Appendix G
Second Phase Pre-Design Investigation
Field Sampling Plan

June 7, 2023
US Moorings Project Area

Second Phase Pre-Design Investigation Field Sampling Plan

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

USMS0038185

June 7, 2023
US Moorings Project Area

Second Phase Pre-Design Investigation Field Sampling Plan

Prepared for
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Project Number: Project Number: 000029-02.82

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ATTACHMENT

ABBREVIATIONS

AOC	*Administrative Settlement Agreement and Order on Consent for Removal Action*
ASTM	ASTM International
bml	below mudline
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMA	Coastal Monitoring Associates
COC	contaminant of concern
Combined DSR-PDIWP	*Final Revised First Phase Pre-Design Investigation Data Summary Report and Second Phase Pre-Design Investigation Work Plan*
COP	City of Portland datum
CP	Control Point
DDx	sum of dichlorodiphenyldichloroethane, dichlorodiphenyldichloroethylene, and dichlorodiphenyltrichloroethane
DGPS	differential global positioning system
DOC	depth of contamination
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FCR	field change request
First Phase FSP	*Revised Final Field Sampling Plan*
GAC	granular activated carbon
GNSS	Global Navigation Satellite System
HARN91	High Accuracy Reference Network 91
IDW	investigation-derived waste
LiDAR	Light Detection and Ranging
mg/L	milligrams per liter
NAD83	North American Datum of 1983
NAPL	nonaqueous phase liquid
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDI	pre-design investigation
PDIWP	*Revised Final Pre-Design Investigation Work Plan*
PPK	post-processed kinematic
Project Area	US Moorings Project Area
PTW	principal threat waste
QA	quality assurance
QC	quality control

RAL	remedial action level
RCRA	Resource Conservation and Recovery Act
ROD	*Record of Decision – Portland Harbor Superfund Site, Portland, Oregon*
RTK	real-time kinematic
Second Phase PDI FSP	*Second Phase Field Pre-Design Investigation Sampling Plan*
Second Phase PDI QAPP	*Second Phase Pre-Design Investigation Quality Assurance Project Plan*
SMA	sediment management area
SOW	*Remedial Design Statement of Work, Portland Harbor Superfund Site, U.S. Moorings Project Area*
SVOC	semivolatile organic compound
T&D	transportation and disposal
TC	toxicity characteristic
TOC	total organic carbon
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbons
TS	total solids
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
USM	Universal Sonar Mount
VOC	volatile organic compound

1 Introduction

This *Second Phase Pre-Design Investigation Field Sampling Plan* (Second Phase PDI FSP) 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 downriver end of the St. Johns Bridge and river mile 6.1 on the west side of the Willamette River (Figure G1-1). This Second Phase PDI FSP 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, US Moorings Project Area* (SOW; EPA 2020). The *Revised Final Field Sampling Plan* (First Phase FSP; Anchor QEA 2020a) was approved by the U.S. Environmental Protection Agency (EPA) for the first phase pre-design investigation (PDI) at the Project Area, which was completed between October 2020 and May 2021. This Second Phase PDI FSP builds off the approved First Phase FSP and presents the data objectives, the proposed field sampling and data collection methodologies, and the analytical testing to be conducted during the implementation of the second phase PDI at the Project Area. The following sampling and analyses were not included in the First Phase FSP but are included herein:

- Seepage meter deployment (Section 3.4)
- Dredged material haul barge dewatering (standard elutriate testing) (Section 5.2.2)
- Dredged material disposal suitability testing (Section 5.2.3)
- Dredged material stabilization testing (Section 5.2.4)

1.1 Purpose and Objectives of the Second Phase Pre-Design Investigation Field Sampling Plan

This Second Phase PDI FSP, which is Appendix G of the *Final Revised First Phase Pre-Design Investigation Data Summary Report and Second Phase Pre-Design Investigation Work Plan* (Combined DSR-PDIWP), details the methods and processes that will be used to collect data in support of the objectives laid out in the Combined DSR-PDIWP.

The second phase PDI is being implemented to fill data gaps necessary to support the following objectives:

- **Sediment Management Area Refinement Objective**: The first phase PDI included sampling and analysis of surface sediment at less than 150-foot sample spacing to support refinement of the surface sediment-driven sediment management areas (SMAs) within the Project Area based on exceedances of the *Record of Decision – Portland Harbor Superfund Site, Portland, Oregon* (ROD; EPA 2017) remedial action levels (RALs) and principal threat waste (PTW)-highly toxic thresholds using the dataset set forth in Section 3.2(a)(1) of the Project Area SOW

(EPA 2020) and described in the Combined DSR-PDIWP. The following data gaps were identified for the second phase PDI:

  - Six additional surface sediment samples within the navigation channel to laterally bound surface sediment RAL and PTW threshold exceedances
  - Six additional subsurface sediment cores to delineate DOC at each of the proposed surface sediment sample locations to support buried contamination chemical stability evaluation
  - Deployment of eleven seepage meters during spring high river elevations to obtain empirical data on zones of groundwater discharge and recharge in the Project Area to support buried contamination chemical stability evaluation

- **Conceptual Site Model Refinement Objective**: The first phase PDI included sampling and analysis of erodible riverbank surface soils at approximately 150-foot sample spacing to inform the potential for riverbank erosion and need for remedial action on the riverbank based on exceedances of the RALs and PTW-highly toxic thresholds. No additional second phase PDI data is needed for conceptual site model refinement.
- **Remedial Technology Refinement Objective**: The first phase PDI included sampling and analysis of subsurface sediment and angled top of riverbank borings at less than 150-foot sample spacing to determine the depth of contamination (DOC; bottom depth of RAL and PTW-highly toxic exceedances) throughout the Project Area and provide subsurface sediment data to support capping evaluations. The following data gaps were identified for the second phase PDI:
  - Six additional subsurface sediment cores to delineate DOC at each of the proposed surface sediment sample locations to support buried contamination evaluations (these are the same sampling and analysis locations described in the SMA Refinement Objective)
  - Deployment of seven seepage meters during fall low river elevations and four meters during spring high river elevations to obtain empirical data on zones of groundwater discharge and recharge in the Project Area (these are the same sampling locations described in the SMA Refinement Objective) to support capping demonstrations
  - Dredged material waste handling, transport, and disposal classification evaluations to preliminarily characterize the sediments that may be dredged, transported, and disposed of off site. Consistent with the SOW (EPA 2020), dredged material would be further characterized during remedial action. These evaluations will be informed by the collection of 12 sediment cores throughout the Project Area.
- **Bathymetry and Topography Surveys**: The site conceptual site model information discussed in Section 4 of the *Revised Final Pre-Design Investigation Work Plan* (PDIWP; Anchor QEA 2020b) can be used to complete most of the physical stability evaluations described in the *Buried Contamination Guidelines for Portland Harbor Site* (EPA 2022). However, there are

