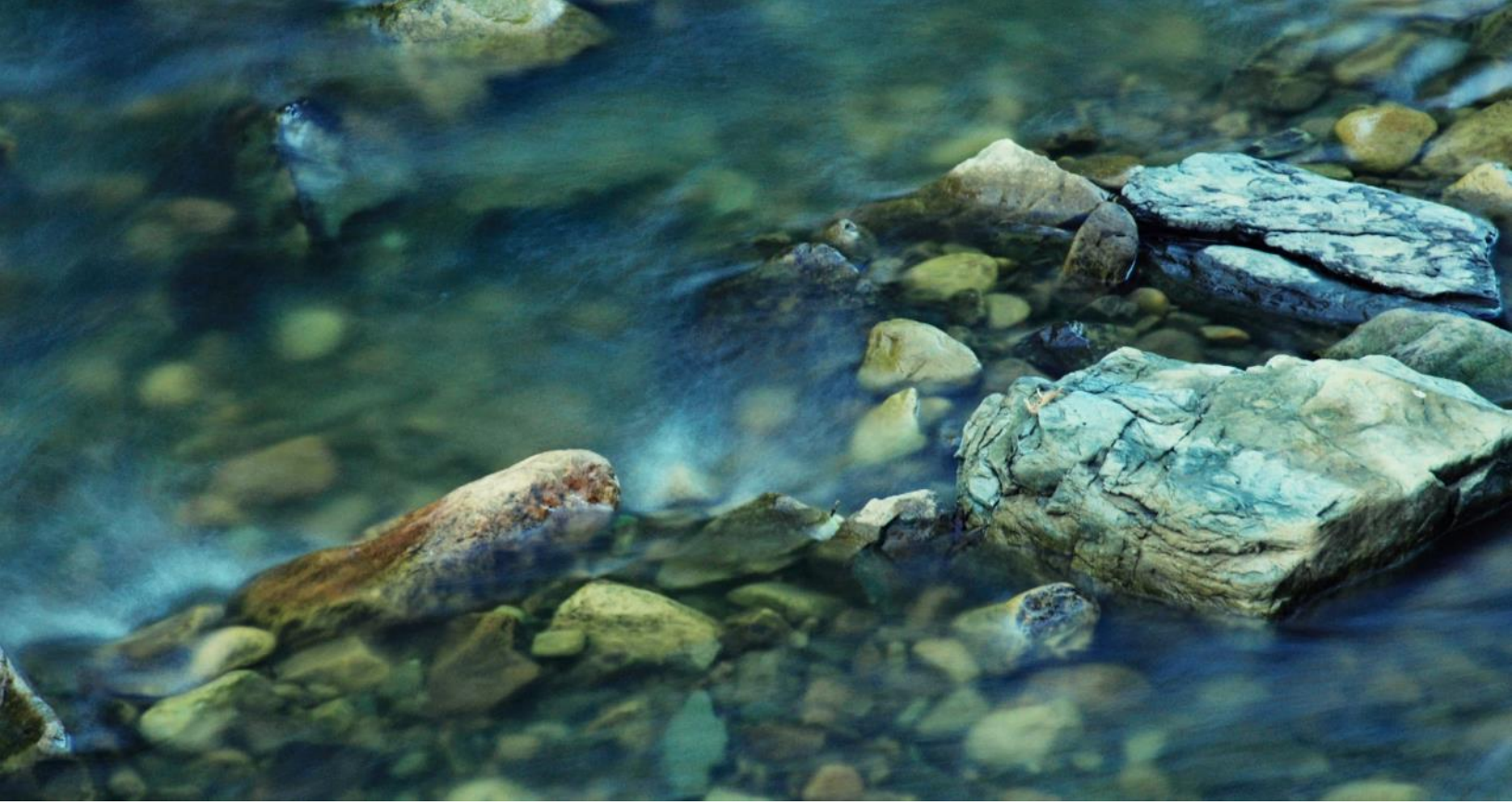


August 2018
Everett East Waterway PSO4 Combined Sewer Overflow Characterization

ANCHOR QEA

# Sampling and Quality Assurance Project Plan

Prepared for Kimberly-Clark Corporation

August 2018
Everett East Waterway

# Sampling and Quality Assurance Project Plan

**Prepared for**
Kimberly-Clark Corporation

**Prepared by**
Anchor QEA, LLC
720 Olive Way Suite 1900
Seattle, Washington 98101

Project Number: 170092.01.01
C:\Users\cpatmont\Files\Share\Kimberly Clark\East Waterway RI_FS\CSOs\KC-EEW_PS04_SQAPP_Text_16Aug2018.docx

# TABLE OF CONTENTS

## TABLES



## FIGURES

# ABBREVIATIONS

| | |
|---|---|
| CSO | combined sewer overflow |
| DQO | data quality objectives |
| Ecology | Washington State Department of Ecology |
| EPA | U.S. Environmental Protection Agency |
| FC | Field Coordinator |
| GC | gas chromatography |
| MD | matrix duplicate |
| MDL | method detection limit |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| NAD 83 | North American Datum 1983 |
| OSHA | Occupational Safety and Health Act |
| PAH | polycyclic aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| PQL | practical quantitation limit |
| PSO4 | Puget Sound Outfall Number 4 |
| QA/QC | quality assurance/quality control |
| RI/FS | remedial investigation/feasibility study |
| RL | reporting limit |
| RPD | relative percent difference |
| SOP | standard operating procedures |
| SQAPP | Sampling and Quality Assurance Project Plan |
| SVOC | semivolatile organic compound |

# 1 Introduction

This Sampling and Quality Assurance Project Plan (SQAPP) describes collection methods and analytical protocols for combined sewer overflow (CSO) conveyance solids in the lower portion of the City of Everett CSO Puget Sound Outfall Number 4 (PSO4) conveyance system. PSO4 currently discharges across the Kimberly-Clark Worldwide, Inc. (K-C), property and into the Everett East Waterway (Figure 1). This work is being conducted as part of the cleanup investigation for the East Waterway Site in Everett, Washington, under Agreed Order DE 11350. The site is currently on the Washington State Department of Ecology's (Ecology) database of confirmed and suspected contaminated sites under Facility/Site Number 2733 and Cleanup Site ID 4297.

Sampling and analysis described in this SQAPP would be performed in coordination with the planned rerouting and decommissioning of the lower portion of PSO4 in August and September 2018. Three locations have been targeted to collect and test CSO solids (Figure 2).

## 1.1 Document Organization

This SQAPP was prepared in accordance with Ecology guidance, as described in the Sediment Cleanup User's Manual II (Ecology 2017). This SQAPP is organized into the following sections:

- Section 2 – Data Quality Objectives
- Section 3 – Project Management
- Section 4 – Sample Collection
- Section 5 – Quality Assurance/Quality Control
- Section 6 – Assessments and Response Actions
- Section 7 – Data Validation, Usability, and Reporting
- Section 8 – References

# 2 Data Quality Objectives

A systematic planning process is a key step in developing successful sampling and analysis programs to ensure the appropriate sampling, analyses, and data evaluations are conducted to meet program objectives. U.S. Environmental Protection Agency's (EPA's) Guidance on Systematic Planning Using the Data Quality Objective (DQO) Process (EPA 2006) is used herein to guide data collection to support development of the forthcoming Everett East Waterway remedial investigation/feasibility study (RI/FS). The DQO process is a tool to determine the type, quantity, and quality of data. It is a seven-step process that establishes performance and acceptance criteria to ensure that data that are collected to support the goals of the RI/FS.

Some key objectives of the forthcoming RI/FS are to identify the nature of historical sources to the waterway along with ongoing sources that have the potential to result in sediment recontamination at levels greater than sediment cleanup or remediation levels. Source control assessments to be performed in the RI/FS are anticipated to involve evaluation of surface sediment quality between mean higher high water and the deep subtidal zone in the East Waterway. The goal of these assessments is to identify areas that may be influenced by ongoing sources of hazardous substances into the waterway. Consistent with current Sediment Management Standards requirements, Ecology will use this information along with its Water Quality Program and Model Toxics Control Act upland cleanup authorities to ensure the long-term success of the sediment cleanup efforts. Adequate source controls to prevent recontamination must be in place prior to selection and implementation of a final sediment remedial action, which is necessary to ensure that recontamination of remediated sediments does not occur, and natural recovery continues.

A single DQO to evaluate PSO4 sediment recontamination potential is detailed in Table 1. Note that a full set of DQOs will be developed as part of the work plan development for the East Waterway RI/FS investigation. The DQO described in Table 1 for PSO4 represents one of multiple DQOs that will be developed for the cleanup project. The sampling results from PSO4 will be included in the East Waterway RI/FS.

# 3 Project Management

This section identifies key project personnel, describes the rationale for conducting the investigation studies, identifies the studies to be performed, outlines project DQOs and criteria, lists training and certification requirements for sampling personnel, and describes documentation and recordkeeping procedures.

## 3.1 Project/Task Organization

Responsibilities of the team members, as well as laboratory project managers, are described in the following paragraphs.

