Appendix H
Second Phase Pre-Design Investigation
Quality Assurance Project Plan

May 10, 2023
US Moorings Project Area

ANCHOR QEA

Second Phase Pre-Design Investigation Quality Assurance Project Plan

Prepared for U.S. Environmental Protection Agency, Region 10

May 10, 2023
US Moorings Project Area

Second Phase Pre-Design Investigation Quality Assurance Project Plan

Prepared for
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Region 10
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The Anchor QEA Project Quality Assurance Manager is responsible for maintaining the official, approved *Second Phase Pre-Design Investigation Quality Assurance Project Plan*.

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FIGURE

ATTACHMENT

ABBREVIATIONS

AOC	*Administrative Settlement Agreement and Order on Consent for Removal Action*
ASTM	ASTM International
CCV	continuing calibration verification
Combined DSR-PDIWP	*Final First Phase Pre-Design Investigation Data Summary Report and Second Phase Pre-Design Investigation Work Plan*
DQO	data quality objective
EDL	estimated detection limit
EPA	U.S. Environmental Protection Agency
FC	Field Coordinator
HAZWOPER	Hazardous Waste Operations and Emergency Response
MD	matrix duplicate
MDL	method detection limit
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
NIST	National Institute of Standards and Technology
OPR	ongoing precision and recovery sample
OSHA	Occupational Safety and Health Administration
PDI	pre-design investigation
Project Area	US Moorings Project Area
QA	quality assurance
QC	quality control
ROD	*Record of Decision – Portland Harbor Superfund Site, Portland, Oregon*
RPD	relative percent difference
Second Phase DSR	*Second Phase Pre-Design Investigation Data Summary Report*
Second Phase PDI FSP	*Second Phase Pre-Design Investigation Field Sampling Plan*
Second Phase PDI QAPP	*Second Phase Pre-Design Investigation Quality Assurance Project Plan*
SOP	standard operating procedure

1 Introduction

This *Second Phase Pre-Design Investigation Quality Assurance Project Plan* (Second Phase PDI QAPP) has been prepared by Anchor QEA on behalf of NW Natural for the US Moorings Project Area (Project Area), located on the Willamette River between approximately the downstream end of the St. Johns Bridge to river mile 6.1 on the west side of the Willamette River. This Second Phase PDI QAPP has been prepared under the *Administrative Settlement Agreement and Order on Consent for Removal Action* (AOC; CERCLA Docket No. 10-2009-0255), the AOC *Amendment No. 2 for Remedial Design at B1 Navigation Channel Project Area and U.S. Moorings Project Area,* and the *Remedial Design Statement of Work, Portland Harbor Superfund Site, U.S. Moorings Project Area* (EPA 2020).

This Second Phase PDI QAPP was prepared following U.S. Environmental Protection Agency's (EPA's) *Guidance for Quality Assurance Project Plans* (EPA 2002). Analytical quality assurance (QA)/quality control (QC) procedures were also developed based on the analytical protocols and QA guidance of EPA's *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods* (EPA 1986) and the EPA Contract Laboratory Program National Functional Guidelines for Data Review (EPA 2020a, 2020b, 2020c).

1.1 Purpose and Objectives

This purpose of this Second Phase PDI QAPP is to establish the QA objectives for conducting the second phase pre-design investigation (PDI) sampling and analytical activities described therein. The analytical methods and QA procedures described here will be followed by NW Natural and its contractors during sample collection activities described in the *Final First Phase Pre-Design Investigation Data Summary Report and Second Phase Pre-Design Investigation Work Plan* (Combined DSR-PDIWP) and the associated *Second Phase Pre-Design Investigation Field Sampling Plan* (Second Phase PDI FSP; Appendix G of the Combined DSR-PDIWP). The objective of this Second Phase PDI QAPP is to ensure that data of sufficiently high quality are generated to support the project data quality objectives (DQOs). This Second Phase PDI QAPP will address project management responsibilities; sampling and analytical procedures; assessment and oversight; and data reduction, validation, and reporting.

1.2 Document Organization

EPA guidance (EPA 2002) specifies four groups of information that must be included in a QAPP (Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Validation and Usability). Each group comprises several QAPP elements. EPA's guidance provides a suggested outline for the QAPP elements. However, the guidance indicates that certain elements may not be applicable to a given project and that the elements need not be presented in the order presented in the guidance.

The remainder of this Second Phase PDI QAPP is organized into the following sections:

- Section 2 – Project Management
- Section 3 – Data Generation and Acquisition
- Section 4 – Assessment and Oversight
- Section 5 – Data Validation and Usability
- Section 6 – References

2 Project Management

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

2.1 Project Organization

Responsibilities of the team members, as well as Laboratory Project Managers, are described in the following subsections. Contact information for each member of the project is provided in Table H-1. The independent investigation being undertaken by NW Natural, as described in this Second Phase PDI QAPP and the associated Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP), was developed in consultation with EPA. A project organizational chart showing the relationships and lines of communication among project participants is presented in Figure H-1.

2.1.1 Project Planning and Coordination

The Project Manager, Ryan Barth of Anchor QEA, will act as the direct line of communication between contractors, NW Natural, and EPA, and he is responsible for implementing activities described in this Second Phase PDI QAPP. He will also be responsible for producing project deliverables and performing the administrative tasks needed to ensure the timely and successful completion of the investigation. The Project Manager will also be responsible for resolving project concerns or conflicts related to technical matters.

Mr. Barth will be responsible for preparation of the *Second Phase Pre-Design Investigation Data Summary Report* (Second Phase DSR). The Second Phase DSR will summarize the sampling effort, analytical methods, QA/QC narrative, and analytical results.

2.1.2 Field Sample Collection

Nik Bacher of Anchor QEA, or his designee, will serve as the Field Coordinator (FC) and will provide direction to the field sampling activities in logistics, personnel assignments, and field operations. The FC will supervise the field collection of samples and will be responsible for ensuring accurate positioning and recording of sample locations, depths, and identification; conformity to sample collection and handling requirements, including field decontamination procedures; physical evaluation and documentation of the samples; and delivery of the samples to the laboratories. He will ensure that the samples are stored under proper conditions while in custody until transfer to the laboratories. The FC will be responsible for summarizing field sampling activities, including details of the sampling effort, sample preparation, sample storage and transport procedures, field QA, and documentation of any deviations from this Second Phase PDI QAPP.

The sampling will be completed by Anchor QEA and its subconsultants, as described in the Combined DSR-PDIWP and Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP). Subconsultants will follow the QA/QC and analytical protocols established in this Second Phase PDI QAPP.

2.1.3 Quality Assurance/Quality Control Management

Delaney Peterson of Anchor QEA, or her designee, will serve as the Project QA Manager and will be responsible for coordination with the analytical laboratories and field team. She will perform oversight for both the field sampling and laboratory programs. She will be kept fully informed of field program procedures and progress during sample collection and laboratory activities during sample preparation and analyses. She will record and correct any activities that vary from this Second Phase PDI QAPP. She will be responsible for the review of laboratory reports and case narratives describing any anomalies and exceptions that occurred during analyses. Any QA/QC problems will be brought to her attention as soon as possible to discuss issues related to the problem and evaluate potential solutions. She will be responsible for performing or overseeing the validation of the data according to the requirements of this Second Phase PDI QAPP and incorporating the results of the validation into the final project database, in coordination with the database manager. Upon completion of the sampling and analytical program, she will review laboratory QA/QC results and incorporate findings into the Second Phase DSR.

The analytical laboratories will be responsible for physical and chemical analyses of sediment samples and will ensure that the submitted samples are handled and analyzed in accordance with the selected analytical testing protocols and QA/QC requirements, as well as the requirements specified in this Second Phase PDI QAPP. The laboratories will provide certified, pre-cleaned sample containers and sample preservatives, as appropriate, and prepare a data package containing the analytical and QA/QC results.

2.1.4 Laboratory Project Managers

The Laboratory Project Managers for the physical and chemical testing are listed in Table H-1. Each of them will oversee laboratory operations associated with the receipt of the environmental samples, chemical/physical analyses, and laboratory report and electronic deliverables preparation for this project. They will review the laboratory reports and prepare case narratives describing any anomalies and exceptions that occurred during sample preparation and analyses. They will also notify the Project QA Manager of any QA/QC problems when they are identified to allow for quick resolution.

2.2 Problem Definition/Background

The Combined DSR-PDIWP describes the investigations that will be performed as part of the PDI at the Project Area in Portland, Oregon. A detailed project overview, site description, project figures,

and supporting field sampling details are provided in the Combined DSR-PDIWP and the Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP). See PDIWP Sections 2 through 6 for the sampling design rationale. Sampling methods are described in Section 3 of the Second Phase PDI FSP. Details of sample types and sample depths are included in Second Phase PDI FSP Tables G3-1, G3-2, G3-3, and G3-4. The sampling event is being implemented to collect additional site-specific data necessary to further refine the lateral and vertical extent of contamination exceeding the remedial action levels and principal threat waste thresholds within the Project Area and further refine the remedial technology assignments.

2.3 Project/Task Description and Schedule

Sampling activities described in the Combined DSR-PDIWP and Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP) will be initiated following EPA approval. The sampling activities are currently estimated to occur between October and November 2022, contingent on meeting the current EPA approval timeline for the Combined DSR-PDIWP. See Section 5 of the Combined DSR-PDIWP and Section 3 of the Second Phase PDI FSP for descriptions of the specific tasks to be conducted. Sampling locations are shown in the Combined DSR-PDIWP (Figures 5-1 through 5-5). The sampling schedule is discussed in Section 6 of the Second Phase PDI FSP. The laboratories are expected to deliver data within 30 days of sample receipt and level 4 data packages within 15 days of data receipt. Data validation will commence immediately after level 4 reports are received and is expected to be completed within 30 days.

2.4 Data Quality Objectives and Criteria

The DQOs for this project are to develop and implement procedures that will ensure the collection of representative data of known, acceptable, and defensible quality to achieve the project objectives described in the Combined DSR-PDIWP and Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP). The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, completeness, bias, and sensitivity (see Section 3.4).

2.5 Special Training Requirements/Certifications

Field personnel will be trained in standardized data collection requirements so that the data collected are consistent among the field crew. Field personnel must be fully trained in the collection and processing of surface sediment grab samples and subsurface sediment core samples, decontamination protocols, visual inspections, and chain-of-custody procedures. Training for staff will be provided through on-the-job training and attendance at internal and external seminars and workshops on relevant subject matter. The Anchor QEA FC will be responsible for ensuring that staff and any contractors have the necessary training required to conduct the field investigation procedures described in the Combined DSR-PDIWP, Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP), and this Second Phase PDI QAPP.

In addition, the 29 Code of Federal Regulations 1910.120 Occupational Safety and Health Administration (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. Sampling personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and 8-hour refresher courses, as necessary, to meet OSHA regulations. Anchor QEA's project Health and Safety Officer, David Templeton, is responsible for the completion and retention of HAZWOPER certification. In addition, all sampling personnel will have basic training in boat safety for the over-water work. Certifications will be maintained in Anchor QEA's project files.

