PFAS SAMPLING AND ANALYSIS PLAN

C Street Landfill, Shelton, Washington

Prepared for: City of Shelton

Project No. AS150074 • July 8, 2025 FINAL

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Aspect
A Geosyntec Company

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Acronyms

Aspect	Aspect Consulting
CAP	Cleanup Action Plan
CCR	Construction Completion Report
CMP	Compliance Monitoring Plan
COC	chain-of-custody
DOT	Department of Transportation
DQOs	data quality objectives
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
HDPE	high-density polyethylene
IDW	investigation-derived waste
LDPE	low-density polythene
LCS/LCSD	laboratory control sample / laboratory control sample duplicate
MDL	method detection limit
MQIs	Measurement Quality Indicators
MQOs	Measurement Quality Objectives
MRL	method reporting limit
MS/MSD	matrix spike / matrix spike duplicate
MTCA	Model Toxics Control Act
PFAS	per- and polyfluoroalkyl substances
PPE	personal protective equipment
PQLs	practical quantitation limits
PTFE	polytetrafluoroethylene
PVC	polyvinyl chloride
QA/QC	quality assurance / quality control

QAPP	Quality Assurance Project Plan
RI/FS	Remedial Investigation/Feasibility Study
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SOPs	standard operating procedures
WAC	Washington Administrative Code
WWTP	Wastewater Treatment Plan

1 Introduction

Aspect Consulting, a Geosyntec Company, (Aspect) has prepared this PFAS Sampling and Analysis Plan (SAP) for the C Street Landfill (Site) on behalf of the City of Shelton (City). The C Street Landfill is a former municipal solid waste landfill located in Shelton, Washington, on a 16.7-acre parcel (Property; Figure 1) owned by the City. The Property is at the west end of West C Street, just west of the overpass across U.S. Highway 101. The Site is undergoing active remedial action pursuant to Agreed Order No. DE 19541 (Agreed Order) between the City and the Washington State Department of Ecology (Ecology). The cleanup action construction was completed in 2023 (Aspect, 2023) and semi-annual compliance groundwater monitoring and sampling is occurring in accordance with the Site Compliance Monitoring Plan (CMP; Aspect, 2022). In a March 20, 2025, letter to the City, Ecology identified landfills as sources of per- and polyfluoroalkyl substances (PFAS) to the environment and stated a requirement to add PFAS to the analytical program for groundwater sampling at the Site (Ecology, 2025).

The purpose of this PFAS SAP is to ensure that field sample collection, handling, and laboratory analysis will generate data that meet the project-specific data needs and be conducted in accordance with the Model Toxics Control Act (MTCA) requirements (Washington Administrative Code [WAC] 173-340-350). The SAP consists of a Field Sampling Plan (FSP), which identifies the number and location of groundwater samples and defines field protocols for sample collection, and a Quality Assurance Project Plan (QAPP), which defines analytical laboratory methods and field and laboratory quality assurance (QA) protocols for the samples' chemical analysis. It is the responsibility of the designated 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.

1.1 Report Organization

The following sections of this SAP are organized as follows:

- **Section 2 – Site Background** briefly presents the general background of the Site including the use history, geology, and hydrogeology.
- **Section 3 – Field Sampling Plan** presents the sampling objectives and approaches and describes the field methods for sample collection, handling, and documentation.
- **Section 4 – Quality Assurance Project Plan** describes the quality objectives and criteria for measurement data, and data generation and acquisition.
- **Section 5 – Limitations** provides guidelines for additional information governing the use of this SAP.

2 Project Background

This section provides a summary of the project background, including a history of the Site use and a summary of the remedial action.

2.1 Site Use History

The Property was purchased by the City in May 1928, including both the parcel and a perpetual easement for access; landfilling activities started the same year. In July 1931, the City sold the Property to Rainier Pulp and Paper Company but retained the right to continue to use the land as a garbage dump. Rayonier, Incorporated, successor of Rainier Pulp and Paper Company, sold the Property back to the City in July 1949.

