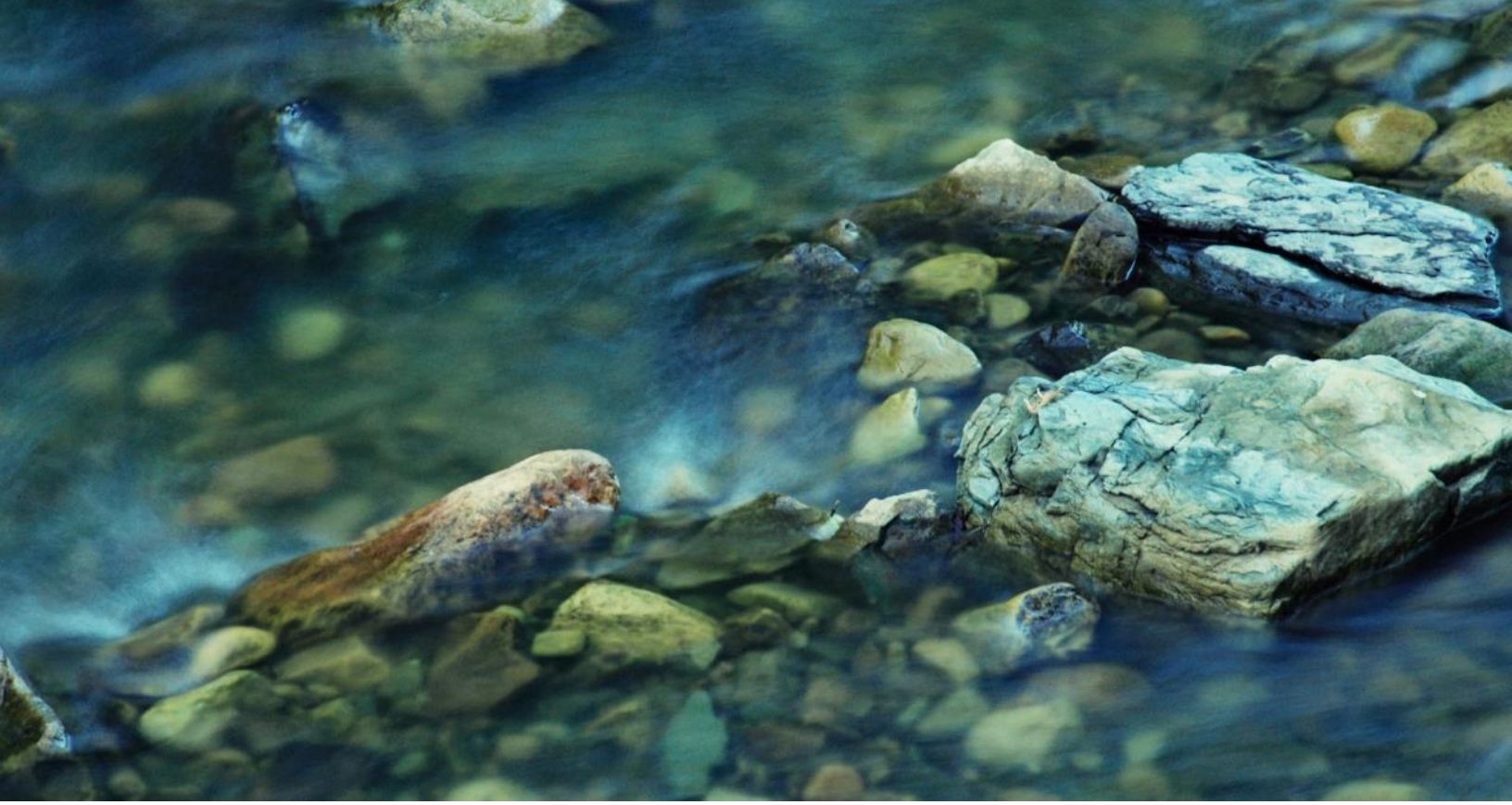

February 2017
Port Gamble Bay Cleanup Project

ANCHOR QEA

Post-stockpile Removal – Sampling and Quality Assurance Project Plan

Pope Resources, LP, and OPG Properties, LLC

February 2017
Port Gamble Bay Cleanup Project

Post-stockpile Removal – Sampling and Quality Assurance Project Plan

Prepared for
Pope Resources, LP, and OPG Properties, LLC
and
Washington State Department of Ecology

Prepared by
Anchor QEA, LLC

Project Number: 160388-01.01
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ABBREVIATIONS

ARI	Analytical Resources, Inc.
COC	chain-of-custody
cPAH	carcinogenic polycyclic aromatic hydrocarbon
cy	cubic yard
DQO	data quality objective
Ecology	Washington State Department of Ecology
EDL	estimated detection limit
EDR	engineering design report
EPA	U.S. Environmental Protection Agency
GPS	global positioning system
HASP	health and safety plan
MDL	method detection limit
Mill Site	Pope & Talbot sawmill facility
P&T	Pope & Talbot
PR/OPM	Pope Resources/Olympic Property Management
QA	quality assurance
QC	quality control
RL	reporting limit
RPD	relative percent difference
SQAPP	Sampling and Quality Assurance Project Plan
TEQ	toxic equivalents

1 Introduction

This Sampling and Quality Assurance Project Plan (SQAPP) describes procedures to verify that sediments dredged from Port Gamble Bay and stockpiled in non-hardscape upland areas of the former Pope & Talbot (P&T) sawmill facility (Mill Site) in Port Gamble, Washington (Figure 1), are removed from the Mill Site after cleanup activities are complete. Remedial construction conducted on the Mill Site, including dredge sediment stockpiling, were implemented in accordance with the Washington State Department of Ecology (Ecology)-approved design presented in the Engineering Design Report (EDR; Anchor QEA 2015a), project Technical Specifications, and associated permitting requirements. Chemicals of concern targeted by the sediment cleanup actions include wood waste, carcinogenic polycyclic aromatic hydrocarbon (cPAH) toxic equivalents (TEQ), dioxin/furan TEQ, and cadmium, as described in the Cleanup Action Plan (Ecology 2013). Once the stockpiles are removed, this SQAPP will be implemented to confirm that soil quality underlying the stockpiles is equivalent to pre-construction baseline concentrations for chemicals of concern.

1.1 Project Planning and Coordination

Artie Kapell, of Ecology, will serve as the government project manager, who will conduct the overall project coordination, review reports, and coordinate with Pope Resources/Olympic Property Management (PR/OPM) and Anchor QEA. Jason Cornetta will serve as the PR/OPM and Anchor QEA task and field manager and is responsible for executing this SQAPP by overseeing the collection and analysis of field samples and reporting the analytical results to Ecology.

