consistent units to report analytical results. Data comparability also depends on data quality. Data of unknown quality cannot be compared.

A.2.5.5. Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid. Results will be considered valid if the precision, accuracy, and representativeness objectives are met and if MRLs are sufficient for the intended uses of the data. Completeness is calculated as follows:

$$Completeness\ (\%) = \frac{V}{P} \times 100$$

where:
V = number of valid measurements
P = number of measurements taken

Valid and invalid data (i.e., data qualified with the R flag [rejected]) will be identified during data validation. The target completeness goal for this project is 95 percent.

A.2.5.6. Sensitivity

Sensitivity depicts the level of ability an analytical system (i.e., sample preparation and instrumental analysis) has in detecting a target component in a given sample matrix with a defined level of confidence. Factors affecting the sensitivity of an analytical system include: analytical system background (e.g., laboratory artifact or method blank contamination), sample matrix (e.g., mass spectrometry ion ratio change, co-elution of peaks, or baseline elevation), and instrument instability.

A.2.6. Quality Control Procedures

Field and laboratory QC procedures are outlined below.

A.2.6.1. Field Quality Control

Beyond the use of standard sampling and decontamination protocols defined in the SAP, field QC procedures include maintaining the field instruments. Field instruments (e.g., the Aqua TROLL 600 water quality sonde or equivalent meter for measuring field parameters during groundwater sampling) are maintained and calibrated regularly prior to use, in accordance with manufacturer recommendations.

In addition, field QC samples will be collected and submitted for analyses to monitor the precision and accuracy associated with field procedures. Field QC samples to be collected and analyzed for this Sampling Plan include field blanks, field duplicates, and equipment rinsate blanks. The definition and sampling requirements for field QC samples are presented below.

A.2.6.1.1. Field Blanks

Field blank samples evaluate the potential for cross-contamination during sample collection, storage, and transport. Field blanks will be collected on each day groundwater sampling is conducted. The laboratory will supply PFAS-free water that will be decanted into sample bottles at the Site each day. At least one field blank will be collected in the middle of each day when sampling is occurring, unless a potential source of cross-contamination is identified during each day's field activities (in which case additional field blanks will be collected). The field blank sample bottles will be placed with and accompany the collected groundwater samples throughout the entire transporting process from the field to the laboratory.

A.2.6.1.2. Field Duplicates

Field duplicate samples are used to check for sampling and analysis reproducibility; however, the field duplicate sample results include variability introduced during both field sampling and laboratory preparation and analysis, and EPA data validation guidance provides no specific evaluation criteria for field duplicate samples. Advisory evaluation criteria are set forth at 35 percent for RPD (if both results are greater than five times the MRL) and two times the MRLs for concentration difference (if either result is less than five times the MRL) between the original and field duplicate results.

Field duplicates will be submitted "blind" to the laboratory as discrete samples (i.e., given unique sample identifiers to keep the duplicate identity unknown to the laboratory), but will be clearly identified in the field log. Field duplicate samples will be collected at a frequency of 10 percent (1 per 10) of the field samples, but not less than one duplicate per sampling event per matrix.

A.2.6.1.3. Equipment Rinsate Blanks

Equipment rinsate blanks are collected to determine the potential of cross-contamination introduced by equipment that is used and decontaminated at multiple sample locations (e.g., water level indicator probes). Equipment rinsate blanks will be collected at the end of each day for the only piece of sampling equipment which is expected to directly contact groundwater and/or the groundwater samples – the water level indicator probe (while the Aqua TROLL 600 water quality sonde contacts groundwater, it does not contact groundwater in the well, and the groundwater sample is ultimately collected from the tubing before the flow-through cell). One additional equipment blank will be collected from the roll of new, unused tubing (HDPE or silicon) that will be used to collect groundwater samples (i.e., one tubing equipment rinsate blank per event).

PFAS-free water will be poured over the decontaminated sampling equipment and collected into sample containers for analysis of PFAS. The equipment rinsate blank is handled in a manner identical to the primary samples collected with that piece of equipment. The equipment rinsate blank is then processed, analyzed, and reported as a regular field sample.

When dedicated equipment is used (e.g., new, dedicated tubing that is certified PFAS-free), these blanks are not needed. If an item that may contain PFAS cannot be avoided during the sampling program (Section A.1.1), additional equipment rinsate blanks will be collected to evaluate the potential impact of sample cross-contamination.

A.2.6.2. Laboratory Quality Control

The laboratory's analytical procedures must meet requirements specified in the respective analytical methods or approved laboratory standard operating procedures (SOPs), such as instrument performance check, initial calibration, calibration check, blanks, extracted internal standard spikes, internal standards, and/or labeled compound spikes. Specific laboratory QC analyses required for this project will consist of the following at a minimum:

- Instrument tuning, instrument initial calibration, and calibration verification analyses as required in the analytical methods and the laboratory SOPs
- Laboratory and/or instrument method blank measurements at a minimum frequency of 5 percent (1 per 20 samples) or in accordance with method requirements, whichever is more frequent
- Accuracy and precision measurements as defined in Table A.4, at a minimum frequency of 5 percent (1 per 20 samples) or in accordance with method requirements, whichever is more frequent. A set of LCS/LCSD analyses will be performed to provide sufficient measures for analytical precision and accuracy evaluation.