relatively small portions of the Project Area with relatively old elevation data, particularly in the nearshore-most areas where the 2018 David Evans and Associates survey, performed as part of the Pre-RD Group baseline monitoring sampling work, did not achieve complete coverage. The nearshore data was most recently collected by Light Detection and Ranging (LiDAR) in 2014. NW Natural proposes the collection of nearshore bathymetry/topography data (the data collection method will be determined by the surveyor based on water levels and equipment access) to further support sediment physical stability evaluations to be performed in the Basis of Design Report. The methodologies used will be identical to those used during the Gasco 2019 bathymetric/topographic data collection effort (Anchor QEA 2019a).

1.2 Document Organization

The remainder of this document is organized into the following sections:

- Section 2 – Project Management and Responsibilities
- Section 3 – Sample Collection, Processing, and Handling Procedures
- Section 4 – Field Documentation, Sample Handling, Decontamination Procedures, and Investigation-Derived Waste Management
- Section 5 – Chemical and Physical Testing
- Section 6 – Field Sampling Schedule
- Section 7 – References

2 Project Management and Responsibilities

This section describes the project management structure for implementing this Second Phase PDI FSP. Additional information about staff responsible for project management and other roles is defined in the *Second Phase Pre-Design Investigation Quality Assurance Project Plan* (Second Phase PDI QAPP; Appendix H of the Combined DSR-PDIWP).

The project manager for Anchor QEA is Ryan Barth. Mr. Barth will be responsible for overall project coordination and providing oversight on planning and coordination, all project deliverables, and performance of the administrative tasks needed to ensure timely and successful completion of the project. He will also be the main point of contact for the EPA regional project manager and will be responsible for coordinating EPA approval of Combined DSR-PDIWP deviations via submittal field change request (FCR) forms. Any deviations from the Combined DSR-PDIWP will be provided expeditiously to EPA for approval.

The field coordinator for Anchor QEA is Nik Bacher. Mr. Bacher will provide overall direction for the sampling program in terms of logistics, personnel assignments, and field operations. Furthermore, he will be responsible for managing field activities and general field quality assurance (QA)/quality control (QC) oversight. He will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and oversee delivery of environmental samples to the designated laboratories for chemical and physical analyses.

The project chemist will be Delaney Peterson. Ms. Peterson's responsibilities will include coordination with laboratories regarding sample receipt, requested analyses, and turnaround times. She will also answer technical and logistical questions related to the analyses requested, including issues related to limited sample availability, which impact detection limits and matrix interferences.

Sample analysis will be conducted by pre-qualified laboratories, and the laboratory project managers will act as the primary points of contact at each analytical laboratory, as discussed in the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP). The project chemist will communicate with the laboratory project managers to resolve sampling, receipt, analysis, and storage issues. Multiple laboratories will be analyzing samples during the Second Phase PDI sampling program; each laboratory will have a laboratory project manager.

3 Sample Collection, Processing, and Handling Procedures

The surface sediment and subsurface sediment sampling methods described in this document were previously presented in the EPA-approved First Phase FSP (Anchor QEA 2020a) and *Revised Final Quality Assurance Project Plan* (Anchor QEA 2020c), which are Appendices B and C of the PDIWP (Anchor QEA 2020b), and associated EPA-approved FCRs. Section 3.4 ("Seepage Meter Deployment") of this Second Phase PDI FSP was not included in the First Phase FSP (Anchor QEA 2020a). However, NW Natural proposes to complete the work using identical methodologies to the 2017 summer and 2018 spring interim PDI events for the Gasco Sediments Site, as detailed in the *Revised NW Natural Proposed Summer 2017 Interim Pre-Remedial Design Data Gaps Field Sampling – Gasco Sediments Site* (Anchor QEA 2017) and the *Revised NW Proposed Spring 2018 Interim Pre-Remedial Design Data Gaps Field Sampling – Gasco Sediments Site* (Anchor QEA 2018). Components of this work that rely on ASTM International (ASTM) methods will refer to currently adopted versions of the methods to ensure data quality.

To complete the field activities, Anchor QEA will work with qualified health-and-safety-focused subconsultants to implement the surface and subsurface sediment coring sampling and seepage meter deployment.

3.1 Principal Threat Waste-Nonaqueous Phase Liquid Identification

Anchor QEA will visually inspect the full depth of each individual sediment grab sample and sediment core and will note the presence of PTW-nonaqueous phase liquid (NAPL) and the depth interval of occurrence.

PTW-NAPL will be identified in accordance with the Gasco Sediments Site Project Area site-specific visual definition, defined in Section 3.6.2.1 of the Statement of Work to the 2009 AOC (CERCLA Docket No. 10-2009-0255): "Any layer or seam of product, regardless of thickness, that is clearly defined as liquid NAPL that is also mobile (i.e., 'oozes' or 'drips' out of the core during core observations)."

Small depressions will be made in each surface grab and core in areas showing the visual absence and presence of petroleum-impacted sediments to evaluate the presence of PTW-NAPL. If NAPL freely flows into a depression, additional depressions will be made immediately above and below to delineate the depth of PTW-NAPL.

3.2 Surface Sediment Sampling

Sections 3.2.1 through 3.2.3 describe the sample collection, processing, and handling procedures to be followed during the collection of surface sediment samples during the Second Phase PDI. The Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP) outlines the analytical methods and details the data quality objectives (DQOs) and QA/QC protocols to be followed during these activities.