**Anchor QEA Project Manager**. Nathan Soccorsy will be responsible for directing the project team for the implementation of all activities described in this SQAPP. He will also be responsible for production of work plans, producing all project deliverables, and performing the administrative tasks needed to ensure timely and successful completion of these studies. The Project Manager will provide the overall programmatic guidance to support staff and will ensure that all documents, procedures, and project activities meet the objectives contained within this SQAPP. The Project Manager will also be responsible for resolving project concerns or conflicts related to technical matters.

**Field Coordinator (FC)**. Bernadette Wright will be responsible for coordination of field sampling activities. She will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will oversee submission of environmental samples to the designated laboratory for chemical and physical analyses.

**Quality Assurance/Quality Control (QA/QC) Manager**. Cindy Fields will also provide QA/QC oversight for both the field sampling and laboratory programs, ensure that samples are collected and documented appropriately, coordinate with the analytical laboratories, ensure data quality, oversee data validation, and supervise project QA coordination.

## 3.2 Special Training Requirements/Certifications

For sample preparation tasks, it is important that field crews are trained in standardized data collection requirements so that the data collected are consistent among the field crews. Field crews will be composed of individuals who are fully trained in the collection and processing of sediments, decontamination protocols, and chain-of-custody procedures.

In addition, the 29 Code of Federal Regulations 1910.120 Occupational Safety and Health Act (OSHA) regulations require training to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health. All field personnel will have

completed the 40-hour HAZWOPER training course and 8-hour refresher courses, as necessary, to meet the OSHA regulations.

## 3.3 Documentation and Records

This project will require central project files to be maintained at Anchor QEA. Project records will be stored and maintained in a secure manner. Each project team member is responsible for filing all necessary project information or providing it to the person responsible for the filing system. Individual team members may maintain files for individual tasks but must provide such files to the central project files upon completion of each task. Hard copy documents will be kept on file at Anchor QEA or at a document storage facility throughout the duration of the project, and all electronic data will be maintained in the database or in a designated directory at Anchor QEA.

### *3.3.1 Field Records*

All documents generated during the field effort are controlled documents that become part of the project file. Field team members will keep a daily record of significant events, observations, and measurements on field forms specific to the collection activity. Field forms will be maintained by the FC. The sampling documentation will contain information on each sample collected and will include, at a minimum, the following information:

- Project name
- Field personnel on site
- Site visitors
- Weather conditions
- Field observations
- Sample collection date and time
- Sample collection method and description of activities
- Identification or serial numbers of instruments or equipment used
- Deviations from this SQAPP
- Meetings associated with field sampling activities

Entries for each day will begin on a new form. The person recording information must enter the date and time. In general, sufficient information will be recorded during sampling so that reconstruction of the event can occur without relying on the memory of the field personnel.

The field forms may be electronic or handwritten. If handwritten they will be on water-resistant, durable paper. Notes will be made in indelible, waterproof blue or black ink. Errors will be corrected by crossing out with a single line, dating, and initialing. Each form will be marked with the project name, number, and date. The field forms will be scanned or saved into Anchor QEA's project file directory as convenient during the sampling event or upon completion of each sampling event.

### *3.3.2 Analytical Records*

The laboratory will retain analytical data records. Additionally, Anchor QEA will retain a copy of analytical data in the central project files. Data reporting requirements will include those items necessary to complete data validation, including copies of raw data. Elements to be reported in the laboratory data packages are listed in Section 5.4.6.

Instrument data must be fully restorable at the laboratory from electronic backup. The laboratory will be required to maintain records relevant to project sample analyses for a minimum of 5 years. Data validation reports will be maintained in the central project files with the analytical data reports.

### *3.3.3 Data Reduction*

Data reduction is the process by which original data (analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample mass or volume analyzed, sample moisture content, and/or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which are subject to further review by the Laboratory Manager, the Project Manager, the QA/QC Manager, and independent reviewers. Data reduction may be performed manually or electronically.

# 4 Sample Collection

The rationale for the sampling design and design assumptions for locating and selecting samples, as well as methods and procedures for the collection of field samples, are provided in this section. Sampling will be conducted following standard procedures documented in this SQAPP.

## 4.1 Sampling Design

Historical (2012) and recent (2018) video inspection work conducted by City of Everett indicate that three representative locations within the PS04 conveyance system scheduled to be decommissioned have a likelihood of sediment accumulation sufficient for this SQAPP, subject to field confirmation and adjustment as necessary:

- SMHQ03 located immediately upgradient of numerous 90-degree pipe ends under the railroad track (Figure 2; to serve as an indicator of source solids upstream of the K-C property; potential alternate location: SMHQ02)
- SMHQ16 located immediately upgradient of a section of pipe that historically accumulated the greatest amount of sediment (Figure 2; representing the location with the highest likelihood of sediment accumulation sufficient for this SQAPP; potential alternate location: SMHQ14)
- SMHP01 located near the end of the conveyance system (Figure 2; to serve as an indicator of source solids just prior to entering the East Waterway; potential alternate location: SMHP02)

These manhole structures will be field located, opened, and assessed (with a telescoping rod or equivalent) to determine if sufficient sediment mass is present for testing. No entry into any confined space structure will be allowed during sample acquisition. If insufficient sediment mass is present in the target locations, potential alternate manhole structures will be opened and assessed for sediment accumulation. If mass is very limited, compositing of masses of multiple manholes will be allowed, if necessary. The priority for analysis and minimum sample masses are presented in Tables 2 and 3.

Triplicate field replicates at all three sediment sampling locations (three separate grabs as practicable, subject to field confirmation of sediment accumulation sufficient for this SQAPP) will allow for the assessment of variability of the CSO solids matrix (three sampling locations result in a total of nine tests). Table 2 summarizes sample locations and analyses to be conducted. Figure 2 depicts sample locations.

## 4.2 Sampling Methods

This section describes sampling methods and includes sample identification, station positioning, sediment, and processing.

### *4.2.1 Sample Identification*

Each sediment sample will be assigned a unique alphanumeric identifier according to the following method:

- Each sample ID will be identified by the overall site (KC) and location within the site as well as the sample collection method.
  - The sample matrix will be identified by "S" for sediment.
  - Station numbers will be added after the sample matrix identifier and are listed in Table 3 and shown in Figure 2.
  - Sediment will be analyzed in triplicate. An A, B, or C will identify the three field replicates.
  - The date in YYMMDD format will be appended to the end of the sample ID.
- Example sample identification nomenclature includes the following:
  - KC-S-SMHQ16-A-180815: The first replicate of a sediment sample collected from station SMHQ16 on August 15, 2018

### *4.2.2 Station Positioning*

Stations will be located in the field. Where manhole structures differ from anticipated conditions, notes will be recorded to inform further evaluation. Differential global positioning system coordinates will be collected at each structure location.

### *4.2.3 Sediment Sampling Methodology*

A sediment sample will be collected from the pipe where there is no accumulated water to facilitate collection of all grain sizes present in the sediment, as practicable. If standing or running water is present, sampling will be performed in a manner to minimize as practicable the mobilization of solids while collecting the sample. Sample collection and handling will be consistent with procedures described below and in Section 4. Sediments will be sampled as follows:

- Open the manhole using the appropriate safety equipment, exercising care not to drop the grate or cover on hands or feet.
- Sample from above ground (no confined space entry is allowed).
- Lower a decontaminated stainless-steel sampling instrument, potentially deploying a range of sediment sampling equipment such as a Ponar sampler, core, or other gear as appropriate for

the specific circumstance, to reach and sample accumulated sediment within the conveyance system.

- If sufficient mass is present, discretely collect two additional replicate samples.
- Place the sediment sample from each grab replicate into decontaminated stainless-steel bowls, homogenize, and place into pre-cleaned, laboratory-supplied sample jars.
- Chill samples immediately by placing in a cooler with sealed ice bags or blue ice and maintain at 4°C or below without freezing.
- Transport or ship samples via courier to the laboratory following the chain-of-custody procedures listed in Section 4.3.3.

Laboratory analyses will include Sediment Management Standard-listed physical and chemical testing for total solids, grain size, total organic carbon, metals, semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and dioxins/furans, as outlined in Table 4. If limited sample mass is collected, chemical analyses will be prioritized as specified in Table 2.

## 4.3 Sample Handling Requirements

This section addresses the sampling program requirements for field decontamination, investigation-derived waste management, sample custody, and sample shipping requirements.

### *4.3.1 Field Decontamination Procedures*

Sample containers, instruments, working surfaces, and other items that may come into contact with the sample must meet high standards of cleanliness. All equipment and instruments used that are in direct contact with the sediment for analysis must be made of glass, stainless steel, high-density polyethylene, or polytetrafluoroethylene. These items will be cleaned prior to each day's use and between sampling or compositing events. Decontamination of all items will follow Puget Sound Estuary Program protocols. The decontamination procedure is as follows:

1. Pre-wash rinse with tap water or site water.
2. Wash with a solution of tap water and phosphate-free soap (e.g., Alconox) (use a brush).
3. Rinse with tap water.
4. Rinse three times with distilled water.
5. Cover (no contact) all decontaminated items with aluminum foil.
6. Store in a clean, closed container; for bowls, store inverted on a foil-covered surface for next use.

### *4.3.2 Investigation-Derived Waste Management*

Sediment remaining after sample processing and without visible indications (such as sheens) of contamination will be returned back into PSO4 conveyance system.