The landfill received municipal solid waste between approximately 1928 and the mid-1980s. Early on, waste consolidation practices included open burning and on-Property incineration, common for the era (Aspect, 2021). Between 1931 and 1974, the landfill received by-products, research waste, and demolition debris from nearby pulp mills. Sludge from the City's Wastewater Treatment Plant (WWTP) was brought to the landfill between 1973 and the mid-1980s. From 1976 to 1981, fly ash from the wood-burning power plant at the Simpson Timber Company mill was mixed with the WWTP sludge and put in the landfill. The WWTP sludge was disposed of in the northwestern part of the landfill and is estimated to be up to 5 feet thick. The cover soil and WWTP sludge overlie municipal solid waste that is approximately 20 to 25 feet thick.

The Property has been generally unused since the mid-1980s, and public access to the Property and surrounding properties is restricted for safety reasons. There is no available information documenting landfill closure activities, and it is not known whether any were completed. However, the results of investigation activities suggest that some of the landfill waste was covered with imported soil.

2.2 Remedial Action Summary

In 2016, the City entered into Agreed Order No. DE 12929 with Ecology to perform a Remedial Investigation and Feasibility Study (RI/FS) and submit a draft Cleanup Action Plan (CAP) for the Site. The RI field work was completed in 2020, and the final RI/FS report was provided to Ecology in 2021 along with the draft CAP, fulfilling the requirements of Agreed Order No. DE 12929.

In 2021, the City entered into Agreed Order No. DE 19541 with Ecology to implement the cleanup action in the draft CAP. The completed requirements of the 2021 Agreed Order include preparation of the Engineering Design Report (EDR) with CMP, construction plans, and specifications between 2021 and July 2022 (Aspect, 2022a); conducting the cleanup construction between January and June 2023; preparation of the Construction Completion Report (CCR) in October 2023 (Aspect, 2023a); and recording of an Environmental Covenant in April 2025.

Post-cleanup construction monitoring at the Site began in late 2023 and is ongoing in accordance with the Compliance Monitoring Plan. Post-cleanup construction monitoring at the Site includes annual soil cap inspections, annual soil cap settlement surveys, and semi-annual groundwater monitoring. The groundwater monitoring occurs in the late summer/early fall and winter of each year. Ecology has requested that sampling groundwater for PFAS should begin with the August 2025 semiannual groundwater sampling event (Ecology, 2025).

3 Field Sampling Plan

This section describes the scope of work that will be implemented to complete groundwater sampling at the Site for PFAS. The information provided herein is supplemental to the Groundwater Sampling and Analysis Plan portion of the CMP (Aspect, 2022).

3.1 Sampling Objectives and Approach

The objectives of the work are to:

- collect sufficient data to evaluate whether the landfill is a likely source of PFAS compounds to groundwater at the Site; and
- if a potential source of PFAS is present, evaluate whether PFAS concentrations in groundwater pose a potential risk to human health or the environment.

The approach to achieve these objectives is to collect groundwater samples from the four existing compliance monitoring wells for laboratory analysis of PFAS. Semi-annual compliance monitoring occurs in August/September and February of each year. The collection and analysis of groundwater samples for PFAS will be conducted as part of the regular compliance monitoring in August/September 2025 and February 2026. The requirements for PFAS sampling beyond February 2026 will be dependent on the results of these two sampling events and will be determined by Ecology.

3.2 Screening Levels

The screening levels for evaluating PFAS in groundwater are the MTCA Method B Cleanup Levels for groundwater (the lowest of the cancer or noncancer values) in Ecology's Cleanup Level and Risk Calculation (CLARC) database, in accordance with Ecology's *Guidance for Investigating and Remediating PFAS Contamination in Washington State* (Ecology, 2023). As of the most recent CLARC release (February 2025), Method B Cleanup Levels are included for 10 analytes, as shown in the table below.