The laboratory's QA officers are responsible for ensuring that the laboratory implements the internal QC and QA procedures detailed in each laboratory's Quality Assurance Manual.

A.2.7. Corrective Actions

If routine QC audits by the laboratory result in detection of unacceptable conditions or data, actions specified in the laboratory SOPs will be taken. Specific corrective actions are outlined in each SOP used and can include the following:

- Identifying the source of the violation
- Reanalyzing samples if holding time criteria permit
- Resampling and analyzing
- Evaluating and amending sampling and analytical procedures
- Accepting but qualifying data to indicate the level of uncertainty

If unacceptable conditions occur, the laboratory will contact Aspect's project coordinator to discuss the issues and determine the appropriate corrective action. Corrective actions taken by the laboratory during analysis of samples for this project will be documented by the laboratory in the case narrative associated with the affected samples.

In addition, the project data quality manager will review the laboratory data generated for this investigation to ensure that project DQOs are met. If the review indicates that non-conformances in the data have resulted from field sampling or documentation procedures or laboratory analytical or documentation procedures, the impact of those non-conformances on the overall project data usability will be assessed. Appropriate actions, including re-sampling and/or re-analysis of samples may be recommended to the project coordinator to achieve project objectives.

A.2.8. Data Reduction, Quality Review, and Reporting

All data will undergo a QA/QC evaluation at the laboratory, which will then be reviewed by the Aspect database manager and the project data quality manager. Initial data reduction, evaluation, and reporting at the laboratory will be carried out in full compliance with the method requirement and laboratory SOPs. The laboratory internal review will include verification (for correctness and completeness) of the electronic data deliverable (EDD) accompanied with each laboratory report. The Aspect database manager will verify the completeness and correctness of all laboratory deliverables (i.e., laboratory report and EDDs) before releasing the deliverables for data validation.

A.2.9. Minimum Data Reporting Requirements

The following sections specify general and specific requirements for analytical data reporting to provide sufficient deliverables for project documentation and data quality assessment.

A.2.9.1. General Requirements

The following requirements apply to laboratory reports for all types of analyses:

- A cover page signed by the laboratory director, the laboratory QA officer, or his/her designee to certify the eligibility of the reported contents and the conformance with applicable analytical methodology.
- Definitions of abbreviations, data flags, and data qualifiers used in the report.
- Cross reference of field sample names and laboratory sample identity for all samples in the sample delivery group (SDG).
- Completed COC document signed and dated by parties who acquired and received the samples.
- Completed sample receipt document with record of cooler temperature and sample conditions upon receipt at the laboratory. Anomalies such as inadequate sample preservation, inconsistent bottle counts, and sample container breakage, and the communication record and corrective actions in response to the anomalies will be documented and incorporated in the sample receipt document. The document will be initialed and dated by personnel that complete the document.
- Case narrative that addresses any anomalies or QC outliers in relation to sample receiving, sample preparation, and sample analysis on samples in the SDG. The

narrative will be presented separately for each analytical method and each sample matrix.

- All pages in the report are to be paginated. Any insertion of pages after the laboratory report is issued will be paginated with starting page number suffixed with letters (e.g., pages inserted between pages 134 and 135 should be paginated as 134A, 134B, etc.)
- Any resubmitted or revised report pages will be submitted to Aspect with a cover page stating the reason(s) and scope of the resubmission or revision, and signed by the laboratory director, QA officer, or the designee.

A.2.9.2. Specific Requirements

The following presents specific requirements for laboratory reports:

- Sample results: Sample results will be evaluated and reported down to the MRLs, provided the MRL is less than the selected screening level for a given PFAS analyte (Table A.4). If the MRL is greater than the selected screening level or if the MRL for a specific sample is elevated (for example, due to dilution), the sample results will be reported down to the MDLs. Detections at levels greater than the MDLs but less than the MRLs will be reported and flagged with “J.” If samples results are reported to the MRL, results less than the MRLs will be reported at the MRLs and flagged with “U.” Likewise, if sample results are reported down to the MDL, results less than the MDLs will be reported at the MDL and flagged with “UJ.” The report pages for sample results (namely Form 1s) will, at a minimum, include sample results, MRLs, MDLs, unit, proper data flags, dates of sample collection, preparation and analysis, dilution factor, and sample volume (used for analysis).
- Instrument run log: The run log will list, in chronological order, all analytical runs on field samples, QC samples, calibrations, and calibration verification analyses in the SDG with data file name (and/or legible laboratory codes) and analysis date/time for each analytical run.
- Original sample preparation and analyst worksheet: The worksheet will be initialed and dated by analyst and reviewer.
- Initial calibration summary: The summary will include the data file name for each calibration standard file; response factor (RF) or calibration factor (CF) for each calibration standard and each target and extracted internal standard compound; average RF or CF, percent relative standard deviation (%RSD), correlation coefficient, or coefficient of determination; and absolute and relative retention times and ion ratios for mass spectrometry methods for each target compound and extracted internal standard (labeled) compounds.
- Calibration verification summary: The summary will include the true amount, calculated amount, and percent difference (%D), or percent drift (%D_f) as applicable for target compounds.
- Method blank results will be included.
- LCS and LCSD results with laboratory acceptance criteria for %R and RPD.