3.2.1 Surface Sediment Sampling Plan

As described in Section 5.1.1 of the Combined DSR-PDIWP, the intent of the surface sediment sampling program is to collect additional information to achieve surface SMA refinement in the outer perimeter (immediately adjacent) of the Project Area (within the B1 Navigation Channel Project Area). To achieve this objective, three-point composite surface sediment samples will be collected at six step out locations (as shown in Figure G3-1) within the B1 Navigation Channel Project Area, immediately adjacent to the Project Area, to refine the Interim Project Area Boundary. One of the step out locations will be a three-point composite surface sediment sample to laterally bound the downriver extents of contamination near location PDI-171 (see Figure G3-1). As described in Section 5.1.1 of the Combined DSR-PDIWP, and for the purposes of the Gasco Sediments Site *Combined Sediment Remedy Basis of Design and Preliminary Design Report* (Anchor QEA 2021), the downriver boundary of the Gasco Sediments Site was artificially set 75 feet downriver of PDI-171 to reflect the midpoint of the targeted distance between locations during the second phase PDI sampling. The boundary will, therefore, be refined as part of the proposed second phase PDI of the Project Area.

Each of the surface sediment grab samples will be analyzed for the contaminants of concern (COCs) associated with the ROD Table 21 RAL and PTW-highly toxic thresholds (EPA 2017). Sample location IDs and proposed coordinates are shown in Table G3-1. Chemical and physical testing is discussed in Section 5.1. Analytical methods, QA/QC information, and DQOs are discussed in the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP).

3.2.2 Surface Sediment Collection Methods

The surficial sediment sampling protocols used in this investigation are consistent with those conducted as part of the EPA-approved First Phase FSP (Anchor QEA 2020a). Surface sediment samples will be collected using either a hydraulic or gravity-driven Van Veen grab sampling device capable of collecting a sample to a minimum depth of 1 foot below mudline (bml). Sampling locations will be located using a differential global positioning system (DGPS), and the proposed sampling location coordinates are provided in Table G3-1. The sampling locations will be approached at slow boat speeds to minimize the disturbance of bottom sediments. Prior to collecting each sample, the depth to mudline will be determined using a calibrated fathometer or lead line.

At each surface sediment location, three grab samples will be collected in a triangular pattern with an equidistant spacing of approximately 25 feet around the proposed target location. Each of these subsamples will be composited and homogenized into one sample as further described in this section. The final sample location will be reported as the centroid of the triangle formed by the three subsample locations after post-processing the GPS data. During the collection of each subsample, the grab sampler will be lowered over the side of the boat using a winch and davit connected to a cable at an approximate speed of 0.3 foot per second. When the sampler reaches the mudline, the sampler will be closed, and DGPS coordinates will be recorded. The sampler will be weighted as necessary to help achieve the target penetration depth and acceptance criteria. At this time, the depth to mudline will be determined using a calibrated fathometer or lead line. The sampler will be retrieved aboard the vessel and evaluated for acceptance based on the following criteria:

1. Overlying water is present, and the turbidity does not visually suggest disturbance of the mudline.
2. The sampler is not overfilled.
3. The sediment surface appears visually undisturbed.
4. There are no visual signs of winnowing or leaking from the sampling device.
5. At least 8 inches of material is recovered, consistent with the criteria in the EPA-approved First Phase FSP (Anchor QEA 2020a).

Grab samples not meeting these criteria will be rejected and the sample collection steps repeated until the acceptance criteria are met, but no more than six individual subsample attempts will occur at each composite location, and the three attempts with the highest recovery will be retained. If the composite average recovery is greater than 0.3 foot, the sample will be retained for analysis. Deployments will be repeated within an approximately 10-foot radius of the target subsample location. Subsample locations may be adjusted based on unexpected field conditions (e.g., presence of riprap, large debris, or other obstructions). If no material is recovered after two attempts at a subsample location, the location will be offset to a maximum of a 50-foot radius from the target location. If adequate recovery is not achieved (i.e., 8 inches) after two attempts at a target subsample location, the grab with the largest recovery will be accepted and noted in the field log and surface sediment sample log.

All grab samples, regardless of acceptance, will be logged as they are collected, and accepted subsamples will be processed as described in Section 3.2.3. Representative volumes from the full recovered depth of each subsample grab will be collected in separate decontaminated stainless-steel bowls and covered with aluminum foil. Once all three acceptable subsamples have been collected, an approximately equal-volume aliquot of each of the three subsample grabs will then be composited and homogenized to create the final sample for that location. The sampler will be rinsed with river water to remove all solid material between subsample grabs and decontaminated after completing the sampling at a given location using the procedures identified in Section 4.3.

Visual observations for PTW-NAPL using the site-specific definition will be made on the sediment surface and throughout the entire depth, by sequentially removing 4-inch sediment layers until the bottom of the sampler is reached, for each individual grab sample collected using the logging and processing procedures identified in Section 3.2.3. All surface sediment grab sample information and observations will be recorded in the field log and the surface sediment sample log sheet (Attachment A) following the specifications in Section 3.2.3.

3.2.3 Surface Sediment Logging and Processing Procedures

The following procedures will be used to log and process accepted and rejected surface sediment samples:

- Siphon off water overlying the mudline, taking care not to remove sediment.
- Take digital photographs of each grab with a label indicating project, sample location, and date.
- Record the sample description on the grab sample log form, including, but not limited to, the following observations as appropriate:
  - Physical soil description in accordance with the Unified Soil Classification System (USCS; ASTM D2488 – Standard Practice for Description and Identification of Soils [Visual-Manual Procedures]) including soil type, density/consistency, color, and other similar descriptors
  - Presence of PTW-NAPL and other signs of petroleum contamination (e.g., sheens)
  - Odor (e.g., hydrogen sulfide, petroleum)
  - Presence of organic material (e.g., vegetation, roots, or twigs)
  - Anthropogenic debris
  - Biological activity (e.g., shells, tubes, bioturbation, or organisms)
  - Any other distinguishing characteristics or features
- Do not subsample materials more than 2 inches in diameter or debris into sample containers.
- Visually assess the presence of PTW-NAPL using the site-specific definition provided in Section 3.1. Prior to subsampling for chemical analyses, depressions will be made in the sediment using a decontaminated stainless-steel spoon or similar to evaluate for the presence of NAPL that oozes or drips out of the depression during processing.
- Collect the upper 1 foot (i.e., 30 centimeters), or less if acceptance recovery criteria are met, of sediment without touching the sidewalls using a decontaminated stainless-steel trowel or equivalent. Place the sediment into a single decontaminated stainless-steel bowl and homogenize until uniform color and texture are achieved.
- Collect one archive jar for each grab subsample in case it is later determined that individual analyses could be useful to refine the results of the composite sample.
- Once the samples are homogenized, cover the bowl containing representative material from each subsample grab with aluminum foil and place on ice.