2.6 Documentation and Records and Data Management

This project will require central project files to be maintained at Anchor QEA for a minimum of 10 years. Project records will be stored and maintained in a secure manner. The Project QA Manager will be responsible for maintaining and providing updated copies of the most current approved version of the QAPP. Updates will be distributed to appropriate personnel electronically. Each project team member is responsible for filing 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 scanned and saved electronically and kept on file at Anchor QEA or at a document storage facility throughout the duration of the project. Electronic data will be maintained in the Anchor QEA central database and backed up regularly as part of routine file maintenance.

2.6.1 Field Records

Documents generated during the field effort are controlled documents that become part of the project file. Field documents may be generated electronically or recorded on hard copies in the field. Field team members will keep a daily record of significant events, observations, and measurements on field logs developed specifically for each activity. The field logs will be the main source of documentation for field activities and 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
- Facility visitors
- Weather conditions
- Field observations
- Sample collection date and time
- Sampling method and description of activities
- Identification or serial numbers of instruments or equipment used

- Deviations from the Combined DSR-PDIWP, Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP), or Second Phase PDI QAPP
- Conferences 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 and initial each entry. Additional specific field reporting requirements and checklists are defined in the Combined DSR-PDIWP and Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP). In general, sufficient information will be recorded during each sampling event so that reconstruction of the event can occur without relying on the memory of the field personnel.

The field forms will be either collected electronically or on water-resistant, durable paper to prevent deterioration of the project record due to adverse field conditions. Hard copy notes will be taken in indelible, waterproof blue or black ink. Errors will be corrected by drawing a single line through the error, writing in the correct information, and then dating and initialing the change. Each form will be marked with the project name, number, and date. The field forms will be scanned into Anchor QEA's project file directory as convenient during the sampling event or upon completion of each sampling event.

Sample collection tables are included in the Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP) and will be used to inform proposed coordinates of each location and the sampling and analyses scheme.

2.6.2 Analytical and Chemistry Records

The laboratories will retain analytical data records. Additionally, Anchor QEA will retain them in central project files. For chemical analyses, the data reporting requirements will include those items necessary to complete data validation, including copies of raw data. The laboratories will prepare a detailed laboratory data package within 45 days of sample receipt documenting the activities associated with the sample analyses. Laboratory data packages will contain information necessary to perform a Stage 4 data validation per EPA guidelines (EPA 2009), and Stage 4 validations will be performed at the same rate conducted for the first phase. Stage 2B validations will be conducted on all data except for geotechnical data unless the Stage 2B validations reveal errors or issues that warrant additional Stage 4 validations. Stage 1 validations will be conducted on geotechnical data. The laboratory data reports will include, but are not limited to, the following information, as applicable to the analyses:

- **Project Narrative.** This summary, in the form of a cover letter, will discuss problems (if any) encountered during any aspect of sample receipt, preparation, and analyses. This summary will discuss, but not be limited to, sample receipt, sample storage, QC deviations, and any other analytical difficulties. Problems encountered, actual or perceived, 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
  - Date and time of analysis
  - Weight and/or volume used for analysis
  - Final dilution or concentration factor for the sample
  - Identification of the instrument used for analysis
  - Method detection and reporting limits 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 contains the results of the laboratory QA/QC samples and 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 include, but are not limited to, the following:
  - **Calibration Data Summary.** This summary will report the concentrations of the initial calibration and daily calibration standards and the date and time of analysis. The response factor, percent relative standard deviation, percent difference, percent recovery, and retention time for each analyte will be listed, as appropriate. Results for standards used to quantify instrument sensitivity will be documented.
  - **Instrument Performance Check.** Ion abundances and the ranges of acceptable criteria will be reported for gas chromatography/mass spectrometry methods. Mass calibration atomic mass unit and percent relative standard deviation values will be reported for inductively coupled plasma/mass spectrometry methods.
  - **Internal Standard Area Summary.** Internal standard areas will be reported for each sample analyzed, as appropriate.
  - **Method Blank Analysis.** The method blank analyses associated with each sample and the concentration of analytes of interest identified in these blanks will be reported.
  - **Surrogate Spike Recovery.** Surrogate spike recovery results for organic analyses will be reported for each sample. The names and concentrations of the compounds added, percent recoveries, and range of acceptable recoveries will be reported.

  - **Matrix Spike Recovery.** The names and concentrations of analytes added, percent recoveries, and range of acceptable recoveries will be listed. The relative percent difference (RPD) for matrix spike duplicate (MSD) analyses will be reported.
  - **Matrix Duplicate.** This summary will include the RPD or difference value for matrix duplicate (MD) analyses, as appropriate to the sample concentrations.
  - **Laboratory Control Sample.** The name and concentration of analytes added, percent recoveries, and range of acceptable recoveries will be listed. The RPD values for laboratory control sample duplicate analyses will be included.
  - **Relative Retention Time.** This summary will include a report of the relative retention time of each analyte detected in the samples for both primary and confirmatory analyses.
- **Original Data.** Legible copies of the original data generated by the laboratory will include the following:
  - Identification of preparation method used and cleanup logs, as appropriate
  - Instrument specifications and analysis logs for instruments used on days of calibration and analysis
  - Original printouts of full-scan chromatograms and quantitation reports for gas chromatography and/or gas chromatography/mass spectrometry samples, blanks, calibrations, spikes, replicates, and reference materials
  - Reconstructed ion chromatograms for samples, standards, blanks, spikes, replicates, and reference materials
  - Enhanced spectra of detected compounds with associated best-match spectra for each sample
  - Instrument outputs for inorganic analyses, including calibrations and sample analyses
  - Calculation worksheets

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

2.6.3 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 aspects of sample preparation that could affect the test result (such as sample volume analyzed or dilutions required) be taken into account in the final result. Data reduction is the laboratory analyst's responsibility, and final results are subjected to further review by the Laboratory Project Managers, the Project Manager, the Project QA Manager, and independent reviewers. Data reduction may be

performed manually or electronically. If performed electronically, software used must be demonstrated to be true and free from error.

2.6.4 Electronic Data Deliverables and Database Development

All data generated in the field will be documented electronically or on hard copy and provided to the Data Manager, who is responsible for the data's entry into the database. Laboratory data will be provided to the Data Manager in the EQuIS electronic data deliverable format and loaded into Anchor QEA's centralized database.

2.6.5 Data Management

Field data sheets will be checked for completeness and accuracy by the FC prior to delivery to the Project QA Manager. Data generated in the field will be documented electronically or on hard copy and loaded directly into the database or provided to the Project QA Manager, who will coordinate data entry into the database. Manually entered data will be checked by a second party. Field documentation will be filed in the main project file after data entry and checking are complete.

Laboratory data will be loaded directly into the database or provided to the Project QA Manager in the EQuIS electronic format. Laboratory data that are 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 manually entered data will be verified. Data tables and reports will be exported from EQuIS to Microsoft Excel tables for report presentations and data analysis.

3 Data Generation and Acquisition

Data generation and acquisition begins with the development of the rationale for locating and selecting environmental samples for analysis and ends with the generation and reporting of analytical data for those samples by the analytical laboratories.

3.1 Sampling Design

The sampling design including the rationale for locating and selecting environmental samples for analyses is detailed in the Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP).

3.2 Sampling Methods and Handling Requirements

Sample collection procedures are described in detail in the Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP). Sampling procedures are generally consistent with EPA protocols or other approved sample collection standards established for the Project Area.

3.3 Analytical Methods

Analytical methods for chemical and physical analyses are listed in Tables H-2 through H-5, corresponding to the surface, subsurface, dredge material waste suitability, and barge dewatering standard elutriate testing sample collection and analytical programs described in Section 5 of the Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP).

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

- Adhere to the methods outlined in this Second Phase PDI QAPP, including methods referenced for each analytical procedure.
- Follow documentation, custody, and sample tracking procedures.
- Notify the Project QA Manager of any QA/QC problems when they are identified.
- Provide a detailed discussion of any modifications made to approved analytical methods.
- Deliver Adobe PDF and electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet turnaround times for deliverables.
- Implement QA/QC procedures, including the DQOs, laboratory QA requirements, and performance evaluation testing requirements.
- Allow laboratory and data audits to be performed, if deemed necessary.

Analytical methods, method detection limits (MDLs), and method reporting limits (MRLs) for sediment and aqueous samples are presented in Tables H-2 through H-5. Table H-6 presents the field and laboratory QA/QC sample frequency requirements (e.g., field duplicates, matrix spikes [MSs], and laboratory control samples).

3.4 Data Quality Objectives

The DQOs for this program are to provide results of known quality to inform the remedial design. The parameters used to assess data quality are precision, accuracy, representativeness, comparability, completeness, bias, and sensitivity. These parameters are presented on Table H-7 and discussed in greater detail in the following subsections. DQO results will be reviewed by the laboratory analysts, Project QA Manager, and data validator. Re-extraction and/or reanalyses may be warranted in some instances for results outside of control limits in cases of extreme or key failures. Data will be qualified accordingly by the validator if DQOs described herein and presented in Table H-7 are not met for final data.

3.4.1 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 sample collection and laboratory analyses.
ASTM International (ASTM) recognizes the following two levels of precision (ASTM 2002):

1. 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
2. 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 replicate sample or QC analyses and is expressed as the RPD between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of field duplicates analyses at a frequency of 1 per 20 samples collected. Field chemistry duplicate precision will be screened against an RPD of 50% for all analyses and matrices. Data qualification based on field duplicate precision will be at the discretion of the data validator. The equation used to express precision is as follows:

Equation 1

$$\text{RPD} = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2)/2}$$

where:

RPD	=	relative percent difference
C_1	=	larger of the two observed values
C_2	=	smaller of the two observed values

Precision measurements can be affected by the nearness of a chemical concentration to the MRL, where the percent error (expressed as RPD) increases. In cases where either the parent or duplicate result is less than five times the MRL, results will be evaluated by the difference with a control limit of ± MRL for aqueous sample matrices and ± 2 times the MRL for solid sample matrices.

3.4.2 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 evaluated by calculating percent recovery results from analyses of laboratory control samples, standard reference materials, surrogate standards, and standard solutions. In addition, matrix-spiked samples, laboratory control samples (e.g., blank spikes and reference materials), and surrogate spikes are also analyzed, which provide accuracy or bias information in the actual sample matrix. Accuracy measurements will be carried out at a minimum frequency of 1 per 20 samples analyzed, with the exception of surrogates, which will be added to all samples for applicable analyses. 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 result is not the true or expected value, the process is said to be biased. Bias is discussed further in Section 3.4.6.

Laboratory accuracy will be evaluated against quantitative spike recovery performance criteria provided by the laboratory and shown in Table H-7. Accuracy can be expressed as a percentage of 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

$$\%R = 100\% \times \frac{(S-U)}{C_{sa}}$$

where:

%R	=	percent recovery
S	=	measured concentration in the spiked aliquot
U	=	measured concentration in the unspiked aliquot
C_{sa}	=	actual concentration of spike added

MS recovery values become distorted when the sample concentration is greater than four times the spike concentration. No data will be qualified in these instances, regardless of percent recovery values.

Field accuracy will be controlled by adherence to sample collection procedures outlined in the Combined DSR-PDIWP and the Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP).