- Extracted internal standard spike and labeled compound results with laboratory acceptance criteria for %R.
- Laboratory duplicate results with RPD and acceptance criteria.
- Internal standard (as applicable) results: Internal standard response areas in field samples, QC analyses, and associated calibration verification analyses.
- Interference check standards.
- All instrument printouts (raw data) for tests receiving EPA Stage 4 data validation.

A.2.10. Data Quality Verification and Validation

Reported analytical results will be qualified by the laboratory to identify QC concerns in accordance with the specifications of the analytical methods. Additional laboratory data qualifiers may be defined and reported by the laboratory to more completely explain QC concerns regarding a particular sample result. All data qualifiers will be defined in the laboratory's narrative reports associated with each case.

LDC, under subcontract to Aspect, will conduct an independent Level 4 validation (as defined in EPA, 2009) on any PFAS analytical data collected. Data validation will be conducted following the guidance below:

- EPA, Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technical Innovation, January 2017, EPA-540-R-2017-002
- EPA, Per- and Polyfluoroalkyl Substances (PFAS): Reviewing Analytical Methods Data for Environmental Samples, Technical Brief, April 2019, EPA-600-5-19-056.
- United States Department of Defense, Data Validation Guidelines Module 6: Data Validation for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories, October 18, 2022.

The data validation will examine and verify the following parameters against the method requirements and laboratory control limits specified in Table A.4:

- Sample management and holding times
- Instrument performance check, calibration, and calibration verification
- Laboratory and field blank results
- Detection and reporting limits
- Laboratory replicate results
- LCS/LCSD and/or standard reference material results
- Field duplicate results
- Extracted internal standard recovery

Data qualifiers will be assigned based on the outcome of the data validation. Data qualifiers are limited to and defined as follows:

- **U** - The analyte was analyzed for but was determined to be non-detect above the reported sample quantitation limit, or the quantitation limit was raised to the concentration found in the sample due to blank contamination.
- **J** - The associated numerical value is an estimate of the concentration of the analyte in the sample. E.g., the analyte was positively identified at levels greater than the MDLs but less than the MRLs.
- **UJ** - The analyte was not detected above the reported quantitation limit; however, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- **H –** The sample was analyzed outside the method specified holding time requirement.
- **R** - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified.
- **DNR** - Do not report from this analysis; the result for this analyte is to be reported from an alternative analysis.

In cases of multiple analyses (such as an undiluted and a diluted analysis) performed on one sample, the most representative result will be determined and only the determined result will be reported for the sample.

The scope and findings of the data validation will be documented and discussed in the Data Validation Report(s). The Data Validation Report(s) will be included as an appendix to the RI Addendum.

A.2.11. Preventative Maintenance Procedures and Schedules

Preventative maintenance in the laboratory will be the responsibility of the laboratory personnel and analysts. This maintenance includes routine care and cleaning of instruments and inspection and monitoring of carrier gases, solvents, and glassware used in analyses. Details of the maintenance procedures are addressed in the respective laboratory SOPs.

Precision and accuracy data are examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to change as indicated by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or another of the method-specific QC criteria.

Maintenance and calibration of instruments used in the field for sampling (e.g., the Aqua TROLL 600 meter for measuring field parameters during groundwater sampling) will be conducted regularly in accordance with manufacturer recommendations prior to use.

A.2.12. Performance and System Audits

The Aspect project coordinator has responsibility for reviewing the performance of the laboratory QA program; this review will be achieved through regular contact with the analytical laboratory's project manager.

A.2.13. Data and Records Management

Records will be maintained documenting all activities and data related to field sampling and chemical analyses.

A.2.13.1. Field Documentation

The Aspect field manager will ensure that the field team receives and understands the final approved version of this SAP/QAPP and the Site Health and Safety Plan prior to initiation of field activities and that all approved plans are followed at all times. Field documents will be maintained in the project file.

A.2.13.2. Analytical Data Management

Raw data received from the analytical laboratory in electronic data deliverable (EDD) format will be reviewed, entered into a computerized database, and verified for consistency and correctness. The database will be updated based on data review and independent validation if necessary.

