LANDAU ASSOCIATES

PFAS SAMPLING AND ANALYSIS PLAN

West Olympia Commercial Property
Olympia, Washington

November 14, 2024

Prepared for

City of Olympia
P.O. Box 1967
Olympia, Washington

PFAS SAMPLING AND ANALYSIS PLAN
West Olympia Commercial Property
1305 Cooper Point Road Southwest
Olympia, Washington

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Project Coordinator: tmh

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LIST OF ABBREVIATIONS AND ACRONYMS

City .... City of Olympia
dCAP .... draft cleanup action plan
DI .... deionized
DQIs .... data quality indicators
DQOs .... data quality objectives
Ecology .... Washington State Department of Ecology
Enthalpy .... Enthalpy Analytical
EPA .... US Environmental Protection Agency
FS .... feasibility study
Landau .... Landau Associates
MQOs .... measurement quality objectives
NFG .... National Functional Guidelines
PFAS .... per- and polyfluoroalkyl substances
PM .... Project Manager
RPD .... relative percent difference
Site .... former West Olympia landfill at 1305 Cooper Point Road Southwest
SAP .... Sampling and Analysis Plan
QA .... quality assurance
QC .... quality control
WOCP .... West Olympia Commercial Property

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1.0 INTRODUCTION

This document presents a per- and polyfluoroalkyl substances (PFAS) Sampling and Analysis Plan (SAP) for the City of Olympia's (City's) former West Olympia landfill (Site). The Site is located at 1305 Cooper Point Road Southwest in Olympia, Washington (Washington State Department of Ecology [Ecology] Facility/Site Identification [ID] Number [No.] 1425; Ecology Cleanup Site ID No. 4807). A vicinity map is provided on Figure 1. The City intends to sell its real property, referred to hereafter as the "West Olympia Commercial Property (WOCP)," for private development.

The City has conducted investigations at the Site to characterize the environmental conditions documented in the Ecology-approved (Ecology 2019) remedial investigation report (GEI/Landau 2019a) and addendum (GEI/Landau 2019b). The City also conducted a feasibility study (FS) for evaluation and selection of cleanup action alternatives described in the Ecology-approved (Ecology 2020) FS report (Landau 2020) and prepared a draft cleanup action plan (Landau 2024; dCAP). Prior to finalization of the dCAP, Ecology has required additional groundwater samples be collected for PFAS. Investigation activities and identification of cleanup action at the Site is occurring pursuant to Agreed Order No. DE 13797 between Ecology and the City.

The purpose of this PFAS SAP is to document the presence of potential PFAS contamination at the Site as required by Ecology per the letter dated May 6, 2024 (Ecology 2024a). The scope of this SAP includes collecting groundwater samples from 3 monitoring wells: one upgradient well (LAI-MW-1), and two downgradient wells as required by Ecology (LAI-1 and LAI-MW-2). Site monitoring wells and wells selected for PFAS monitoring are shown on Figure 2.

This document describes the plans and procedures for sampling as well as quality assurance (QA) and quality control (QC) requirements specifically for PFAS. The PFAS procedures described in this report were developed using the June 2023 Washington State Department of Ecology *Guidance for Investigating and Remediating PFAS Contamination in Washington State* (Ecology 2023).

2.0 PROJECT TEAM ORGANIZATION AND RESPONSIBILITIES

The specific roles, activities, and responsibilities of project participants are described in Table 1. Before field work commences, project participants listed in Table 1 will receive a copy of the final approved SAP. The City of Olympia has the primary responsibility for managing the work completed at the Site. Landau is the primary consultant for management and execution of this PFAS sampling event. Data shall undergo an independent data quality review, performed by a person not involved in the planning or sampling. The data quality review team is in a separate organization structure than the project team within Landau. Enthalpy Analytical (Enthalpy) will perform the laboratory chemical analysis of groundwater.

Table 1. Project Team Roles and Responsibilities

Title/Role	Name	Organization	Responsibilities
City of Olympia Project Manager	Jesse Barham	City	Manages the Project for City of Olympia.
Ecology Project Manager	John Pearch	Ecology	Oversees the Project on behalf of the Washington State Department of Ecology.
Consultant Project Managers	Sarah Fees	Landau	Supervises and coordinates all work for the Project. These responsibilities include Project planning and execution, scheduling, staffing, data evaluation, report preparation, subcontracts, and managing deliverables.
Quality Assurance Manager	Danille Jorgensen	Landau	Oversees and directs quality assurance reviews for the Project, including laboratory procedures and actions. Coordinates and reviews data validation. Has oversight responsibility for management and integrity of the data.
Data Validator	Kristi Schultz	Landau	Reviews laboratory analytical data and provides data validation. Reports directly to Landau Quality Assurance Manager.
Field Lead	Qualified field personnel	Landau	Leads and coordinates field activities, including documentation, sampling, and sample handling. Reports directly to the Consultant Project Managers (PM).
Health and Safety Manager	Christine Kimmel	Landau	Responsible for review and implementation of the Project HASP.
Field Equipment Manager	Ken Reid	Landau	Ensures equipment is properly maintained and in good condition for Project use.
Environmental, Laboratory Project Manager(s)	Emily Uebelhoer	Enthalpy (El Dorado Hills, CA)	Manages laboratory analysis and reporting, including supervising in-house chain of custody and scheduling sample analyses within required holding times; oversees data review and preparation of laboratory reports and electronic data deliverables.

3.0 GROUNDWATER MONITORING

This section discusses the planned one-time groundwater monitoring procedures and specific PFAS sampling considerations. Groundwater samples will be collected from the three monitoring wells (LAI-MW-2, LAI-1, and LAI-MW-1) and appropriate field quality control samples. All samples will be analyzed for the standard list of 40 PFAS compounds using US Environmental Protection Agency (EPA) Method 1633 (EPA 2024).

3.1 Pre-Sampling Considerations

Given the widespread presence of fluoropolymers, the low laboratory PFAS detection levels, and the high cost for PFAS sample analysis, special care will be taken during sampling for PFAS compounds to avoid cross-contamination of samples and potential compromise of data quality. Field staff will follow Landau's PFAS Sampling Guidance (Appendix A) to identify methods to prevent cross-contamination of PFAS samples.

Prior to the start of sampling, field equipment will be screened to determine if the materials that will be used are confirmed to be PFAS-free. Rental and non-disposable equipment will be decontaminated using Alconox® and laboratory-supplied PFAS-free water before sampling, in between sampling locations, and after conclusion of sampling activities. Field staff will fill out a PFAS checklist (Appendix A) each data of sampling.

3.2 Groundwater Sampling

Groundwater sampling will be conducted following Landau's low-flow sampling SOP (Appendix B) along with PFAS specific sampling guidance (Appendix A). Water levels will be measured in each monitoring well prior to sampling. Monitoring wells LAI-MW-2, LAI-1 and LAI-MW-1 will be sampled using PFAS-free bladder pump by low-flow sampling techniques. Samples will be collected using single-use disposable downhole tubing and a submersible bladder pump. The bladder pump will be attached to an air compressor (or other source of compressed gas) and a variable speed controller with the pump intake set at the approximate center of the well screen. Non-dedicated and non-disposable equipment will be decontaminated between wells and new bladders will be used at each sampling location. The well will be purged at a rate of less than 0.5 liters per minute (L/min) and with drawdown of less than 4 inches (0.3 ft) during purging. Field parameters (pH, dissolved oxygen, oxidation reduction potential, conductivity, and turbidity) will be measured using a water quality meter with a flow-through cell. Purging will continue until field parameters become stable for three successive readings. The three successive readings should be within +/- 3 percent for temperature, +/- 3 percent for conductivity, +/- 10 percent for DO, +/- 10 millivolts for ORP, and +/- 10 percent for turbidity. If one or more of the readings have not stabilized within 30 minutes, samples will be collected, and the unstable readings will be noted on the sampling form. Following well purging, the flow-through cell will be disconnected, and groundwater samples will be collected in laboratory-provided containers. A PFAS Shake Test (see Appendix A) will also be conducted at each monitoring well location. Laboratory containers for PFAS analysis are described in Table 2.