1.2 Laboratory Coordination and QA/QC Management

Cindy Fields, of Anchor QEA, will serve as the project chemist and quality assurance (QA) manager and laboratory coordinator. She is responsible for subcontracting the state-certified laboratory, ensuring observation of established protocols for sample processing, decontamination, sample preservation, holding times, chain-of-custody (COC) documentation, and data management. She will provide QA oversight of the analytical and data validation programs ensuring that the chemistry data are valid and usable for their intended purpose, and that all sample processing and analytical procedures meet the quality control (QC) requirements.

1.3 Subcontractor Support

Samples collected by Anchor QEA will be analyzed by Analytical Resources, Inc. (ARI), located in Tukwila, Washington. ARI is accredited by Ecology. All chemical testing will adhere to SW-846 QA/QC procedures and analysis protocols (USEPA 1998) or follow the appropriate ASTM International or

Standard Method protocols. If more current analytical methods are available, the laboratory may use them.

Amanda Volgardsen will serve as the laboratory project manager at ARI. The laboratory manager will oversee all laboratory operations associated with the receipt of the environmental samples, chemical analyses, and laboratory report preparation for this project. The laboratory manager will review all laboratory reports and prepare case narratives describing any anomalies and exceptions that occurred during analyses.

The Data Validator project manager will be Christina Rink, of Laboratory Data Consultants, who will serve as the primary contact and perform all applicable data validation.

1.4 Health and Safety Program

Anchor QEA is already operating under a site-specific health and safety plan (HASP; Anchor QEA 2015b). A job safety analysis specific to the sample collection and described herein, will be added to the current HASP that will identify identification of potential physical and chemical hazards, and identification of key project personnel.

1.5 Project Schedule

The schedule for implementing the SQAPP will be determined, in coordination with Ecology, once full stockpile removal has been communicated by the construction contractor and visual inspection shows no signs of residual stockpile material.

2 Sampling and Analysis Plan

This sampling and analysis plan describes the procedures that will be used to collect post-stockpile removal soil samples from non-hardscape dredge sediment stockpile areas within the Mill Site (Figure 2). The Mill Site was subdivided into 79 stockpile areas in which dredged sediments have been handled in accordance with the Stockpile Management Plan (see Section 2.1). Some stockpile areas are underlain by soil and are not hardscaped (e.g., soil at the ground surface interface). Following removal of the stockpiled dredge sediment material from the non-hardscaped stockpile areas, soil samples, composed of 5 representative aliquots within each 100- by 100-foot grids, will be collected and analyzed to confirm stockpile removal. The target sampling locations are coordinates are included in Table 1 and depicted on Figure 3.

2.1 Stockpile Management Plan

As described in the EDR (Anchor QEA 2015a) and Season 2 Stockpile Management Plan (Anchor QEA 2016), stockpiles of excavated and dredged sediments from Port Gamble Bay are being stored on the adjacent Mill Site uplands until saltwater and ammonia within these materials can be effectively rinsed out with fresh water (sparged), so that these materials are suitable for beneficial reuse or disposal at other upland locations without the need for leachate controls. Elements of the stockpile management plan include exterior containment, interior containment, and additional temporary erosion control measures. The contractor has managed the dredge sediment stockpiles in accordance with the plan.

Following completion of sparging, excavated and dredged materials will be segregated into approximately 1,100 to 1,500 cubic yard (cy) stockpiles for sampling and chemical analysis, consistent with Kitsap County Health District requirements. The results of this testing will be used to verify that individual stockpiles meet suitability requirements, which will determine their ultimate disposition.

2.2 Exclusions from Sampling

Dredge sediment stockpile areas that are underlain by hardscape surface (e.g., cement, asphalt, or mixed debris cover, as shown on Figure 2, are excluded from the sampling and analysis described in this SQAPP. Visual inspection will be conducted in hardscaped areas to verify stockpile removal.

2.3 Soil Sampling

To verify that the stockpiles have been removed and have not degraded underlying soil quality in non-hardscape areas, representative composite samples composed of five sub-samples (see Section 2.3.2) will be collected from the 22 target locations depicted in Figure 2.

2.3.1 Spatial Scale

Several lines of evidence were used to determine the 100- by 100-foot grid sampling approach. To provide further coverage and minimize small-scale spatial variability, this SQAPP includes composite sampling of five sub-samples within each grid area. The rationale for the 100- by 100-foot grid spacing is summarized as follows:

- The Kitsap County Health District requirements for profiling of stockpiled materials (e.g., to verify suitability for disposal of these materials at the Port Gamble Model Airplane Field Limited Purpose Landfill) include collecting representative samples of individual 1,100 to 1,500 cy soil stockpiles, requiring the construction contractor to manage 1,100 to 1,500 cy stockpiles on at least 100- by 100-foot grids.
- Baseline soil sampling and analysis of dioxin/furan TEQ in the stockpile management areas was performed by Ecology (Leidos 2014) on an approximately 200- by 200-foot grid.
- The upland surface soil dioxin/furan TEQ semivariogram depicted in Figure 4 reveals a spatial correlation distance of up to approximately 200 feet (i.e., data points more than 200 feet apart are independent), further supporting Ecology's baseline sampling grid.
- The U.S. Environmental Protection Agency's (EPA's) Uniform Federal Policy Quality Assurance Project Plan Template for Soils Assessment of Dioxin Sites (2011a) recommends composite sampling across a minimum decision unit (residential use) of 0.25 acre, which corresponds to a composite grid of approximately 100 by 100 feet.

2.3.2 Sample Depth

All sub-samples will be collected from surface to 12 inches (1 foot) below ground surface. The composited analytical result will therefore be representative the top 12 inches of soil within the stockpile area. This sampling depth is consistent with baseline soil sampling performed by Ecology (Leidos 2014), which will be used as part of the baseline data set to confirm that soil quality immediately underlying the stockpiles is returned to pre-construction concentrations for chemicals of concern.

2.3.3 Compositing Scheme

Within each stockpile areas, one or two centroid target locations will be collected in each 100- by 100-foot grid in non-hardscape areas. A subsample of soil will be collected from a depth of 0 to 12 inches below ground surface at each centroid and four additional sub-locations within the grid (half the distance to each of the four grid corners). The five-point soil composite will be homogenized in a decontaminated stainless steel vessel and processed into a single sample for testing, as described in the remainder of this section.