All disposable sampling materials and personal protective equipment used in sample processing, such as disposable gloves and paper towels, will be placed in heavy-duty garbage bags or other appropriate containers. Disposable supplies will be placed in a normal refuse container on site for disposal as solid waste.

### *4.3.3 Sample Custody and Shipping Requirements*

Samples are considered to be in one's custody if they are in the custodian's possession or view, in a secured location (under lock) with restricted access, or in a container that is secured with official seals such that the sample cannot be reached without breaking the seals.

Chain-of-custody procedures will be followed for all samples throughout the collection, handling, and analytical process. The principal document used to track possession and transfer of samples is the chain-of-custody form. Each sample ID will be listed on an electronic or handwritten chain-of-custody form the day it is collected. All handwritten 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 chain-of-custody form will be lined-out, dated, and initialed by the individual maintaining custody.

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

All samples will be shipped or hand-delivered to the analytical laboratory no later than the day after collection. Samples collected on Friday may be held until the following Monday for shipment, provided that this does not jeopardize any holding time requirements. Specific sample shipping procedures are as follows:

- Each cooler or container holding the samples for analysis will be hand-delivered the day of sample collection, couriered, or shipped via overnight delivery to the appropriate analytical laboratory. In the event that Saturday delivery is required, the FC will contact the analytical laboratory before 3 p.m. on Friday to ensure that the laboratory is available to accept the samples and is aware of the number of containers shipped. The airbill tracking numbers for those containers will be provided to the laboratory.

- Ice will be sealed in separate plastic bags and placed in the shipping containers. Ice may be kept in the bag provided and placed in the cooler if the samples will be couriered or hand-delivered.
- Individual samples will be placed in sealable plastic bags, 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.
- If the samples are transferred using a commercial shipping company, the following procedures will be followed:
  - 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 placed inside the cooler.
  - A minimum of two signed and dated chain-of-custody seals will be placed on adjacent sides of each cooler prior to shipping.
  - Each cooler will be wrapped securely with packing tape and 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 persons transferring custody of the sample container will sign the chain-of-custody form. Upon receipt of samples at the laboratory, the person receiving the sample will sign the chain-of-custody form. The shipping container seals will be broken (if applicable) 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 lab to track sample handling and final disposition.

## 4.4 Laboratory Methods

This section summarizes the target physical and chemical analyses that will be conducted on the samples collected. All sample analyses will be conducted in accordance with EPA-approved methods or other commonly acceptable methods and this SQAPP. Prior to analyses, all samples will be maintained according to the appropriate holding times and temperatures for each analysis (Table 3). Analytes, analytical methods, and target detection limits for chemical and physical testing are presented in Table 4. The analytical laboratory will prepare a detailed report in accordance with this SQAPP.

Prior to the analyses of the samples, the laboratory will calculate method detection limits (MDLs) and establish reporting limits (RLs) and target practical quantitation limit (PQL) for each analyte of interest, where applicable. For this purpose, a target PQL value is specified in Table 4, if technically feasible.

Chemical/physical testing will be conducted at Analytical Resources, Inc., in Tukwila, Washington. Analytical Resources, Inc. is accredited under the National Environmental Laboratories Accreditation Program. All chemical and physical testing will adhere to the most recent EPA QA/QC procedures outlined in the approved analytical methods and in this SQAPP. If more current analytical methods are available, the laboratories may use them.

In completing chemical analyses for this project, the contract laboratories are expected to meet the following minimum requirements:

- Adhere to the methods outlined in this SQAPP, including methods referenced for each analytical procedure (Table 4).
- Deliver electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet turnaround times for deliverables.
- Implement QA/QC procedures discussed in this SQAPP, including following DQOs, laboratory QC requirements, and performance evaluation testing requirements.
- Notify the project QA/QC Manager of any SQAPP QA/QC problems when they are identified to allow for quick resolution.
- Allow laboratory and data audits to be performed, if deemed necessary.

# 5 Quality Assurance/Quality Control

Field and laboratory activities will be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols developed for EPA SW-846 (1986), the EPA Contract Laboratory Program (EPA 2016, 2017a, 2017b), and the cited methods. Laboratory Data Consultants of Carlsbad, California, will conduct third-party validations of the applicable laboratory results.

## 5.1 Field Quality Control

Anchor QEA personnel will identify and label samples in a consistent manner to ensure that field samples are traceable. Labels should be used in conjunction with the chain-of-custody and this SQAPP to provide all information necessary for the laboratory to conduct required analyses properly. QA samples will be collected in the field to ensure project analytical DQOs are met. Samples will be placed in appropriate containers and preserved for shipment to the laboratory in accordance with the requirements presented in Table 3.

## 5.2 Field Quality Assurance Sampling

Field QA procedures will consist of following procedures for acceptable practices for sample collection and handling. This also includes periodic and routine equipment inspection.

If sufficient samples can be collected, field QA samples will include the collection of additional sample mass or volume as required to ensure that the laboratory has sufficient sample mass or volume to run the matrix-specified analytical QA/QC (matrix duplicate [MD]/matrix spike [MS]/MS duplicate [MSD]) samples for analyses as specified in Table 4. The samples designated for MD/MS/MSD analyses should be clearly marked on the chain-of-custody.

All field QA samples will be documented on the field forms and verified by the QA/QC Manager or designee.

### *5.2.1 Sample Containers*

Sample containers and preservatives will be provided by the laboratory. The laboratory will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided. Container requirements are listed in Table 3.

### *5.2.2 Sample Identification and Labels*

Each sample will have an adhesive plastic or waterproof paper label affixed to the container 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 identification
- Date and time of sample collection
- Preservative type (if applicable)
- Analysis to be performed

## 5.3 Analytical Data Quality Objectives and Criteria

The analytical DQOs for this project will ensure that the data collected are of known and acceptable quality so that the project objectives described in this SQAPP are achieved. The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, and completeness (the "PARCC" parameters). Definitions of these parameters and the applicable QC procedures are given below. Applicable quantitative goals for these data quality parameters are listed or referenced in Table 5.

### *5.3.1 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 laboratory analyses. The ASTM recognizes two levels of precision (ASTM 2002):

- 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
- 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

In the laboratory, "within-batch" precision is measured using duplicate 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 analyses of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of three replicates for sediment chemistry samples. Field chemistry triplicate precision will be screened against an RSD of 50%. However, data may not be qualified based solely on field homogenization duplicate precision but will be left to the

discretion of the validator. Laboratory precision control limits are listed in Table 5 for each analysis. The RSD equation used to express precision is as follows:

**Equation 1**

$$RSD = 100S/\bar{x}$$

where:

| | | |
|---|---|---|
| $RSD$ | = | relative standard deviation |
| S | = | standard deviation of the three observed values |
| $\bar{x}$ | = | average of the three observed values |

Precision measurements can be affected by the nearness of a chemical concentration to the MDL, where the percent error (expressed as RSD) increases. Parent and/or field duplicate results that are < 5x the RL will be evaluated by using the average difference between the results using a control limit of ± 2x RL.

### *5.3.2 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 value of results from analyses of laboratory control samples, standard reference materials, and standard solutions. In addition, matrix-spiked samples are also measured, which indicate 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 that are not the true or expected values, 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 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 using quantitative laboratory control sample, MS, surrogate spike, and calibration standard recoveries compared with method-specified performance criteria or criteria listed in Table 5. Accuracy can be expressed as a concentration compared to the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

**Equation 2**

$$\%\mathrm{R} = 100\% \times (\mathrm{S} - \mathrm{U})/\mathrm{Csa}$$

where:

| | | |
|---|---|---|
| $\%R$ | = | percent recovery |
| $S$ | = | measured concentration in the spiked aliquot |
| $U$ | = | measured concentration in the unspiked aliquot |
| $Csa$ | = | actual concentration of spike added |

Field accuracy will be controlled by adherence to sample collection procedures outlined in this SQAPP.

### *5.3.3 Representativeness*

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition.

### *5.3.4 Comparability*

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

### *5.3.5 Completeness*

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

**Equation 3**

$$\mathrm{C} = \frac{(Number\ of\ acceptable\ data\ points) \times 100}{Total\ number\ of\ data\ points}$$

where:

| | | |
|---|---|---|
| C | = | completeness |

The analytical DQO for completeness for all components of this project is 95%. Data that have been qualified as estimated because the QC criteria were not met, will be considered valid for the purpose of assessing completeness. Data that have been rejected will not be considered valid for the purpose of assessing completeness.

### *5.3.6 Sensitivity*

Sensitivity is a measure of analytical detection and reporting limits. In general, the lowest technologically achievable MDLs, RLs, and PQLs will be targeted for this project. The sediment matrix is complex and may result in elevated MDLs, RLs, and PQLs above those targets (Table 4).

The MDL is defined as the minimum concentration at which a given target analyte can be measured and reported with 99% 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. Laboratory MDLs and RLs will be used to evaluate the method sensitivity and applicability prior to the acceptance of a method for this program. Method blanks will be analyzed to ensure target analytes are not introduced during sample preparation or analysis that would affect the analytical sensitivities.

The sample-specific MDLs and RLs will be reported by the laboratory and will take into account any factors relating to the sample analysis that might decrease or increase these limits (e.g., dilution factor, percent moisture, and analytical mass/volume). In the event that MDLs and RLs are elevated due to matrix interferences and subsequent dilutions or reductions in sample aliquots, the data will be evaluated by Anchor QEA and the laboratory to determine if an alternative course of action is required or possible. The sample-specific MDLs and RLs will be the values provided in the project database.