The following data will be included in the database:

- Laboratory analytical results, including laboratory data qualifiers
- Data validator qualifiers
- Sample location name and coordinates
- Sample media (i.e., groundwater or soil)
- Sample date
- Sample ID
- Sampling depth interval for soil samples
- Sample fraction (e.g., total or dissolved phase)
- Sample type (e.g., parent, field duplicate, trip blank, rinsate blank, or dilution)

Data will be submitted to Ecology's Environmental Information Management (EIM) database once data have been reviewed and validated.

A.3. References

Aspect Consulting (Aspect), 2024, Remedial Investigation Report, South Park Marina Site, Ecology Review Draft, dated October 2, 2024.

Field Jennifer, A., Trever Schwichtenberg, R.A. Deeb, Elisabeth L. Hawley, Claire Sayler, Dorin Bogdan, E. Schaefer Charles, B. DiGuiseppi, and A. Struse (Field et al.), 2021, Assessing the Potential for Bias in PFAS Concentrations during Groundwater and Surface Water Sampling, SERDP Project ER19-1205.

Interstate Technology and Regulatory Council (ITRC), 2023, Per- and Polyfluoroalkyl Substances Technical and Regulatory Guidance, Published September 2023, https://pfas-1.itrcweb.org/11-sampling-and-analytical-methods/, accessed February 7, 2025.

Michigan Department of Environment, Great Lakes, and Energy (Michigan), 2025, General PFAS Sampling Guidance, dated January 2024.

United States Department of Defense (DOD), Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-24, Environmental Data Quality Workgroup, dated October 18, 2022.

United States Environmental Protection Agency (EPA), 2009, Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, Office of Solid Waste and Emergency Response, EPA 540-R-08-005, dated January 13, 2009.

United States Environmental Protection Agency (EPA), 2017, Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, Office of Superfund Remediation and Technology Innovation, EPA-540-R-2017-002, dated January 2017.

United States Environmental Protection Agency (EPA), 2024, Method 1633, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS, EPA 820-R-24-007, dated January 31, 2024.

Washington State Department of Ecology (Ecology), 2016, Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies, Ecology, No. 04-03-030.

Washington State Department of Ecology (Ecology), 2023, Guidance for Investigating and Remediating PFAS Contamination in Washington State, Toxics Cleanup Program, Publication No. 22-09-058, dated: July 2023.

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TABLES

Table A.1. Analytical Methods, Sample Containers, Preservation, and Holding Time

Project No. AS190293A, South Park Marina, Seattle, Washington

Sample Matrix	Analyte	CAS Number	Laboratory	Analytical Method	Sample Container	No. Containers	Preservation Requirements	Holding Time
Groundwater	Perfluorobutanoic acid (PFBA)	375-22-4	Eurofins Environment Testing	United States Environmental Protection Agency Method 1633	125 milliliter high-density polyethylene	2	Cool 0 - 6ºC	28 Days
	Perfluoropentanoic acid (PFPeA)	2706-90-3						
	Perfluorohexanoic acid (PFHxA)	307-24-4						
	Perfluoroheptanoic acid (PFHpA)	375-85-9						
	Perfluorooctanoic acid (PFOA)	335-67-1						
	Perfluorononanoic acid (PFNA)	375-95-1						
	Perfluorodecanoic acid (PFDA)	335-76-2						
	Perfluoroundecanoic acid (PFUnA)	2058-94-8						
	Perfluorododecanoic acid (PFDoA)	307-55-1						
	Perfluorotridecanoic acid (PFTrDA)	72629-94-8						
	Perfluorotetradecanoic acid (PFTeDA)	376-06-7						
	Perfluorobutanesulfonic acid (PFBS)	375-73-5						
	Perfluoropentanesulfonic acid (PFPeS)	2706-91-4						
	Perfluorohexanesulfonic acid (PFHxS)	355-46-4						
	Perfluoroheptanesulfonic acid (PFHpS)	375-92-8						
	Perfluorooctanesulfonic acid (PFOS)	1763-23-1						
	Perfluorononanesulfonic acid (PFNS)	68259-12-1						
	Perfluorodecanesulfonic acid (PFDS)	335-77-3						
	Perfluorododecanesulfonic acid (PFDoS)	79780-39-5						
	4:2 FTS	757124-72-4						
	6:2 FTS	27619-97-2						
	8:2 FTS	39108-34-4						
	Perfluorooctanesulfonamide (PFOSA)	754-91-6						
	NMeFOSA	31506-32-8						
	NEtFOSA	4151-50-2						
	NMeFOSAA	2355-31-9						
	NEtFOSAA	2991-50-6						
	NMeFOSE	24448-09-7						
	NEtFOSE	1691-99-2						
	HFPO-DA (GenX)	13252-13-6						
	4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4						
	PFMPA	377-73-1						
	PFMBA	863090-89-5						
	NFDHA	151772-58-6						
	9Cl-PF3ONS	756426-58-1						
	11Cl-PF3OUdS	763051-92-9						
	PFEESA	113507-82-7						
	3:3 FTCA	356-02-5						
	5:3 FTCA	914637-49-3						
	7:3 FTCA	812-70-4						
	13C4 PFBA	STL00992						
	13C5 PFPeA	STL01893						
	13C5 PFHxA	STL02577						
	13C4 PFHpA	STL01892						
	13C8 PFOA	STL01052						
	13C9 PFNA	STL02578						
	13C6 PFDA	STL02579						
	13C7 PFUnA	STL02580						
	13C2 PFDoA	STL00998						
	13C2 PFTeDA	STL02116						
	13C3 PFBS	STL02337						
	13C3 PFHxS	STL02581						
	13C8 PFOS	STL01054						
	13C8 FOSA	STL01056						
	d3-NMeFOSAA	STL02118						
	d5-NEtFOSAA	STL02117						
	13C2 4:2 FTS	STL02395						
	13C2 6:2 FTS	STL02279						
	13C2 8:2 FTS	STL02280						
	13C3 HFPO-DA	STL02255						
	d7-N-MeFOSE-M	STL02277						
	d9-N-EtFOSE-M	STL02278						
	d5-NEtPFOSA	STL02704						
	d3-NMePFOSA	STL02705						