2.3.4 Field Sampling Methods

At each sub-sampling location, soil will be mechanically evacuated and collected from the excavator bucket using decontaminated stainless steel spoons or scoops, following procedures listed in ASTM E1676. Sufficient soil will be collected for all soil chemical testing and placed into a stainless steel mixing vessel for homogenization. Consistent with ASTM recommendations, the following procedures for sample collection and processing will be followed:

- The surface of the location at which the sample is to be collected will be cleared of debris such as leaves and twigs.
- If grass or other plants are present, the plants will be cut to ground level and removed before the sample is collected.
- Gravel and rocks greater than 2 inches will be excluded from the sample.
- Soil samples will be qualitatively described, including color, texture, and the presence of roots, leaves, and soil organisms.
- Following homogenization, an aliquot of soil will be placed into laboratory-supplied sample containers and placed into a cooler for delivery to the analytical laboratory.

Table 2 provides the recommended containers, preservation techniques, and holding times.

2.3.4.1 Sample Identification and Labels

Each sample will be assigned a unique alphanumeric identifier. The identifier will have the format of "Project Identifier-Station ID-Media Code-Date." Samples will be identified according to the following procedure:

- The project designator will be "PG" to denote Port Gamble.
- The station ID will correspond to sample locations shown on Figure 3.
- The media code for soil is "SO".
- The number will indicate the stockpile grid area number.
- Date of collection, in the form of YYYYMMDD.
- As an example, a soil sample collected on August 24, 2017, from stockpile area PG-SO-07 will have an ID of PG-SO-07-20170824.

Each sample will have an adhesive plastic or waterproof paper label affixed to the container or bag and will be labeled at the time of collection. The following information will be recorded on the container label at the time of collection:

- Project name
- Sample identifier
- Date and time of sample collection
- Analysis to be performed

2.3.4.2 Station Positioning

A handheld Differential Global Positioning System (GPS) will be used to navigate to the planned sampling locations. GPS coordinates for each sub-sampling station are provided in Table 1. Collection at the sampling location will be guided by the navigation system, with an accuracy of ±10 feet. When positioned at the sampling location, the coordinates will be recorded in latitude and longitude, in decimal degrees, to five decimal places. Positions will be relative to the Washington State Plane Coordinates, North; North American Datum 1983.

2.4 Equipment Decontamination

The following general decontamination procedures will be followed for field sampling equipment:

- Pre-wash rinse with tap or site water.
- Wash with a solution of tap water or site water and phosphate-free soap (e.g., Alconox).
- Rinse three times with distilled water.
- Cover (no contact) all decontaminated items with aluminum foil.
- Store in a clean, closed container for next use.

2.5 Sample Storage and Delivery

Sample container requirements, holding times, and preservation requirements are outlined in Table 2. Sample containers, instruments, working surfaces, technician protective gear, and other items that may come into contact with sample material must meet high standards of cleanliness. All equipment and instruments that will be used and are in direct contact with various media collected for chemical analyses must be made of glass, stainless steel, or HDPE, and will be cleaned prior to each day's use and between sampling or compositing events.

2.6 Waste Management

Upon the completion of soil sample collection at a station, excess soil collected and not needed for analysis will be disposed of at the sample location where it was collected. All disposable sampling materials and personal protective equipment used in sample collection and processing (e.g., disposable gloves and paper towels) will be placed in heavy-duty garbage bags for disposal in the municipal waste. No hazardous materials will be used during fieldwork for this study.

2.7 Field Documentation

A complete record of field activities will be maintained. Documentation necessary to meet data quality objectives (DQOs) for this project includes field notes and field forms, sample container labels, and COC forms. The field documentation will provide descriptions of all sampling activities, sampling personnel, and weather conditions; and it will record all modifications, decisions, and/or corrective actions to the study design and procedures identified in this SQAPP.

A field logbook made of water-resistant paper will be maintained during field operations. All entries will be made legibly, in indelible ink, and will be signed and dated daily. Information recorded will include the following:

- Date, time, place, and location of sampling
- On-site personnel and visitors
- Daily safety discussion and any safety issues
- Field measurements (depth of soil sample) and their units
- Observations about site, location, and samples (weather, odors, appearance, etc.)
- Equipment decontamination verification

Field logbooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occur during project field activities. Entries will be factual, detailed, and objective. Unless restricted by weather conditions, all original data recorded in field logbooks and on sample identification tags, COC records, and field forms will be written in waterproof ink. If an error is made, the individual responsible may make corrections simply by crossing out the error with a single line and adjacently recording the correct information with their initials and the date of correction. The erroneous information must not be obliterated. All documentation, including voided entries, must be maintained within project files.

2.8 Chain-of-Custody Procedures

Chain-of-custody procedures will be followed for all samples throughout the collection, handling, and analysis processes. The principal document used to track possession and transfer of samples is the COC form. Each sample will be represented on a COC form the day it is collected. All manual data entries will be made using an indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, and then dating and initialing the change. Blank lines and spaces on the COC form will be lined out, dated, and initialed by the individual maintaining custody. Electronic COC forms generated from a custom field application will be emailed directly to the laboratory and QA managers.

A COC form will accompany each shipment of samples to the analytical laboratory. Each person in custody of samples will sign the COC form and ensure the samples are not left unattended unless properly secured. Copies of all COC forms will be retained in the project files.

All samples will be shipped or hand delivered to the analytical laboratory no later than 1 day after collection. Samples collected on Friday may be held until the following Monday for shipment, provided that this delay does not jeopardize any holding time requirements.

Specific sample shipping procedures are as follows:

- Coolers or containers containing samples for analysis may be shipped via overnight delivery to the laboratory. In the event that Saturday delivery is required, the field coordinator will contact the analytical laboratory before 3 p.m. on Friday to ensure that the laboratory is aware of the number of containers shipped and the airbill tracking numbers for those containers. Following each shipment, the field coordinator will call the laboratory and verify that the shipment from the day before has been received and is in good condition.
- Coolant ice will be sealed in separate plastic bags and placed in the shipping containers.
- Individual sample containers will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- Glass jars will be separated in the shipping container by shock-absorbent material (e.g., bubble wrap) to prevent breakage.
- The shipping containers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container, and consultant's office name and address) to enable positive identification.
- Chain-of-custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- A minimum of two signed and dated custody seals will be placed on adjacent sides of each cooler prior to shipping.
- Each cooler will be wrapped securely with strapping tape, labeled "Glass – Fragile" and "This End Up," and will be clearly labeled with the laboratory's shipping address and the consultant's return address.