## 5.4 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. A summary of the analytical DQOs is provided in Table 5. QA/QC sample analytical frequencies are provided in Table 6.

The analyst will review the results of the QC samples from each sample group 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 will be contacted immediately, and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

### 5.4.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used prior to the start of the project, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria. An initial calibration verification will be analyzed following each initial calibration and will meet method criteria prior to analyses of samples. Continuing calibration verifications will be analyzed at method-required frequencies to track instrument performance. The frequency of continuing calibration verifications varies with method. For gas chromatography (GC)/mass spectrometer methods, one will be analyzed every 12 hours. For GC, metals, and inorganic methods, one will be analyzed for every 10 field samples analyzed and at the end of each run. If the continuing calibration is out of control, the analysis will be terminated until the source of the control failure is eliminated or reduced to meet control specifications, which may include analyzing a new initial calibration. Any project samples analyzed while the instrument calibration was out of control will be reanalyzed.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to or immediately following continuing calibration verification at the instrument for each type of applicable analysis.

### 5.4.2 Matrix Spikes and Matrix Spike Duplicates

Analyses of MS samples provide information on the extraction efficiency of the method on the sample matrix, as well as any interferences introduced by the sample matrix. By analyzing MS samples in duplicate, information on the precision of the method is also provided.

### 5.4.3 Laboratory Duplicates/Replicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample. An MSD may be analyzed in lieu of a laboratory duplicate.

### 5.4.4 Method Blanks

Method blanks are prepared and analyzed in the same manner as project samples to assess possible laboratory contamination at all stages of sample preparation and analysis. The method blank for all analyses must be less than the method reporting limit of any single target analyte. If a laboratory method blank exceeds this criterion for any analyte, and the concentration of the analyte in any of the samples is less than five times the concentration found in the blank (10 times for common

contaminants), analyses must stop, and the source of contamination must be eliminated or reduced. Affected samples should be re-prepared and reanalyzed, if possible.

### *5.4.5 Laboratory Control Samples*

Laboratory control samples are analyzed to assess possible laboratory bias at all stages of sample preparation and analysis. The laboratory control sample is a matrix-dependent spiked sample prepared at the time of sample extraction along with the preparation of the sample, MD, MS, and method blank. The laboratory control sample will provide information on the accuracy of the analytical process, and when analyzed in duplicate, will provide precision information as well.

### *5.4.6 Laboratory Deliverables*

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. The analytical laboratory will be required, where applicable, to report the following:

- **Project Narrative**. This summary, in the form of a cover letter, will include a discussion of any problems encountered during analyses. This summary should include (but not be limited to) QA/QC, sample receipt, sample storage, and analytical difficulties. Any problems encountered and their resolutions will be documented in as much detail as appropriate.
- **Chain-of-Custody Records**. Legible copies of the chain-of-custody forms will be provided as part of the data package. This documentation will include the time of receipt and condition of the samples received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented on a sample receipt form. The form must include sample shipping container temperatures measured at the time of sample receipt.
- **Sample Results**. The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identification code and the corresponding laboratory identification code
  - Sample matrix
  - Date of sample preparation/extraction
  - Date and time of analysis
  - Mass or volume used for preparation and analysis
  - Final dilution or concentration factors for the sample
  - Identification of the instrument used for analysis
  - MDLs and method RLs accounting for sample-specific factors (e.g., dilution and total solids)
  - Analytical results with reporting units identified
  - Data qualifiers and their definitions

- **QA/QC Summaries**. This section will contain the results of the laboratory QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results. No recovery or blank corrections will be made by the laboratory. The required summaries are as follows (additional information may be requested):
  - **Instrument Performance Checks**. Injection times and percent relative ion abundances will be reported and compared to method criteria. Associated samples and analysis times will also be reported.
  - **Calibration Data Summary**. These summaries will report the concentrations of the initial calibration and continuing calibration standards and the date and time of analyses. The response factor, percent relative standard deviation, percent drift/difference, percent recovery, and retention time for each analyte will be listed, as appropriate. Calibration results for standards will be documented to indicate instrument sensitivity.
  - **Internal Standard Area Summary**. Internal standard areas will be reported and evaluated against method criteria.
  - **Method Blank Analysis**. The method blank analysis associated with each sample and the concentration of all target analytes identified in these blanks will be reported.
  - **Surrogate Spike Recovery**. All surrogate spike recoveries for organic analyses will be reported. The name and concentration of all compounds added, percent recoveries, and range of acceptable recoveries will be provided.
  - **MS Recovery**. MS recovery data for all applicable analyses will be reported. The names and concentrations of analytes added, percent recoveries, and range of acceptable recoveries will be listed. The percent recoveries and RPD values for MSD analyses will be reported.
  - **Matrix Duplicates**. The RPD values for MD analyses will be reported.
  - **Laboratory Control Sample**. Laboratory control sample recovery data will be reported. The names and concentrations of analytes added, percent recoveries, and range of acceptable recoveries will be included. The percent recoveries and RPD values for laboratory control sample duplicate analyses will be included.
- **Original Data**. Legible copies of the original data generated by the laboratory will include the following information:
  - Sample extraction, preparation, and cleanup logs including methods used
  - Instrument analysis logs for all instruments used on days of calibration and sample analyses
  - Calculation worksheets as applicable
  - Ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials as applicable

  - Copies of full scan chromatograms and quantitation reports for GC/mass spectrometer analyses of samples, standards, blanks, calibrations, spikes, replicates, and reference materials
  - Enhanced spectra of detected compounds with associated best-match spectra for each sample
- **Electronic Data Deliverable**. An electronic data deliverable in the Anchor QEA custom EQuIS format specified in advance.

## 5.5 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

### *5.5.1 Field Instruments/Equipment*

In accordance with the QA program, Anchor QEA shall maintain an inventory of field instruments and equipment. The frequency and types of maintenance will be based on the manufacturer's recommendations and previous experience with the equipment.

The Anchor QEA FC will be responsible for the preparation, documentation, and implementation of the preventive maintenance program. The equipment maintenance information will be documented in the instrument's calibration log. The frequency of maintenance is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in each specific manufacturer's instruction manuals.

All maintenance records will be verified prior to each sampling event. The FC will be responsible for verifying that required maintenance has been performed prior to using the equipment in the field. For this project, maintenance inspections will include the following activities:

- The subcontractor responsible for navigation will confirm proper operation of the navigation equipment daily. This verification may consist of internal diagnostics or visiting a location with known coordinates to confirm the coordinates indicated by the navigation system.
- The winch line, as well as sediment samplers, will be inspected daily for fraying, misalignment, loose connections, and any other applicable mechanical problems.

Any problems will be noted in the field logbook and corrected prior to continuing sampling operations.

### *5.5.2 Laboratory Instruments/Equipment*

In accordance with the QA program, the laboratory must maintain an inventory of instruments and equipment, and the frequency of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The laboratory preventative maintenance program, as detailed in the laboratory QA Plan, is organized to maintain proper instrument and equipment performance and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics, the availability of spare parts, and the frequency at which maintenance is required. Any equipment that has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure that it is in proper operational condition. The client will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. The client will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding or turnaround times.

Laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. Maintenance records will be checked according to the schedule on an annual basis and recorded by laboratory personnel. The Laboratory QA/QC Manager or designee shall be responsible for verifying compliance.

#### 5.5.2.1 Laboratory Instrument/Equipment Calibration

As part of their QC program, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals (e.g., balances, drying ovens, refrigerators, and thermometers), and operational calibrations are performed daily at a specified frequency or prior to analysis (i.e., initial calibrations) according to method requirements. Calibration procedures and frequency are discussed in the laboratory QA Plan. Calibrations are discussed in the laboratory standard operating procedures (SOPs) for analyses.

The Laboratory QA/QC Manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program will be the responsibility of the respective laboratory Group Supervisors. Recognized procedures (EPA, ASTM, or manufacturer's instructions) will be used when available.

Physical standards (i.e., weights or certified thermometers) will be traceable to nationally recognized standards such as the National Institute of Standards and Technology. Chemical reference standards will be National Institute of Standards and Technology standard reference materials or vendor-certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions will be accessible, either in the laboratory SOPs or in the laboratory's QA Plan for each instrument or analytical method in use. All calibrations will be preserved on electronic media.

## 5.6 Inspection/Acceptance of Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory-prepared sampling bottles, will be performed by the FC. All primary chemical standards and standard solutions used for this project, either in the field or laboratory, will be traceable to documented, reliable commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

## 5.7 Data Management

Field data sheets will be checked for completeness and accuracy by the FC prior to delivery to the Data Manager. Data generated in the field will be documented on electronic or hard copy and provided to the Data Manager, who is responsible for the data entry into the database. All manually entered data will be verified by a second party. Field documentation will be filed in the main project folder after data entry and verification are complete.

Laboratory data will be provided to the Data Manager in the EQuIS electronic format. Laboratory data that is electronically provided and loaded into the database will undergo a check against the laboratory hard copy data. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. The accuracy of all manually entered data will be verified. Data tables and reports will be exported from EQuIS to Microsoft Excel tables.