One field duplicate will be collected during the sampling and analyzed for the same analytes as the parent sample. The field duplicate will be collected by splitting the water approximately equally between parent and duplicate containers for each analysis. In addition, one equipment rinse blank and one field blank will be collected. The field blank sample will be collected by pumping lab prepared PFAS-free deionized (DI) water into sample bottles using new tubing. The equipment rinse blank will be collected by pouring PFAS-free DI water over decontaminated reusable sampling equipment (i.e., water level indicator and bladder pump housing) into sample bottles.

Sample containers will be labeled as described in Section 3.3. Containers will be placed into a cooler with ice, and shipped to Enthalpy lab of El Dorado Hills, California, under standard chain-of-custody procedures.

3.3 Sample Labeling

Sample containers will be labeled with the following information at the time of sample collection:

- Project number
- Sample ID number: well name followed by date of sample collection, year, month, and day. For example, a sample collected from LAI-1 on August 1, 2024 would be labeled: LAI-1-20240801.
- Date and time of sampling
- Name(s) of sampling personnel
- Analyses

Field quality control samples will be given fictitious sample ID numbers beginning with a 9 (e.g., MW-900). No indication that the sample is a QC sample will be provided on the sample label or the COC form. A cross-reference of sample ID numbers for duplicates will be clearly recorded on the sample collection form.

3.4 Equipment Decontamination

Equipment that may come in direct contact with potentially contaminated media includes the water level indicator probe and the bladder pump housing. Single-use disposable tubing and bladders will be used to collect groundwater samples. All equipment that directly or indirectly contacts potentially contaminated media will be decontaminated using a phosphate-free, PFAS-free detergent (e.g., Alconox®) solution wash followed by a PFAS-free DI water rinse.

3.5 Waste Management

Purge and decontamination water will be collected into a lidded 5-gallon bucket. The bucket will be transported to DH Environmental, Inc. for coordination of disposal once results are received. Purge water cannot be stored onsite due to security issues at the Site. Disposable investigation derived waste such as paper towels, used nitrile gloves, and other disposables will be collected into a garbage bag and disposed of as municipal waste.

4.0 ANALYTICAL TESTING

Chemical analysis of groundwater collected will consist of PFAS by EPA method 1633 (EPA 1633). Target analytes and reporting limits are provided in Table 3. Environmental analytical laboratories performing work under this document shall maintain current accreditation through Ecology's lab accreditation program. The contracted laboratory will implement standard operating procedures based on EPA 1633. Documentation of these SOPs will be kept on file at the contracted laboratory.

Documentation of appropriate method performance for the project target compounds will be available from the selected laboratory and will include the criteria for acceptance, rejection, or qualification of data. The laboratory is also required to periodically update method performance data such as control limits and method detection limits.

5.0 QUALITY ASSURANCE

This section establishes QA objectives and functional activities associated with the work being performed under this SAP.

5.1 Data Quality Objectives

Data quality objectives (DQOs) reflect the overall degree of data quality or uncertainty that the decision-maker is willing to accept during decision-making. DQOs are used to specify the quality of the data, usually in terms of precision, bias, representativeness, comparability, and completeness. DQOs apply to the entire measurement system (e.g., sampling locations, methods of collection and handling, field analysis, laboratory analysis). DQOs are used to ensure that environmental data are scientifically valid, defensible, and of an appropriate level of quality given the intended use for the data (EPA 2006). The main DQO for the investigation being performed under this SAP is to collect and analyze a sufficient number of samples to document the presence or absence of PFAS contamination at the Site as required by Ecology (Ecology 2024b), along with achieving the quantitative determinations of the data quality indicators (DQIs) as presented in the next section.

5.2 Data Quality Indicators

DQIs are used to establish quality objectives and are discussed in detailed below. A summary of DQIs and their associated measurement quality objectives (MQOs) is presented in Table 4.

Precision

Precision is a measure of variability in the results of replicate measurements due to random error (Ecology 2016). Precision is best expressed in terms of the standard deviation or relative percent difference (RPD). QC sample types that can be used to evaluate precision include field and laboratory duplicates, matrix spike duplicates, and laboratory control sample duplicates. The precision of duplicate measurements will be expressed as an RPD, which is calculated by dividing the absolute value of the difference of the two measurements by the average of the two measurements and expressing as a percentage.

Field precision will be evaluated by the collection of field duplicates at a frequency of 1 in 10 samples and will be screened against an RPD of 40 percent for aqueous samples.

In the laboratory, within-batch precision is measured using replicate sample or QC analyses and is expressed as the RPD between the measurements. The batch-to-batch precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches. Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit (MDL), where the percent error increases. Laboratory precision will be matrix spikes and their duplicates; and initial precision and recovery (IPR), ongoing precision and recovery (OPR), and low-level precision and recovery samples (LLOPR).

The formula for calculation of the RPD is shown below and is used to determine the precision between two values.

Relative Percent Difference = [(ABS (R1 – R2)) / ((R1 + R2) / 2)] x 100

Where:
ABS = Absolute difference between values
R1 = first measurement value
R2 = second measurement value (duplicate)

The formula for calculation of RSD is shown below and is used two determine the precision of more than two values

Relative Standard Deviation = (100 * s)/x

Where:
S = sample standard deviation
x = mean of results from more than two values.

Accuracy and Bias

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory-fortified blanks, standard reference materials, and standard solutions. Laboratory-fortified (i.e., matrix-spiked) samples are also measured; this indicates the accuracy or bias in the actual sample matrix.

Accuracy is expressed as percent recovery (%R) of the measured value, relative to the true or expected value. If a measurement process produces results whose mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories use several QC measures to infer analytical bias, including systematic analysis of method blanks, and laboratory control samples. Because bias can be positive or negative, and because several types of bias can occur simultaneously, either the net, or total, bias can be evaluated in a measurement.

Laboratory accuracy will be evaluated against performance acceptance criteria for the recoveries of surrogates and matrix spikes, as well OPR and LLOPR samples.

Accuracy can be expressed as a percentage of the true or reference value, or as a %R in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is shown below.

Percent Recovery = [(SSR – SR) / SA] x 100

Where:
SSR = Spiked sample result

SR = Sample result
SA = Spike added

Representativeness

Representativeness is an indicator of how accurately a result reflects the desired characteristic(s) of a defined population, accounting for both temporal and spatial variability (Ecology 2016). Representativeness qualitatively describes how well the analytical data characterize an area of concern. Representativeness is largely determined by the sampling design; analytical parameters for use in its evaluation include method-specified holding times and preservation requirements, and matrix heterogeneity.