Upon transfer of sample possession to the analytical laboratory, the person(s) transferring custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the custody seals will be broken, and the receiver will record the condition of the samples on a sample receipt form. Chain-of-custody forms will be used internally in the laboratory to track sample handling and final disposition.

2.9 Sample Analyses

The chemicals of concern and analytical suite will include cadmium, dioxin/furan, and cPAHs (Table 1). Analytical methods and expected reporting limits (RLs) for each parameter are included in Table 3. Samples will be submitted to ARI for analyses. The laboratory will be responsible for the following:

- Analyze the samples following the methods described in this SQAPP and laboratory Standard Operating Procedures
- Follow documentation and custody procedures
- Meet all RL requirements

- Meet QA/QC frequency and DQO requirements (Tables 4 and 5)
- Deliver electronic data files as specified in this SQAPP
- Meet turnaround times for deliverables as described in this SQAPP
- Allow Ecology and the QA/QC contractor to perform laboratory and data audits

3 Quality Assurance Project Plan

The purpose of the project SQAPP is to provide confidence in the analytical results through a system of QA/QC performance checks with respect to sample collection methods, laboratory analyses, data reporting, and corrective action procedures to achieve compliance with established performance and data quality criteria. This section presents the QA/QC procedures to ensure that the data derived from this investigation are defensible and usable for their intended purpose.

3.1 Measurements of Data Quality

The overall DQO for field sampling and laboratory analysis is to produce data of known and appropriate quality to support the project objectives. DQOs for the project are provided in Table 5. The quality of laboratory data is assessed by precision, accuracy, representativeness, comparability, completeness, and sensitivity. The definitions for the data quality indicators are as follows.

3.1.1 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling, and in laboratory analysis. ASTM recognizes two levels of precision: repeatability—the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions; and reproducibility—the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material (ASTM 2002).

In the laboratory, "within-batch" precision is measured using replicate sample or QC analyses and is expressed as the relative percent difference (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 (expressed as RPD) increases. RPD is calculated using Equation No. 1.

Equation No. 1

$$\text{RPD} = \frac{(C1 - C2)\ x\ 100\%}{(C1 + C2)/2}$$

where:

RPD	=	relative percent difference
C1	=	larger of two values
C2	=	smaller of two values

3.1.2 Accuracy

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 control samples, standard reference materials, and standard solutions. In addition, spiked project samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery of the measured value, relative to the true or expected value. If a measurement process produces results for which the 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 utilize several QC measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples, and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

Laboratory accuracy will be evaluated against quantitative laboratory control sample and matrix spike recovery performance criteria outlined in Table 1. Surrogate spike recoveries will be evaluated against laboratory control limits, and internal standard recoveries will be evaluated against method criteria. Accuracy can be expressed as a percentage of the true or reference value, or as a percentage of the spiked concentration. Equation No. 2 is used to express accuracy.

Equation No. 2

$$\%\mathrm{R} = \frac{100\%\ x\ (S - U)}{Csa}$$

where:
%R = percent recovery
S = measured concentration of spiked aliquot
U = measured concentration of unspiked aliquot
Csa = actual concentration of spike added

3.1.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For the sampling program, the list of analytes has been identified to provide a comprehensive assessment of the known and potential contaminants at the Mill Site.

3.1.4 Comparability

Comparability expresses the confidence with which one dataset can be evaluated in relation to another dataset. For this program, comparability of data will be established through the use of standard analytical methodologies, reporting formats, and the use of common traceable calibration standards and reference materials.

3.1.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected.

3.1.6 Sensitivity

Sensitivity is measured by the achievable laboratory detection and RLs. The MDL is defined as the minimum concentration at which a given target analyte can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. Laboratory RLs are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The estimated detection limit (EDL) is defined as the sample and analyte-specific detection limit achievable at the time of analysis.

The sample-specific EDL, MDL, and RL will be reported by the laboratory and will take into account any factors relating to the sample analysis that might decrease or increase the RL (e.g., dilution factor, percent moisture, sample mass). In the event that the MDL and RL are elevated for a sample due to matrix interferences and subsequent dilution or reduction in the sample aliquot, the data will

be evaluated by Anchor QEA and the laboratory to determine if an alternative course of action is required or possible. If this situation cannot be resolved readily (i.e., RLs less than criteria are achieved), Ecology will be contacted to discuss an acceptable resolution.

3.2 Laboratory Quality Control

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, matrix spikes, surrogate spikes (for organic analyses), and method blanks. Table 3 lists the frequency of analysis for laboratory QA/QC samples, and Table 1 summarizes the DQOs for precision, accuracy, and completeness.

Results of the QC samples from each analytical batch will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the sample group, the QA/QC manager may be contacted to determine if correction action is required. Corrective action may include re-preparation and/or re-analysis of affected samples or possible method modifications if the concern is determined to be due to method failure.

3.3 Data Validation

Data generated in the field and at the laboratories will be verified and validated according to methods and procedures described in this section.

3.3.1 Data Review, Validation, and Verification

The analytical data will undergo EPA Stage 2B validation (USEPA 2009). During the validation process, analytical data will be evaluated for SQAPP, method, and laboratory quality control compliance, and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers, will be entered into the project database, thus enabling this information to be retained or retrieved, as needed.

3.3.2 Validation and Verification Methods

Field and laboratory data for this task will undergo a formal verification and validation process. All entries into the database will be verified. All errors found during the verification of field data, laboratory data, and the database will be corrected prior to release of the final data.

Data verification includes a review for completeness and accuracy by the field coordinator and laboratory manager; review by the data manager for outliers and omissions; and the use of performance criteria to identify laboratory QC sample outliers. Data verification will be conducted manually by Anchor QEA staff or by an external validator.

For this program, Stage 2B validation (USEPA 2009) will be conducted following National Functional Guidelines for data validation (USEPA 2011b, 2016a, 2016b), this Plan, and professional judgment. Data will be reviewed with regard to the following, as appropriate to the particular analysis:

- Completeness
- Holding times
- MRLs, MDLs, and EDLs
- Laboratory control samples
- Matrix spike/matrix spike duplicates
- Matrix duplicates
- Standard reference materials
- Internal standard area counts
- Surrogate recoveries
- Method blanks
- Initial calibration data
- Continuing calibration data
- Instrument performance checks

A data validation report will be generated to document any issues with data quality and any qualifications applied to data and this report will be peer reviewed prior to finalization. All validated data will be entered into the database established for this program, and a final data file will be exported. Verification of the database export against the PDF data report will be performed by the QA manager or designee. Any errors found in the data file export will be corrected in the database and reviewed for systemic reporting errors.