Screening Levels for PFAS Compounds

Analyte	Method B Cleanup Level (ng/L)
6:2 FLUOROTELOMER SULFONIC ACID (6:2 FTS)	3.2E+00
HEXAFLUOROPROPYLENE OXIDE DIMER ACID (HFPO-DA; GenX)	1.0E-02
PERFLUOROBUTANESULFONIC ACID (PFBS)	4.8E+00
PERFLUOROBUTANOIC ACID (PFBA)	8.0E+00
PERFLUORODECANOIC ACID (PFDA)	3.2E-05
PERFLUOROHEXANESULFONIC ACID (PFHxS)	6.4E-06
PERFLUOROHEXANOIC ACID (PFHxA)	8.0E+00
PERFLUORONONANOIC ACID (PFNA)	1.0E-02
PERFLUOROOCTANESULFONIC ACID (PFOS)	4.0E-03
PERFLUOROOCTANOIC ACID (PFOA)	4.0E-03

Notes: ng/L = nanograms per liter

3.3 Scope of Work

The scope of work for PFAS sampling and analysis is provided in detail in the following subsections.

3.3.1 Sampling Locations

The monitoring well network at the Site consists of wells AMW-1 through AMW-4, all of which were originally installed as part of the RI. The monitoring wells are constructed with a 20-foot screened interval at the top of the water bearing zone, present within recessional outwash, to total depths of 105 to 120 feet bgs (Aspect, 2021). Full construction details of the monitoring wells are provided in Table 1. The locations of the monitoring wells are shown relative to the landfill and other Property features on Figure 2.

3.3.2 Field Methods

The groundwater monitoring events consist of measuring groundwater levels and collecting groundwater samples for laboratory analysis using the general field procedures described in the CMP (Aspect, 2022). The field procedures and quality control measures specific to PFAS sampling, intended for limiting the potential for cross-contamination or other introduction of PFAS in the environment or sampling equipment to the groundwater samples, are presented below.

3.3.2.1 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

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
- 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)[1]

[1] 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.

- 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.

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 4.1.1.

3.3.2.2 Monitoring Well Purging and Sampling Procedures

Groundwater samples will be collected from the monitoring wells using low-flow sampling methodology[2] following purging and stabilization of field geochemical parameters in accordance with the CMP (Aspect, 2022). Each monitoring well will be purged using a certified PFAS-free portable bladder pump and new PFAS-free tubing.

When water quality parameters and the pumping water level (i.e., draw down) have stabilized, groundwater samples will be collected from the pump discharge tubing, following removal of the flow cell. Samples will be collected directly into laboratory-provided and certified PFAS-free bottleware. After the sample collection, the samples will be placed in a cooler with enough wet ice to keep them at 4 degrees Centigrade (blue ice is not permitted for PFAS-sampling) until received by the laboratory. Samples collected for PFAS analysis will be stored together, in a separate cooler from samples collected for other analyses.

3.3.2.3 Sample Handling and Custody

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 put on new nitrile gloves immediately prior to sampling 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 for PFAS analysis will be packed separately for shipment from samples for other analyses:

- Sample bottles from each groundwater sampling location will be sealed into an LDPE bag (e.g., Ziploc®).

[2] U.S. Environmental Protection Agency (EPA), Low Stress (low-flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, dated January 19, 2010.

- 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.

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 purpose of this work, custody of the samples is defined as

- in plain view of Aspect field representative,
- inside a cooler that is in plain view of Aspect field representative; or
- inside any locked space such as a locker, car, 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 manager.

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.

3.3.2.4 Field Documentation

For recordkeeping purposes, field measurements, sampling procedures and logs, and general Site observations will be recorded throughout the monitoring event. The recordkeeping documents include:

- **Groundwater Sampling Form(s)** will be recorded during groundwater monitoring activities to log information regarding well purging, date and elapsed time from sample start to sample finish, purging data including time-series measurements of indicator parameters and water levels during purging, appearance of samples, type of sample and necessary treatment. Groundwater sampling forms are included in Appendix A.