3.4.3 Representativeness

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

3.4.4 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 and reporting formats and common traceable calibration and spike materials.

3.4.5 Completeness

Field completeness is a measure of the number of samples collected and successfully analyzed as required in proportion to the number of samples expected to be collected. The depths achieved for each core sample will not be considered for the measurement of field completeness. Field completeness is calculated as follows:

Equation 3

$$C = \frac{(\text{Number of samples collected and successfully analyzed}) \times 100}{(\text{Number of samples expected to be collected})}$$

where:

C = Completeness (%)

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

Equation 4

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

where:

C = Completeness (%)

The DQO for completeness of components of this project is 95%. Data that have been qualified as estimated because 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.

3.4.6 Bias

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias can be either inherent in a method of analysis (e.g., extraction efficiency) or caused by an artifact of the measurement system (e.g., contamination). Bias assessments for environmental measurements are made using personnel, equipment, and spiking materials or reference materials as independent as possible from those used in the calibration of the measurement system. Analytical laboratories use several QC measures to eliminate analytical bias, including systematic analyses of method blanks, laboratory control samples, and independent calibration verification standards. When possible, bias assessments should be based on analysis of spiked samples or matrix-matched reference samples rather than spiked blanks so that the effect of the matrix on recovery is incorporated into the assessment. A documented spiking protocol and consistency in following that protocol are important to obtaining meaningful data quality estimates. 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.

3.4.7 Sensitivity

Analytical sensitivities must be consistent with or lower than the target limits listed in Tables H-2 through H-5 to demonstrate compliance with this Second Phase PDI QAPP.

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. The limit of detection is the smallest amount or concentration of a substance that must be present in a sample to be detected at a 99% confidence level. Estimated detection limits (EDLs) are associated with high-resolution analytical methods and are calculated for each analyte and sample based on the signal-to-noise ratio. Undetected compounds analyzed by high-resolution methodology (e.g., dioxin/furans) will be reported at the EDL, which is typically lower than the MDL listed in Tables H-2 through H-5 and is sample and compound specific. The EDL is anticipated to meet *Record of Decision – Portland Harbor Superfund Site, Portland, Oregon* (ROD; EPA 2017) cleanup levels in most cases. Detections between the EDL and MRL will be reported as estimated. Laboratory practical quantitation limits, limits of quantitation, or MRLs are defined as the lowest level that produces a quantitative result within specified limits of precision and accuracy during routine laboratory operating conditions. Laboratory MDLs and MRLs (Tables H-2 through H-5) will be used to evaluate the method sensitivity and/or applicability prior to the acceptance of a method for this program.

The sample-specific MDLs, EDLs, and MRLs will be reported by the laboratory and will take into account factors relating to the sample analysis that might decrease or increase the MDLs and MRLs (e.g., dilution factor, percent moisture, and sample aliquot weight or volume). In the event that the MDL (or EDL) and MRL are elevated for sample results 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. The sample-specific MDLs or EDLs and MRLs will be the values recorded in the project database.

EDLs are dependent on sample- and analysis-specific factors. They are calculated at the time of analysis and are typically only reported when analytes are below detection. Because EDLs are not pre-determined, NW Natural cannot include them in the Second Phase PDI QAPP tables. However, NW Natural anticipates that, based on past project experience, EDLs will be below MDLs and the ROD Table 17 cleanup levels for samples without significant matrix interferences.

3.5 Quality Assurance and Quality Control

Field and laboratory activities must 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's *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods*

(EPA 1986), the EPA National Functional Guidelines for Data Review (EPA 2020a, 2020b, 2020c), and the cited methods.

3.5.1 Field Quality Control

Anchor QEA personnel will identify and label samples in a consistent manner to ensure that field samples are traceable, and labels provide the information necessary for the laboratory to properly conduct the required analyses. Samples will be placed in appropriate containers and preserved for shipment to the laboratory.

3.5.1.1 Sample Containers

The analytical laboratories will provide certified pre-cleaned sample containers (Table H-8) with the exceptions of the geotechnical analyses. The laboratories will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided.

Geotechnical samples will be collected in clean sample containers.

3.5.1.2 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:

- Project name
- Sample identification
- Date and time of sample collection
- Preservative type (if applicable)
- Required analyses
- Sampler's name or initials

Samples will be uniquely identified with a sample identification that, at a minimum, specifies sample matrix, sample number, sample location, and type of sample. Specific sample nomenclature is described in the Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP).

3.5.1.3 Sample Custody and Shipping Requirements

Samples are considered to be in one's custody if they are in the following: 1) the custodian's possession or view; 2) a secured location (under lock) with restricted access; or 3) 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 the samples throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the chain-of-custody form. Each sample will be represented on a chain-of-custody form the day it is collected. Data entries will be made using indelible ink pen. Corrections will be made by drawing a

single line through the error, writing in the correct information, then dating and initialing the change. Blank lines or 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 cooler of samples sent to the analytical laboratories. Each person who has custody of the samples will sign the chain-of-custody form and establish that the samples were not left unattended unless properly secured. Copies of chain-of-custody forms will be retained in the project files.

Filled sample containers for chemistry and physical analyses will be stored in coolers containing ice to maintain the samples at 2°C to 6°C until delivery to the analytical laboratories.

Samples will be shipped 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 hold time requirements (Tables H4-1 and H-8). Specific sample shipping procedures are as follows:

- Each cooler or container with the samples for analyses will be hand-delivered, couriered, or shipped the same day as collection or via overnight delivery to the appropriate analytical laboratory. In the event that Saturday delivery is required, the FC will contact the analytical laboratory before 3:00 p.m. on Friday to ensure that the laboratory will be staffed to receive samples on a Saturday and is aware of the number of containers shipped and the airbill tracking numbers for those containers. Following shipment, the FC will confirm the samples have been received and are in good condition.
- Coolant ice will be sealed in separate zip-top plastic bags and placed in the shipping containers. Plastic bags will be doubled for overnight shipping.
- 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 bottles and 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 placed inside of 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. Chain-of-custody seals are not required when custody is maintained and transferred directly.
- Each cooler will be wrapped securely with packing tape 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 transferring custody of the sample container will sign the chain-of-custody form. Upon receipt of samples at the laboratory, the shipping container seals will be broken, if applicable, and the receiver will sign the chain-of-custody forms and record the condition of the samples and any discrepancies encountered on a sample receipt form.

3.5.1.4 Field Quality Assurance Sampling

Field QA procedures will consist of following procedures for acceptable practices for collection and handling of samples. Adherence to these procedures will be complemented by periodic and routine equipment inspection.

Field QA samples will be collected along with the environmental samples. Field QA samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field QA samples includes equipment rinsate blanks and field duplicates as specified in Table H-6. Rinsate blanks will be collected at a frequency of one per collection method per sampling event. If decontamination procedures are not adequate, additional rinsate blanks will be collected after procedures have been modified. Adequacy of decontamination procedures will be evaluated by rinsate blank chemistry results. Results will be compared to associated samples, and the Project QA Manager's best professional judgment will be used to evaluate whether decontamination procedures should be modified. Field duplicate samples will be collected at a frequency of one per sampling event or 1 in 20 samples collected, whichever is more frequent.

Field QA samples will also include the collection of additional sample volume or mass to ensure that the laboratory has a sufficient sample amount to analyze the method and program-required analytical QA/QC (MD/MS/MSD) samples as specified in Table H-6. Additional sample volume or mass to meet this requirement will be collected at a frequency of one per sampling event or 1 in 20 samples processed, whichever is more frequent. The sample collection team will confirm with the laboratory the appropriate extra volume or mass required for these analyses. The samples designated for MD/MS/MSD analyses should be clearly marked on the chain-of-custody form.

Field QA samples will be documented on the field forms and verified by the Project QA Manager or designee.

3.5.2 Chemistry Laboratory Quality Control

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, MSs, surrogate spikes (for organic analyses), and method blanks. Table H-6 lists the frequency of analyses for laboratory QA/QC samples, and Table H-7 summarizes the DQOs for precision, accuracy, and completeness.

An analyst will review the results of the QC samples from each analytical batch 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 batch and reanalysis or re-extraction does not correct the exceedance, the Project QA Manager will be contacted, and alternative corrective action (e.g., method modifications followed by reprocessing the affected samples) will be explored prior to reporting the results.

3.5.2.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used prior to analyses, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method criteria. A calibration verification sample will be analyzed following each initial calibration and will meet method criteria prior to analyses of samples. Continuing calibration verifications (CCVs) will be analyzed at required frequencies to track instrument performance. The frequency of CCVs varies with method. For gas chromatography/mass spectrometry methods, one will be analyzed every 12 hours. For gas chromatography, metals, and inorganic methods, one will be analyzed at the method-specified frequencies and at the end of each run. If the CCV is out of control, the analyses must come to a halt until the source of the failure is eliminated or reduced enough to meet control specifications. Project samples analyzed while 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 right after the CCV as applicable to the method.

3.5.2.2 Laboratory Duplicates

Laboratory duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Laboratory duplicates are subsamples of the original sample that are prepared and analyzed as a separate sample. For high-resolution mass spectrometry analyses, laboratory duplicates will be analyzed to assess laboratory precision. An MSD, ongoing precision and recovery sample (OPR) duplicate, or laboratory control sample duplicate may be analyzed in lieu of a laboratory duplicate.

3.5.2.3 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 performing duplicate MS analyses, information on the precision of the method is also provided.

3.5.2.4 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at every stage of sample preparation and analysis. The method blank results must be less than the reporting limit of each target analyte. If a laboratory method blank exceeds this criterion for any analyte, and the analyte is detected in any of the samples and 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.

3.5.2.5 Laboratory Control and Ongoing Precision and Recovery Samples

Laboratory control samples and OPRs are analyzed to assess possible laboratory bias at the 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, method blank, and MS. The laboratory control sample and OPR will provide information on the accuracy of the analytical process and, when analyzed in duplicate, will provide precision information as well.

3.5.2.6 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested in Section 2.6.2 are present.

3.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Testing, inspection, and maintenance of field and laboratory equipment are important determinants of the quality of sampling and analysis results.

3.6.1 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/or previous experience with the equipment.

The Anchor QEA FC will be responsible for the preparation, documentation, and implementation of the preventative 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 maintenance procedures and frequency of equipment maintenance is provided in the specific manufacturer's instruction manuals.

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.

The worker or 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, grab sampler, and vibracore head will be inspected daily for fraying, jaw misalignment, loose connections, and any other applicable mechanical problems. All equipment will be operated and maintained according to manufacturer specifications. Any problems will be noted in the field logbook and corrected prior to continuing sampling operations.

3.6.2 Laboratory Instruments/Equipment

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

The laboratory preventative maintenance program, as detailed in the laboratory QA Manuals (Attachment A), 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 or 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 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 the responsible individual. The Laboratory Manager, or designee, shall be responsible for verifying compliance with the preventative maintenance program.

3.7 Instrument Calibration

Proper calibration of equipment and instrumentation is an integral part of the process that provides quality data. Instrumentation and equipment used to generate data must be calibrated at a frequency that ensures sufficient and consistent accuracy and reproducibility.