Comparability

Comparability is the "degree of confidence with which one data set can be compared to another" (Ecology 2016). QC procedures and MQOs, as stated in this SAP, will provide for measurements that are consistent and representative of the media and conditions measured.

Completeness

Completeness is a measure of "the amount of valid data obtained from a measurement system compared to the amount that could be expected to be obtained under normal conditions" (EPA 2009). Field completeness is calculated as the number of actual samples collected divided by the number of planned samples. Analytical completeness is calculated as the number of valid data points divided by the total number of data points requested. Data points are considered invalid if they are rejected during data validation. The data validation approach for this project is provided in Section 6.0. The completeness objectives for this project are 95% for both field and analytical.

Sensitivity

Sensitivity is the capability of a method or an instrument to discern the difference between very small amounts of a substance. For the purposes of this project, sensitivity is the lowest concentration that can be accurately detected by the analytical method. Target reporting limits (RLs) are provided in Table 3.

6.0 DATA EVALUATION

Upon receipt of laboratory data, data will be verified and validated to determine if the results are acceptable and meet the quality objectives as described in Section 5.0.

Sample collection forms and field notes will be reviewed by the PM or designee and placed in the electronic Project files. Field data will be entered into an Excel spreadsheet (or alternate software) and verified to determine that entered data are correct and without omissions and errors.

Laboratory data will be provided as an abbreviated Level 4 report or a Level 4 report, transmitted as a pdf, and an electronic data deliverable in Landau specified format. Abbreviated Level 4 data packages include all elements of Level 2 reports along with instrument-related QC forms, but do not include raw data.

Data will undergo a Stage 2B data verification and validation, in accordance with applicable portions of the National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (EPA 2020), Module 6: Data Validation Procedure for PFAS (DoD 2022), Guidance for Labelling Externally Validated Data (EPA 2009) the analytical method, and Landau SOPs. Data validation will be performed by Landau and will include the elements listed below. Raw data is not reviewed during Stage 2B validation.

- Verification that the laboratory data package contains all necessary documentation (including COC records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related QC data, and QC acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were conducted.
- Evaluation of RLs compared to target RLs specified in this QAPP
- Evaluation of sample holding times.
- Evaluation of field QC samples.
- Evaluation of sample and extract dilution and reanalysis.
- Evaluation of QC data compared to acceptance criteria (including method blanks; laboratory duplicate and/or replicate results; surrogates; ion ratios; extracted internal standard (EIS); non-extracted internal standard (NIS), bile salt interference check, and qualitative identification standard; sequence and preparation logs; instrument performance check summary; initial calibration, continuing calibration verification, and instrument sensitivity checks, and instrument blanks.

Analytical data may be qualified based on the data validation review. Qualifiers will be consistent with applicable EPA national functional guidelines and will be used to provide data users with an estimate of the level of uncertainty associated with the qualified result. Data validation results will be evaluated with respect to assigned qualifiers to determine any data usability issues.

The following qualifiers may be assigned during the data validation process:

J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the result may be biased high.
J–	The result is an estimated quantity, but the result may be biased low.
NJ	The analyte has been “tentatively identified” or “presumptively identified” as present and the associated numerical value is the estimated concentration in the sample.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
UJ	The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

The objectives, evaluations, and actions employed during the data validation process will be guided by EPA national functional guidelines. Laboratories will be permitted to provide CLP-like forms in lieu of true CLP forms. The data validation criteria will not strictly adhere to these guidelines but will also take into consideration method criteria for preservation and holding times; laboratory-specified criteria for surrogate, laboratory control samples, laboratory duplicates, and matrix spikes; and the data validator’s professional judgment.

Data qualification arising from data validation activities will be documented in validation worksheets and as qualifiers in data tables.

7.0 REPORTING

Following data evaluation, a technical memorandum will be prepared describing the field activities and tabulating results of the PFAS analysis. Results will be compared to Method B PFAS cleanup levels presented in Table 3. The technical memorandum will include a summary of data validation and any variations to the procedures described in this SAP. Environmental data collected will be submitted to Ecology's Environmental Information Management System when this technical memorandum is submitted to Ecology.

8.0 USE OF THIS REPORT

This SAP has been prepared for the exclusive use of the City of Olympia and Ecology for specific application to the West Olympia Commercial Property. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau, shall be at the user's sole risk. Landau warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

9.0 REFERENCES

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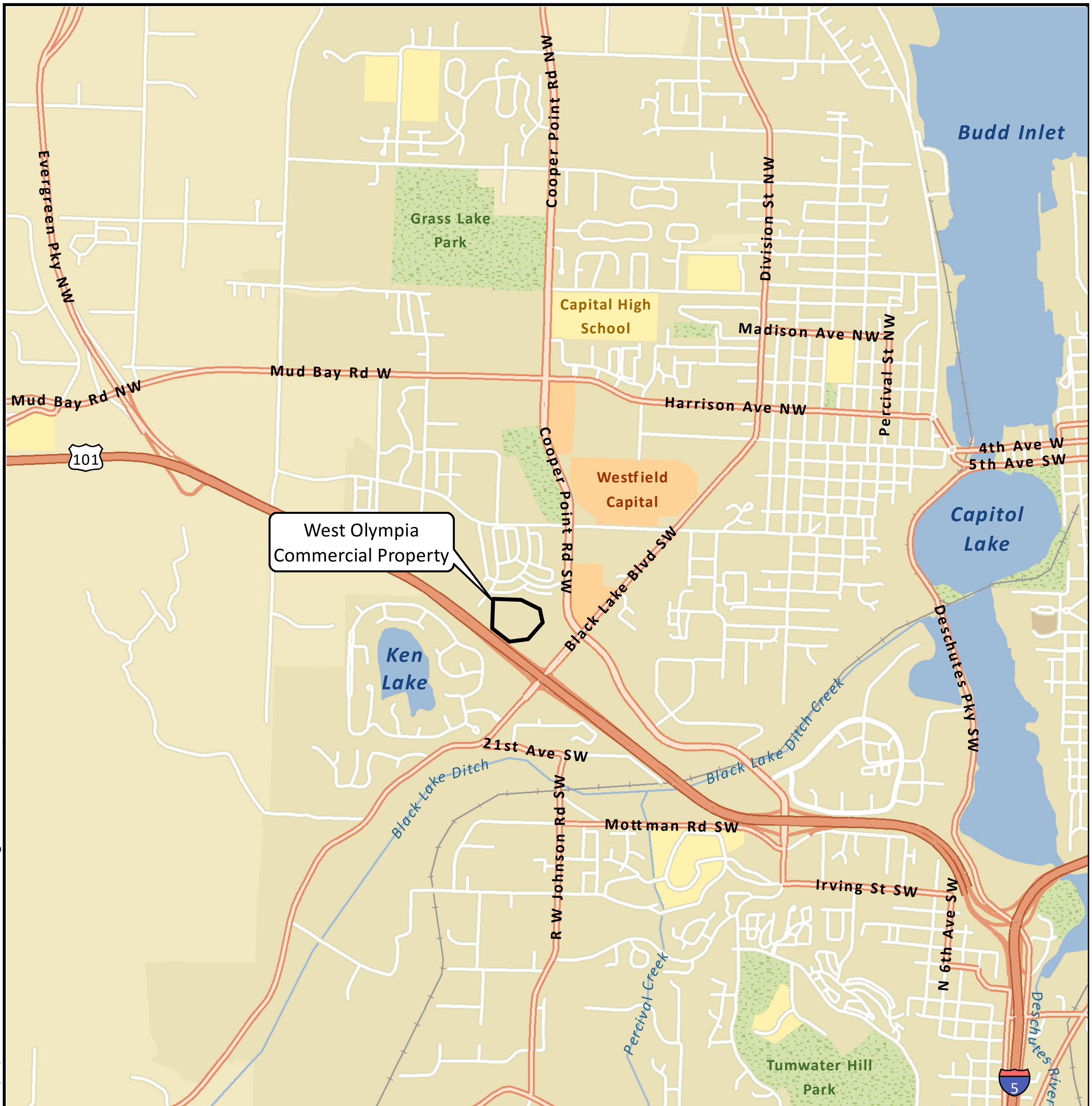