- **Daily Field Note(s)** will be recorded during groundwater monitoring activities to keep the record of facility site name, sample point identification number, equipment calibration and decontamination notes, field observations, and other pertinent identifiers.

- **Chain of Custody Form(s)** should be completed for each set of groundwater samples and placed in the shipping cooler for travel with the sample shipment. These forms are provided by the analytical laboratory as a record for tracking samples from the point of collection to the laboratory. Upon receipt of samples at the laboratory, the shipping container seal will be broken and the condition of the samples, including temperature, will be recorded by the receiver. The records will be reviewed in the preparation of the analytical report prepared by the laboratory and will be considered an integral part of that report.

3.3.2.5 Investigation-Derived Waste Management

Investigation-derived waste (IDW) generated by groundwater sampling will include purged groundwater and decontamination water. 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 on-Site, profiled based on available analytical data and disposed appropriately. Documentation for off-Site disposal of IDW will be maintained in Aspect's project file.

Personal protective equipment (PPE), paper towels, baggies, and other disposable field supplies will be placed in a garbage bag, sealed, and disposed of in a municipal dumpster.

3.3.3 Decontamination Procedures

Field personnel will thoroughly wash their hands with Alconox® detergent and PFAS-free water[3], 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

All non-disposable sampling equipment that is in contact with groundwater (e.g., water level indicator probes and water quality meters) must be cleaned prior to and between uses at each groundwater sampling location. The decontamination of sampling tools and equipment parts will be performed using laboratory-supplied verified PFAS-free deionized water. Aspect's field personnel will use the following procedures for

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

decontaminating all non-dedicated sampling collection equipment when sampling for PFAS:

- Wash equipment thoroughly and vigorously with PFAS-free water containing a detergent (Alconox®) and using a bristle brush or similar utensil.
- Rinse thoroughly with laboratory-supplied de-ionized PFAS-free water (1^{st} rinse)
- Rinse thoroughly with laboratory-supplied de-ionized PFAS free water (2^{nd} rinse)
- Complete a free-standing (e.g., non-bucket) rinse with PFAS-free water (3^{rd} 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.
- Store and secure equipment in clean Ziploc storage bags
- Store decontamination fluids in a sealed and labeled 55-gal drum. Do not reuse decontamination fluids for decontamination procedure.

4 Quality Assurance Project Plan

This QAPP identifies procedures and criteria required to ensure that data collected during implementation of the SAP are of known quality and acceptable to achieve the objectives.

This section describes additional quality assurance/quality control (QA/QC) measures pertaining specifically to PFAS sampling and data quality that will be performed during PFAS sampling and analysis. These measures were developed in accordance with Ecology's *Guidance for Investigating and Remediating PFAS Contamination in Washington State* (Ecology, 2023). 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 data quality objectives (DQOs) are achieved.

4.1.1 Analytical Methods

Groundwater 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 (EPA) Method 1633 for 40 PFAS compounds, including those ten with applicable screening levels (see Table 3 and Section 3.2). Laboratory method details, including method reporting limits, are summarized in Table 2.

4.1.2 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. Method reporting limits (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 3, which also compares the MDLs and MRLs to the screening levels for PFAS in groundwater.

4.1.3 Measurement Quality Objectives

Measurement quality objectives (MQOs), including the Measurement Quality Indicators (MQIs)—precision, accuracy, representativeness, comparability, completeness, and sensitivity—and sample-specific 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 *Remedial Investigation Work Plan, Shelton C Street Landfill* (Aspect, 2017). 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 3 along with the MRLs.

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.

4.1.4 Quality Control Procedures

4.1.4.1 Field Quality Control

Field quality control samples will be collected at the time of sampling and submitted to the Ecology-accredited laboratory for analysis of PFAS using EPA Draft Method 1633. All field quality control samples will be assigned a unique sample number and submitted to the laboratory blind.

For PFAS sampling, Ecology recommends collecting the following field quality control samples as suggested in *Guidance for Investigating and Remediating PFAS Contamination in Washington State* (Ecology, 2023).