- Once all three subsample grabs have been successfully collected, use a decontaminated stainless-steel spoon to place an equal volume of sediment from each grab into a single clean stainless-steel bowl and homogenize until uniform color and texture is achieved.
- Using a decontaminated stainless-steel spoon, fill pre-labeled, laboratory-provided sample containers for sediment chemistry analysis, including one archive jar per sampling interval (sufficient volume allowing).
- Immediately place filled and sealed sample containers in a cooler with ice to maintain temperature at approximately 4°C until delivered to the project laboratory, while following the handling and chain-of-custody procedures described in Section 4.2.3. The required sample volumes, preservation, and maximum holding times for the categories of analytes are presented in the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP).

3.3 Subsurface Sediment Sampling

Sections 3.3.1 through 3.3.3 describe the subsurface sediment sample collection, processing, and handling procedures to be followed during the second phase PDI sampling to be performed by Anchor QEA. The Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP) details the QA/QC protocols to be followed during these activities.

3.3.1 Subsurface Sediment Sampling Plan

As described in Section 5.2 of the Combined DSR-PDIWP, the intent of the subsurface sediment sampling program is to collect subsurface sediment data to support the following objectives:

- SMA refinement and remedial technology refinement, through additional DOC and dredge prism delineation (to support buried contamination evaluations), as described in Sections 5.1.1 and 5.1.2 of the Combined DSR-PDIWP.
- Remedial technology refinement, through dredged material waste handling, transport, and disposal sampling and analysis to pre-characterize the dredged material waste and inform potential appropriate options for handling, transport, and disposal off site. In addition, these data will support determination of constructability, environmental protectiveness, and cost-effectiveness of dredging and capping technologies within the SMAs (as described in Section 5.3.1 of the Combined DSR-PDIWP).

To achieve these objectives, 16-foot and 20-foot sediment cores will be collected as follows:

- For the SMA Refinement and Remedial Technology Refinement Objectives, six cores will be collected within the B1 Navigation Channel Project Area immediately adjacent to the Project Area (co-located with the surface sediment samples described in Section 3.2.1), as shown in Figure G3-2. Each of these samples will be collected using a 20-foot sediment core.

- For the waste handling, transport, and disposal sampling and analysis described under the Remedial Technology Refinement Objective, 12 cores will be collected from within the Project Area and tested and analyzed for the following two purposes:
  - Dredged barge material haul barge dewatering and stabilization testing (as shown in Figure G3-3)
  - Dredged material waste suitability characterization (as shown in Figure G3-4)

The longest core tube possible will be used based on accessibility from the first phase. This will be dependent upon depth and access.

Sample location IDs and proposed coordinates for the six cores intended for SMA refinement (co-located with the surface sediment samples described in Section 3.2.1) are listed in Table G3-1. Sample location IDs and proposed coordinates for the 12 cores intended for the waste handling, transport, and disposal sampling and analysis are listed in Table G3-2 (for dredged material haul barge dewatering and stabilization testing) and Table G3-3 (for dredged material waste suitability characterization).

Chemical and physical testing is discussed in Section 5.2. Analytical methods, QA/QC information, and DQOs are discussed in the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP). The subsurface sediment sampling protocols used in this investigation are consistent with the protocols in the EPA-approved First Phase FSP (Anchor QEA 2020a).

3.3.2 Subsurface Sediment Collection Methods

Subsurface sediment samples will be collected using a vibracore sampler. Sampling locations will be located using a DGPS, and the proposed sampling location coordinates are provided in Tables G3-2, G3-3, and G3-4. Prior to collecting each core, the depth to mudline will be determined using a calibrated fathometer or lead line.

Subsurface sediment will be collected in 3.75-inch-inside-diameter aluminum core tubes with a stainless-steel core catcher riveted to the bottom end. Core tubes will be decontaminated prior to use following the protocols outlined in Section 4.3. Care will be taken during sampling to avoid contact of the core tube with potentially contaminated surfaces. Extra core tubes will be available during sampling operations for uninterrupted sampling in the event of potential core tube breakage or contamination. Core tubes suspected to have been accidentally contaminated will not be used.

The vibracore will be deployed from the bow of the vessel using an A-frame and winch assembly. A 16- or 20-foot decontaminated aluminum pipe will be clamped to the vibracore. If the location is on a sloping mudline, the vibracore base can be reconfigured to attempt to match the slope to facilitate vertical penetration of the core. Once in position, the vibracore unit will be deployed, energized, and driven to a maximum of 16 or 20 feet bml or refusal. The physical characteristics at each proposed sampling location are anticipated to be variable precluding an accurate estimation of the core recovery at each location prior to collection. Once a penetration of 16 or 20 feet bml or refusal occurs, the vibracore will be turned off and returned to the surface for comparison to the sample acceptability criteria. The location of refusal will be recorded using a DGPS for future reference. The penetration depth will be evaluated based on data from the vessel's onboard penetration monitor and marker rings attached to the side of the vibracore base guiding rods that are pushed up on the guiding rods as the core barrel is driven into the sediments. Upon retrieving a core, the following information will be recorded:

- Date and time the core was collected
- Depth to mudline
- Total drive length
- Recovered length
- Condition of core surface (whether overlying water is present and the core surface is intact)
- Condition of core tube (whether the core tube is in good condition and not excessively bent)
- Preliminary assessment of sediment characteristics contained in the core catcher at the bottom of the tube
- Project name, location, and sampling date on an appropriately labeled photograph

Based on May 4, 2021 Field Change Request Form #4 (Appendix A of the Combined DSR-PDIWP), it is anticipated that proposed subsurface sample location USMPDI-111 will require an 8-foot coring assembly, as this station is located in the vicinity of first phase PDI stations USMPDI-028, USMPDI-030, USMPDI-031, and USMPDI-035, where shallow refusal was previously experienced.