# 6 Assessments and Response Actions

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

## 6.1 Compliance Assessments

Laboratory and field performance audits consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement. Laboratory audits will not be conducted as part of this study. However, all laboratory audit reports will be made available to the project QA/QC Manager upon request. The laboratory is required to have written procedures addressing internal QA/QC. These procedures have been submitted and the project QA/QC Manager will review them to ensure compliance with this SQAPP. The laboratory must ensure that personnel engaged in analytical tasks have appropriate training. The laboratory will provide written details of any and all method modifications planned prior to project commencement.

## 6.2 Response and Corrective Actions

The following paragraphs identify the responsibilities of key project team members and actions to be taken in the event of an error, problem, or non-conformance of protocols identified in this document.

### *6.2.1 Field Activities*

The FC will be responsible for correcting equipment malfunctions during the field sampling effort. The project QA/QC Manager will be responsible for resolving situations identified by the FC that may result in non-compliance with this SQAPP. All corrective measures will be immediately documented in the field logbook.

### *6.2.2 Laboratory*

The laboratory is required to comply with its SOPs. The Laboratory Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this SQAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The Laboratory Project Manager will be notified immediately if any QC sample exceeds the project-specified control limits and corrective action does not improve the result. The analyst will identify and correct the anomaly before continuing with the sample analysis. If the laboratory internal corrective action does not resolve the non-conformance, the Laboratory Project Manager will notify the QA/QC Manager. A narrative describing the anomaly, the steps taken to identify and correct the

anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and re-extraction) will be submitted with the data package in the form of a cover letter.

## 6.3 Reports to Management

QA reports to management include verbal status reports, data validation reports, and final project reports. These reports are the responsibility of the QA/QC Manager.

# 7 Data Validation, Usability, and Reporting

This section describes the processes that will be used to review project data quality.

## 7.1 Data Review, Validation, and Verification

During the validation process, analytical data will be evaluated for project, method, and laboratory QC 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.

## 7.2 Validation and Verification Methods

Data validation includes signed entries by the field and laboratory technicians on field datasheets and laboratory datasheets, respectively; review for completeness and accuracy by the FC and Laboratory Manager; review by the QA/QC Manager for outliers and omissions; and the use of QC criteria to accept or reject specific data. All data will be entered into the EQuIS database and a raw data file printed or exported. A second Data Manager or designee will perform a cursory verification of the database raw data file. If errors are found, further verification will be performed to ensure that all data are accurate. Any errors found will be corrected in the database and the laboratory will be notified of the errors.

All laboratory data will be reviewed and verified to determine whether analytical DQOs have been met and that appropriate corrective actions have been taken, when necessary. The project QA/QC Manager or designee will be responsible for the final review of data generated from analyses of samples.

The first level of review will take place in the laboratory as the data are generated. The laboratory department manager or designee will be responsible for ensuring that the data generated meet minimum QA/QC requirements and that the instruments were operating under acceptable conditions during generation of data. Analytical DQOs will also be assessed at this point by comparing the results of QC measurements with pre-established criteria as a measure of data acceptability.

The analysts or laboratory department manager will prepare a preliminary QC checklist for each parameter and for each sample delivery group as soon as analysis of a sample delivery group has been completed. Any deviations from the analytical DQOs listed on the checklist will be brought to the attention of the Laboratory Manager to determine whether corrective action is needed and to determine the impact on the reporting schedule.

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. Stage 2B validations (EPA 2009) will be conducted on all data packages except dioxins/furans, which will undergo Stage 4 validation. Data validation will be conducted by a reviewer using current National Functional Guidelines data validation requirements (EPA 2016, 2017a, 2017b) by considering the following information, as applicable:

- Chain-of-custody documentation and sample receipt condition
- Holding times
- Instrument performance checks
- Initial calibrations
- Continuing calibrations
- Method blanks
- Surrogate recoveries
- Internal standard recoveries
- Detection limits
- Reporting limits
- Laboratory control samples
- MS/MSD samples
- Field and laboratory duplicates
- Rinsate blanks
- Standard reference material results

The data will be validated in accordance with the project-specific analytical DQOs described above, analytical method criteria, and the laboratory's internal performance standards based on their SOPs.

## 7.3 Reconciliation with User Requirements

The QA/QC Manager will review data after each survey to determine if analytical DQOs have been met. If data do not meet the project's specifications, the QA/QC 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. Retraining, revision of techniques, or replacement of supplies/equipment should correct the problem; if not, the analytical DQOs will be reviewed for feasibility. If specific analytical DQOs are not achievable, the QA/QC Manager will recommend appropriate modifications.

## 7.4 Data Reporting

Following data validation, Anchor QEA will prepare the following reporting materials:

### *7.4.1 Data Summary Transmittal*

Anchor QEA will prepare a concise data transmittal memorandum. The memorandum will reference the SQAPP and document any deviations from it. The data memorandum will include the following:

- As-collected sample locations
- Chemical analyses results data tables will be included summarizing chemical and conventional variables and all pertinent QA/QC data.
- Copies of complete laboratory data packages will be included as appendices or attachments.
- Copies of applicable sections of the field logs will be included as appendices or attachments.
- Copies of validation reports and findings will be included as appendices or attachments.

The data memorandum will be produced for a review, revision, and approval cycle with Ecology. Following Ecology's approval of the data memorandum, the final validated result will be loaded into Ecology's Environmental Information Management system.

# 8 References


ASTM (ASTIM International), 2002. Standard Practices for Use of the Term Precision and Bias in ASTM Test Methods. 177-90a.

Ecology, 2017. *Draft Sediment Cleanup User's Manual II*. Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC. Publication No. 12-09-057. April 2017.

EPA (U.S. Environmental Protection Agency), 1986. Test Methods for Evaluation Solid Waste: Physical/Chemical Methods Compendium. SW-846. Available at: https://www.epa.gov/hw-sw846/sw-846-compendium.

EPA, 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA QA/G-4. February 2006. Available at: https://www.epa.gov/fedfac/guidance-systematic-planning-using-data-quality-objectives-process

EPA, 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response. USEPA 540-R-08-005. January 2009.

EPA, 2016. *National Functional Guidelines for High Resolution Superfund Methods Data Review*. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation (OSRTI). EPA 542-B-16-001. April 2016.

EPA, 2017a. *National Functional Guidelines for Organic Superfund Methods Data Review*. OSRTI. EPA 540-R-2017-002. January 2017.

EPA, 2017b. *National Functional Guidelines for Inorganic Superfund Methods Data Review*. OSRTI. EPA 540-R-2017-001. January 2017.

# Tables

**Table 1**
**Data Quality Objectives for Sampling CSO PSO4[1]**

| DQO Step | Description |
|---|---|
| STEP 1: State the problem | East Waterway sediments have received hazardous substance releases from a variety of sources since commercial/industrial operations began, including upland, in-water, and overwater operations; spills; leaks; discharge of stormwater, sewage, and wastewater; nearshore burning; and direct discharge. Along with identifying other elements of the East Waterway conceptual site model, the remedial investigation/feasibility study (RI/FS) will identify ongoing sources that have the potential to result in sediment recontamination. Combined sewer overflow (CSO) PSO4 is a historical and current point source of potential sediment contamination to East Waterway. |
| STEP 2: Identify the goals of the study | Principal Study Questions:<br>• What is the nature (i.e., types and magnitude) of hazardous substances that have been discharged (historically and currently) to East Waterway from PSO4?<br>• Would ongoing sources of hazardous substances from PSO4 pose a recontamination risk to post-remedial sediments in East Waterway? |
| STEP 3: Identify the information inputs | Existing and Forthcoming Data/Reports<br>• Existing investigations will be summarized in the forthcoming RI/FS Work Plan, including sampling data collected by the Washington State Department of Ecology, Kimberly-Clark (K-C), Port of Everett, and others.<br>• Additional data to be considered in the RI/FS include historical and current water quality information for regional industrial and municipal CSO solids, whole water testing, and available National Pollutant Discharge Elimination System information.<br><br>New Data to Be Collected Under this Sampling and Quality Assurance Project Plan (SQAPP):<br>• CSO solids chemical data for the PSO4 CSO conveyance system, scheduled to be decommissioned in fall 2018, provided that finer-grained sediments are present and accessible within the system. |
| STEP 4: Define the boundaries of the study | Geographic Area<br>• While the RI/FS source evaluation process will encompass sediments throughout the East Waterway that exceed sediment cleanup standards and/or remediation levels developed in the RI/FS process, this SQAPP focuses only on the PSO4 CSO, which discharges into the northeast area of the East Waterway (Figures 1 and 2).<br><br>Time Frame<br>• Data collection under this SQAPP is targeted for late August or early September 2018, to be coordinated with the upcoming rerouting of the current discharge into PS05 beginning in late August 2018, and follow-on decommissioning of the PSO4 CSO beginning in September 2018. CSO PSO5 discharges into East Waterway to the south of the current PSO4 (Figure 2).<br><br>Sample Type<br>• CSO solids (if possible). |

[1] A full set of DQOs will be developed as part of the work plan for the East Waterway RI/FS investigation. The DQOs described herein for CSO PSO4 represent one of multiple DQOs that will be developed for the RI/FS. Sampling results from CSO PSO4 will be included in the East Waterway RI/FS.