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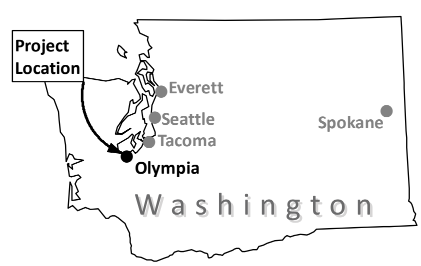

Data Source: Esri.

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LANDAU ASSOCIATES

West Olympia Commercial Property Olympia, Washington	**Vicinity Map**	Figure 1

Legend

- Existing Monitoring Well
- Well Selected for PFAS Monitoring
- Approximate Extent of Waste
- Subject Property

0 200 400

Scale in Feet

Notes

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Thurston County GIS.

West Olympia Commercial Property Olympia, Washington	PFAS Monitoring Plan	Figure 2

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Table 2
Containers, Preservation, Holding Times
PFAS Sampling and Analysis Plan
West Olympia Landfill

Method	Matrix	Minimum Volume	Container	Preservative	Holding Time
EPA 1633	Groundwater	500 mL	500-mL certified clean PFAS-free HDPE bottle with linerless HDPE or polypropylene caps	Cool to 0°–6°C time of collection to lab shipment, dark; ≤-20°C within 48 hrs until sample preparation	90 days if stored at ≤-20°C, dark; 28 days if stored at 0-6°C

Abbreviations and Acronyms:

°C = degrees Celsius
EPA = US Environmental Protection Agency
HDPE = high-density polyethylene
hrs = hours
lab = laboratory
mL = milliliter
PFAS = per- and polyfluoroalkyl substances

Table 3
Groundwater Reporting Limits and Cleanup Levels
PFAS Sampling and Analysis Plan
West Olympia Landfill

Analyte	Method Detection Limit (ng/L)	Reporting Limit (ng/L)	Cleanup Level (a) (ng/L)
PFAS by EPA 1633			
11Cl-PF3OUdS	1.75	6	NL
3:3FTCA	1.12	8	NL
4:2FTS	0.722	6	NL
5:3FTCA	5.33	40	NL
6:2FTS	1.28	6.07	NL
7:3FTCA	3.32	40	NL
8:2FTS	2.85	6.14	NL
9Cl-PF3ONS	1.86	6.24	NL
ADONA	1.44	6.32	NL
EtFOSA	0.688	1.6	NL
EtFOSAA	0.488	1.6	NL
EtFOSE	2.94	16	NL
HFPO-DA	2.31	6.68	10
MeFOSA	0.965	1.6	NL
MeFOSAA	0.606	1.6	NL
MeFOSE	2.44	16	NL
NFDHA	1.85	3.2	NL
PFBA	1.05	6.4	8,000
PFBS	0.502	1.42	4,800
PFDA	0.477	1.6	NL
PFDoA	0.276	1.6	NL
PFDoS	0.759	1.55	NL
PFDS	0.687	1.54	NL
PFEESA	0.49	2.85	NL
PFHpA	0.294	1.6	NL
PFHpS	0.506	1.52	NL
PFHxA	0.364	1.6	8,000
PFHxS	0.631	1.46	10
PFMBA	0.572	3.2	NL
PFMPA	0.445	3.2	NL
PFNA	0.232	1.6	10
PFNS	0.723	1.54	NL
PFOA	0.521	1.6	4
PFOS	1.36	1.49	4
PFOSA	0.452	1.6	NL
PFPeA	0.245	3.2	NL
PFPeS	0.3	1.5	NL
PFTeDA	0.204	1.6	NL
PFTrDA	0.225	1.6	NL
PFUnA	0.459	1.6	NL

Table 3
Groundwater Reporting Limits and Cleanup Levels
PFAS Sampling and Analysis Plan
West Olympia Landfill

Notes:

a) Method B Cleanup Levels from the Washington State Department of Ecology's Cleanup Levels and Risk Calculation (CLARC) Table, dated July 25, 2024.

Abbreviations and Acronyms:

EPA = US Environmental Protection Agency
ng/L = nanograms per liter
NL = not listed
PFAS = per- and polyfluoroalkyl substances

Table 4
Measurement Quality Objectives
PFAS Sampling and Analysis Plan
West Olympia Landfill

Parameter	MQO	Frequency
Field Duplicate	≤20% RPD	1/10 primary samples
Equipment Blank	No analytes detected >½ RL	1/event per piece of sampling equipment
Field Blank	No analytes detected >½ RL	1/event
Matrix Spike/Matrix Spike Duplicate	Laboratory Limits (recovery and RPD)	1/batch
Method Blank	No analytes detected >½ RL	1/batch
Ongoing Precision and Recovery (OPR) and Low-level OPR	EPA 1633 Table 5	1/batch
Surrogate Standards (% Recovery)	EPA 1633 Table 6	All samples
Method Detection Limit	0.2 - 5.3 ng/L (see Table 3)	All samples

Abbreviations and Acronyms:

% = percent
EPA = US Environmental Protection Agency
MQO = measurement quality objectives
ng/L = nanograms per liter
RL = reporting limit
RPD = relative percent difference

APPENDIX A

LANDAU ASSOCIATES PFAS SAMPLING PROCEDURES

Table 1. Sampling Equipment and Material Selection

General Materials Considerations

Allowable	Prohibited
• High-density polyethylene (HDPE) • Low-density polyethylene (LDPE) tubing • Polypropylene • Silicone • Stainless steel • Natural rubber • Nylon, such as nylon cable ties • Uncoated metal springs • Acetate • Glass bottles or containers • Powderless nitrile gloves • Regular wet ice • LDPE bags such as Ziploc® may be used if they do not come into direct contact with the sample media (Category 2)	• Polytetrafluoroethylene (PTFE); Teflon® and Hostaflon® • Polyvinylidene fluoride (PVDF); Kynar® • Polychlorotrifluoroethylene (PCTFE); Neoflon® • Ethylene-tetrafluoroethylene (ETFE); Tefzel® • Fluorinated ethylene propylene (FEP); Teflon®, Hostaflon®, Neoflon® • Perfluoroalkoxy polymer (FAP) • Perfluoropolyethers (PFPE) • Fluorocarbon rubber (FKM); Viton ® • Side-chain fluorinated polymers such as fluorinated acrylates, methacrylate, urethane, and oxetane polymers

Field Documentation

Allowable	Potentially Allowable	Prohibited
• Loose paper (non-waterproof, non-recycled) • Rite in the Rain® notebooks (with a manufacture date after 2021) • Aluminum, polypropylene, or Masonite field clipboards • Ballpoint pens, pencils, and Fine or Ultra-Fine Point Sharpie® markers	• Other plastic clipboards, binders • Other spiral hard cover notebooks • Post-It® Notes, and other waterproof field books • Other markers	• Clipboards coated with PFAS, • Notebooks made with PFAS-treated paper • PFAS-treated loose paper • PFAS-treated adhesive paper products

PFAS SAMPLING PROCEDURES

Purpose

This document outlines the procedures for collecting samples for per- and polyfluoroalkyl substances (PFAS). Special care should be taken during sampling for PFAS compounds to avoid cross-contamination and potential compromise of data quality. This document summarizes the general guidance and procedures for collecting PFAS samples.