3.7.1 Laboratory Instrument/Equipment Calibration

As part of their QC program, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals (i.e., 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 Manual. Calibrations are discussed in the laboratory standard operating procedures (SOPs) for analyses.

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

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

The calibration requirements for each method and respective corrective actions are written in the laboratory SOPs and/or the laboratory's QA Manual for each instrument or analytical method in use. Calibrations shall be preserved on electronic media. Laboratory SOPs and QA manuals are included as Attachment A.

3.8 Inspection/Acceptance Requirements for Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory vendor-supplied sampling bottles, will be the responsibility of the FC. Supplies will be couriered or shipped to the site or obtained from a local vendor and stored in a secure location that is readily accessible to field staff. Primary chemical standards and standard solutions will be used in this project in the field and laboratory and will be traceable to documented, reliable, commercial sources. The laboratory will use certified sample containers and standards from reliable sources and will store certificates of cleanliness, accuracy, and purity for each batch of containers or standards used. Acceptance criteria are listed on the certificates, which will be available upon request. Laboratory standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

3.9 Non-Direct Measurements

Non-direct measurements are suitable for use in the PDI for the purposes stated in the Combined DSR-PDIWP and Second Phase PDI FSP (Appendix G of the Combined DSR-PDIWP) and

will be used without limitation. Specifically, the criteria that will be used to evaluate the surface and subsurface sediment results will include the following:

- Existing data from the Portland Harbor Feasibility Study database, including surface sediment results from 0 to 30 centimeters (0 to 1 foot) below mudline and subsurface sediment results from samples greater than 30 centimeters (1 foot) below mudline
- Bathymetry and other survey data (e.g., debris survey) collected for the Portland Harbor Remedial Investigation/Feasibility Study
- Bathymetry data collected by others within the Project Area during the past 20 years
- Portland Harbor remedial action levels and cleanup goals included in the ROD and updated in Errata No. 2.

4 Assessment and Oversight

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.

4.1 Field and Laboratory Audits/Inspections

Laboratory and field performance audits or inspections 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, laboratory audit reports will be made available to the Project QA Manager upon request. Apex Laboratories, LLC, Analytical Resources, Inc., ALS Environmental, and Vista Analytical Laboratory, Inc., are National Environmental Laboratory Accreditation Program-certified laboratories that undergo regular audits as part of their certification procedures. Audits are conducted no more than 2 years apart. The laboratory is required to have written procedures addressing internal QA/QC. The laboratory must ensure that personnel engaged in preparation and analysis tasks have appropriate training. As part of the audit process, the laboratory will provide written details of any method modifications planned for the consultant's review.

A field inspection is not planned but may be scheduled at the discretion of the FC or Project QA Manager to observe and review field procedures and documentation from sample collection through packaging and shipment to the laboratories. Additional inspections may be scheduled over the course of the field program if determined necessary. The Project Manager will be responsible for identifying an appropriate schedule of inspections prior to commencement of investigation activities.

Field inspections may be performed by the FC in accordance with written procedures or checklists. The field inspection will involve the review and evaluation of (as appropriate) implementation of approved work procedures, sampling procedures, and sampling documentation; labeling, packaging, storage, and shipping of samples; completion of field records; QC compliance; subcontractor performance; and field change documentation. Field records will also be reviewed to verify that field-related activities are performed and documented in accordance with the Second Phase PDI QAPP. Items to be reviewed include, but are not limited to, field activity logs, collection forms, custody transfer forms and/or chain-of-custody forms, field measurement logs, and waste inventory logs. The FC may impose a stop work order at any time if activities being conducted are determined to compromise the integrity of the program.

Preliminary results of the inspections will be reviewed with the Project Manager to ensure that deficiencies adversely affecting data quality are immediately corrected. Inspection findings will be reviewed to determine the cause of any noncompliance issues identified, schedule corrective action to prevent reoccurrence, evaluate the impact of the findings on completed work, and notify the FC

and the Project QA Manager in an email of action taken or planned. The findings of the field inspection, as well as any corrective actions, will be reported to EPA as part of the Sediment Sampling and Analysis Report. The FC and the Project QA Coordinator will be responsible for verifying and documenting completion of the corrective action.

4.2 Response and Corrective Actions

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

4.2.1 Field Activities

The FC will be responsible for correcting equipment malfunctions during the field sampling effort. The Project QA Manager will be responsible for resolving situations identified by the FC that may result in non-compliance with this Second Phase PDI QAPP. Corrective measures will be immediately documented in the field logbook.

4.2.2 Laboratory

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

The Laboratory Project Manager will be notified if any QC sample result grossly exceeds the project-specified control limits and standard corrective actions do not resolve the anomaly. If the anomaly cannot be corrected, the Laboratory Project Manager will document the corrective action taken and relay this to the Project QA Manager in a timely manner, and possible additional corrective actions will be discussed. If the anomaly cannot be corrected by additional measures, 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 described in the case narrative and submitted with the data package.

4.3 Reports to Management

QA reports to management include verbal status reports, written reports on field sampling activities and laboratory processes, data validation reports, data summary reports, and field and laboratory inspection and/or audit reports. These reports shall be prepared in coordination with the project team.

5 Data Validation and Usability

Laboratory data will be provided in both PDF and electronic format. Once data are received from the laboratory, QC procedures will be followed to provide an accurate evaluation of the data quality. The data will be validated in accordance with the EPA National Functional Guidelines for Data Review (EPA 2020a, 2020b, 2020c) project-specific DQOs (Table H-7), analytical method criteria, and the laboratory's internal performance standards based on their SOPs.

5.1 Data Review, Validation, and Verification

During the validation process, analytical data will be evaluated for 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.

5.2 Validation and Verification Methods

Data verification includes signed entries by the field and laboratory technicians on field data sheets and laboratory datasheets, respectively; review for completeness and accuracy by the FC and Laboratory Project Manager; review by the Project QA Manager for outliers and omissions; and the use of QC criteria to accept or reject specific data. Data will be entered into the EQuIS database, and a data file will be generated. A verification of the database file will be performed. One hundred percent of manually entered qualifiers will be verified. Any errors found will be corrected in the database.

Laboratory data will be reviewed and verified to determine whether DQOs have been met and that appropriate corrective actions have been taken, when necessary. The Project QA Manager or designee will be responsible for the final review of the 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 data acquisition. 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.

Stage 2B validations (EPA 2009) will be conducted on all data except for geotechnical data by Laboratory Data Consultants, Inc., or Anchor QEA, in accordance with EPA National Functional Guidelines for Data Review (EPA 2020a, 2020b, 2020c) and this Second Phase PDI QAPP, unless the Stage 2B validations reveal errors or issues that warrant additional Stage 4 validations. Stage 1

validations will be conducted on geotechnical data. Chemical and physical data will be reviewed with regard to the following, as appropriate to the particular analysis:

- Data completeness
- Holding times
- Instrument performance checks
- Initial calibrations
- Continuing calibrations
- Column confirmations
- Equipment blanks
- Method blanks
- Surrogate recoveries
- Detection limits
- Reporting limits
- Laboratory control samples
- Field and laboratory duplicates
- MD/MS/MSD samples
- Standard reference material samples
- Interference check samples
- Serial dilutions

The results of the data validation, including text assigning qualifiers in accordance with the EPA National Functional Guidelines for Data Review (EPA 2020a, 2020b, 2020c) and a tabular summary of qualifiers, will be generated by the validator and submitted to the Project QA Manager for final review and confirmation of the validity of the data.

5.3 Reconciliation with User Requirements

The Project QA Manager will review data after each survey to determine if DQOs have been met. If data do not meet the project's specifications, the Project QA Manager will review the outliers and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors and will then suggest corrective action. If problems cannot be corrected by retraining, revision of techniques, or replacement of supplies or equipment, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the Project QA Manager will consult with EPA and recommend appropriate modifications to either the laboratory or to the program requirements.

6 References

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EPA, 2020d. Memorandum Regarding: Errata #2 for Portland Harbor Superfund Site Record of Decision ROD Table 17. From Sean Sheldrake. Portland, Oregon. EPA Region 10. January 14, 2020.

Tables

Table H-1
Project Contact List

QAPP Recipients	Title	Organization	Telephone Number	Email Address
—	Emergency Response Team	EPA Region 10	(206) 553-4973	—
Ryan Barth	Project Manager	Anchor QEA, LLC	(206) 903-3334	rbarth@anchorqea.com
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Delaney Peterson	QA/QC Manager	Anchor QEA, LLC	(360) 715-2707	dpeterson@anchorqea.com
Darwin Thomas	Laboratory Project Manager	Apex Laboratories, LLC	(503) 718-2323	dthomas@apex-labs.com
Karen Volpendesta	Laboratory Project Manager	Vista Analytical Laboratory, Inc.	(916) 673-1520	kvolpendesta@vista-analytical.com
Shelly Fishel	Laboratory Project Manager	Analytical Resources, LLC	(206) 695-6210	shelly.fishel@arilabs.com
Mark Harris	Laboratory Project Manager	ALS Environmental	(360) 501-3376	mark.harris@ALSGlobal.com
Jon Campbell	Laboratory Manager	Geotesting Express	(978) 893-1291	jcampbell@geotesting.com
Stella Cuenco	Data Validation Project Manager	Laboratory Data Consultants, Inc.	(760) 827-1100	scuenco@lab-data.com
James B. Hyzy	Laboratory Project Manager	Waste Stream Technology, Inc.	(716) 282-2469	Jhyzy@sevenson.com

Notes:
—: not applicable
EPA: U.S. Environmental Protection Agency
QAPP: Quality Assurance Project Plan
QA/QC: quality assurance/quality control

Table H-2
Second Phase PDI Surface Sediment Analytes, Methods, and Targeted Reporting Limits