- **Trip Blank**: Trip blanks are used to assess whether contamination is introduced during sample shipment. Trip blanks are provided by the laboratory and will be shipped in the same cooler as groundwater samples for PFAS analysis.

- **Equipment Rinsate Blank**: 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[4]). Equipment rinsate blanks will be collected at the end of each day for each type of sampling equipment that is in direct contact with groundwater and/or the groundwater samples to assess the adequacy of the decontamination process. 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.

[4] While the sonde and flow-through cells of water quality meters come into contact with groundwater, groundwater samples that are collected for laboratory analysis have no contact with any part of the water quality meter, which is completely disconnected from the purging train before sampling occurs.

- **Field Duplicate**: Field duplicate samples will be used to check for sampling and analysis reproducibility. Field duplicate samples will be collected at a frequency of 10 percent (1 per 10) of the samples, but not less than one duplicate per sampling event.

- **Field Blank:** 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.

Any reduction in the recommended QC samples above will be discussed with Ecology prior to implementation. Ecology requests that potential sources for PFAS cross-contamination should be identified in the field notes, and actions to address these situations should be well documented in the data validation section of the sampling report (i.e., collecting additional quality control samples or making changes to sample handling and decontamination procedures).

4.1.4.2 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 3, at a minimum frequency of 5 percent (1 per 20 samples) or in accordance with method requirements, whichever is more frequent. A set of laboratory control sample / laboratory control sample duplicate (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.

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Washington State Department of Ecology (Ecology). 2025. Letter to mark Ziegler, City Manager, City of Shelton, from Steve Teel, LHG, Cleanup Project Manager/Hydrogeologist regarding Requirement for PFAS Evaluation in Groundwater, Shelton C Street Landfill, March 20, 2025.

6 Limitations

Work for this project was performed for the City of Shelton (Client), and this report 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 report does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client 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.

Please refer to Appendix B titled "Report Limitations and Guidelines for Use" for additional information governing the use of this report.

TABLES

Table 1. Monitoring Well Construction Details
Project No. AS150074, City of Shelton, C Street Landfill, Shelton, WA

		AMW-1	AMW-2	AMW-3	AMW-4
Well Construction Data					
Ecology Tag ID		BKC 045	BKC 047	BKC 048	BKC 046
Ground Surface Elevation (ft NAVD88)		153.48	152.65	170.4	151.23
Top of Monument Elevation (ft NAVD88)		156.76	155.74	173.48	153.96
Casing Stickup Height (ft above ground)		2.42	2.89	2.54	2.45
TOC Elevation (ft NAVD88)		155.9	155.54	172.94	153.68
Total Well Depth (ft bgs)		105	105	120	105
Bottom of Well Elevation (ft NAVD88)		48.48	47.65	50.40	46.23
Top of Screen Elevation (ft NAVD88)		78.48	76.65	80.40	77.23
Bottom of Screen Elevation (ft NAVD88)		58.48	56.65	60.40	57.23
Measured Groundwater Elevations[1]					
1/12/2018	Depth to Water (ft bTOC)	83.07	83.3	100.10	81.22
	Elevation (ft NAVD88)	72.83	72.24	72.84	72.46
12/20/2018	Depth to Water (ft bTOM)	89.13	88.52	104.97	86.56
	Elevation (ft NAVD88)	67.63	67.22	68.51	67.40
4/1/2019	Depth to Water (ft bTOM)	87.65	87.17	104.43	85.19
	Elevation (ft NAVD88)	69.11	68.57	69.05	68.77
7/1/2019	Depth to Water (ft bTOM)	91.53	90.95	107.75	88.98
	Elevation (ft NAVD88)	65.23	64.79	65.73	64.98
8/3/2023	Depth to Water (ft bTOC)	90.85	83.22	92.8	84.99
	Elevation (ft NAVD88)	65.05	72.68	63.10	70.91
2/6/2024	Depth to Water (ft bTOC)	90.83	83.48	92.81	85.19
	Elevation (ft NAVD88)	64.71	72.06	62.73	70.35
9/23/2024	Depth to Water (ft bTOC)	107.20	100.32	108.70	102.12
	Elevation (ft NAVD88)	65.74	72.62	64.24	70.82
2/4/2025	Depth to Water (ft bTOC)	88.70	81.12	89.62	82.89
	Elevation (ft NAVD88)	64.98	72.56	64.06	70.79

Notes:

[1]Depth to groundwater measured relative to the top of the well monuments in December 2018, April 2019, and July 2019 and relative to the top of the well casings in January 2018, August 2023, February 2024, August 2024, and February 2025.