To determine if a core is suitable for processing, the following acceptability criteria will be used:

1. Recovery was at least 75% of the length of core penetration as discussed in the Combined DSR-PDIWP. If refusal or poor recovery is consistently encountered during coring in the Project Area, a change in approach (e.g., reducing the number of required attempts) will be discussed with EPA.
2. Cored material did not extend out of the top of the core tube or contact any part of the sampling apparatus at the top of the core tube.
3. There were no obstructions noted in the core catcher that might have blocked the subsequent entry of sediment into the core tube and resulted in incomplete core collection.

Core tubes of approximately 4 feet or less will be cut to facilitate upright storage and truck transport to the processing location. The cut tubes will be individually labeled and sealed with core caps taped over with duct tape to prevent material loss during transport. Core orientation will also be noted on each tube. Labels identifying the core section will be securely attached to the outside of the tube using tape and waterproof ink or by scribing the information into the core tube with a metal screwdriver. The core sections will be stored upright in the core storage box on the boat until transferred to the upland core processing area. Ice will be added to the core storage box on the boat if the core sections are kept on the boat for extended periods (e.g., not transferred in the middle of the day and at the end of each day). At the upland core processing area, the core sections will be stored approximately upright in iced containers, or in a refrigeration unit, in the appropriate orientation until core processing is conducted. If multiple core rejections (three attempts) occur within a 20-foot radius of the planned location, the core with the best recovery will be deemed acceptable and processed. If moving a core location (location X) due to refusal, low recovery, or obstruction results in that location being collected within 50 feet of another proposed core location (location Y), then the second proposed location (location Y) may not be collected.

3.3.3 Subsurface Sediment Core Logging and Processing Procedures

All cores will be carefully transferred from the sampling vessel to large containers full of ice or a refrigerated space at a designated shoreside location where processing will be conducted. The anticipated processing facility is on the Gasco property along the central portion of the property near the top of the riverbank area. Core processing occurred in this same location during completion of the First Phase FSP (Anchor QEA 2020a) and the *Pre-Remedial Design Data Gaps Field Sampling Plan* (Appendix A to the *Revised Pre-Remedial Design Data Gaps Work Plan* [Anchor QEA 2019b]).

The following is a detailed account of the core processing procedures:

- Lay out the core tubes for the entire penetration depth for a sampling location. Cut the core tubes longitudinally using a circular saw, setting the saw blade depth to minimize penetration and disturbance of the sediment during cutting.
- Identify sample intervals in each core per Table G3-4. Cores will be sampled for both DOC (1-foot intervals) and cap modeling (2- or 3-foot intervals). The cap modeling intervals for the navigation channel region are specified in Table G3-4.
- Immediately following opening of the core for volatile organic compound (VOC) sampling, collect representative samples from the necessary intervals using a clean T-bar and place them into a pre-labeled container with methanol preservative. Collect the sample prior to homogenization to minimize volatilization. Close the container lid tightly and examine to minimize the potential for excess sediment inhibiting a tight seal.
- Visually assess for the presence of PTW-NAPL using the site-specific definition provided in Section 3.1. Depressions will be made in the sediment using a melon baller to evaluate for the presence of NAPL that oozes or drips out of the sample during processing.
- Record the description of the full length of the core sample on the core log form, including but not limited to the following observations, as appropriate:
  - Sample recovery (recovered sediment depth relative to penetration depth and percent compaction)

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- Physical soil description in accordance with USCS (includes soil type, density/consistency, color, and other similar descriptors)
  - Presence of PTW-NAPL and other signs of petroleum contamination (e.g., sheens)
  - Odor (e.g., hydrogen sulfide, petroleum)
  - Presence of organic material (e.g., vegetation, roots, or twigs)
  - Anthropogenic debris
  - Biological activity (e.g., shells, tubes, bioturbation, or organisms)
  - Any other distinguishing characteristics or features
- Take digital photographs of each 1-foot core interval with a label indicating the location and depth of the core interval.
- Using a decontaminated stainless-steel spoon, place a proportionate volume of sediment from every sample interval into a single clean stainless-steel bowl or high-density polyethylene bucket and homogenize until uniform color and texture is achieved.
- Using a decontaminated stainless-steel spoon, fill pre-labeled, laboratory-provided sample containers for all proposed analyses. After filling the sample containers, place a portion of the remaining volume into additional laboratory-provided sample containers to be archived for potential future analysis.
- Immediately place filled and sealed sample containers in a cooler with ice to maintain temperature at approximately 4°C until delivered to the project laboratory, while following the handling and chain-of-custody procedures described in Section 4.2.3. The required sample volumes, preservation, and maximum holding times for the categories of analytes are presented in the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP).
- Analysis will be performed at the depth intervals specified for DOC testing in Section 5.2.1.

3.4 Bathymetry and Topography Surveys

As discussed in Section 5.1.2 of the Combined DSR-PDIWP, the intent of nearshore bathymetric and topographic data collection is to support the sediment physical stability evaluations described in the *Buried Contamination Guidelines for Portland Harbor Site* (EPA 2022). eTrac, Inc., has been selected to perform a full-coverage bathymetric and topographic surveys over the entire Project Area (as shown on Figure G1-1), which will extend channelward into the river approximately an additional 150 feet and into the uplands beyond the top of the riverbank.

Sections 3.4.1 through 3.4.3 describe the objectives, methodologies, equipment, and personnel that eTrac is proposing for the bathymetric and topographic surveys.