Parameter	Recommended Analytical Method	Cleanup Level[1]	Site-Wide RALs[2]	Navigation Channel RALs[2]	PTW Highly Toxic Thresholds[2]	MDL[3]	MRL[3]
Geotechnical							
Moisture content	ASTM D2216	—	—	—	—	—	—
Specific gravity	ASTM D854	—	—	—	—	—	—
Grain size	ASTM D6913 and D7928	—	—	—	—	—	—
Bulk density	ASTM D7263	—	—	—	—	—	—
Atterberg limits	ASTM D4318		—	—	—	—	—
Conventionals							
Total Solids (%)	SM 2540 G	—	—	—	—	0.10	0.10
Total Organic Carbon (%)	SM 5310 B	—	—	—	—	0.10	0.20
Polycyclic Aromatic Hydrocarbons (µg/kg)							
2-Methylnaphthalene	EPA 8270E	—	—	—	—	2.67	5.33
Acenaphthene	EPA 8270E	—	—	—	—	1.33	2.67
Acenaphthylene	EPA 8270E	—	—	—	—	1.33	2.67
Anthracene	EPA 8270E	—	—	—	—	1.33	2.67
Benzo(a)anthracene	EPA 8270E	—	—	—	—	1.33	2.67
Benzo(a)pyrene	EPA 8270E	—	—	—	—	2.00	4.00
Benzo(b)fluoranthene	EPA 8270E	—	—	—	—	2.00	4.00
Benzo(g,h,i)perylene	EPA 8270E	—	—	—	—	1.33	2.67
Benzo(j)+(k)Fluoranthene	EPA 8270E	—	—	—	—	2.00	4.00
Chrysene	EPA 8270E	—	—	—	—	1.33	2.67
Dibenz(a,h)anthracene	EPA 8270E	—	—	—	—	1.33	2.67
Fluoranthene	EPA 8270E	—	—	—	—	1.33	2.67
Fluorene	EPA 8270E	—	—	—	—	1.33	2.67
Indeno(1,2,3-c,d)pyrene	EPA 8270E	—	—	—	—	1.33	2.67
Naphthalene[4]	EPA 8270E	—	—	—	140,000	2.67	5.33
Phenanthrene	EPA 8270E	—	—	—	—	1.33	2.67
Pyrene	EPA 8270E	—	—	—	—	1.33	2.67
cPAHs (BaP eq)[4,5]	—	774/85/1076[8]	—	—	774,000	—	—
Total PAHs[4,6,7]	—	23,000	30,000	170,000	—	—	—
Polychlorinated Biphenyl Congeners (ng/kg)							
PCB-001 - 209	EPA 1668A	—	—	—	—	9.05	10
Total PCBs[5]	—	9000	75,000	1,000,000	200,000	—	—
Dioxin/Furans (ng/kg)							
2,3,7,8-TCDD	EPA 1613B	0.2	0.6	2	10	0.28	0.5
1,2,3,7,8-PeCDD	EPA 1613B	0.2	0.8	3	10	0.59	2.5
1,2,3,4,7,8-HxCDD	EPA 1613B	—	—	—	—	0.60	2.5
1,2,3,6,7,8-HxCDD	EPA 1613B	—	—	—	—	0.38	2.5
1,2,3,7,8,9-HxCDD	EPA 1613B	—	—	—	—	0.57	2.5
1,2,3,4,6,7,8-HpCDD	EPA 1613B	—	—	—	—	0.54	2.5
OCDD	EPA 1613B	—	—	—	—	1.58	5.0
2,3,7,8-TCDF	EPA 1613B	0.40658	—	—	600	0.31	0.5
1,2,3,7,8-PeCDF	EPA 1613B	—	—	—	—	0.49	2.5
2,3,4,7,8-PeCDF	EPA 1613B	0.3	200	1,000	200	0.30	2.5
1,2,3,4,7,8-HxCDF	EPA 1613B	0.4	—	—	400	0.65	2.5
1,2,3,6,7,8-HxCDF	EPA 1613B	—	—	—	—	0.89	2.5
1,2,3,7,8,9-HxCDF	EPA 1613B	—	—	—	—	0.63	2.5
2,3,4,6,7,8-HxCDF	EPA 1613B	—	—	—	—	0.78	2.5
1,2,3,4,6,7,8-HpCDF	EPA 1613B	—	—	—	—	0.43	2.5
1,2,3,4,7,8,9-HpCDF	EPA 1613B	—	—	—	—	0.65	2.5
OCDF	EPA 1613B	—	—	—	—	0.83	5.0
2,3,7,8-TCDD eq (2005 WHO TEQ)[5]	—	10	—	—	—	—	—
Pesticides (µg/kg)							
2,4'-DDD	EPA 8081B	114	—	—	—	0.50	1.00
2,4'-DDE	EPA 8081B	50	—	—	—	0.50	1.00
2,4'-DDT	EPA 8081B	246	—	—	—	0.50	1.00
4,4'-DDD	EPA 8081B	114	—	—	—	0.50	1.00
4,4'-DDE	EPA 8081B	50	—	—	—	0.50	1.00
4,4'-DDT	EPA 8081B	246	—	—	—	0.50	1.00
DDx[4]	—	6.1	160	650	7,050	—	—
Parent and Alkylated Polycyclic Aromatic Hydrocarbons (µg/kg)							
1-Methylnaphthalene	EPA 8270D-SIM	—	—	—	—	0.378	5.00
1-Methylphenanthrene	EPA 8270D-SIM	—	—	—	—	0.496	5.00
2,3,5-Trimethylnaphthalene	EPA 8270D-SIM	—	—	—	—	0.449	5.00
2,6-Dimethylnaphthalene	EPA 8270D-SIM	—	—	—	—	0.388	5.00
2-Methylnaphthalene	EPA 8270D-SIM	—	—	—	—	0.445	5.00
Acenaphthene	EPA 8270D-SIM	—	—	—	—	0.459	5.00

Table H-2
Second Phase PDI Surface Sediment Analytes, Methods, and Targeted Reporting Limits

Parameter	Recommended Analytical Method	Cleanup Level[1]	Site-Wide RALs[2]	Navigation Channel RALs[2]	PTW Highly Toxic Thresholds[2]	MDL[3]	MRL[3]
Acenaphthylene	EPA 8270D-SIM	—	—	—	—	0.257	5.00
Anthracene	EPA 8270D-SIM	—	—	—	—	0.0468	5.00
Benzo(a)anthracene	EPA 8270D-SIM	—	—	—	—	1.41	5.00
Benzo(a)pyrene	EPA 8270D-SIM	—	—	—	—	0.977	5.00
Benzo(b)fluoranthene	EPA 8270D-SIM	—	—	—	—	0.794	5.00
Benzo(b)naphtho(2,1-d)thiophene	EPA 8270D-SIM	—	—	—	—	5.00	5.00
Benzo(b)thiophene	EPA 8270D-SIM	—	—	—	—	0.357	5.00
Benzo(e)pyrene	EPA 8270D-SIM	—	—	—	—	0.622	5.00
Benzo(g,h,i)perylene	EPA 8270D-SIM	—	—	—	—	0.519	5.00
Benzo(k)fluoranthene	EPA 8270D-SIM	—	—	—	—	0.794	5.00
Biphenyl	EPA 8270D-SIM	—	—	—	—	0.335	5.00
C1-Benzo(a)anthracenes/Chrysenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Benzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Decalins	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Dibenzo(a)anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Dibenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Fluoranthenes/Pyrenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Fluorenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Naphthalenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Naphthobenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Phenanthrenes/Anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Benzo(a)anthracenes/Chrysenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Benzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Decalins	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Dibenzo(a)anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Dibenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Fluoranthenes/Pyrenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Fluorenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Naphthalenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Naphthobenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Phenanthrenes/Anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Benzo(a)anthracenes/Chrysenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Benzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Decalins	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Dibenzo(a)anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Dibenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Fluoranthenes/Pyrenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Fluorenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Naphthalenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Naphthobenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Phenanthrenes/Anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Benzo(a)anthracenes/Chrysenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Decalins	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Dibenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Fluoranthenes/Pyrenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Naphthalenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Naphthobenzothiopenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Phenanthrenes/Anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
Carbazole	EPA 8270D-SIM	—	—	—	—	0.711	5.00
Chrysene	EPA 8270D-SIM	—	—	—	—	0.706	5.00
cis-Decalin	EPA 8270D-SIM	—	—	—	—	0.486	5.00
Dibenzo(a,h)anthracene	EPA 8270D-SIM	—	—	—	—	0.674	5.00
Dibenzofuran	EPA 8270D-SIM	—	—	—	—	0.411	5.00
Dibenzothiophene	EPA 8270D-SIM	—	—	—	—	0.652	5.00
Fluoranthene	EPA 8270D-SIM	—	—	—	—	1.36	5.00
Fluorene	EPA 8270D-SIM	—	—	—	—	0.468	5.00
Indeno(1,2,3-cd)pyrene	EPA 8270D-SIM	—	—	—	—	0.372	5.00
Naphthalene	EPA 8270D-SIM	—	—	—	—	0.448	5.00
Perylene	EPA 8270D-SIM	—	—	—	—	0.449	5.00
Phenanthrene	EPA 8270D-SIM	—	—	—	—	0.934	5.00
Pyrene	EPA 8270D-SIM	—	—	—	—	1.02	5.00
Total Benzofluoranthenes	EPA 8270D-SIM	—	—	—	—	1.59	15.00
trans-Decalin	EPA 8270D-SIM	—	—	—	—	0.0286	5.00
cPAHs (BaP eq)[3,4]	—	774/85/1076[6]	—	—	—	—	—
Total PAHs[3,5]	—	2300	—	—	—	—	—

Table H-2
Second Phase PDI Surface Sediment Analytes, Methods, and Targeted Reporting Limits

Parameter	Recommended Analytical Method	Cleanup Level[1]	Site-Wide RALs[2]	Navigation Channel RALs[2]	PTW Highly Toxic Thresholds[2]	MDL[3]	MRL[3]
Total Petroleum Hydrocarbons (mg/kg)							
Diesel range organics	NWTPHDx	91	—	—	—	20.3	50.0
Motor oil range organics	NWTPHDx	—	—	—	—	21.0	

Notes:

1. The Riverbank Soil/Sediment Cleanup Levels are presented in ROD Table 17 (EPA 2017) and as updated in ROD Errata #2 (EPA 2020d).

2. The sediment RALs and PTW highly toxic threshold values are presented in ROD Table 21 (EPA 2017) as amended for PAHs by the *Explanation of Significant Differences* (EPA 2019).

3. Actual MDLs and MRLs may vary based on sample aliquot size, moisture content, and required dilution factor.

4. The naphthalene threshold value was developed for the ROD based on feasibility-level harborwide assumptions that are not applicable at the site. NW Natural is performing a site-specific capping demonstration evaluation to determine if any of the ROD Table 17 contaminants of concern containing groundwater cleanup levels cannot be reliably contained.

5. cPAH (BaPEq), total PAHs, total PCBs, 2,3,7,8-TCDD eq, and DDx are calculated values; therefore, there are no MDLs or MRLs for these parameters.

6. Total cPAH is the sum of benzo(a)pyrene equivalent concentrations, calculated by multiplying the cPAHs by their respective potency factors. cPAHs include benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, and dibenzo(a,h)anthracene.

7. Total PAH is the sum of 2-methylnaphthalene, acenapthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

8. The cleanup level for cPAHs of 774 µg/kg is based on direct contact with sediment and is applicable to nearshore sediment exclusive of recreational beaches and navigation channel sediments. The cleanup level applicable to recreational beach sediments is 85 µg/kg and the cleanup level applicable to the navigation channel sediment is 1,076 µg/kg and is based on human consumption of clams.

9. The cleanup levels for 2,3,7,8-TCDD and 1,2,3,7,8-PeCDD are below laboratory MDLs. For EPA Method 1613B, the laboratory will report results to the EDL. EDLs are analyte specific and are typically lower than the laboratory MDLs.