**Table 1**
**Data Quality Objectives for Sampling CSO PSO4[1]**

| DQO Step | Description |
|---|---|
| STEP 5: Develop the analytical approach | Historical (2012) and recent (2018) video inspection work conducted by City of Everett indicate that three representative locations within the PS04 conveyance system scheduled to be decommissioned have a likelihood of sediment accumulation sufficient for this SQAPP, subject to field confirmation and adjustment as necessary:<br>• SMHQ03 located immediately upgradient of numerous 90-degree pipe ends under the railroad track (Figure 2; to serve as an indicator of source solids upstream of the K-C property)<br>• SMHQ16 located immediately upgradient of a section of pipe that historically accumulated the greatest amount of sediment (Figure 2; representing the location with the highest likelihood of sediment accumulation sufficient for this SQAPP)<br>• SMHP01 located near the end of the conveyance system (Figure 2; to serve as an indicator of source solids just prior to entering the East Waterway)<br><br>Triplicate field replicates at all three sediment sampling locations (three separate grabs as practicable, subject to field confirmation of sediment accumulation sufficient for this SQAPP) will allow for the assessment of variability of the CSO solids matrix.<br><br>The CSO solids data will be used with other available information to evaluate whether ongoing sources of hazardous substances currently discharging through the PSO4 conveyance system pose a recontamination risk to post-remedial sediments in East Waterway (i.e., potential for exceedance of sediment cleanup standards and/or remediation levels developed in the RI/FS process). It may also inform source characterization and the nature and extent of sediment contamination that may have been associated with discharges from PSO4. With regard to recontamination risk, these data could be used in a simplified mass balance or fate/transport modeling framework, and regarding historical and ongoing sources, these data could be helpful in a weight-of-evidence assessment involving line history, sediment contamination distribution, and sediment transport dynamics. Details will be developed as part of the forthcoming East Waterway RI/FS Work Plan. |
| STEP 6: Specify performance or acceptance criteria | Performance or acceptance criteria will be described in the SQAPP. The following quality control considerations will be addressed:<br>• Field quality control samples<br>• Laboratory quality control<br>• Data quality indicators for laboratory analyses (precision, accuracy, representativeness, completeness, and comparability) |
| STEP 7: Develop the detailed plan for obtaining data | CSO solids:<br>• CSO solids sampling targets, methods, and analytes are described in other sections of this SQAPP (analytes include total solids grain size, total organic carbon, metals, semivolatile organic compounds, polycyclic aromatic hydrocarbons, polychlorinated biphenyl congeners, and dioxin/furan congeners) |

## Table 2
## Sample Stations, Priority, and Analyses Summary

| Location ID[a] | Analysis Priorty / Parameter / Sample ID | 1[b] Dioxin/Furans | 1[b] PCB Congeners | 2 SVOCs/PAHs | 3 Metals | 4 TOC | 5 Grain size | 6 Archive |
|---|---|---|---|---|---|---|---|---|
| SMHPO1 | KC-S-SSMHPO1-A-YYMMDD | X | X | X | X | X | X | X |
| | KC-S-SMHPO1-B-YYMMDD | X | X | X | X | X | X | X |
| | KC-S-SMHPO1-C-YYMMDD | X | X | X | X | X | X | X |
| SMHQ02 | KC-S-SMHQ02-A-YYMMDD | X | X | X | X | X | X | X |
| | KC-S-SMHQ02-B-YYMMDD | X | X | X | X | X | X | X |
| | KC-S-SMHQ02-C-YYMMDD | X | X | X | X | X | X | X |
| SMHQ16 | KC-S-SMHQ16-A-YYMMDD | X | X | X | X | X | X | X |
| | KC-S-SMHQ16-B-YYMMDD | X | X | X | X | X | X | X |
| | KC-S-SMHQ16-C-YYMMDD | X | X | X | X | X | X | X |

Notes:

a. Actual sample locations may vary based on access and presence or absence of sediment. If no accessible location provides enough sediment for all analyses, sediment may be composited from multiple locations.

b. Total solids mass is to be taken from first available jar for dry weight conversion. Assumes dioxin/furans and PCB congeners are co-extracted

ID: identification

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

TOC: total organic carbon

SVOC: semivolatile organic compound

**Table 3**

**Sediment Sample Sizes, Holding Times, and Preservation**

| Parameter | Requested Sample Size | Minimum Sample Size | Container Size and Type | Holding Time | Sample Preservation Technique |
|---|---|---|---|---|---|
| Dioxin/furans | 150 g | 50 g | 4-oz Glass | None | < -10°C |
| PCB Congeners | | | | | |
| SVOCs, PAHs | 100 g | 25 g | 8-oz Glass | 14 days until extraction | 0 to 6°C |
| | | | | 1 year until extraction | < -10°C |
| | | | | 40 days after extraction | 0 to 6°C |
| Metals | 50 g | 10 g | 4-oz Glass | 6 months; 28 days for Hg | 0 to 6°C |
| | | | | 2 years (except Hg) | < -10°C |
| TS/TOC | 50 g | 10 g | 4-oz Glass | 14 days | 0 to 6°C |
| | | | | 6 months | < -10°C |
| Grain size | 300 g | 150 g | 16-oz HDPE or Glass | 6 months | 0 to 6°C |
| Archive | -- | -- | 16-oz Glass | 1 year | < -10°C |

Notes:
g: gram
HDPE: high density polyethylene
Hg: mercury
oz: ounce
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SVOC: semivolatile organic compound
TOC: total organic carbon
TS: total solid

## Table 4
## Analytical Parameters, Methods, and Target Reporting Limits

| Parameter | Analytical Method | Marine Sediment AETs[a] | | Laboratory Sediment PQL |
|---|---|---|---|---|
| | | SCO | CSL | |
| **Conventional Parameters** | | -- | | |
| Grain size | PSEP 1986 | -- | -- | 1.0 |
| Total solids | PSEP 1986 | -- | -- | 0.01 |
| Total organic carbon (TOC) | 9060A | -- | -- | 0.05 |
| **Metals** | | **mg/kg dry wt** | | **mg/kg dry wt** |
| Arsenic | 6020A | 57 | 93 | 0.2 |
| Cadmium | 6020A | 5.1 | 6.7 | 0.1 |
| Chromium | 6020A | 260 | 270 | 0.5 |
| Copper | 6020A | 390 | 390 | 0.5 |
| Lead | 6020A | 450 | 530 | 0.1 |
| Mercury | 7471A/7470A | 0.41 | 0.59 | 0.025 |
| Silver | 6020A | 6.1 | 6.1 | 0.2 |
| Zinc | 6020A | 410 | 960 | 4.0 |
| **SVOCs** | | | | |
| **Organic Chemicals** | | **µg/kg dry wt** | | **µg/kg dry wt** |
| 2,4-Dimethylphenol | 8270D-SIM | 29 | 29 | 20 |
| 2-Methylphenol | 8270D-SIM | 63 | 63 | 5.0 |
| 4-Methylphenol | 8270D-SIM | 670 | 670 | 5.0 |
| Benzoic Acid | 8270D-SIM | 650 | 650 | 100 |
| Benzyl Alcohol | 8270D-SIM | 57 | 73 | 20 |
| Dibenzofuran | 8270D | 540 | 540 | 20 |
| Phenol | 8270D-SIM | 420 | 1,200 | 5.0 |
| N-Nitrosodiphenylamine | 8270D-SIM | 28 | 40 | 5.0 |
| **Phthalates** | | **µg/kg dry wt** | | **µg/kg dry wt** |
| Bis(2-ethylhexyl) phthalate | 8270D | 1,300 | 1,900 | 25 |
| Butyl benzyl phthalate | 8270D-SIM | 63 | 900 | 5.0 |
| Diethyl phthalate | 8270D-SIM | 200 | >1,200 | 5.0 |
| Dimethyl phthalate | 8270D-SIM | 71 | 160 | 5.0 |
| Di-n-butyl phthalate | 8270D | 1,400 | 1,400 | 20 |
| Di-n-octyl phthalate | 8270D | 6,200 | 6,200 | 20 |
| **PAHs** | | **µg/kg dry wt** | | **µg/kg dry wt** |
| Total PAHs | 8270D-SIM | -- | -- | -- |
| Total LPAH | 8270D-SIM | 5,200 | 5,200 | -- |
| Naphthalene | 8270D-SIM | 2,100 | 2,100 | 0.6 |
| Acenaphthylene | 8270D-SIM | 1,300 | 1,300 | 0.5 |
| Acenaphthene | 8270D-SIM | 500 | 500 | 0.5 |
| Fluorene | 8270D-SIM | 540 | 540 | 0.5 |
| Phenanthrene | 8270D-SIM | 1,500 | 1,500 | 0.5 |
| Anthracene | 8270D-SIM | 960 | 960 | 0.5 |
| 2-Methylnaphthalene | 8270D-SIM | 670 | 670 | 0.5 |
| Total HPAHs | 8270D-SIM | 12,000 | 17,000 | -- |
| Fluoranthene | 8270D-SIM | 1,700 | 2,500 | 0.5 |
| Pyrene | 8270D-SIM | 2,600 | 3,300 | 0.5 |
| Benzo(a)anthracene | 8270D-SIM | 1,300 | 1,600 | 0.5 |
| Chrysene | 8270D-SIM | 1,400 | 2,800 | 0.5 |
| Total benzo(b+j+k)fluoranthenes | 8270D-SIM | 3,200 | 3,600 | 1.0 |
| Benzo(a)pyrene | 8270D-SIM | 1,600 | 1,600 | 0.5 |
| Indeno(1,2,3-cd)pyrene | 8270D-SIM | 600 | 690 | 0.5 |
| Dibenz(a,h)anthracene | 8270D-SIM | 230 | 230 | 0.5 |