3.3.3 Reconciliation with User Requirements

The QA manager will review data at the completion of the task to determine if DQOs have been met. If data do not meet the project's specifications, the QA manager will review the errors and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors and will suggest corrective action, if appropriate. The problem should be able to be corrected by retraining, revising techniques, or replacing supplies/equipment; if not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA manager will recommend appropriate modifications. If matrix interference is suspected to have attributed to the exceedance, adequate laboratory documentation must be presented to demonstrate that instrument performance or laboratory technique did not bias the result. In cases where the DQOs have been exceeded and corrective actions did not resolve the outlier, data will be qualified per EPA National Functional Guidelines (USEPA 2011b, 2016a, 2016b). In these instances, the usability of data will be determined by the extent of the exceedance. Rejected data will be assigned an "R" qualifier and will not be used for any purposes.

4 Data Analysis, Recordkeeping, and Reporting Requirements

This section describes the data analysis, recordkeeping, and data reporting elements of the SQAPP.

4.1 Analysis of Chemistry Data

The chemical results will be processed using the data management rules presented in Section 3. Dioxin/furan TEQ will be calculated in accordance with the Port Gamble Sawmill Area Soil (Appendix B; Leidos 2014) and cPAH TEQ will be calculated in accordance with Washington Administrative Code 173-340-708(e).

4.2 Recordkeeping and Data Report

At the conclusion of the data acquisition and validation, all records, including field records, laboratory data reports, data validation reports, and other relevant documentation, will be provided to Ecology in a data report. The data report will include the following:

- A description of field events
- Deviations from sample, analysis, and validation described in this SQAPP
- Field and laboratory records, including laboratory COC forms
- Chemical and physical testing results, sampling depth, and final data qualifiers
- A summary of the sampling results relative to pre-construction results
- A summary of data quality and usability
- Laboratory reports

When the testing results are validated and finalized, they will be loaded onto Ecology's Environmental Information Management database.

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Tables

Table 1
Target Sample Locations and Analytes

Sample Area	Sub-Sample ID	Northing	Easting	Cadmium	cPAH TEQ	Dioxin/Furan TEQ	Total Solids
PG-SO-01	PG-SO-01-1	316747	1211120	X	X	X	X
	PG-SO-01-2	316778	1211102	X	X	X	X
	PG-SO-01-3	316765	1211150	X	X	X	X
	PG-SO-01-4	316720	1211136	X	X	X	X
	PG-SO-01-5	316730	1211090	X	X	X	X
PG-SO-02	PG-SO-02-1	316721	1211217	X	X	X	X
	PG-SO-02-2	316752	1211199	X	X	X	X
	PG-SO-02-3	316739	1211247	X	X	X	X
	PG-SO-02-4	316691	1211234	X	X	X	X
	PG-SO-02-5	316704	1211186	X	X	X	X
PG-SO-03	PG-SO-03-1	316844	1211146	X	X	X	X
	PG-SO-03-2	316874	1211128	X	X	X	X
	PG-SO-03-3	316862	1211176	X	X	X	X
	PG-SO-03-4	316814	1211163	X	X	X	X
	PG-SO-03-5	316826	1211116	X	X	X	X
PG-SO-04	PG-SO-04-1	316818	1211243	X	X	X	X
	PG-SO-04-2	316848	1211225	X	X	X	X
	PG-SO-04-3	316836	1211273	X	X	X	X
	PG-SO-04-4	316788	1211260	X	X	X	X
	PG-SO-04-5	316800	1211212	X	X	X	X
PG-SO-05	PG-SO-05-1	316792	1211339	X	X	X	X
	PG-SO-05-2	316822	1211322	X	X	X	X
	PG-SO-05-3	316810	1211369	X	X	X	X
	PG-SO-05-4	316762	1211357	X	X	X	X
	PG-SO-05-5	316774	1211309	X	X	X	X
PG-SO-06	PG-SO-06-1	316940	1211172	X	X	X	X
	PG-SO-06-2	316971	1211154	X	X	X	X
	PG-SO-06-3	316958	1211202	X	X	X	X
	PG-SO-06-4	316910	1211189	X	X	X	X
	PG-SO-06-5	316923	1211142	X	X	X	X
PG-SO-07	PG-SO-07-1	316915	1211268	X	X	X	X
	PG-SO-07-2	316945	1211251	X	X	X	X
	PG-SO-07-3	316932	1211299	X	X	X	X
	PG-SO-07-4	316884	1211286	X	X	X	X
	PG-SO-07-5	316897	1211238	X	X	X	X
PG-SO-08	PG-SO-08-1	316889	1211365	X	X	X	X
	PG-SO-08-2	316916	1211356	X	X	X	X
	PG-SO-08-3	316904	1211404	X	X	X	X
	PG-SO-08-4	316856	1211392	X	X	X	X
	PG-SO-08-5	316868	1211344	X	X	X	X

Table 1
Target Sample Locations and Analytes

Sample Area	Sub-Sample ID	Northing	Easting	Cadmium	cPAH TEQ	Dioxin/Furan TEQ	Total Solids
PG-SO-09	PG-SO-09-1	316863	1211462	X	X	X	X
	PG-SO-09-2	316893	1211444	X	X	X	X
	PG-SO-09-3	316881	1211492	X	X	X	X
	PG-SO-09-4	316833	1211479	X	X	X	X
	PG-SO-09-5	316845	1211431	X	X	X	X
PG-SO-10	PG-SO-10-1	316837	1211558	X	X	X	X
	PG-SO-10-2	316867	1211541	X	X	X	X
	PG-SO-10-3	316855	1211588	X	X	X	X
	PG-SO-10-4	316824	1211572	X	X	X	X
	PG-SO-10-5	316819	1211528	X	X	X	X
PG-SO-11	PG-SO-11-1	317037	1211198	X	X	X	X
	PG-SO-11-2	317067	1211180	X	X	X	X
	PG-SO-11-3	317055	1211228	X	X	X	X
	PG-SO-11-4	317007	1211215	X	X	X	X
	PG-SO-11-5	317019	1211167	X	X	X	X
PG-SO-12	PG-SO-12-1	317011	1211294	X	X	X	X
	PG-SO-12-2	317041	1211277	X	X	X	X
	PG-SO-12-3	317029	1211324	X	X	X	X
	PG-SO-12-4	316981	1211312	X	X	X	X
	PG-SO-12-5	316994	1211264	X	X	X	X
PG-SO-13	PG-SO-13-1	316985	1211391	X	X	X	X
	PG-SO-13-2	317016	1211373	X	X	X	X
	PG-SO-13-3	317003	1211421	X	X	X	X
	PG-SO-13-4	316955	1211408	X	X	X	X
	PG-SO-13-5	316968	1211361	X	X	X	X
PG-SO-14	PG-SO-14-1	316934	1211584	X	X	X	X
	PG-SO-14-2	316964	1211566	X	X	X	X
	PG-SO-14-3	316943	1211600	X	X	X	X
	PG-SO-14-4	316903	1211602	X	X	X	X
	PG-SO-14-5	316916	1211554	X	X	X	X