Table A.3. QC Parameters Associated with Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity (PARCCS)

Project No. AS190293A, South Park Marina, Seattle, Washington

Data Quality Indicators	Quality Control Parameters
Precision	Relative Percent Difference (RPD)
	(1) Blank Spikes
	(2) Laboratory Control Samples / Laboratory Control Sample Duplicates
	(3) Field Duplicates
Accuracy/Bias	Percent Recovery (%R) or RPD values of:
	(1) Initial Calibration and Calibration Verification
	(2) Blank Spikes
	(3) Laboratory Control Samples / Laboratory Control Duplicate Samples
	(4) Extracted Internal Standard Spikes
	Results of:
	(1) Instrument and Calibration Blank(s)
	(2) Method (Preparation) Blank(s)
	(3) Field Blank(s)
	(4) Equipment Rinsate Blank(s)
Representativeness	Results of All Blanks
	Sample Integrity (Chain-of-Custody and Sample Receipt Forms)
	Holding Times
Comparability	Sample-specific Reporting Limits
	Sample Collection Methods
	Laboratory Analytical Methods
Completeness	Data Qualifiers
	Laboratory Deliverables
	Requested/Reported Valid Results
Sensitivity	Method Detection Limits and Method Reporting Limits

Table A.4. Measurement Quality Objectives (MQOs) for Groundwater Samples

Project No. AS190293A, South Park Marina, Seattle, Washington

Analyte Name	CAS Number	Selected SL (ug/L)	MRL (ug/L)	MDL (ug/L)	LCS/LCSD %R$^{(A)}$	RPD (%)	EIS %R$^{(A)}$
Per- and Polyfluoroalkyl Substances (PFAS) by EPA Method 1633							
Perfluorobutanoic acid (PFBA)	375-22-4	8.0E+00	4.00E-03	1.00E-03	70 - 140	30	5 - 130
Perfluorohexanoic acid (PFHxA)	307-24-4	8.0E+00	2.00E-03	5.00E-04	70 - 145	30	40 - 130
Perfluorooctanoic acid (PFOA)	335-67-1	1.2E+02	2.00E-03	5.00E-04	70 - 150	30	40 - 130
Perfluorononanoic acid (PFNA)	375-95-1	1.0E+01	2.00E-03	5.00E-04	70 - 150	30	40 - 130
Perfluorodecanoic acid (PFDA)	335-76-2	7.8E+01	2.00E-03	5.00E-04	70 - 140	30	40 - 130
Perfluorobutanesulfonic acid (PFBS)	375-73-5	1.3E+05	2.00E-03	5.00E-04	60 - 145	30	40 - 135
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	6.4E-06	2.00E-03	5.00E-04	65 - 145	30	40 - 130
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	1.1E+00	2.00E-03	5.00E-04	55 - 150	30	40 - 130
Fluorotelomer Sulfonic acid (6:2 FTS)	27619-97-2	3.2E+00	4.00E-03	1.00E-03	65 - 155	30	40 - 200
Hexafluoropropylene Oxide Dimer acid (	13252-13-6	1.0E-02	1.50E-03	3.90E-04	70 - 140	30	40 - 130
Perfluoropentanoic acid (PFPeA)	2706-90-3	--	2.00E-03	5.00E-04	65 - 135	30	40 - 130
Perfluoroheptanoic acid (PFHpA)	375-85-9	--	2.00E-03	5.00E-04	70 - 150	30	40 - 130
Perfluoroundecanoic acid (PFUnA)	2058-94-8	--	2.00E-03	5.00E-04	70 - 145	30	30 - 130
Perfluorododecanoic acid (PFDoA)	307-55-1	--	2.00E-03	5.50E-04	70 - 140	30	10 - 130
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	--	2.00E-03	5.80E-04	65 - 140	30	--
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	--	2.00E-03	8.10E-04	60 - 140	30	10 - 130
Perfluoropentanesulfonic acid (PFPeS)	2706-91-4	--	2.00E-03	5.00E-04	65 - 140	30	50 - 200