Applicability

This document applies to Landau field staff collecting samples for PFAS laboratory analysis. Modifications to these procedures may be acceptable on a case-by-case basis and should be approved by the Landau project manager and thoroughly documented.

Pre-Sampling Considerations

Many materials used in the environmental sampling environment can potentially contain PFAS and increase the risk of sample cross-contamination including certain sampling equipment, field clothing and personal protective equipment (PPE), sun and biological protection products, personal hygiene and personal care products (PCPs), food packing, other materials, and the environment itself.

Prior to the start of sampling, field equipment will be screened to determine if the materials that will be used are confirmed to be PFAS-free in accordance with the requirements in the Equipment and Sampling Materials Selection section of this document. Sampling equipment selection will be documented on the PFAS Sampling Equipment Checklist (attached).

In addition to standard field forms, field staff should also fill out the Daily PFAS Sampling Protocol Checklist (attached) at the start of each day of sampling activities. Copies of the equipment selection and daily protocol checklists, as well as other certification documents confirming sampling equipment do not contain PFAS compounds, will be saved in the project file.

Equipment and Materials Selection

This section provides a detailed overview of the considerations that should be utilized when selecting equipment and materials to be used for PFAS sampling activities. Table 1 provides a summary table that should be referenced during pre-field work planning. Items selected for sampling activities should be documented on the PFAS Sampling Equipment Checklist.

Sampling Equipment Categories

Two scenarios where cross-contamination during sampling may occur are direct contact of the sample media with the sampling supplies and equipment and incidental contamination while a sample container is open. Direct contact of the sample media with supplies and equipment is the most likely pathway for potential cross-contamination.

Equipment associated with sampling can be divided into two main categories:

- **Category 1**: Items and materials that are expected to come into direct contact with the sample media. Items and materials that are made of or known to contain PFAS are prohibited or should otherwise be avoided if possible. An equipment rinse blank (EB) should be collected for all Category 1 equipment to confirm the absence of PFAS cross-contamination (see the Quality Control Samples section of this document).
- **Category 2**: Items and materials that are not expected to come into direct contact with the sample media. Category 2 items and materials have a low risk of resulting in cross-contamination if best practices are used to avoid contact between the PFAS-containing materials and the sample media.

During field preparation, staff should identify which category applies for each piece of sampling equipment on the *PFAS Sampling Equipment Checklist.*

General Materials Information

This section described general information on allowable and prohibited materials that can and cannot be used during PFAS sampling activities. Safety Data Sheets (SDSs) should be obtained and reviewed prior to the start of sampling activities. If "PFAS" or the terms "fluoro" or "halo" are listed in the SDS, the equipment may not be used.

- **Allowable Materials:** Materials that have been screened in PFAS literature to be appropriate for use, as they have little to no potential to introduce cross-contamination into PFAS samples.
- **Prohibited Materials:** Materials known to contain PFAS. If an item containing these materials is expected to come into direct contact with samples (Category 1), the item is prohibited from use. If an alternative for a material listed is unavailable and the specified use of the material is not expected to come into direct contact with the samples (Category 2), discuss the material selection with the Project Manager prior to start of field activities.
- **Potentially Allowable Materials:** These are items that either do not have sufficient research or may have potential for PFAS cross-contamination depending on the manufacturer/source. Items that are listed as "potentially allowable" should be avoided if an "allowable" alternative material is available for use. Materials should be screened before use through collection of a pre-field work blank (WB) to confirm the absence of PFAS cross-contamination (see the Quality Control Samples section of this document). Use of these materials should be discussed with the Project Manager prior to start of field activities.
- **Special Considerations for low-density polyethylene (LDPE):** LDPE does not contain PFAS in the raw material but may contain PFAS cross-contamination from the manufacturing process. Current guidance recommends that LDPE tubing for Category 1 use is "allowable". Current guidance also recommends that LDPE plastic storage bags (i.e. Ziploc®) for Category 2 use, such

as packing of samples into a cooler, is "allowable". The selection of other LDPE sampling equipment should be screened before use and discussed with the Project Manager.

It should also be noted that in response to elevated concerns with PFAS-cross contamination, many materials used in sampling have now been reformulated by manufacturers as "PFAS-free." However, a close review of documentation associated with some of these materials indicates that they are not actually PFAS-free, but only free of select PFAS identified as higher-regulatory risk (such as Perfluorooctanoic acid or Perfluorooctane sulfonate). These materials may contain other PFAS that can degrade into target PFAS of concern. A close review of any material identified as "PFAS-free" by the manufacturer should be conducted prior to use. In addition, the manufacture date of these materials should also be reviewed to ensure that they were made after the materials were reformulated, often in 2022 or 2023.

Sampling Methods

Eating, drinking, and application of PCPs within the sampling environment should be avoided. If application of PCPs such as sunscreen or insect repellent is necessary, the sampler should step away from the sampling area, remove PPE, apply PCPs with well-washed hands, and don powderless nitrile gloves. Food and beverages should also be consumed outside of the sampling area after removing PPE. After eating, wash hands thoroughly and don new PPE. A list of recommended insect repellants and sunscreens is provided in Table 1.

Sampling Sequence

If previous site PFAS data is available, the sampling sequence should start in areas with the least known amount of contamination and move into more contaminated areas (for groundwater samples, these are often from "upgradient" wells). If sampling is to include multiple types of water media from a site, the samples should be collected in the following order: drinking water, surface water, and groundwater.

If the sampling event is the first time the equipment setup has been used, two EB samples should be collected – one prior to the collection of any other samples and one immediately following the collection of a sample anticipated to contain higher concentrations of PFAS, following appropriate decontamination of sampling equipment. If the equipment has previously been used without equipment blank detections, only the latter EB sample is required.

Sample Container Handling

Sample containers used for sampling should not be stored on or come into contact with carpets and car interiors. The sampling container cap or lid should never be placed on any surface unless it is PFAS-free. The sampling containers cap or lid must never be placed directly on the ground.

Shake Testing

If surface, groundwater, or wastewater samples are being collected and the PFAS source is related to firefighting foams or aqueous film-forming foam (AFFF), conduct a shake test by collecting small amount of sample media in a small, single use vial. Shake the vial for approximately five seconds and record if foaming is identified, ensuring to document the results of any foaming on the laboratory chain of custody to ensure that the laboratory identifies that sample for special treatment such as higher-dilution runs.

Quality Control Samples

Field quality control (QC) samples are used to evaluate the field equipment and supplies and assess the possibility of cross-contamination during sampling, transport, and storage of samples. Types of field quality control samples that may be collected during PFAS sampling are listed below. The frequency of QC and acceptance criteria for field QC samples should be specified in the project QAPP, SAP, or Work Plan.