Notes:
1. North American Datum 1983 WA State Plane North, US Survey Feet
cPAH: carcinogenic polycyclic armotic hydrocarbons
TEQ: toxicity equivalence

Table 2
Guidelines for Sample Handling and Storage

Analyte	Container[a]	Holding Time	Preservative
Total solids	4-ounce glass jar	14 days	Cool/4°C
		6 months	Freeze -18°C
Cadmium		6 months	Cool/4°C
		2 years	Freeze/-18°C
PAHs	8-ounce glass jar	14 days until extraction	Cool/4°C
		1 year until extraction	Freeze/-18°C
		40 days after extraction	Cool/4°C
PCDD/PCDF Congeners	4-ounce glass jar	1 year until extraction	Freeze -18°C
		1 year after extraction	Freeze -18°C

Notes:

a. Actual containers used will be verified with the lab prior to sample collection.

PAHs: Polycyclic aromatic hydrocarbons

PCDD/PCDF: polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans

Table 3
Analyte List, Analytical Methods, and Reporting Limits

Analyte	Analytical Method	Target Reporting Limit
Conventionals and Physical Tests		
Total solids (%)	SM 2540B	0.1
Metals (mg/kg)		
Cadmium	6010C/6020A	0.1
Polycyclic Aromatic Hydrocarbons (µg/kg)		
1-Methylnaphthalene	8270D/SIM	20
2-Methylnaphthalene	8270D/SIM	20
Naphthalene	8270D/SIM	20
Acenaphthylene	8270D/SIM	20
Acenaphthene	8270D/SIM	20
Fluorene	8270D/SIM	20
Phenanthrene	8270D/SIM	20
Anthracene	8270D/SIM	20
Fluoranthene	8270D/SIM	20
Pyrene	8270D/SIM	20
Benzo(a)anthracene	8270D/SIM	20
Chrysene	8270D/SIM	20
Total benzo(b+j+k)fluoranthenes	8270D/SIM	20
Benzo(a)pyrene	8270D/SIM	20
Indeno(1,2,3-cd)pyrene	8270D/SIM	20
Dibenz(a,h)anthracene	8270D/SIM	20
Benzo(g,h,i)perylene	8270D/SIM	20
PCDD/PCDF (ng/kg)		
2,3,7,8-TCDD	1613B	0.5
1,2,3,7,8-PeCDD	1613B	2.5
1,2,3,4,7,8-HxCDD	1613B	2.5
1,2,3,6,7,8-HxCDD	1613B	2.5
1,2,3,7,8,9-HxCDD	1613B	2.5
1,2,3,4,6,7,8-HpCDD	1613B	2.5
OCDD	1613B	5.0
2,3,7,8-TCDF	1613B	0.5
1,2,3,7,8-PeCDF	1613B	2.5
2,3,4,7,8,-PeCDF	1613B	2.5
1,2,3,4,7,8-HxCDF	1613B	2.5
1,2,3,6,7,8-HxCDF	1613B	2.5
1,2,3,7,8,9-HxCDF	1613B	2.5
2,3,4,6,7,8-HxCDF	1613B	2.5
1,2,3,4,6,7,8-HpCDF	1613B	2.5
1,2,3,4,7,8,9-HpCDF	1613B	2.5
OCDF	1613B	5.0

Notes:
µg: microgram
kg: kilogram
mg: milligram
ng: nanogram
PAH: polycyclic aromatic hydrocarbons
PCDD/PCDF: polychlorinated dibenzo-p-dioxins/ polychlorinated dibenzofurans

Table 4

Field and Laboratory Quality Assurance/Quality Control Sample Analysis Summary

Analysis Type	Field Duplicate	Field/Equipment Blank	Initial Calibration	Ongoing Calibration	SRM or LCS	Matrix Duplicates	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
Total solids	1 per 20 samples	NA	Each batch[a]	NA	NA	1 per 20 samples	NA	NA	NA	NA
Metals	1 per 20 samples	1 per sampling event	Daily	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
PAHs	1 per 20 samples	1 per sampling event	As needed[b]	Every 12 hours	1 per 20 samples	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
PCDD/PCDF Congeners	1 per 20 samples	1 per sampling event	As needed[b]	Every 12 hours	1 per 20 samples	1 per 20 samples	Nac	Nac	1 per 20 samples	Every sample

Notes:

a. Calibration and certification of drying ovens and weighing scales are conducted bi-annually.

b. Initial calibrations are considered valid until the continuing calibration no longer meets method specifications. At that point, a new initial calibration is analyzed.

c. Labeled standards are added to each sample in isotope-dilution analyses as required by the method.

LCS: laboratory control sample

NA: not applicable

PCDD/PCDF: polychlorinated dibenzo-p-dioxins/ polychlorinated dibenzofurans

SRM: standard reference material

Table 5
Data Quality Objectives

Parameter	Precision	Accuracy	Completeness
Total solids	± 20% RPD	NA	95%
Metals	± 30% RPD	75-125% R	95%
PAHs	± 35% RPD	50-150% R	95%
PCDD/PCDF Congeners	± 35% RPD	50-150% R	95%

Notes:
PAH: polycyclic aromatic hydrocarbon
PCDD/PCDF: polychlorinated dibenzodioxin/polychlorinated dibenzofuran
RPD: relative percent difference
R: recovery