—: not applicable
µg/kg: micrograms per kilogram
ASTM: ASTM International
BaP eq: benzo(a)pyrene equivalent
cPAH: carcinogenic polycyclic aromatic hydrocarbon
DDx: the sum of DDD, DDE, and DDT
EDL: estimated detection limit
EPA: U.S. Environmental Protection Agency
ESD: Explanation of Significant Differences
MDL: method detection limit
mg/kg: milligrams per kilogram
MRL: method reporting limit
ng/kg: nanogram per kilogram
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PTW: principal threat waste
RAL: remedial action level
ROD: *Record of Decision – Portland Harbor Superfund Site*
SM: Standard Method
WHO TEQ: World Health Organization Toxic Equivalency

Table H-3
Second Phase PDI Depth of Contamination Subsurface Sediment Analytes, Methods, and Targeted Reporting Limits

Parameter	Recommended Analytical Method	Cleanup Level[1]	Site-Wide RALs[2]	Navigation Channel RALs[2]	PTW-Highly Toxic Thresholds[2]	MDL[3]	MRL[3]
Geotechnical							
Moisture content	ASTM D2216	—	—	—	—	—	—
Specific gravity	ASTM D854	—	—	—	—	—	—
Grain size	ASTM D6913 and D7928	—	—	—	—	—	—
Bulk density	ASTM D7263	—	—	—	—	—	—
Atterberg limits	ASTM D4318		—	—	—	—	—
Conventionals (%)							
Total Solids	SM 2540 G	—	—	—	—	0.10	0.10
Total Organic Carbon	SM 5310 B	—	—	—	—	0.10	0.20
Polycyclic Aromatic Hydrocarbons (µg/kg)							
2-Methylnaphthalene	EPA 8270E	—	—	—	—	2.67	5.33
Acenaphthene	EPA 8270E	—	—	—	—	1.33	2.67
Acenaphthylene	EPA 8270E	—	—	—	—	1.33	2.67
Anthracene	EPA 8270E	—	—	—	—	1.33	2.67
Benzo(a)anthracene	EPA 8270E	—	—	—	—	1.33	2.67
Benzo(a)pyrene	EPA 8270E	—	—	—	—	2.00	4.00
Benzo(b)fluoranthene	EPA 8270E	—	—	—	—	2.00	4.00
Benzo(g,h,i)perylene	EPA 8270E	—	—	—	—	1.33	2.67
Benzo(j)+(k)Fluoranthene	EPA 8270E	—	—	—	—	2.00	4.00
Chrysene	EPA 8270E	—	—	—	—	1.33	2.67
Dibenz(a,h)anthracene	EPA 8270E	—	—	—	—	1.33	2.67
Fluoranthene	EPA 8270E	—	—	—	—	1.33	2.67
Fluorene	EPA 8270E	—	—	—	—	1.33	2.67
Indeno(1,2,3-c,d)pyrene	EPA 8270E	—	—	—	—	1.33	2.67
Naphthalene[4]	EPA 8270E	—	—	—	140,000	2.67	5.33
Phenanthrene	EPA 8270E	—	—	—	—	1.33	2.67
Pyrene	EPA 8270E	—	—	—	—	1.33	2.67
cPAHs (BaP eq)[4,5,6]	—	774/85/1,076[8]	—	—	774,000	—	—
Total PAHs[4,5,7]	—	23,000	30,000	170,000	—	—	—
PCB Aroclors (µg/kg)							
Aroclor 1016	EPA 8082A	—	—	—	—	2.00	4.00
Aroclor 1221	EPA 8082A	—	—	—	—	2.00	4.00
Aroclor 1232	EPA 8082A	—	—	—	—	2.00	4.00
Aroclor 1242	EPA 8082A	—	—	—	—	2.00	4.00
Aroclor 1248	EPA 8082A	—	—	—	—	2.00	4.00
Aroclor 1254	EPA 8082A	—	—	—	—	2.00	4.00
Aroclor 1260	EPA 8082A	—	—	—	—	2.00	4.00
Aroclor 1262	EPA 8082A	—	—	—	—	2.00	4.00
Aroclor 1268	EPA 8082A	—	—	—	—	2.00	4.00
Total PCB Aroclors[4,5]	—	9	75	1,000	200	—	—
Dioxin/Furans (ng/kg)							
2,3,7,8-TCDD[9]	EPA 1613B	0.2	0.6	2	10	0.28	0.5
1,2,3,7,8-PeCDD[9]	EPA 1613B	0.2	0.8	3	10	0.59	2.5
1,2,3,4,7,8-HxCDD	EPA 1613B	—	—	—	—	0.60	2.5
1,2,3,6,7,8-HxCDD	EPA 1613B	—	—	—	—	0.38	2.5
1,2,3,7,8,9-HxCDD	EPA 1613B	—	—	—	—	0.57	2.5
1,2,3,4,6,7,8-HpCDD	EPA 1613B	—	—	—	—	0.54	2.5
OCDD	EPA 1613B	—	—	—	—	1.58	5.0
2,3,7,8-TCDF	EPA 1613B	0.40658	—	—	600	0.31	0.5
1,2,3,7,8-PeCDF	EPA 1613B	—	—	—	—	0.49	2.5
2,3,4,7,8-PeCDF	EPA 1613B	0.3	200	1,000	200	0.30	2.5
1,2,3,4,7,8-HxCDF	EPA 1613B	0.4	—	—	400	0.65	2.5
1,2,3,6,7,8-HxCDF	EPA 1613B	—	—	—	—	0.89	2.5
1,2,3,7,8,9-HxCDF	EPA 1613B	—	—	—	—	0.63	2.5
2,3,4,6,7,8-HxCDF	EPA 1613B	—	—	—	—	0.78	2.5
1,2,3,4,6,7,8-HpCDF	EPA 1613B	—	—	—	—	0.43	2.5
1,2,3,4,7,8,9-HpCDF	EPA 1613B	—	—	—	—	0.65	2.5
OCDF	EPA 1613B	—	—	—	—	0.83	5.0
2,3,7,8-TCDD eq (2005 WHO TEQ)[4,5]	—	—	—	—	—	—	—
Low-Resolution Pesticides (µg/kg)							
2,4'-DDD	EPA 8081B	114	—	—	—	0.50	1.00
2,4'-DDE	EPA 8081B	226	—	—	—	0.50	1.00
2,4'-DDT	EPA 8081B	246	—	—	—	0.50	1.00
4,4'-DDD	EPA 8081B	114	—	—	—	0.50	1.00
4,4'-DDE	EPA 8081B	226	—	—	—	0.50	1.00
4,4'-DDT	EPA 8081B	246	—	—	—	0.50	1.00
DDx[5]	—	6.1	160	650	7,050	—	—

Table H-3
Second Phase PDI Depth of Contamination Subsurface Sediment Analytes, Methods, and Targeted Reporting Limits

Parameter	Recommended Analytical Method	Cleanup Level[1]	Site-Wide RALs[2]	Navigation Channel RALs[2]	PTW-Highly Toxic Thresholds[2]	MDL[3]	MRL[3]
Parent and Alkylated Polycyclic Aromatic Hydrocarbons (µg/kg)							
1-Methylnaphthalene	EPA 8270D-SIM	—	—	—	—	0.378	5.00
2,3,5-Trimethylnaphthalene	EPA 8270D-SIM	—	—	—	—	0.449	5.00
2,6-Dimethylnaphthalene	EPA 8270D-SIM	—	—	—	—	0.388	5.00
2-Methylnaphthalene	EPA 8270D-SIM	—	—	—	—	0.445	5.00
Acenaphthene	EPA 8270D-SIM	—	—	—	—	0.459	5.00
Acenaphthylene	EPA 8270D-SIM	—	—	—	—	0.257	5.00
Anthracene	EPA 8270D-SIM	—	—	—	—	0.0468	5.00
Benzo(a)anthracene	EPA 8270D-SIM	—	—	—	—	1.41	5.00
Benzo(a)pyrene	EPA 8270D-SIM	—	—	—	—	0.977	5.00
Benzo(b)fluoranthene	EPA 8270D-SIM	—	—	—	—	0.794	5.00
Benzo(b)naphtho(2,1-d)thiophene	EPA 8270D-SIM	—	—	—	—	5.00	5.00
Benzo(b)thiophene	EPA 8270D-SIM	—	—	—	—	0.357	5.00
Benzo(e)pyrene	EPA 8270D-SIM	—	—	—	—	0.622	5.00
Benzo(g,h,i)perylene	EPA 8270D-SIM	—	—	—	—	0.519	5.00
Benzo(k)fluoranthene	EPA 8270D-SIM	—	—	—	—	0.794	5.00
Biphenyl	EPA 8270D-SIM	—	—	—	—	0.335	5.00
C1-Benzo(a)anthracenes/Chrysenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Benzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Decalins	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Dibenzo(a)anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Dibenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Fluoranthenes/Pyrenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Fluorenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Naphthalenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Naphthobenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C1-Phenanthrenes/Anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Benzo(a)anthracenes/Chrysenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Benzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Decalins	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Dibenzo(a)anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Dibenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Fluoranthenes/Pyrenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Fluorenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Naphthalenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Naphthobenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C2-Phenanthrenes/Anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Benzo(a)anthracenes/Chrysenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Benzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Decalins	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Dibenzo(a)anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Dibenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Fluoranthenes/Pyrenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Fluorenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Naphthalenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Naphthobenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C3-Phenanthrenes/Anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Benzo(a)anthracenes/Chrysenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Decalins	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Dibenzothiophenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Fluoranthenes/Pyrenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Naphthalenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Naphthobenzothiopenes	EPA 8270D-SIM	—	—	—	—	—	10.00
C4-Phenanthrenes/Anthracenes	EPA 8270D-SIM	—	—	—	—	—	10.00
Carbazole	EPA 8270D-SIM	—	—	—	—	0.711	5.00
Chrysene	EPA 8270D-SIM	—	—	—	—	0.706	5.00
cis-Decalin	EPA 8270D-SIM	—	—	—	—	0.486	5.00
Dibenzo(a,h)anthracene	EPA 8270D-SIM	—	—	—	—	0.674	5.00
Dibenzofuran	EPA 8270D-SIM	—	—	—	—	0.411	5.00
Dibenzothiophene	EPA 8270D-SIM	—	—	—	—	0.652	5.00
Fluoranthene	EPA 8270D-SIM	—	—	—	—	1.36	5.00
Fluorene	EPA 8270D-SIM	—	—	—	—	0.468	5.00
Indeno(1,2,3-cd)pyrene	EPA 8270D-SIM	—	—	—	—	0.372	5.00
Naphthalene	EPA 8270D-SIM	—	—	—	—	0.448	5.00
Perylene	EPA 8270D-SIM	—	—	—	—	0.449	5.00
Phenanthrene	EPA 8270D-SIM	—	—	—	—	0.934	5.00
Pyrene	EPA 8270D-SIM	—	—	—	—	1.02	5.00
Total Benzofluoranthenes	EPA 8270D-SIM	—	—	—	—	1.59	15.00

Table H-3
Second Phase PDI Depth of Contamination Subsurface Sediment Analytes, Methods, and Targeted Reporting Limits

Parameter	Recommended Analytical Method	Cleanup Level[1]	Site-Wide RALs[2]	Navigation Channel RALs[2]	PTW-Highly Toxic Thresholds[2]	MDL[3]	MRL[3]
trans-Decalin	EPA 8270D-SIM	—	—	—	—	0.0286	5.00
cPAHs (BaP eq)[3,4]	—	774/85/1,076[6]	—	—	—	—	—
Total PAHs[3,5]	—	23,000	—	—	—	—	—
Total Petroleum Hydrocarbons (mg/kg)							
Diesel range organics	NWTPHDx	91	—	—	—	20.3	50.0
Motor oil range organics	NWTPHDx	—	—	—	—	21.0	

Notes:

1. The Riverbank Soil/Sediment Cleanup Levels are presented in ROD Table 17 (EPA 2017).

2. The sediment RALs and PTW highly toxic threshold values are presented in ROD Table 21 (EPA 2017) as amended for PAHs by the *Explanation of Significant Differences* (EPA 2019).