Surveyed elevations by Professional Land Surveyors, Inc., dated January 12, 2018

ft = feet

NAVD88 = North American Vertical Datum of 1988

bgs = below ground surface

bTOC = below top of well casing, measured from the north edge.

bTOM = below top of well monument, measured from the north rim.

Table 2. Analytical Methods, Sample Containers, Preservation, and Holding Time

Project No. AS150074, C Street Landfill, Shelton, 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						

Notes:

ug/L – microgram per liter

MRL – method reporting limit

MDL – method detection limit

CAS – Chemical Abstracts Service (CAS) Registry Number

Table 3. Measurement Quality Objectives (MQOs) for Groundwater Samples

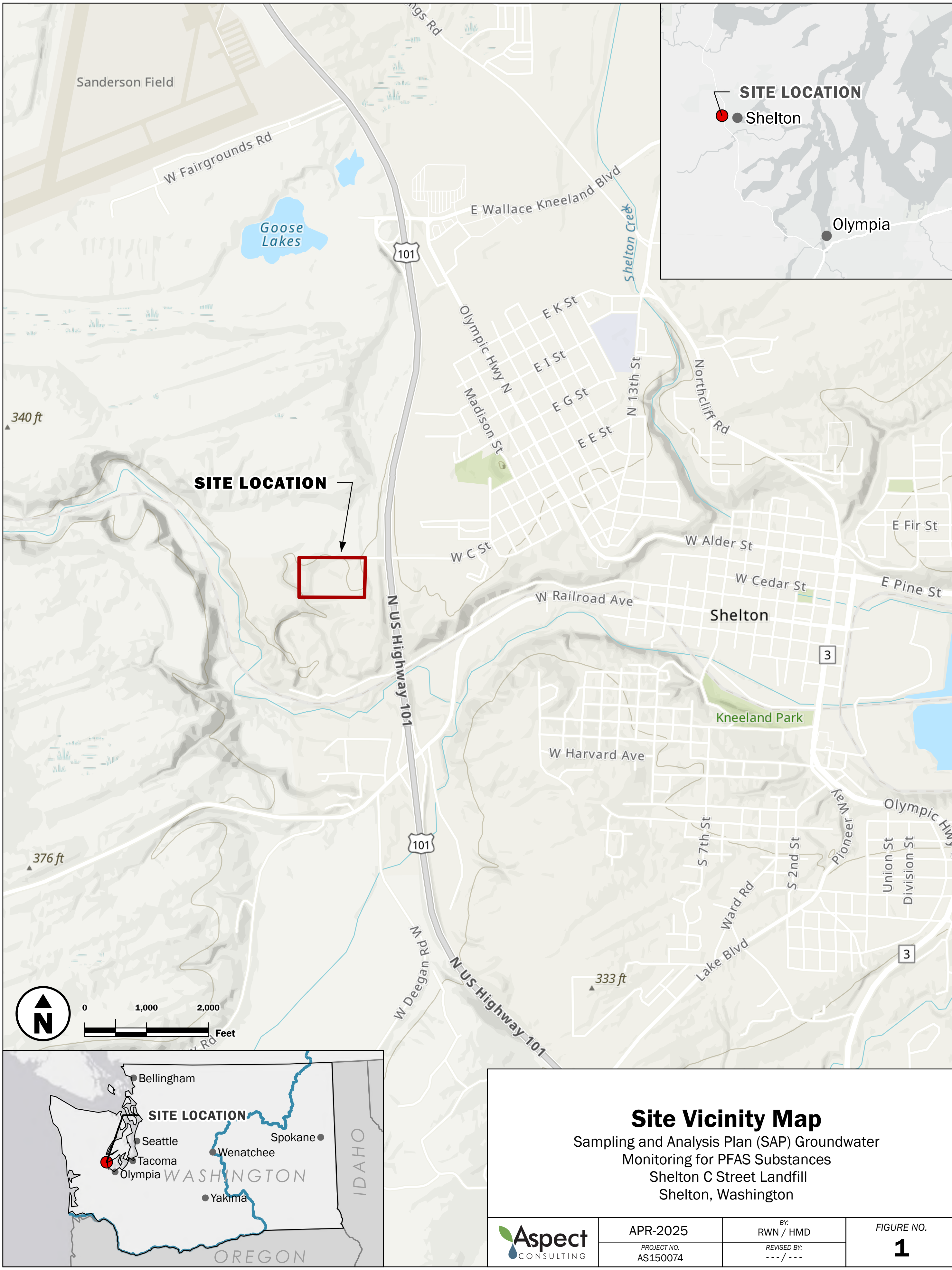
Project No. AS150074, C Street Landfill, Shelton, Washington