- The **field duplicate (FD)** is a replicate sample collected in the field and submitted to the laboratory as two distinct samples. The purpose of the FD is to verify the precision of field and laboratory activities. The FD is a sample collected at the sampling location at the same time and under identical circumstances as the corresponding field sample and handled similarly throughout field and laboratory procedures.
- The **equipment rinse blank (EB)** should be collected by passing PFAS-free water over or through decontaminated field sampling equipment before collecting samples to assess the adequacy of the decontamination process and/or to evaluate potential contamination from the equipment used during sampling.
- The **field blank (FB)** is prepared in the laboratory by placing an aliquot of PFAS-free reagent water in a sample container. The field blank is treated as a regular sample in all respects, including shipment to the sampling site, exposure to sampling site conditions, transfer to a clean sample container in the field, storage, preservation, and all analytical procedures. The FB should be collected daily where the risk for PFAS sample cross-contamination is the most likely (e.g. before the first sample is collected in the morning, before the first sample is collected after lunch, or where the potential for cross-contamination is determined to be the highest). The purpose of the FB is to determine if method analytes or other interferences are present in the field environment.

Published guidance also lists two other types of QC samples that could be collected during a PFAS sampling event. The applicability of these samples should be discussed with the Project Manager.

- The **trip blank (TB)** is a bottle of PFAS-free water that should be prepared in the laboratory, travel from the laboratory to the site, and be transported back to the laboratory without having been exposed to any sampling procedures. Typically, a TB is used for volatile compounds, but it may be recommended for shorter chain PFAS which are volatile in their nonionic forms in solvents.
- The **pre-field work blanks (WB)** should be collected to screen if any piece of sampling equipment not certified to be PFAS-free may be a potential source of PFAS compounds. The WB should be collected by passing PFAS-free water over or through the field equipment.

Decontamination Procedures

Rental and non-disposable equipment must be decontaminated using laboratory supplied PFAS-free water and a PFAS-free detergent before sampling, in between sampling locations, and after conclusion of sampling activities. PFAS-free detergents that may be used are Alconox® or Liquinox®. The use of Decon 90® detergent is prohibited.

Two decontamination procedures for non-disposable and non-dedicated sampling equipment are outlined below. The selection of the appropriate method will depend on the size of the piece of equipment.

Scrub and Rinse Method:

1. Spray the equipment with PFAS-free water and PFAS-free detergent, and scrub using a HDPE or PVC brush to remove particulates, if needed.
2. Triple rinse the equipment with PFAS-free water.
3. Contain and store the decontamination water for proper disposal.

Bucket Method:

1. In Bucket #1, wash the equipment with a mixture of PFAS-free water and PFAS-free detergent, and scrub using a HDPE or PVC brush to remove particulates.
2. In Bucket #2, rinse the equipment with PFAS-free water.
3. In Bucket #3, rinse the equipment again with PFAS-free water.
4. Change the decontamination water in between cleanings of different equipment, and in between sampling locations.

References

Ecology. 2023. Guidance for Investigating and Remediating PFAS Contamination in Washington State. Washington State Department of Ecology. Toxics Cleanup Program. Publication No. 22-09-058. June.

EGLE. 2024. General PFAS Sampling Guidance. Michigan Department of Environment, Great Lakes, and Energy. January.

ITRC. 2023. PFAS — Per- and Polyfluoroalkyl Substances Sampling and Analysis. Interstate Technology Regulation Council. September. https://pfas-1.itrcweb.org/11-sampling-and-analytical-methods/

Field Clothing and PPE

Allowable	Potentially Allowable	Prohibited
• Well-laundered (washed at least 6 times) synthetic or 100% cotton clothing • Polyurethane • Polyvinyl chloride (PVC) • Wax-coated fabrics • Rubber • Neoprene • Uncoated Tyvek® • Powderless nitrile gloves • Any boots made of polyurethane and/or PVC	• latex gloves • special gloves required by the project HASP • Tyvek® suits, or clothing that contains Tyvek® or coated Tyvek®	• New or unwashed field clothing • Field clothing recently washed with fabric softeners, fabric protectors, or insect resistant chemicals • Clothing advertised as having waterproof, water-repellant, or dirt and/or stain-resistant characteristics.

Personal Care Products

Allowable Insect Repellents	Allowable Sunscreens
• OFF Deep Woods • Sawyer Permethrin	• Banana Boat Performance Sunscreen Lotion Broad Spectrum SPF 30 • Banana Boat Performance Sunscreen Stick SPF 50 • Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50 • Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30 • Coppertone Sunscreen Stick Kids SPF 55 • L'Oréal Silky Sheer Face Lotion 50+ • Neutrogena Ultra-Sheer Dry-Touch Sunscreen Broad Spectrum SPF 30 • Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70 & Spray Broad Spectrum SPF 30 • Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+

**This is not a complete listing, but a list provided by Michigan's General PFAS Sampling Guidance*

Decontamination Equipment

Allowable	Potentially Allowable	Prohibited
• Laboratory supplied PFAS-free water • Commercially available detergents such as Alconox® or Liquinox® • Cotton cloth or untreated paper towels • HDPE or PVC brushes	Recycled paper towels or chemically treated paper towels are potentially allowed but should be avoided if cotton cloth or untreated paper towels are available.	Decon 90® detergent

Daily PFAS Sampling Protocol Checklist

LANDAU ASSOCIATES

Date ____________ Project Name ____________________ Project Number ________________________

Agreed

Prevent introduction of Prohibited items into the sampling environment ☐

Specific prohibited materials include:
- PTFE (Teflon®), PVDF, PCTFE, ETFE, FEP, FAP, PFPE, FKM
- Clipboards coated with PFAS, or PFAS-treated paper
- New or unwashed clothing
- Clothing washed with fabric softeners or waterproofing, water-repellant, or dirt and/or stain-resistant compounds (ie. Gore-Tex)
- Decon 90® detergent

Follow protocols for handling Personal Care Products and Food & Beverages ☐
- Apply insect repellants and sunscreens outside of the work area.
- Consume food and beverages outside of the work area.
- Wash hands and don new nitrile gloves after handling personal care products and food/beverages.

Follow protocols for Sampling Methods ☐
- Collect samples in sequential order from least to more contaminated areas.
- Handle sample containers to prevent contact with carpets and car interiors.
- Do not place sample container cap/lids on the ground.
- Complete shake test before sample collection.

Follow protocols for Nitrile Glove Use ☐

location.

- Contact with sample containers
- Decon of sampling equipment
- Insertion of anything into the well
- Insertion of silicon tubing into the peri pump
- Completion of monitoring well purging
- Sample collection
- Handling QA/QC samples
- Handling any non-dedicated sampling equip.