3. Actual MDLs and MRLs may vary based on sample aliquot size, moisture content, and required dilution factor.

4. The naphthalene threshold value was developed for the ROD based on feasibility-level harborwide assumptions that are not applicable at the site. NW Natural is performing a site-specific capping demonstration evaluation to determine if any of the ROD Table 17 contaminants of concern containing groundwater cleanup levels cannot be reliably contained.

5. cPAH (BaPEq), total PAHs, total PCBs, 2,3,7,8-TCDD eq, and DDx are calculated values; therefore, there are no MDLs or MRLs for these parameters.

6. Total cPAH is the sum of benzo(a)pyrene equivalent concentrations, calculated by multiplying the cPAHs by their respective potency factors. cPAHs include benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, and dibenzo(a,h)anthracene.

7. Total PAH is the sum of 2-methylnaphthalene, acenapthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

8. The cleanup levels for 2,3,7,8-TCDD and 1,2,3,7,8-PeCDD are below laboratory MDLs. For EPA Method 1613B, the laboratory will report results to the EDL. EDLs are analyte specific and are typically lower than the laboratory MDLs.

9. As communicated in EPA's email with the subject "Portland Harbor RDGC Update - Dioxin RALS - FAQs" dated October 28, 2022, the remediation thresholds for TCDD and PeCDD are 0.001 and 0.0025 µg/kg respectively. It is NW Natural's understanding that these remediation thresholds will be used in the BODR to fully delineate SMAs and identify DOC.

—: not applicable
µg/kg: micrograms per kilogram
ASTM: ASTM International
BaP eq: benzo(a)pyrene equivalent
cPAH: carcinogenic polycyclic aromatic hydrocarbon
DDX: the sum of DDD, DDE, and DDT
EDL: estimated detection limit
EPA: U.S. Environmental Protection Agency
ESD: Explanation of Significant Differences
MDL: method detection limit
MRL: method reporting limit
ng/kg: nanogram per kilogram
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PTW: principal threat waste
RAL: remedial action level
ROD: *Record of Decision – Portland Harbor Superfund Site*
SM: Standard Method
WHO TEQ: World Health Organization Toxic Equivalency

Table H-4
Second Phase PDI Dredge Material Waste Suitability Analytes, Methods, and Targeted Reporting Limits

Parameter	Recommended Analytical Method	MDL[1]	MRL[1]
Conventionals			
pH (SU)	EPA 9045D	—	—
Ignitablility (°)	EPA 1010A	—	—
Total Solids (%)	SM 2540 G	0.10	0.10
TCLP Metals (mg/L)			
Arsenic	EPA 6020A	0.05	0.10
Barium	EPA 6020A	2.5	5.00
Cadmium	EPA 6020A	0.05	0.10
Chromium	EPA 6020A	0.05	0.10
Lead	EPA 6020A	0.025	0.05
Mercury	EPA 6020A	0.0035	0.007
Selenium	EPA 6020A	0.05	0.10
Silver	EPA 6020A	0.05	0.10
TCLP VOCs (mg/L)			
Benzene	EPA 8260C	0.00625	0.0125
Carbon tetrachloride	EPA 8260C	0.0125	0.025
Chlorobenzene	EPA 8260C	0.0125	0.025
Chloroform	EPA 8260C	0.025	0.05
1,2-Dichloroethane	EPA 8260C	0.0125	0.025
1,1-Dichloroethene	EPA 8260C	0.0125	0.025
1,4-Dichlorobenzene	EPA 8260C	0.0125	0.025
2-Butanone	EPA 8260C	0.25	0.5
Tetrachloroethene	EPA 8260C	0.0125	0.025
Trichloroethene	EPA 8260C	0.0125	0.025
Vinyl chloride	EPA 8260C	0.0125	0.025
TCLP SVOCs (mg/L)			
2,4,5-Trichlorophenol	EPA 8270D	0.0025	0.005
2,4,6-Trichlorophenol	EPA 8270D	0.0025	0.005
2,4-Dinitrotoluene	EPA 8270D	0.001	0.002
2-Methylphenol	EPA 8270D	0.0025	0.005
3- & 4-Methylphenol	EPA 8270D	0.0025	0.005
Hexachlorobenzene	EPA 8270D	0.001	0.002
Hexachlorobutadiene	EPA 8270D	0.0025	0.005
Hexachloroethane	EPA 8270D	0.0025	0.005
Nitrobenzene	EPA 8270D	0.0025	0.005
Pentachlorophenol	EPA 8270D	0.005	0.01
Pyridine	EPA 8270D	0.005	0.01
TCLP Pesticides (mg/L)			
Lindane	EPA 8081B	0.000075	0.00015
Heptachlor	EPA 8081B	0.000075	0.00015
Heptachlor epoxide	EPA 8081B	0.000075	0.00015
Endrin	EPA 8081B	0.000075	0.00015
Methoxychlor	EPA 8081B	0.000075	0.00015
Toxaphene	EPA 8081B	0.000075	0.00015
Chlordane	EPA 8081B	0.000075	0.00015
TCLP Herbicides (mg/L)			
2,4-D	EPA 8151A	0.000408	0.002
2,4,5-TP (Silvex)	EPA 8151A	0.000117	0.0006

Notes:
1. Actual MDLs and QLs may vary based on sample aliquot size, moisture content, and required dilution factor.
2. Total xylenes are calculated values; therefore, there are no MDLs or MRLs for these parameters.

—: not applicable
µg/kg: micrograms per kilogram
EPA: U.S. Environmental Protection Agency
MDL: method detection limit
mg/kg: milligrams per kilogram
mg/L: milligrams per liter
MRL: method reporting limit
ng/kg: nanograms per kilogram
PDI: pre-design investigation
QL: quantitation limit
SM: Standard Method

Table H-5

Second Phase PDI Barge Dewatering Standard Elutriate Test Analytes, Methods, and Targeted Reporting Limits

Analyte	Analytical Method	Method Detection Limit[1]	Target Reporting Limit[1]
Conventionals			
pH (SU)	SM 9040C	0.1	0.1
Total Suspended Solids (mg/L)	SM 2540 D	5.0	5.0
Metals (µg/L)			
Arsenic	EPA 6020A	0.5	1.0
Chromium	EPA 6020A	0.5	1.0
Copper	EPA 6020A	0.5	1.0
Zinc	EPA 6020A	2.0	4.0
Semivolatile Organic Compounds (µg/L)			
Benz(a)anthracene	EPA 8270D	0.01	0.02
Benzo(a)pyrene	EPA 8270D	0.015	0.03
Benzo(b)fluoranthene	EPA 8270D	0.015	0.03
Benzo(k)fluoranthene	EPA 8270D	0.015	0.03
Chrysene	EPA 8270D	0.01	0.02
Dibenz(a,h)anthracene	EPA 8270D	0.01	0.02
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.01	0.02
Naphthalene	EPA 8270D	0.02	0.04
Pentachlorophenol (PCP)	EPA 8270D	0.1	0.2
Bis(2-ethylhexyl)phthalate	EPA 8270D	0.2	0.4
Hexachlorobenzene	EPA 8270D	0.01	0.02
Volatile Organic Compounds (µg/L)			
Ethylbenzene	EPA 8260C	0.25	0.5
Polychlorinated Biphenyl Aroclors (µg/L)			
Aroclor 1016	EPA 8082A	0.01	0.02
Aroclor 1221	EPA 8082A	0.01	0.02
Aroclor 1232	EPA 8082A	0.01	0.02
Aroclor 1242	EPA 8082A	0.01	0.02
Aroclor 1248	EPA 8082A	0.01	0.02
Aroclor 1254	EPA 8082A	0.01	0.02
Aroclor 1260	EPA 8082A	0.01	0.02
Pesticides (µg/L)			
Aldrin	EPA 8081B	0.005	0.01
cis-Chlordane	EPA 8081B	0.005	0.01
trans-Chlordane	EPA 8081B	0.005	0.01
2,4'-DDD	EPA 8081B	0.005	0.01
2,4'-DDE	EPA 8081B	0.005	0.01
2,4'-DDT	EPA 8081B	0.005	0.01
cis-Nonachlor	EPA 8081B	0.005	0.01
trans-Nonachlor	EPA 8081B	0.005	0.01
Oxychlordane	EPA 8081B	0.005	0.01

Table H-5

Second Phase PDI Barge Dewatering Standard Elutriate Test Analytes, Methods, and Targeted Reporting Limits

Analyte	Analytical Method	Method Detection Limit[1]	Target Reporting Limit[1]
4,4'-DDD	EPA 8081B	0.005	0.01
4,4'-DDE	EPA 8081B	0.005	0.01
4,4'-DDT	EPA 8081B	0.005	0.01

Notes:

1. Actual MDLs and QLs may vary based on sample aliquot size and required dilution factor.

µg/L: micrograms per liter

EPA: U.S. Environmental Protection Agency

MDL: method detection limit

mg/L: milligrams per liter

SU: standard unit

Table H-6
Field and Laboratory Quality Control Sample Analysis Frequency

Analysis Type	Rinsate Blanks	Field Duplicates	Initial Calibration	Ongoing Calibration	LCS/SRM[2]	Duplicates	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
pH/Ignitability	—	—	Daily	—	—	—	—	—	—	—
Total Solids/Total Suspended Solids	—	1 per 20 samples	Daily	—	—	1 per 20 samples	—	—	—	—
Total Organic Carbon	—	1 per 20 samples	As needed[1]	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	—	1 per 20 samples	—
Metals/ TCLP Metals	1 per collection method per event	1 per 20 samples	Daily or each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	—	1 per 20 samples	—
Herbicides/ TCLP Herbicides	1 per collection method per event	1 per 20 samples	As needed[1]	1 per 10 samples	1 per 20 samples	—	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Pesticides/ TCLP Pesticides	1 per collection method per event	1 per 20 samples	As needed[1]	1 per 10 samples	1 per 20 samples	—	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
PCB Aroclors	1 per collection method per event	1 per 20 samples	As needed[1]	1 per 10 samples	1 per 20 samples	—	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
TPH	—	—	As needed[1]	1 per 10 samples	1 per 20 samples	—	—	—	1 per 20 samples	Every sample
VOCs/ TCLP VOCs	1 per collection method per event[3]	1 per 20 samples	As needed[1]	Every 12 hours	1 per 20 samples	—	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
SVOCs/ TCLP SVOCs	1 per collection method per event	1 per 20 samples	As needed[1]	Every 12 hours	1 per 20 samples	—	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
PAHs and alkylated PAHs	1 per collection method per event	1 per 20 samples	As needed[1]	Every 12 hours	1 per 20 samples	—	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
PCB Congeners	1 per collection method per event	1 per 20 samples	As needed[1]	Every 12 hours	1 per 20 samples	1 per 20 samples	—[3]	—[3]	1 per 20 samples	Every sample
Dioxin/Furans	1 per collection method per event	1 per 20 samples	As needed[1]	Every 12 hours	1 per 20 samples	1 per 20 samples	—[3]	—[3]	1 per 20 samples	Every sample

Notes:

1. Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed.
2. When a standard reference material is available, it may be used in lieu of an LCS.
3. Isotope dilution is required by the method.