Analyte Name	CAS Number	Screening Level[1] (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	4.0E-03	2.00E-03	5.00E-04	70 - 150	30	40 - 130
Perfluorononanoic acid (PFNA)	375-95-1	1.0E-02	2.00E-03	5.00E-04	70 - 150	30	40 - 130
Perfluorodecanoic acid (PFDA)	335-76-2	3.2E-05	2.00E-03	5.00E-04	70 - 140	30	40 - 130
Perfluorobutanesulfonic acid (PFBS)	375-73-5	4.8E+00	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	4.0E-03	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 (G	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:

CAS – Chemical Abstract Service
ug/L – microgram per liter
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.
Red text indicates a screening level that is lower than the MRL and MDL.
[1]Washington State Model Toxics Control Act (MTCA) Groundwater Cleanup Levels for PFAS using Method B for potable groundwater.

FIGURES

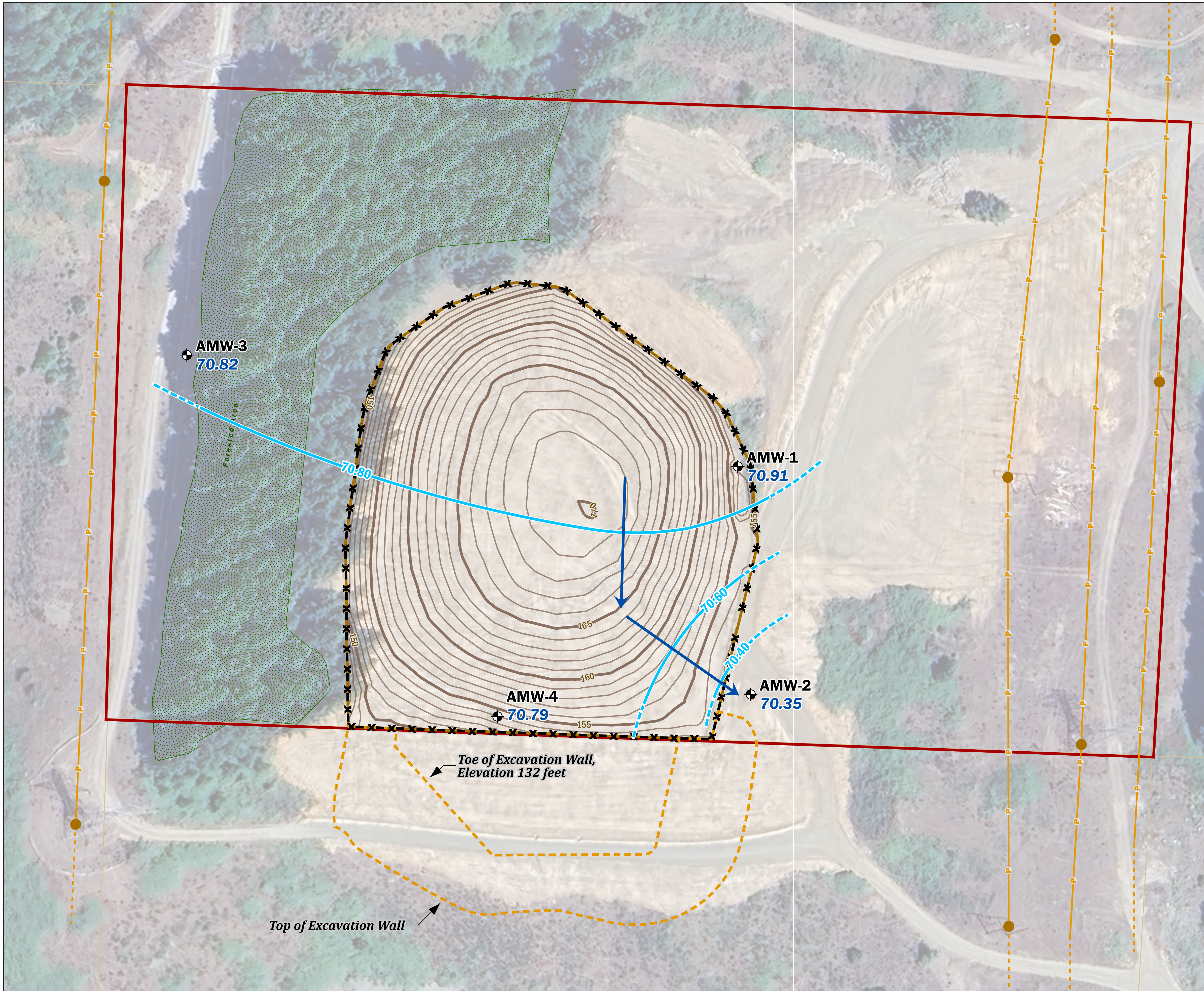


Site Vicinity Map

Sampling and Analysis Plan (SAP) Groundwater Monitoring for PFAS Substances
Shelton C Street Landfill
Shelton, Washington

Aspect CONSULTING	APR-2025	BY: RWN / HMD	FIGURE NO.
	PROJECT NO. AS150074	REVISED BY: - - - / - - -	1

Data source credits: None || Basemap Service Layer Credits: Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, WA State Parks GIS, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USFWS, Esri, HERE, Garmin, USGS, EPA, NPS



Compliance Groundwater Monitoring Well