Perfluoroheptanesulfonic acid (PFHpS)	375-92-8	--	2.00E-03	5.00E-04	70 - 150	30	--
Perfluorononanesulfonic acid (PFNS)	68259-12-1	--	2.00E-03	5.00E-04	65 - 145	30	--
Perfluorodecanesulfonic acid (PFDS)	335-77-3	--	2.00E-03	5.00E-04	60 - 145	30	--
Perfluorododecanesulfonic acid (PFDoS)	79780-39-5	--	2.00E-03	5.30E-04	50 - 145	30	--
4:2 FTS	757124-72-4	--	4.00E-03	1.00E-03	70 - 145	30	40 - 200
8:2 FTS	39108-34-4	--	4.00E-03	1.00E-03	60 - 150	30	40 - 300
Perfluorooctanesulfonamide (PFOSA)	754-91-6	--	2.00E-03	5.00E-04	70 - 145	30	40 - 130
NMeFOSA	31506-32-8	--	2.00E-03	5.00E-04	60 - 150	30	10 - 130
NEtFOSA	4151-50-2	--	2.00E-03	5.00E-04	65 - 145	30	10 - 130
NMeFOSAA	2355-31-9	--	2.00E-03	5.00E-04	50 - 140	30	40 - 170
NEtFOSAA	2991-50-6	--	2.00E-03	5.00E-04	70 - 145	30	25 - 135
NMeFOSE	24448-09-7	--	1.00E-02	2.50E-03	70 - 145	30	10 - 130
NEtFOSE	1691-99-2	--	1.00E-02	2.50E-03	70 - 135	30	10 - 130
4,8-Dioxa-3H-perfluorononanoic acid (AD	919005-14-4	--	2.00E-03	5.00E-04	65 - 145	30	--
PFMPA	377-73-1	--	2.00E-03	5.00E-04	55 - 140	30	--
PFMBA	863090-89-5	--	2.00E-03	5.00E-04	60 - 150	30	--
NFDHA	151772-58-6	--	2.00E-03	7.20E-04	50 - 150	30	--
9Cl-PF3ONS	756426-58-1	--	2.00E-03	5.80E-04	70 - 155	30	--
11Cl-PF3OUdS	763051-92-9	--	2.00E-03	5.00E-04	55 - 160	30	--
PFEESA	113507-82-7	--	2.00E-03	5.00E-04	70 - 140	30	--
3:3 FTCA	356-02-5	--	4.00E-03	1.00E-03	65 - 130	30	--
5:3 FTCA	914637-49-3	--	1.00E-02	2.50E-03	70 - 135	30	--
7:3 FTCA	812-70-4	--	1.00E-02	2.50E-03	50 - 145	30	--
13C4 PFBA	STL00992	--	2.00E-03	5.00E-04	5 - 130	--	50 - 200
13C5 PFPeA	STL01893	--	2.00E-03	5.00E-04	40 - 130	--	--
13C5 PFHxA	STL02577	--	2.00E-03	5.00E-04	40 - 130	--	50 - 200
13C4 PFHpA	STL01892	--	2.00E-03	5.00E-04	40 - 130	--	--
13C8 PFOA	STL01052	--	2.00E-03	5.00E-04	40 - 130	--	50 - 200
13C9 PFNA	STL02578	--	2.00E-03	5.00E-04	40 - 130	--	50 - 200
13C6 PFDA	STL02579	--	2.00E-03	5.00E-04	40 - 130	--	50 - 200
13C7 PFUnA	STL02580	--	2.00E-03	5.00E-04	30 - 130	--	--
13C2 PFDoA	STL00998	--	2.00E-03	5.00E-04	10 - 130	--	--
13C2 PFTeDA	STL02116	--	2.00E-03	5.00E-04	10 - 130	--	--
13C3 PFBS	STL02337	--	2.00E-03	5.00E-04	40 - 135	--	--
13C3 PFHxS	STL02581	--	2.00E-03	5.00E-04	40 - 130	--	50 - 200
13C8 PFOS	STL01054	--	2.00E-03	5.00E-04	40 - 130	--	50 - 200
13C8 FOSA	STL01056	--	2.00E-03	5.00E-04	40 - 130	--	--
d3-NMeFOSAA	STL02118	--	2.00E-03	5.00E-04	40 - 170	--	--
d5-NEtFOSAA	STL02117	--	2.00E-03	5.00E-04	25 - 135	--	--
13C2 4:2 FTS	STL02395	--	2.00E-03	5.00E-04	40 - 200	--	--
13C2 6:2 FTS	STL02279	--	2.00E-03	5.00E-04	40 - 200	--	--
13C2 8:2 FTS	STL02280	--	2.00E-03	5.00E-04	40 - 300	--	--
13C3 HFPO-DA	STL02255	--	2.00E-03	5.00E-04	40 - 130	--	--
d7-N-MeFOSE-M	STL02277	--	2.00E-03	5.00E-04	10 - 130	--	--
d9-N-EtFOSE-M	STL02278	--	2.00E-03	5.00E-04	10 - 130	--	--
d5-NEtPFOSA	STL02704	--	2.00E-03	5.00E-04	10 - 130	--	--
d3-NMePFOSA	STL02705	--	2.00E-03	5.00E-04	10 - 130	--	--