## Table 4
## Analytical Parameters, Methods, and Target Reporting Limits

| Parameter | Analytical Method | Marine Sediment AETs[a] | | Laboratory Sediment PQL |
|---|---|---|---|---|
| | | SCO | CSL | |
| Benzo(g,h,i)perylene | 8270D-SIM | 670 | 720 | 0.5 |
| 1-Methylnaphthalene | 8270D-SIM | -- | -- | 0.5 |
| 2-Chloronaphthalene | 8270D-SIM | -- | -- | 0.5 |
| Biphenyl | 8270D-SIM | -- | -- | 0.5 |
| 2,6-Dimethylnaphthalene | 8270D-SIM | -- | -- | 0.5 |
| 2,3,5-Trimethylbenzene | 8270D-SIM | -- | -- | 0.5 |
| Dibenzothiophene | 8270D-SIM | -- | -- | 0.5 |
| 1-Methylphenanthrene | 8270D-SIM | -- | -- | 0.5 |
| Benzo(b)fluoranthene | 8270D-SIM | -- | -- | 0.5 |
| Benzo(k)fluoranthene | 8270D-SIM | -- | -- | 0.5 |
| Benzo(j)fluoranthene | 8270D-SIM | -- | -- | 0.5 |
| Benzo(e)pyrene | 8270D-SIM | -- | -- | 0.5 |
| Carbazole | 8270D-SIM | -- | -- | 0.5 |
| **Chlorinated Organics** | | **µg/kg dry wt** | | **µg/kg dry wt** |
| 1,2,4-Trichlorobenzene | 8270D-SIM | 31 | 51 | 5.0 |
| 1,2-Dichlorobenzene | 8270D-SIM | 35 | 50 | 5.0 |
| 1,3-Dichlorobenzene | 8270D-SIM | -- | -- | 5.0 |
| 1,4-Dichlorobenzene | 8270D-SIM | 110 | 110 | 5.0 |
| Hexachlorobenzene | 8081B | 22 | 70 | 0.5 |
| Hexachlorobutadiene | 8081B | 11 | 120 | 0.5 |
| Pentachlorophenol | 8270D-SIM | 360 | 690 | 20 |
| **Miscellaneous SVOCs** | | | | **µg/kg dry wt** |
| N-Nitroso-di-n-Propylamine | 8270D-SIM | -- | -- | 20 |
| N-Nitrosodimethylamine | 8270D-SIM | -- | -- | 25 |
| bis(2-chloroethyl)ether | 8270D | -- | -- | 20 |
| 2-Chlorophenol | 8270D | -- | -- | 20 |
| 2,2'-Oxybis(1-chloropropane) | 8270D | -- | -- | 20 |
| Hexachloroethane | 8270D | -- | -- | 20 |
| Nitrobenzene | 8270D | -- | -- | 20 |
| Isophorone | 8270D | -- | -- | 20 |
| 2-Nitrophenol | 8270D | -- | -- | 20 |
| bis(2-Chloroethoxy)methane | 8270D | -- | -- | 20 |
| 2,4-Dichlorophenol | 8270D | -- | -- | 100 |
| 4-Chloroaniline | 8270D | -- | -- | 100 |
| 4-Chloro-3-methylphenol | 8270D | -- | -- | 100 |
| Hexachlorocyclopentadiene | 8270D | -- | -- | 100 |
| 2,4,6-Trichlorophenol | 8270D | -- | -- | 100 |
| 2,4,5-Trichlorophenol | 8270D | -- | -- | 100 |
| 2-Nitroaniline | 8270D | -- | -- | 100 |
| 2,6-Dinitrotoluene | 8270D | -- | -- | 100 |
| 3-Nitroaniline | 8270D | -- | -- | 100 |
| 2,4-Dinitrophenol | 8270D | -- | -- | 200 |
| 4-Nitrophenol | 8270D | -- | -- | 100 |
| 2,4-Dinitrotoluene | 8270D | -- | -- | 100 |
| 4-Chlorophenylphenyl ether | 8270D | -- | -- | 20 |
| 4-Nitroaniline | 8270D | -- | -- | 100 |
| 4,6-Dinitro-2-methylphenol | 8270D | -- | -- | 200 |
| 4-Bromophenol phenyl ether | 8270D | -- | -- | 20 |
| 3,3'-Dichlorobenzidine | 8270D | -- | -- | 20 |

## Table 4
## Analytical Parameters, Methods, and Target Reporting Limits

| Parameter | Analytical Method | Marine Sediment AETs[a] | | Laboratory Sediment PQL |
|---|---|---|---|---|
| | | SCO | CSL | |
| **PCB Congeners** | | **µg/kg dry wt** | | **µg/kg dry wt** |
| PCB-001 to PCB 209 | 1668 | -- | -- | 4.0 |
| Total PCB Congeners | calculated | 130 | 1,000 | 10 |
| **Dioxin/furans** | | | | **ng/kg dry wt** |
| 2,3,7,8-TCDD | 1613B | -- | -- | 1.0 |
| 1,2,3,7,8-PeCDD | 1613B | -- | -- | 1.0 |
| 1,2,3,4,7,8-HxCDD | 1613B | -- | -- | 1.0 |
| 1,2,3,6,7,8-HxCDD | 1613B | -- | -- | 1.0 |
| 1,2,3,7,8,9-HxCDD | 1613B | -- | -- | 1.0 |
| 1,2,3,4,6,7,8-HpCDD | 1613B | -- | -- | 1.0 |
| OCDD | 1613B | -- | -- | 10 |
| 2,3,7,8-TCDF | 1613B | -- | -- | 1.0 |
| 1,2,3,7,8-PeCDF | 1613B | -- | -- | 1.0 |
| 2,3,4,7,8-PeCDF | 1613B | -- | -- | 1.0 |
| 1,2,3,4,7,8-HxCDF | 1613B | -- | -- | 1.0 |
| 1,2,3,6,7,8-HxCDF | 1613B | -- | -- | 1.0 |
| 1,2,3,7,8,9-HxCDF | 1613B | -- | -- | 1.0 |
| 2,3,4,6,7,8-HxCDF | 1613B | -- | -- | 1.0 |
| 1,2,3,4,6,7,8-HpCDF | 1613B | -- | -- | 1.0 |
| 1,2,3,4,7,8,9-HpCDF | 1613B | -- | -- | 1.0 |
| OCDF | 1613B | -- | -- | 2.0 |

Notes:
a. Reporting limits may vary depending on moisture content of sediment, dilutions necessary due to non-target analytes and matri
µg/kg: microgram per kilogram
mg/kg: milligram per kilogram
ng/kg: nanogram per kilogram
AET: apparent effects threshold
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PQL: Practical Quantitation Limits
PSEP: Puget Sound Estuary Program
SCO: Sediment Cleanup Objective
SVOC: semivolatile organic carbon
TOC: total organic carbon
wt: weight

**Table 5**
**Laboratory Data Quality Objectives**

| Parameter | Precision | Accuracy[a] | Completeness |
|---|---|---|---|
| Grain size | ± 20% RPD | N/A | 95% |
| Total solids | ± 20% RPD | N/A | 95% |
| Total organic carbon | ± 25% RPD | 75 – 125% R | 95% |
| Metals | ± 25% RPD | 75 – 125% R | 95% |
| SVOCs/PAHs | ± 35% RPD | 50 – 150% R | 95% |
| PCBs | ± 35% RPD | 50 – 150% R | 95% |
| Dioxin/furans | ± 35% RPD | 50 – 150% R | 95% |

Notes:
a: Accuracy goals apply to laboratory control samples and matrix spike samples, as applicable to the analysis.
N/A: not applicable
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
R: recovery
RPD: relative percent difference
SVOC: semivolatile organic compound

**Table 6**

**Field and Laboratory Quality Control Sample Analysis Summary**

| Analysis Type | Rinsate Blank | Field Duplicate | Initial Calibration[a] | Ongoing Calibration[c] | LCS/OPR | SRM | Laboratory Duplicates | Matrix Spikes | Matrix Spike Duplicates | Method Blanks | Surrogate Spikes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dioxin/furans and PCB congeners | N/A | 1 per 20 samples collected, if possible | As needed | Every 12 hours | 1 per 20 samples | N/A | 1 per 20 samples | N/A[d] | N/A[d] | 1 per 20 samples | Every sample |
| SVOCs/PAHs | N/A | 1 per 20 samples collected, if possible | As needed | Every 12 hours | 1 per 20 samples | N/A | N/A | N/A | N/A | 1 per 20 samples | Every sample |
| Metals | N/A | 1 per 20 samples collected, if possible | Daily | Every 10 samples | 1 per 20 samples | N/A | 1 per 20 samples | 1 per 20 samples | N/A | 1 per 20 samples | N/A |
| Total solids | N/A | 1 per 20 samples collected, if possible | Daily[b] | N/A | N/A | N/A | 1 per 20 samples | N/A | N/A | N/A | N/A |
| Total organic carbon | N/A | 1 per 20 samples collected, if possible | Daily | Every 10 samples | 1 per 20 samples | N/A | 1 per 20 samples | 1 per 20 samples | N/A | 1 per 20 samples | N/A |
| Grain size | N/A | 1 per 20 samples collected, if possible | Daily[b] | N/A | N/A | N/A | 1 per 20 samples | N/A | N/A | N/A | N/A |

Notes:

a. Initial calibration verification and calibration blank must be analyzed after initial calibration and before samples are analyzed.