Complete daily Decontamination (All tools, field equipment, and rain gear) ☐
- Use Alconox® or Liquinox® and PFAS-free water

Describe any deviations from above list and rationale for deviation:

____

____

____

PFAS Samplers:

Name	Signature

LANDAU ASSOCIATES

PFAS Sampling Equipment Checklist

Project Name ______________________________________ Project No. ________________________________

Client ____ Date/Time _________________________________

SAMPLING EQUIPMENT SELECTION

Category (1 or 2)	Equipment Name	Disposable? (Y or N)	Equipment Source (select one)			Confirmed PFAS-free? (Y or N)	Reusable equipment decontaminated before use? (Y or N)
			Landau owned	Rental	Dedicated		

APPENDIX B

LANDAU ASSOCIATES LOW-FLOW GROUNDWATER SAMPLING PROCEDURES

LOW-FLOW GROUNDWATER SAMPLING PROCEEDURES

Purpose

This document outlines the procedures for collecting groundwater samples using low-flow methods. The goals of collecting groundwater samples using low-flow purging and sampling procedures are to minimize drawdown within the aquifer system, minimize the turbidity of the sample, minimize purge water generation, and improve sampling efficiency. This document summarizes the general procedures for collecting groundwater samples using low-flow methods.

Applicability

This document applies to Landau field staff collecting groundwater samples from permanent monitoring wells using low-flow methods. Modifications to these procedures may be acceptable on a case-by-case basis and should be approved by the Landau project manager and thoroughly documented.

Low-Flow Definition

Low-flow purging is ideally intended to create a drawdown of <0.1 meters (or <0.3 feet) during purging. Typically, flow rates on the order of 0.1 to 0.5 liters per minute (L/min) are used; however, this is dependent on site-specific hydrogeology. The low-flow rate does not necessarily refer to the flow rate of water discharged at surface; water level drawdown provides the best indication of the stress impacted to the aquifer by a given flow rate for a given hydrological situation. Limiting drawdown to <0.1 meters may be difficult to achieve depending on the site-specific hydrogeology, but minimizing drawdown to this extent is the goal.

Personnel Qualifications and Responsibilities

Groundwater sampling will be conducted by Landau field personnel trained in low-flow sampling techniques. All field personnel should have a working knowledge of project documents such as the Sampling and Analysis Plan, Quality Assurance Project Plan, Health and Safety Plan (HASP), etc., and should be briefed by the Landau project manager prior to conducting work at the site.

Equipment

- Project work plan and well location maps
- Field documentation sheets (as listed in Field Documentation section)
- Well logs, well development records, and previous sample collection forms
- Well keys (Landau "key alike" or client keys)

- Bolt cutter (for stuck locks or replacement of others' well locks)
- Extra locks (if replacement is necessary)
- Monument bolt wrench (for tamper-proof bolts, if necessary)
- Replacement bolts and monument replacement seals (for flush mount monument, if necessary)
- Special manhole wrench or lifting bar/hook (if necessary)
- Hand pump or other tools to bail water out of flush-mount monuments
- Water level indicator (100 or 300 feet [ft])
- Alconox
- Tap water
- Distilled or deionized water
- Other decontamination solutions as needed (ex: hexane, methanol, etc.)
- Paper towels
- Personal protective equipment as listed in the project HASP
- Health and safety monitoring equipment as listed in the project HASP
- Pump and tubing (based on pump selection)
- Control box and air compressor or compressed-gas cylinder regulator and hoses (if using bladder pump)
- Water quality meter for field parameter measurements (parameters include temperature, dissolved oxygen, conductivity, pH, and oxidation reduction potential)
- Turbidity meter
- Meter calibration standards
- Flow cell with appropriate diameter for the water quality meter
- 5-gallon buckets to catch purged groundwater
- Medium-sized clip to attach the sample tubing to the flow cell or purge bucket
- Tubing cutters
- In-line filters (if required in the work plan for the site)
- Sample bottles and labels from the analytical laboratory
- Cooler, ice, and Ziploc bags
- Packing tape (if coolers need to be shipped)

Pump and Tubing Selection

Prior to mobilizing to the site, an appropriate pump and tubing setup should be selected based on site characteristics (i.e., depth to water). The following pumps are commonly used for low-flow groundwater sampling:

Bladder Pump—A bladder pump uses compressed air, nitrogen, or carbon dioxide gas to expand and contract a low-density polyethylene bladder contained within the pump housing, which forces water from the well up the tubing to the surface. A bladder pump is appropriate for sampling all groundwater parameters because the compressed gas does not come in contact with the sample. Bladder pumps may be set up to operate at depths of 300 ft or more. Wells greater than 250 ft deep require high-pressure controllers and compressed-gas cylinders to operate. Pumping rates range from 0 to 2 gallons per minute (gpm) but are typically from 0.2 to 0.75 gpm in deeper wells where longer cycles are required. Bladder pumps must be submerged 5 ft or more to operate efficiently.

Peristaltic Pump—A peristaltic pump is a low-volume suction pump that is suitable for sampling most groundwater parameters in wells where the depth to water is less than 20 ft. Because only the tubing goes into the well while the pump remains on the ground surface, wells as small as ½-inch inside diameter can be sampled with a peristaltic pump.

Procedure

The general procedure for conducting low-flow groundwater sampling is as follows:

1. List and prepare all the equipment needed.
2. Order bottles from the lab identified by the project manager approximately 1 week in advance.
3. Look up well screen intervals for wells to be sampled and record on the SCF prior to field mobilization.
4. Calibrate meters to an appropriate standard prior to use.
5. Decontaminate all non-dedicated sampling equipment.
6. Note well security, whether it has been damaged or tampered with, or whether repair or replacement is necessary.
7. Note any odor and/or well pressure changes when removing well cap.
8. Identify the surveyed reference elevation point for the well. The top of the well casing should be marked with a notch cut (or, less preferably, a paint spot) on the highest point on the outside of well casing. (Note surveyors typically survey the top of well casing at the highest point.) If there is no previous mark, use the north side of the well casing.
9. Record the depth to water measured from the reference elevation point on the top of the well casing and record it on the Groundwater Low-Flow Sample Collection Form.
10. If the top of the screen is submerged or well cap is under pressure prior to installing pump or tubing, wait 2 to 5 minutes to take another water level measurement. If the water elevation has not changed after 2 to 5 minutes, it is considered stabilized, and you may continue. If the water level continues to change, then collect a new measurement every 2 to 5 minutes until the level stabilizes. Record the static water level on the Groundwater Low-Flow Sample Collection Form.
11. Typically, the pump intake will be set at the center or slightly above the center of the saturated portion of the well screen interval. However, different intervals may be selected based on site constraints and project manager direction. Slowly and carefully place the intake in the well to minimize excessive mixing of stagnant water in the casing.