Notes:

ug/L – microgram per liter
SL - screening level
MRL – method reporting limit
MDL – method detection limit
LCS/LCSD – laboratory control samples and laboratory control sample duplicate
%R – percent recovery
RPD – relative percent difference
EIS - extracted internal standard

$^{(A)}$ – Based on current laboratory control criteria. Some values may vary slightly between instruments and can be subject to change as the laboratory updates the charted values periodically.

Blue highlight indicates a screening level based on potable groundwater that is included in accordance with Ecology's guidance (2023), but may not be applicable to the Site.

Red text indicates a screening level that is lower than the MRL and MDL.

Attachment A.1 - Field Forms

Daily PFAS Sampling Checklist

Date: ___________________

Site Name: _____________________________________

Weather (*temperature/precipitation*): ____

Please check all boxes that apply and describe any exceptions in the notes section below along with QA/QC methods used to assess potential sample cross-contamination as a result.

Field Clothing and PPE:

- ☐ No water- or stain-resistant clothing (e.g., GORE-TEX®)
- ☐ During collection of surface water and sediment samples, no water- or stain-resistant boots OR water- or stain-resistant boots covered by PFAS-free over-boots
- ☐ Field boots (or over-boots) are made of polyurethane, PVC, rubber, or untreated leather
- ☐ Waders or rain gear are made of polyurethane, PVC, vinyl, wax-coated or rubber
- ☐ Clothing has not been recently laundered with a fabric softener
- ☐ No coated HDPE suits (e.g., coated Tyvek® suits)
- ☐ Field crew has not used cosmetics, moisturizers, or other related products today
- ☐ Field crew has not used sunscreen or insect repellants today, other than products approved as PFAS-free

Field Equipment:

- ☐ Sample containers and equipment in direct contact with the sample are made of HDPE, polypropylene, silicone, acetate, or stainless steel, not LDPE or glass
- ☐ Sample caps are made of HDPE or polypropylene and are not lined with Teflon™
- ☐ No materials containing Teflon™, Viton™, or fluoropolymers
- ☐ No materials containing LDPE in direct contact with the sample unless an equipment blank has been collected
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks
- ☐ No waterproof field books
- ☐ No waterproof or felt pens or markers (e.g., certain Sharpie® products)
- ☐ No chemical (blue) ice, unless it is contained in a sealed bag
- ☐ No aluminum foil
- ☐ No sticky notes (e.g., certain Post-It® products)

Decontamination:

- ☐ Reusable field equipment (e.g., inner drill rods, samplers) decontaminated prior to reuse
- ☐ "PFAS-free" water is on-site for decontamination of field equipment
- ☐ Alconox®, Luminox®, or Liquinox® used as decontamination detergent

Food and Drink:

- ☐ No food or drink on-site, except within staging area
- ☐ Food in staging area is contained in HDPE or stainless-steel container

Notes:

Field Team Leader Name (Print): ___________________________

Field Team Leader Signature: ______________________________

Date/Time: ____________________________

Aspect
CONSULTING

Sample number ____________________

GROUNDWATER SAMPLING RECORD

WELL NUMBER: _______ **Page:**____ **of** ____

Project Name: ____________________
Date: ____________________
Sampled by: ____________________
Measuring Point of Well: TOC
Screened Interval (ft. TOC) ____________________
Filter Pack Interval (ft. TOC) ____________________

Project Number: ____________________
Starting Water Level (ft TOC): ____________________
Casing Stickup (ft): ____________________
Total Depth (ft TOC): ____________________
Casing Diameter (inches): ____________________

Casing Volume ___________ (ft Water) x ___________ (Lpfv)(gpf) = ___________ (L)(gal)

Casing volumes:	3/4"= 0.02 gpf	2" = 0.16 gpf	4" = 0.65 gpf	6" = 1.47 gpf
	3/4"= 0.09 Lpf	2" = 0.62 Lpf	4" = 2.46 Lpf	6" = 5.56 Lpf

Sample Intake Depth (ft TOC): ___________

PURGING MEASUREMENTS

Criteria:		Typical 0.1-0.5 Lpm	Stable	na	± 3%	± 10%	± 0.1	± 10 mV	± 10%	
Time	Cumul. Volume (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (°C)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mv)	Turbidity (NTU)	Comments