—: not applicable
LCS: laboratory control sample
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SRM: standard reference material
TPH: total petroleum hydrocarbon

Table H-7
Data Quality Objectives

Parameter	Precision (Duplicate RPD)	Accuracy (Spike Recoveries)	Completeness
Sediment Samples			
Total Solids	± 20% RPD	—	95%
pH	± 20% RPD	—	95%
Ignitability	± 20% RPD	—	95%
TOC	± 25% RPD	70 to 130% R	95%
Metals	± 25% RPD	70 to 130% R	95%
PAHs/alkylated PAHs	± 35% RPD	50 to 150% R	95%
SVOCs	± 35% RPD	50 to 150% R	95%
TPH	± 35% RPD	50 to 150% R	95%
VOCs	± 35% RPD	50 to 150% R	95%
Dioxin/Furans	± 35% RPD	50 to 150% R	95%
PCB Congeners	± 35% RPD	50 to 150% R	95%
PCB Aroclors	± 35% RPD	50 to 150% R	95%
Pesticides	± 35% RPD	50 to 150% R	95%
Herbicides	± 35% RPD	50 to 150% R	95%
Aqueous Samples[1]			
pH	± 20% RPD	—	95%
TSS	± 20% RPD	—	95%
Metals	± 20% RPD	75 to 125% R	95%
VOCs	± 30% RPD	60 to 140% R	95%
SVOCs	± 30% RPD	60 to 140% R	95%
Pesticides	± 30% RPD	60 to 140% R	95%
PCB Aroclors	± 30% RPD	60 to 140% R	95%
Herbicides	± 30% RPD	60 to 140% R	95%

Notes:
1. Aqueous samples intended for TCLP testing
—: not applicable
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
R: recovery
RPD: relative percent difference
TOC: total organic carbon
TPH: total petroleum hydrocarbon
TCLP: toxicity characteristic leaching procedure

Table H-8
Guidelines for Sample Handling and Storage

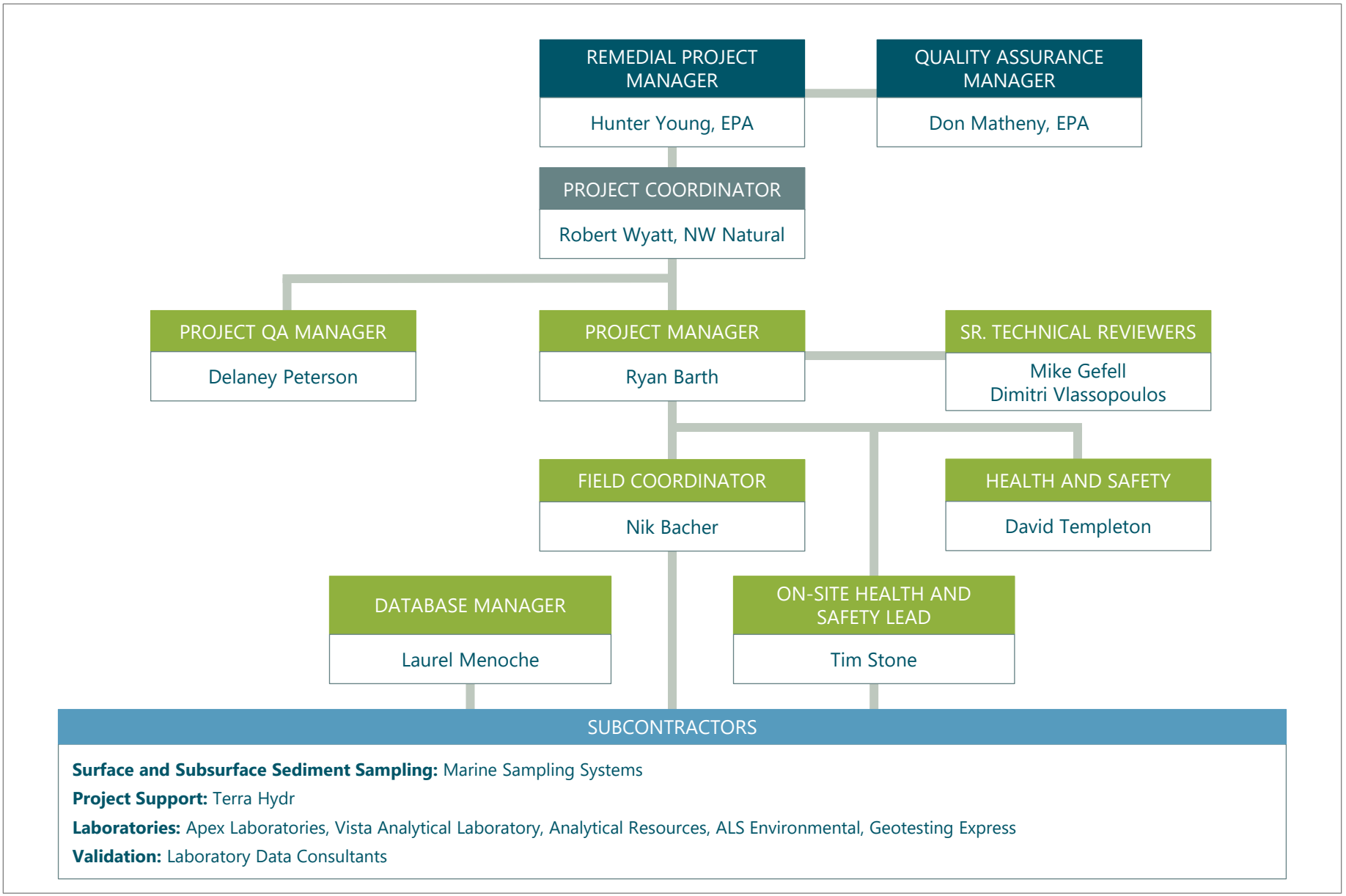
Parameter	Sample Size	Container Size and Type[1]	Holding Time	Sample Preservation Technique	Laboratory
Surface Grabs					
Moisture content	100 g	1 to 4 gallons in zip-top bags	None	None	GTX
Specific gravity	100 g		None	None	
Atterberg limits	100 g		None	None	
Grain size	300 g		None	None	
Total Solids	50 g	16 oz glass	None	Cool < 6°C	All
Total Organic Carbon	50 g		28 days	Cool < 6°C	Apex
			6 months	Freeze -18°C	
PAHs/Pesticides	200 g		14 days until extraction	Cool <6°C	
			1 year until extraction	Freeze -18°C	
			40 days after extraction	Cool <6°C	
Archive	N/A	8 or 16 oz glass	N/A	Freeze -18°C	
PCB Congeners and Dioxins/Furans	20 g	4 oz glass	1 year to extraction	Freeze -18°C	Vista
			1 year after extraction		
PAHs and alkylated PAHs, TPH	200 g	8 oz glass	14 days until extraction	Cool <6°C	ARI
			1 year until extraction	Freeze -18°C	
			40 days after extraction	Cool <6°C	
DOC Subsurface Sediment Cores					
Moisture content	100 g	1 to 4 gallons in zip-top bags	None	None	GTX
Specific gravity	100 g		None	None	
Atterberg limits	100 g		None	None	
Grain size	100 g		None	None	
Total Solids	50 g	16 oz glass	None	Cool < 6°C	All
Total Organic Carbon	50 g		28 days	Cool < 6°C	Apex
			6 months	Freeze -18°C	
PAHs/PCB Aroclors/Pesticides	200 g		14 days until extraction	Cool <6°C	
			1 year until extraction	Freeze -18°C	
			40 days after extraction	Cool <6°C	
Archive	N/A	8 or 16 oz glass	N/A	Freeze -18°C	
PAHs and alkylated PAHs, TPH	100 g	4 oz glass	14 days until extraction	Cool <6°C	ARI
			1 year until extraction	Freeze -18°C	
			40 days after extraction	Cool <6°C	
Dioxins/Furans	10 g	4 oz glass	1 year to extraction	Freeze -18°C	Vista
			1 year after extraction		

Table H-8
Guidelines for Sample Handling and Storage

Parameter	Sample Size	Container Size and Type[1]	Holding Time	Sample Preservation Technique	Laboratory
Dredge Material Waste Suitability Subsurface Sediment Cores					
Total Solids	50 g	16 oz glass	None	Cool < 6°C	All
pH	100 g		None	None	Apex
Ignitability	100 g		None	None	
Archive	N/A	8 or 16 oz glass	N/A	Freeze -18°C	
TCLP Metals	100 g	4 oz glass	180 days to TCLP extraction	Cool <6°C	
			180 days to analysis	HNO_3 to pH < 2	
TCLP SVOCs, Pesticides	300 g	8 oz glass	14 days to TCLP extraction	Cool <2 - 6°C	
			7 days to extraction		
			40 days after extraction		
TCLP Herbicides	300 g	8 oz glass	14 days to TCLP extraction	Cool <2 - 6°C	ALS
			7 days to extraction		
			40 days after extraction		
Barge Dewatering Dredge Elutriates					
pH	10 mL	250 mL HDPE	ASAP	Cool 2 to 6°C	WST
Total Suspended Solids	1 L	1 L HDPE	7 days	2 to 6°C	Apex
Metals	100 mL	500 mL HDPE	180 days	Cool 2 to 6°C; HNO3 to pH < 2	
VOCs	5 mL	40 mL VOA vial with PTFE-lined septum caps (3x); no headspace	14 days	Cool 4 to 6°C/HCl to pH < 2	
SVOCs	1L	2 x 1 L Amber glass	7 days until extraction	Cool 2 to 6°C	
			40 days after extraction		
Pesticides	1L	2 x 1 L Amber glass	7 days until extraction	Cool 2 to 6°C	
			40 days after extraction		
PCB Aroclors	1L	2 x 1 L Amber glass	14 days until extraction	Cool 2 to 6°C	
			40 days after extraction		

Notes:
1. Container size, type, and sample size required
ALS: ALS Environmental
Apex: Apex Laboratories, LLC
ARI: Analytical Resources, Inc.
DOC: depth of contamination
DRO: diesel range organic
EPH: extractable petroleum hydrocarbon
g: gram
GTX: Geotesting Express
HR: high-resolution
mL: milliliter
oz: ounce
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SVOC: semivolatile organic compound
TPH: total petroleum hydrocarbon
Vista: Vista Analytical Laboratory, Inc.
VOA: volatile organic analysis
VOC: volatile organic compound
WST: Waste Stream Technology, Inc.

Figure



ANCHOR QEA

Figure H-1
Project Organizational Chart
Second Phase Pre-Design Investigation Quality Assurance Project Plan
US Moorings Project Area
USMS0029579

Attachment A
Laboratory SOPs and Quality Assurance Manuals

Electronic files provided in separate folder.