Transmission Tower
Transmission Line
Chain Link Fence
Landfill Cap
Extent Landfill Waste Excavation South Property
Subject Property
Forested Area
Topography Contours 5 ft
Topography Contours 1 ft
Mason County Tax Parcel

Notes:
- *All site feature locations are approximate.*
- *Topographic contours from PLS Survey October 2017.*
- *Aerial imagery from July 2023 Google Satellite Imagery.*
- *Groundwater elevation from February 2025*

N

0 100 200
Feet

Monitoring Well Network

PFAS Sampling and Analysis Plan
Shelton C Street Landfill
Shelton, Washington

Aspect CONSULTING

APR-2025	BY: RWN / HMD	FIGURE NO.
PROJECT NO. AS150074	REVISED BY: - - - / - - -	2

Basemap Layer Credits || Google Satellite: © OpenStreetMap (and) contributors, CC-BY-SA

GIS Path: G:\projects\SheltonCStreetLandfill_150074\SheltonCStreetLandfill_150074.aprx || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 4/4/2025 || User: haley.duran || Print Date: 4/4/2025

APPENDIX A

Field Forms and Daily PFAS Sampling Checklist

Attachment A: 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 (e.g., LDPE tubing, Ziploc® bags)
- ☐ 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: ____

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Field Team Leader Name (Print): ___________________________

Field Team Leader Signature: ______________________________

Date/Time: ____________________________