Figures

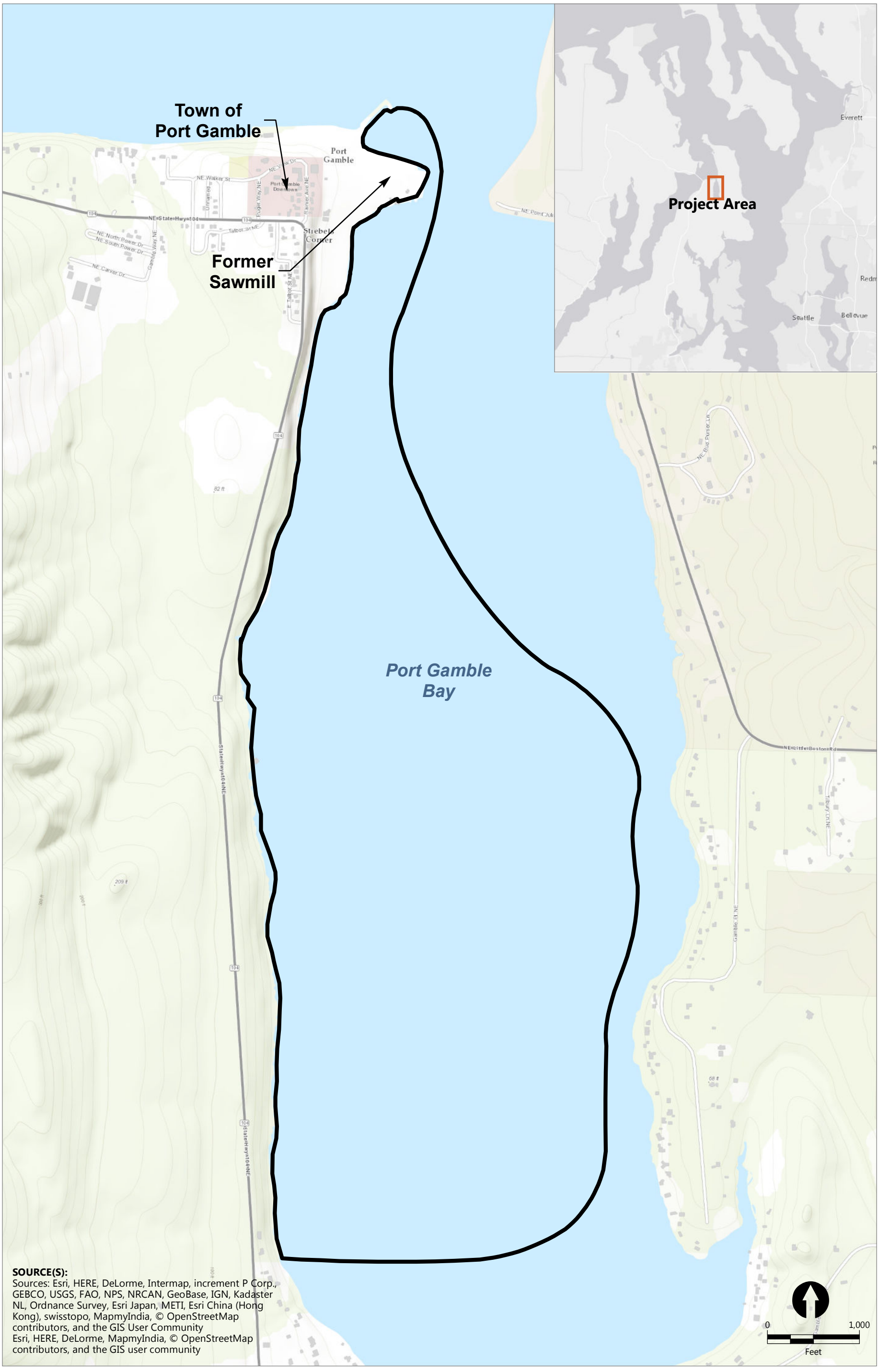

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Figure 1
Vicinity Map
Sampling and Quality Assurance Project Plan
Port Gamble Bay Cleanup Project

LEGEND:

- Stockpile Boundaries
- Hardscape

Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (ng/kg)

- < 5
- 5 - 11
- 11 - 45
- 45 - 86
- 86 - 180
- > 180

NOTE(S):
Additional areas of hardscape have been observed following removal of the stockpiles. Sample locations may need to be adjusted in the field.

SOURCE: Stockpile locations from surveys by Orion Engineering and Google Earth.
Aerial image from Google Earth (July, 2016).
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.

0 150
Feet

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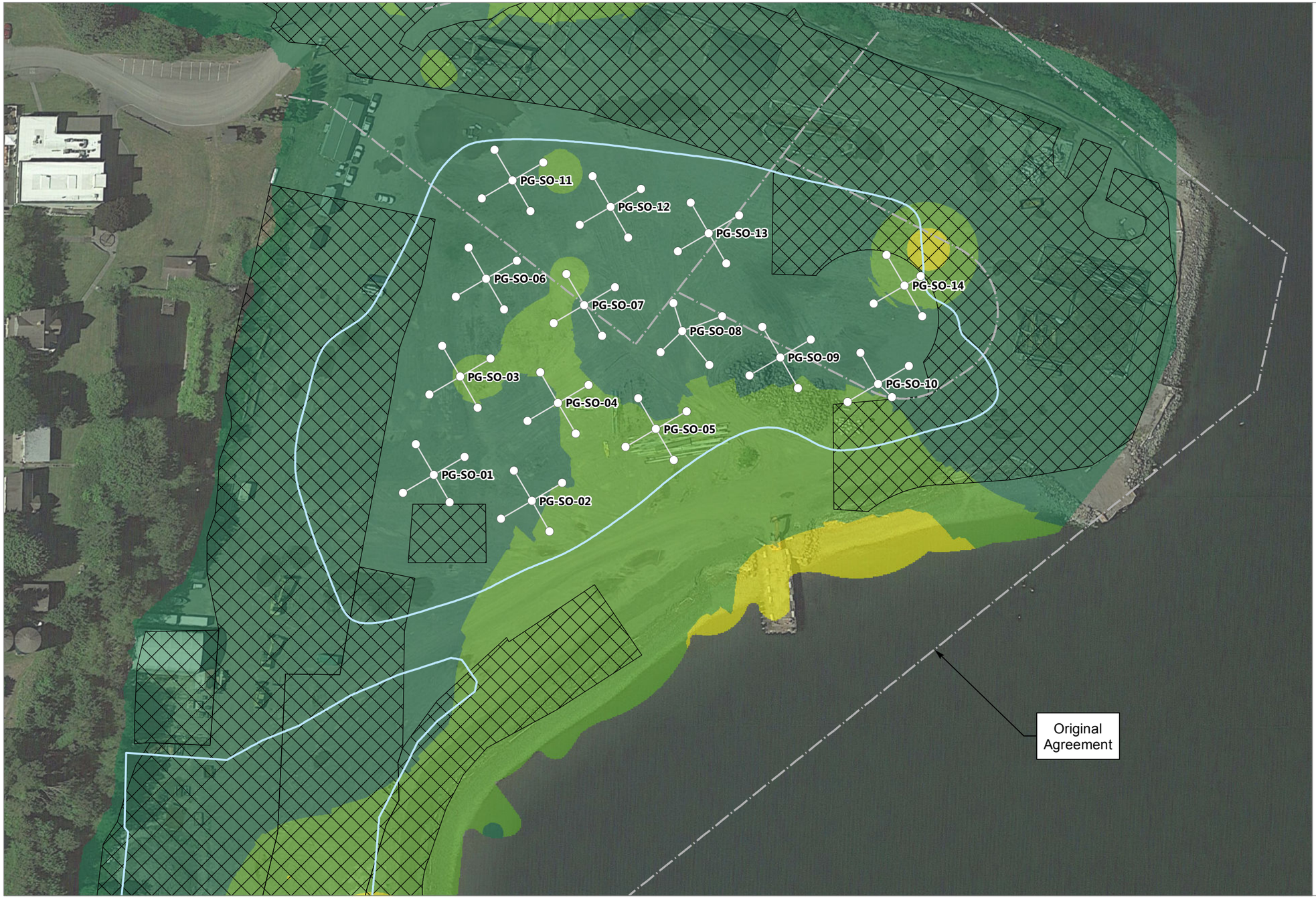
Figure 2
Stockpile Areas and Dioxin/Furan TEQ Interpolation
Sampling and Quality Assurance Project Plan
Port Gamble Bay Cleanup Project