3.4.1 Survey Objectives

Collecting high-resolution survey data below and above the waterline will result in a comprehensive overlapping bathymetric and topographic dataset. The collected data will not only provide the surface contour information of the topographic conditions but will also detect objects that exist both above and below water to support evaluations of debris and the presence of riprap existing above the mudline. The hydrographic multibeam and topographic LiDAR survey will provide the following information:

- **Sediment Bathymetry.** A gridded dataset showing the submerged mudline elevations throughout the survey area.
- **Riverbank Topography.** A gridded dataset showing the topographic riverbank elevations above the water surface. These topographic data will then be merged with the bathymetric data to produce a composite riverbank and sediment elevation surface.
- **Presence of Debris.** Delineation of structures and objects existing above the mudline and riverbank surface.

3.4.2 Survey Methods

The proposed survey will be combined with previous hydrographic and topographic surveys that provide mudline and riverbank elevations outside the proposed survey area. To facilitate this integration, all control points (CPs) used for data collection during the survey and the final delivered data will be referenced as follows:

- Horizontal Datum—North American Datum of 1983 (2011), State Plane Coordinate System Oregon Zone North, International Feet
- Vertical Datum—City of Portland, U.S. Survey Feet

The following list outlines the proposed scope of work for the survey:

- Mobilization and survey control
- Acquisition of multibeam echosounder bathymetric data and mobile LiDAR topographic data
- Data processing

3.4.2.1 Mobilization and Survey Control

eTrac will mobilize its survey vessel *Spectrum* to the survey area. The boat will be outfitted with all positioning and data collection equipment. Upon arrival, a real-time kinematic (RTK) reference station will be deployed on CP 156 on the upriver end of the Gasco Dock structure.[1] Programmed with known coordinates of this point, this reference station will broadcast RTK corrections to the survey vessel and rover GPS. The rover GPS will be used for position tie-in shots on the other CPs located on the uplands US Moorings property, as identified through coordination with US Moorings site personnel. QC check shots will be taken on fixed structures in the survey area for qualification of the LiDAR data. The RTK rover will also confirm positioning accuracy of the reference point on the

[1] The CP used to establish survey control may be revised at or prior to the time of survey if another known CP is identified on any of the main overwater structures at US Moorings. NW Natural will coordinate with eTrac and US Moorings site personnel prior to survey commencement to identify the most appropriate CP to use for the work.

survey vessel as a QC measure. Two additional sources of RTK corrections will be utilized for control verification and QC. They include the Washington State Reference Network station PDXA, as well as eTrac's Actual Reference Station, located at eTrac's office in Vancouver, Washington.

3.4.2.2 Acquisition of Multibeam Echosounder and Mobile LiDAR Data

High-resolution multibeam data will be collected throughout the entire Project Area during a high tide event to maximize the hydrographic survey coverage. Mobile topographic LiDAR data will be collected during a low tide event and then merged with the bathymetric data to maximize riverbank survey coverage. At this time, no grubbing of vegetation is planned along the riverbank. The LiDAR data will be able to detect ground elevations wherever the laser is not blocked by dense vegetation. Filtering software can remove some vegetation in the data, which will help to interpolate the surface between data points that are close. If the proximity of collected data points is too great to accurately represent the ground surface, traditional RTK topographic shots will need to be taken or grubbing will be required prior to LiDAR data collection. This additional survey work, if necessary, would occur during a separate survey episode. In the event a separate survey episode is required, an addendum to this Second Phase PDI FSP will be prepared and submitted to EPA for approval prior to commencing the additional work.

The proposed equipment to be used during this feature of work is described in Sections 3.4.2.2.1 through 3.4.2.2.4.

3.4.2.2.1 Survey Vessel Spectrum

The eTrac-owned and -operated survey vessel *Spectrum* is proposed for all data acquisition. *Spectrum* is field-proven, having conducted numerous surveys throughout the Pacific Northwest, including a recent EPA-approved bathymetric survey at the Gasco Sediments Site in 2019. It is easily transported and can be mobilized for survey rapidly. The vessel is equipped with a Universal Sonar Mount (USM) for side-mounted multibeam data collection. A positioning and motion detection system was professionally installed on the vessel with a long antenna baseline, allowing maximum heading accuracy and better results in areas with low Global Navigation Satellite System (GNSS) coverage. The inter-sensor offsets on the vessels were surveyed by a professionally licensed land surveyor to ensure measurements are millimeter-accurate. The USM positions the system with 100% repeatability and allows for surveying in shallow water due to a specifically designed breakaway block. A work cabin supports modern internet-ready computer networks. Onboard computers support data acquisition and integration of motion reference units. Precise positioning is supplied by RTK or virtual reference station GPS. There is one computer and two monitors onboard, one monitor for the hydrographer and one at the helm.

3.4.2.2.2 High-Resolution Multibeam Echosounder

An R2Sonic 2024 multibeam sonar will be used to acquire the high-resolution multibeam echosounder data. The system will be run at 450 kilohertz throughout the entire Project Area and riverbank. Additional details of the R2Sonic 2024 are provided as follows:

- 450 kilohertz (700 kilohertz in appropriate areas)
- 256 discrete 0.5° by 1.0° beams (0.3°by0.6° at 700 kilohertz) 1024 Ultra High Density
- 1 to 500 meter minimum/maximum range
- 1.25-centimeter-range resolution

The sonar data supply high-resolution imagery, which will allow riprap and debris to be clearly identified.

3.4.2.2.3 Mobile LiDAR

A Riegl VZ-400 Terrestrial Scanner will be used to acquire high-resolution topographic data at low tide. The VZ-400 system has a range of 400 meters and dual return mode to capture greater detailed 3D images. Additional instrument details are provided as follows:

- Measurement range: 400 meters
- Range accuracy: ±3 centimeters (typical)
- Angular resolution (horizontal/azimuth): 0.1° to 0.4°
- Angular resolution (vertical): 2.0°
- Field of view (horizontal): 360°

3.4.2.2.4 Positioning System with Post-Processed Kinematic

During acquisition, online positioning is to be supplied by an onboard Applanix POS MV Wave Master receiving RTK corrections. The POS MV has a tightly coupled GNSS and inertial motion reference unit allowing highly accurate positioning, which accounts for the movement of the vessel along each axis.