12. Start with a low pumping rate and adjust the pumping rate slowly to minimize drawdown during purging and sampling. Water in a well may initially draw down upon the start of pumping; however, drawdown should slow as the head pressure increases on the aquifer, with the eventual goal of remaining stable. Adjust pump rate as needed to achieve a stabilized water level (EPA 2017). Field parameters will be continuously monitored during purging using a flow cell. Parameters such as pH, temperature, conductivity, dissolved oxygen, oxidation-reduction potential, and turbidity will be recorded upon filling the cell flow cell (estimated to be approximately 3 minutes) during purging. Purging of the well will be considered complete when all field parameters become stable for three successive readings. The successive readings should be within +/- 0.1 pH units for pH, +/- 3% for conductivity, and +/- 10% for dissolved oxygen and turbidity. Record purge volume and parameters on Groundwater Low-Flow Sample Collection Form.
13. If a confirmation parameter reading will be recorded, use the shutoff valve to retain the water in the flow cell, then disconnect the flow cell and collect groundwater samples.
14. Follow the project sample plan: collect the samples sensitive to volatilization first (such as volatile organic compounds or gasoline), and field-filtered samples last (such as dissolved metals).
15. If required, collect a final confirmation parameter set, after all sample bottles are filled. Collect and record the confirmation reading by reconnecting the tubing to the flow cell, opening the shutoff valve, and allowing sufficient purge water to enter the flow cell to replace the volume of the water. Record the time of the confirmation reading on the Groundwater Low-Flow Sample Collection Form. Typically, a confirmation parameter set will be collected for wells that are potentially tidally influenced, or where the project manager deems it important to confirm aquifer conditions post sampling. If not specifically requested, the confirmation reading will not be recorded.
16. Record pertinent information requested on the Groundwater Low-Flow Sample Collection Form.
17. Sample should be labeled with the project name, project number, sample number, date and time collected, analysis, and sampler's initials.
18. Duplicate samples will be collected by alternately discharging the sampling pump into duplicate sample bottles. Duplicate samples will be labeled with a unique sample identification and time, which will be noted on the Groundwater Low-Flow Sample Collection Form. Duplicate samples also receive their own Groundwater Low-Flow Sample Collection Form, which should note the sample ID, time, and parent sample ID, and have a record of unique parameter measurements and confirmation parameters, if required.
19. Sample containers will be placed on ice and stored in coolers. Sample custody will be documented on a Chain-of-Custody Form. Periodic well depth verification will be used to provide a check on the integrity of each well.
20. Label and dispose of the purged water according to the site-specified sampling plan.

Field Documentation

The following documentation is required for low-flow sampling:

- Groundwater Low-Flow Sample Collection Form
- Chain-of-Custody Form
- Field Report

An example of each of these forms is included in Attachment A.

Attachment

Attachment A. Field forms

References

ASTM (Vol.04.09) D-6000-96 (or latest version) – "Standard Guide for Presentation of Water-Level Information from Ground-Water Sites."

ASTM (Vol.04.09) D-6089-97 (or latest version) – " Documenting a Ground-Water Sampling Event."

ASTM (Vol.04.09) D-6564-00 (or latest version) – "Field Filtration of Ground-Water Samples."

ASTM (Vol.04.09) D-5903-96 (or latest version) – "Planning and Preparing for a Groundwater Sampling Event"

ASTM (Vol.04.09) D-4448-85a (1992) (or latest version) – "Sampling Groundwater Monitoring Wells."

EPA. 2017. SESD Operating Procedure: Groundwater Sampling SESDPROC-301-R4. US Environmental Protection Agency, Science and Ecosystem Support Division, Athens, Georgia. April 20.

Puls R.W. and Barcelona M.J. 1996. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. EPA/540/S-95/504. April.

LANDAU ASSOCIATES

// GROUNDWATER LOW-FLOW SAMPLE COLLECTION FORM

Project Name: ____________________ Project Number: ____________________
Event: ____________________ Well ID: ____________________
Weather: ____________________ Sample ID: ____________________
Landau Rep.: ____________________ Date: __________ Time: __________

WELL INFORMATION

Screened Interval: Top (ft): ________ Bottom (ft): ________ Well Secure? ☐ No ☐ Yes Damaged? ☐ No ☐ Yes
DTW After Cap Opened (ft): ________ Time: ________ Describe: ____________________
Static DTW (ft): ________ Time: ________ Flow-Thru Cell Vol.: ________ WQM No.: ________
Begin Purge (Date/Time): ________ End Purge (Date/Time): ________ Gallons Purged: ________
Water Disposal: ☐ 55-gal drum ☐ Storage tank ☐ Ground ☐ Other: ________

PURGE DATA

Cell shading indicating purge stabilization is for informational purposes only.

Time	Temp (°C)	DO (mg/L)	Cond (µS/cm)	pH (S.U)	ORP (mV)	Turbidity (NTU)	DTW (ft)	Purge Vol ≥1 flow-thru cell vol.	Comments/ Observations
Stabilization →	± 3%	± 10%	± 3%	± 0.1 units	± 10 mV	± 10%	± 0.00 ft	(Yes/No)	

Sample Description (turbidity, color, odor, sheen): ____________________ Fe^{2+} (mg/L): ________

PUMP AND MATERIAL INFORMATION

Collection Method: ☐ Bailer ☐ Pump Type: ____________________
Material: ☐ Stainless Steel ☐ PVC ☐ Teflon ☐ Polyethylene ☐ Other ☐ Dedicated
Decon Procedure: ☐ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Dedicated
☐ Other (describe sequence): ____________________

CONFIRMATION PARAMETERS (if applicable per Landau Field Manual)

☐ Applicable

Time	Temp (°C)	DO (mg/L)	Cond (µS/cm)	pH (S.U)	ORP (mV)	Turbidity (NTU)	DTW (ft)	Comments/Observations

Scheduled Analysis (Circle/Bold Applicable)							Bottle Information	
							Number	Type
Volatiles:	8260	8260 SIM	8021	524	624			
Semivolatiles:	8270	8270 SIM	8011	625				
Petroleum Hydrocarbons:	NWTPH-HCID	NWTPH-Gx	NWTPH-Dx	NWTPH-Dx SGC				
Total/Dissolved Metals:	6010	6020	200.7	200.8	7471	☐ Field Filtered		
PCBs & Nitroaromatics:	8082	1668	608	8330				
Dioxin-Furans:	1613	8290						
PFAS:	1633	537.1	533	SOP				
Conventionals:	300.0	SM2450C	SM2450D	SM5310C	RSK175			
Other:								

Duplicate or Parent Sample ID: ____________________ ☐ MS/MSD
Comments: ____________________
Signature: ____________________ Date: ____________________

Chain-of-Custody Record

LANDAU ASSOCIATES

- ☐ **North Seattle** (206) 631-8660
- ☐ **Tacoma** (253) 926-2493
- ☐ **Olympia** (360) 791-3178
- ☐ **Spokane** (509) 327-9737
- ☐ **Portland** (503) 542-1080
- ☐ ________

Date ________

Page ______ of ______

Turnaround Time:
Standard ________
Accelerated ________

Project Name ________ Project No. ________

Project Location/Event ________

Sampler's Name ________

Project Contact ________

Send Results To ________

Testing Parameters

Special Handling Requirements:
____

Shipment Method: ________

Stored on ice: Yes / No

Sample I.D.	Date	Time	Matrix	No. of Containers												Observations/Comments

Observations/Comments:

__ Allow water samples to settle, collect aliquot from clear portion ☐

__ NWTPH-Dx - Acid wash cleanup ☐
- Silica gel cleanup ☐

__ Dissolved metal samples were field filtered

Other ________

Relinquished by	**Received by**	**Relinquished by**	**Received by**
Signature ________	Signature ________	Signature ________	Signature ________
Printed Name ________	Printed Name ________	Printed Name ________	Printed Name ________
Company ________	Company ________	Company ________	Company ________
Date ______ Time ______	Date ______ Time ______	Date ______ Time ______	Date ______ Time ______

WHITE COPY - Laboratory **YELLOW COPY - Project File** **PINK COPY - Client Representative**

10/2018

LANDAU ASSOCIATES

Field Report

Project No.: ______________________ Report No.: ________

Client: ______________________ Date: ________

Project Name: ______________________ DPD Permit No.: ________

Location: ______________________

Weather Conditions: ______________________

Prepared By: ______________________

Visitors: ______________________

Unsatisfactory Conditions & Recommended Correction: ______________________

Attachments: ______________________

Signed: ______________________

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