Total Gallons Purged: ____________________

Total Casing Volumes Removed: ____________________

Ending Water Level (ft TOC): ____________________

Ending Total Depth (ft TOC): ____________________

SAMPLE INVENTORY

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance		Remarks
						Color	Turbidity & Sediment	

METHODS

Parameters measured with (instrument model & serial number): ____________________

Purging Equipment: ____________________ Decon Equipment: ____________________

Disposal of Discharged Water: ____________________

Observations/Comments: ____________________

Aspect CONSULTING

Field Staff:

DAILY REPORT

Date: **Project Name:** **Project Number:** **Weather:** **Arrival on site:** **Departure from site:**	Equipment used: Calibration:

Daily PFAS Sampling Checklist

Date: __________________

Site Name: ___________________________________

Weather (*temperature/precipitation*): ____

Please check all boxes that apply and describe any exceptions in the notes section below along with QA/QC methods used to assess potential sample cross-contamination as a result.

Field Clothing and PPE:

- ☐ No water- or stain-resistant clothing (e.g., GORE-TEX®)
- ☐ During collection of surface water and sediment samples, no water- or stain-resistant boots OR water- or stain-resistant boots covered by PFAS-free over-boots
- ☐ Field boots (or over-boots) are made of polyurethane, PVC, rubber, or untreated leather
- ☐ Waders or rain gear are made of polyurethane, PVC, vinyl, wax-coated or rubber
- ☐ Clothing has not been recently laundered with a fabric softener
- ☐ No coated HDPE suits (e.g., coated Tyvek® suits)
- ☐ Field crew has not used cosmetics, moisturizers, or other related products today
- ☐ Field crew has not used sunscreen or insect repellants today, other than products approved as PFAS-free

Field Equipment:

- ☐ Sample containers and equipment in direct contact with the sample are made of HDPE, polypropylene, silicone, acetate, or stainless steel, not LDPE or glass
- ☐ Sample caps are made of HDPE or polypropylene and are not lined with Teflon™
- ☐ No materials containing Teflon™, Viton™, or fluoropolymers
- ☐ No materials containing LDPE in direct contact with the sample unless an equipment blank has been collected
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks
- ☐ No waterproof field books
- ☐ No waterproof or felt pens or markers (e.g., certain Sharpie® products)
- ☐ No chemical (blue) ice, unless it is contained in a sealed bag
- ☐ No aluminum foil
- ☐ No sticky notes (e.g., certain Post-It® products)

Decontamination:

- ☐ Reusable field equipment (e.g., inner drill rods, samplers) decontaminated prior to reuse
- ☐ “PFAS-free” water is on-site for decontamination of field equipment
- ☐ Alconox®, Luminox®, or Liquinox® used as decontamination detergent

Food and Drink:

- ☐ No food or drink on-site, except within staging area
- ☐ Food in staging area is contained in HDPE or stainless-steel container

Notes:

____

____

____

____

____

Field Team Leader Name (Print): __________________________

Field Team Leader Signature: _____________________________

Date/Time: ___________________________

Aspect
CONSULTING

Field Staff:

DAILY REPORT

Date: **Project Name:** **Project Number:** **Weather:** **Arrival on site:** **Departure from site:**	Equipment used: Calibration:

X:\Aspect Forms\Field Forms\Field Note Template.docx

Sample number ____________________

GROUNDWATER SAMPLING RECORD

WELL NUMBER: _______ **Page:**____ **of** ____

Project Name: ____________________

Project Number: ____________________

Date: ____________________

Sampled by: ____________________

Measuring Point of Well: TOC

Screened Interval (ft. TOC) ____________________

Filter Pack Interval (ft. TOC) ____________________

Starting Water Level (ft TOC): ____________________

Casing Stickup (ft): ____________________

Total Depth (ft TOC): ____________________

Casing Diameter (inches): ____________________

Casing Volume ___________ (ft Water) x ___________ (Lpfv)(gpf) = ___________ (L)(gal)

Casing volumes: 3/4"= 0.02 gpf 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf

3/4"= 0.09 Lpf 2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf

Sample Intake Depth (ft TOC): ___________

PURGING MEASUREMENTS

Criteria:		Typical 0.1-0.5 Lpm	Stable	na	± 3%	± 10%	± 0.1	± 10 mV	± 10%	
Time	Cumul. Volume (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (°C)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mv)	Turbidity (NTU)	Comments

Total Gallons Purged: ____________________

Total Casing Volumes Removed: ____________________

Ending Water Level (ft TOC): ____________________

Ending Total Depth (ft TOC): ____________________

SAMPLE INVENTORY

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance		Remarks
						Color	Turbidity & Sediment	

METHODS

Parameters measured with (instrument model & serial number): ____________________

Purging Equipment: ____________________

Decon Equipment: ____________________

Disposal of Discharged Water: ____________________

Observations/Comments: ____________________

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