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

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

d. Isotope dilution method-labeled standards are spiked in every sample to assess method performance in the sample matrix.

LCS: laboratory control sample

N/A: not applicable

OPR: Ongoing Precision and Recovery sample (used for dioxin/furan analysis)

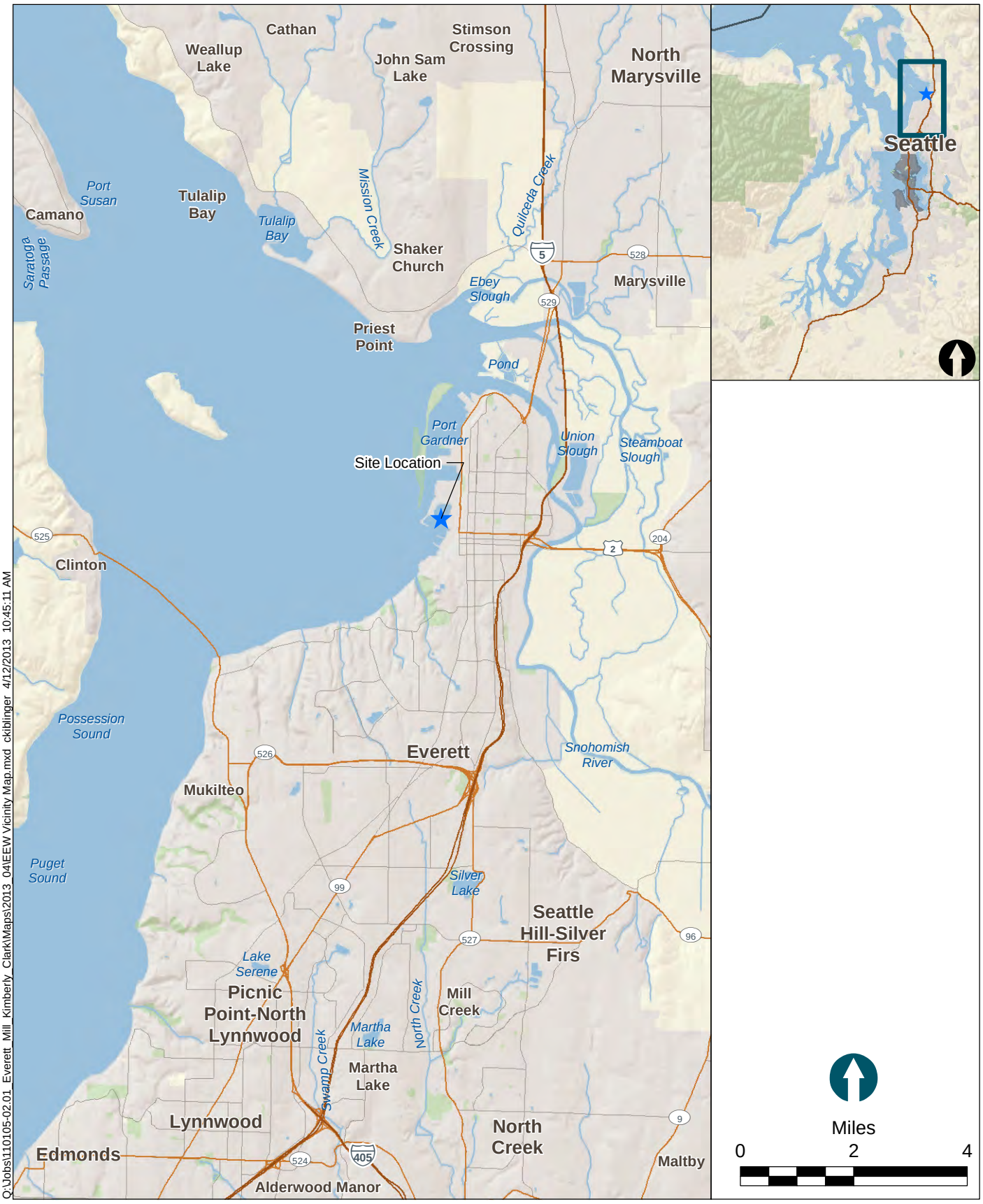
PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

SRM: sediment reference material

SVOC: semivolatile organic carbon

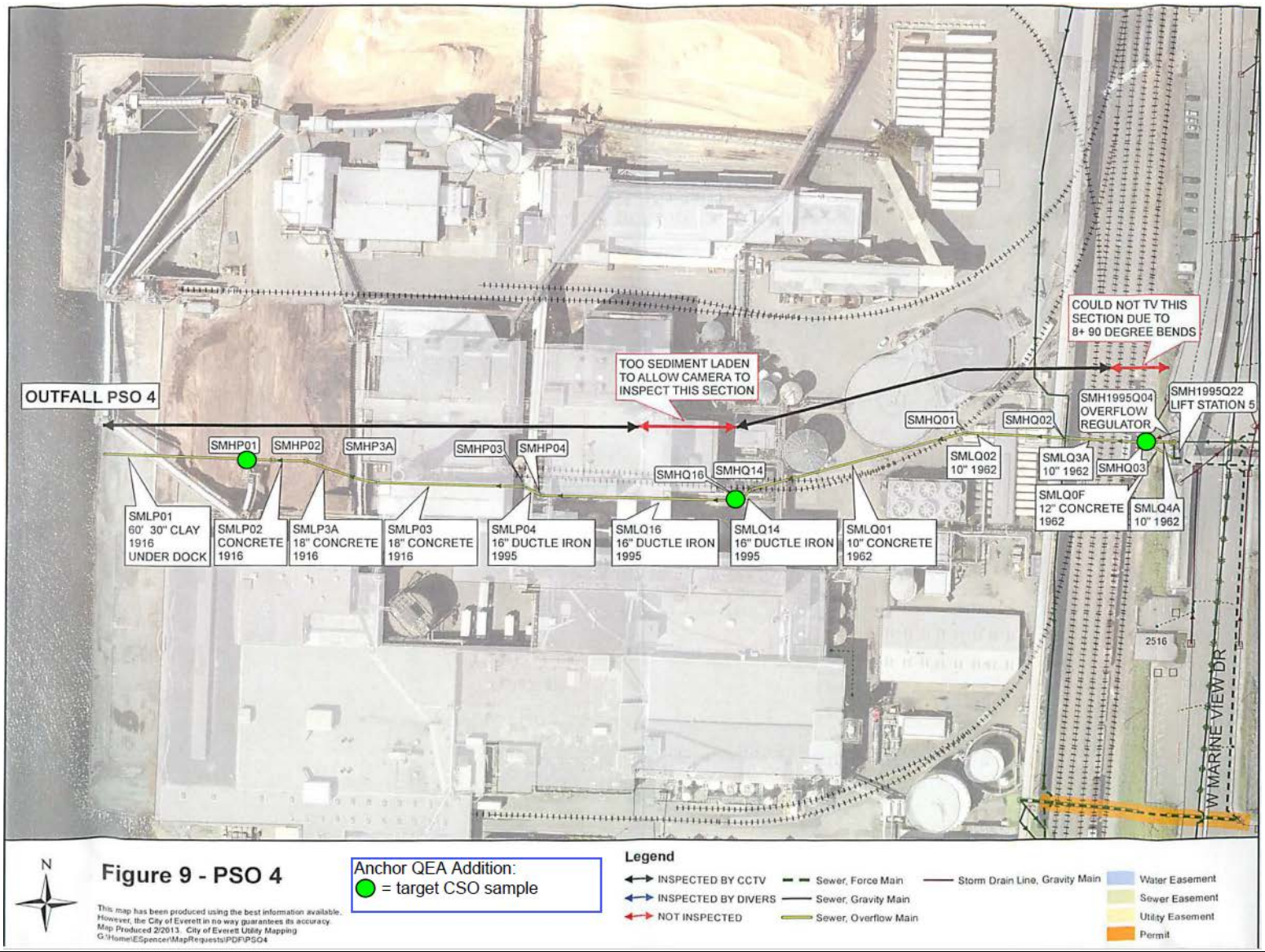
# Figures




Q:\Jobs\110105-02.01_Everett_Mill_Kimberly_Clark\Maps\2013_04\EEW Vicinity Map.mxd ckiblinger 4/12/2013 10:45:11 AM

ANCHOR QEA

**Figure 1**
Vicinity Map
Everett East Waterway




ANCHOR QEA

**Figure 2**
CSO Sampling Location Targets
Everett East Waterway