- Post-processed kinematic (PPK) solution (less than 2-centimeter positional accuracy)
- 0.03° pitch, roll accuracy
- GNSS Azimuth Measurement System-aided heading accuracy of 0.03°

The location of each sensor on the vessel is to be measured and recorded in the software. The positioning system offsets for the vessel will be confirmed with an online and PPK calibration solution.

3.4.2.3 Data Processing

The horizontal and vertical position of the vessel will be post-processed, analyzed, and applied to the data acquired. Post-processing of the positioning will be completed in Applanix POSPac software to allow accuracies in the horizontal and vertical positioning of less than 2 centimeters. Data will then be cleaned and analyzed in 3D viewing software. Analysis of the riverbank will begin within the 3D viewing software, and the identification of significant features will be marked with their position, depth, and size.

Base mapping will be at a scale as requested with an associated terrain model sufficient to define contours at 1.0-foot intervals; errors shall not exceed 0.5-foot-contour intervals. The control network will have a closure of 1:10,000 or better. Data collected will be of higher quality than Geospatial accuracy Tier 1 per the National Geospatial Data Policy (EPA 2008) standards. The data will be managed in accordance with the National Geospatial Data Policy Procedure for Geospatial Metadata Management (EPA 2010).

3.4.3 Survey Personnel

All bathymetric surveys performed by eTrac adhere to International Hydrographic Organization and U.S. Army Corps of Engineers (USACE) Hydrographic Survey Standards and are collected according to the USACE standards set forth in EM 1110-2-1003 (USACE 2013). All topographic surveys performed by eTrac will adhere to USACE Control and Topographic Surveying standards set forth in EM 1110-1-1005 (USACE 2007). The proposed work will be supervised by an Oregon State Professional Land Surveyor as well as a Hydrographic Society of America Certified Hydrographer. Personnel involved with this project will reflect eTrac's priorities of excellence in data quality, safety in all environments, and timely project execution.

3.5 Seepage Meter Deployment

As described in Section 5.1.2.2 of the Combined DSR-PDIWP, the intent of seepage meter deployment is to collect additional empirical data on zones of groundwater discharge and recharge within the Project Area to be used as part of the fate and transport modeling for the buried contamination chemical stability evaluation. In addition, this data will be used to inform cap modeling evaluations within the final SMAs during remedial design.

To achieve these objectives, seepage meters will be deployed at eleven locations within the Project Area. The seepage meters need to be deployed in at least 5 feet of river water to remain submerged during deployment; therefore, four of these seepage meters are proposed to be located within the nearshore areas of the Project Area (which are not expected to have sufficient water depth during periods of low water in the late summer and early fall), and the remaining seven seepage meters are proposed in the offshore areas. Considering water depth requirements and the effects of seasonality of seepage velocities, NW Natural proposes the following rounds of seepage meter deployment:

- The first round of deployment and data collection will occur in September through October when the river surface water elevations are low relative to high upland groundwater elevations, resulting in the highest potential groundwater seepage fluxes. Due to water depth limitation, the first deployment would be limited to the seven seepage meters in the offshore areas of the Project Area, as shown in Figure G3-5. The locations were determined based on spatial coverage of the offshore area of the Project Area that includes both capping and dredging remedial technologies.

- The second round of deployment would allow for collection of data from all eleven proposed locations. This second round of deployment and data collection will occur in March through early April when river surface elevations are high relative to the upland groundwater elevations.
  - Redeployment of the seven offshore seepage meters (the same locations from the late summer/early fall sampling event will be reoccupied)
  - Collection of empirical groundwater seepage in four nearshore areas of the Project Area that were not submerged during the first-round deployment

Seepage meter deployment locations for the eleven meters are shown in Figure G3-5, and proposed coordinates are listed in Table G3-5.

Protocols used in this investigation are consistent with those conducted as part of the EPA-approved 2017 interim summer and 2018 interim spring groundwater seepage investigations at the Gasco Sediments Site. The identical type of seepage meter was used during Portland Harbor Remedial Investigation/Feasibility Study sampling in 2005. A detailed description of these meters and the type of data that will be obtained is provided in the following documents:

- *Revised NW Natural Proposed Summer 2017 Interim Pre-Remedial Design Data Gaps Field Sampling – Gasco Sediments Site* (Anchor QEA 2017)
- *Revised NW Proposed Spring 2018 Interim Pre-Remedial Design Data Gaps Field Sampling – Gasco Sediments Site* (Anchor QEA 2018)
- *Portland Harbor RI/FS round 2 Groundwater Pathway Assessment Sampling and Analysis Plan-Attachment 1 Field Sampling Plan Groundwater Plan Groundwater Plume Discharge Mapping* (Integral 2005).

The meters are ultrasonic seepage meters available through Coastal Monitoring Associates (CMA) located in San Diego, California.

Ultrasonic seepage meters are capable of time-series flow rate measurement, which captures both positive and negative seepage at the surface water-sediment interface. Seepage time series measurements will be reported at hourly average values based on the underlying 1-second sampling rate of the meter. Hourly rates will subsequently be used to determine tidal-cycle averages by averaging over the tidal period of approximately 25 hours.

Conductivity, temperature, and pressure measurements will also be recorded from sensors mounted on the meter to support the seepage flux evaluations. Consistent with the Gasco Sediments Site, study-wide pressure will be monitored by placing a single pressure sensor at a fixed location (pier piling or similar structure) for the duration of the seepage meter deployment period.

The same contractors that performed the deployment during the EPA-approved interim 2017 and 2018 groundwater seepage investigations at the Gasco Sediments Site (CMA) are available to deploy the seepage meters in late September and early October 2022. All meters will be deployed by a certified dive team under an EPA-approved Diver Health and Safety Plan that will be developed by the diving contractor and submitted to EPA for review and approval at least 2 months prior to mobilization. It is expected that the Diver Health and Safety Plan will be similar to the plan developed by Research Support Systems for their diving operations to support the 2017 and 2018 groundwater seepage investigations at the Gasco Sediments Site (RSS 2017) and updated as necessary to reflect current personnel, certifications, and practices. Consistent with the 2017 and 2018 groundwater seepage investigations at the Gasco Sediments Site (Anchor QEA 2017, 2018), NW Natural proposes deployment of each seepage meter for a period of 3 days to update groundwater seepage variations over multiple tidal cycles. The proposed seepage meter discharge flow measurement, decontamination, and field documentation procedures will be performed consistent with the 2017 and 2018 groundwater seepage investigations (Anchor QEA 2017).