LEGEND:

- Proposed Sample Locations
- Hardscape
- Option: 1983 Deed Line with Ordinary High Water

Total Dioxin/Furan TEQ 2005 (Mammal)

(U = 1/2) (ng/kg)

- < 5
- 5 - 11
- 11 - 45
- 45 - 86
- 86 - 180
- > 180

NOTE(S):
Additional areas of hardscape have been observed following removal of the stockpiles. Sample locations may need to be adjusted in the field.

SOURCE: Stockpile locations from surveys by Orion
Engineering and Google Earth.
Aerial image from Google Earth (July, 2016).
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.

0 200
Feet

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Figure 3
Target Sample Locations
Sampling and Quality Assurance Project Plan
Port Gamble Bay Cleanup Project

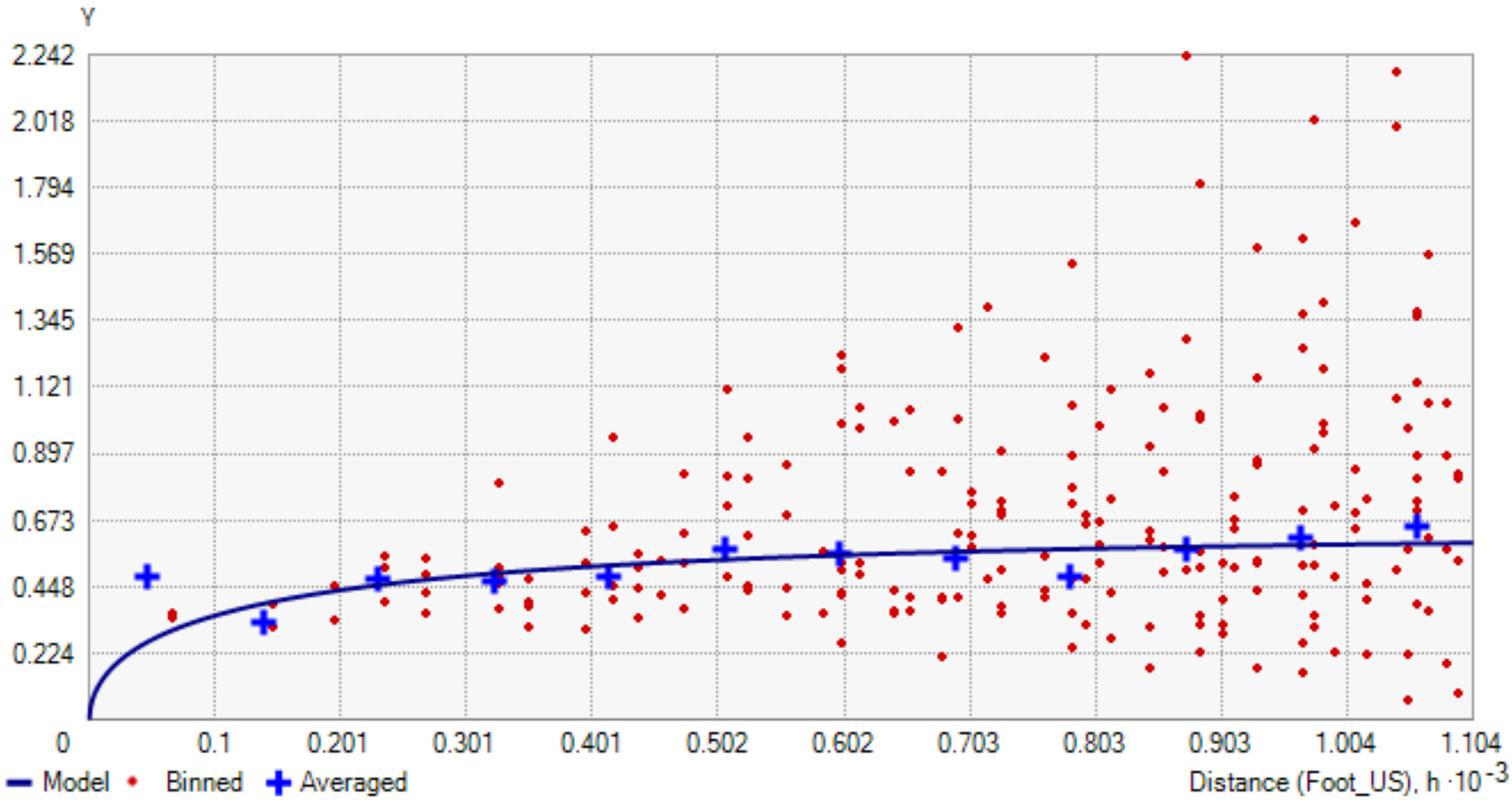

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Figure 4
Dioxin/Furan TEQ Semivariogram
Sampling and Quality Assurance Project Plan
Port Gamble Bay Cleanup Project