3.6 Horizontal Positioning and Vertical Control

Horizontal positioning at each sampling location will be determined using a DGPS with a handheld GPS unit as backup if necessary. All vertical geographical coordinates will be relative to the City of Portland datum (COP), and horizontal geographical coordinates will be in the North American Datum of 1983 (NAD83) High Accuracy Reference Network 91 (HARN91), Oregon State Plane, North Zone, in international feet.

Mudline elevations of each sediment sampling location will be determined relative to COP by measuring the water depth with a calibrated fathometer or lead line and subtracting the tidal elevation. River elevations will be determined using the on-site river gauge transducer installed on the PacTerm dock.

3.7 Field Quality Assurance/Quality Control Samples

Field QA/QC samples will be collected and used to evaluate the variability resulting from sample handling and the efficiency of field decontamination procedures (Section 4.3). All field quality control samples will be documented in the Project Area log book.

3.7.1 Field Duplicates

Field duplicates (i.e., homogenization duplicates) will be collected at a frequency of one per 20 samples. The field duplicates will be prepared by dividing aliquots of the homogenate (during grab, core, or boring processing and/or field collection) into two distinct samples for the laboratory (the original sample and a duplicate). The samples will be processed in the same way as the original sample and will be submitted to the laboratory as blind samples. The duplicate samples will be analyzed for the full suite of bulk sediment testing listed in the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP). This type of field QA/QC sampling is not applicable to VOCs given sampling for these chemicals does not include homogenization of the sample volume. Field duplicates for VOCs will be collected by taking additional samples as close to the original sample as possible. Field duplicate sample identification procedures are described in Section 3.7.1.

3.7.2 Field Blanks

Field blank samples will be collected at the start of each sampling program to evaluate the efficiency of field decontamination procedures. One rinse blank and one field blank will be collected for each type of sampling technique used. The rinse blank will consist of rinsing down the sediment grab, coring, boring, homogenization equipment, or water sampling equipment with distilled water after sample collection and decontamination and collecting the rinsate. The field blank will be collected by pouring distilled water directly into the sampling containers. In addition, a trip blank will be included in each container shipped to the analytical laboratory containing samples to be analyzed for volatiles (i.e., VOCs). The field blank samples will be analyzed for all chemicals within a given sampling program. Rinse, field, and trip blank sample identification procedures are described in Section 3.7.2.

3.8 Location and Sample Identification

Each discrete sediment sample will be assigned a unique alphanumeric identifier according to the method described in this section. The identifiers facilitate sample tracking by incorporating identifying information. The alphanumeric identifiers will be assigned for sediments and field QA/QC samples, as described in Sections 3.7.1 and 3.7.2.

3.8.1 Sample Identification

The alphanumeric identifiers will be assigned in the following manner for surface sediment grab and sediment core samples:

- The first six characters for the in-water locations identify the sample location by the project descriptor: **USMPDI** = US Moorings Pre-Design Investigation.
- The next three characters identify the sample location: **001** = Location 001. It should be noted that Second Phase PDI sample locations start at location 084, consecutive to the last first

phase PDI surface sediment grab, sediment core, riverbank angled boring, and surface soil sample numbering.

- The next two to six characters identify the sampling matrix:
  - **SG** = Surface Sediment Grab (A, B, and C suffixes will be applied to subsample locations)
  - **SC** = Sediment Core
  - **SEEP** = Seepage Meter[2]
- The next two characters identify the subsurface sampling interval in feet below ground surface, though not applicable to surface sediment grab samples.
- The next six characters identify the collection date: YYMMDD.

Examples:

- Sample number USMPDI-002SG-201101 indicates a surface sediment grab sample obtained from Location 002 on November 1, 2020.
- Sample number USMPDI-015SC-4-8-201110 indicates a sediment core sample obtained from Location 015 and collected at a depth of 4 to 8 feet bml on November 10, 2020.

The sampling depth intervals will also be noted in the field logs and provided in the chemical analytical results tables.

3.8.2 Field Quality Assurance/Quality Control Sample Identification

The field QA/QC samples will be assigned a unique alphanumeric identifier according to the following method:

- The first three characters identify the sample location by using the first letter of each word in the location name: **USMPDI** = US Moorings Pre-Design Investigation.
- The rinse blank samples will be followed with an -**RB** and a two-letter identifier for the sample collection technique (**SG** for sediment grab or **SC** for sediment core) followed by the date in YYMMDD format.
- The field blank samples will be followed with an -**FB** (SG for sediment grab and SC for sediment core) followed by the date in YYMMDD format.
- The trip blank samples will be followed with a -**TB** (SG for sediment grab and SC for sediment core) followed by the date in YYMMDD format.
- The homogenization duplicate will be followed with –XXXSG-YYMMDD (surface sediments) where XXX is the location number plus 1,000 and YYMMDD is the sampling date.

[2] It should be noted that no seep samples will be collected as part of the Second Phase PDI FSP scope. However, the SEEP matrix identification will be used to track the seepage meter locations.

For example, sample number USMPDI-RB-SG-201101 and USMPDI-1001SG-201101 represent a sediment grab rinse blank collected on November 1, 2020, and a homogenization duplicate collected from sediment grab sample Location 01 on November 1, 2020, respectively.

4 Field Documentation, Sample Handling, Decontamination Procedures, and Investigation-Derived Waste Management

Consistent methods of field documentation, sample handling, equipment decontamination, and investigation-derived waste (IDW) management will be used throughout the program.

4.1 Field Documentation

A complete record of all field activities will be maintained, including the following:

- Documentation of all field activities in field log books
- Documentation of all samples collected for analysis

The field staff will maintain the field log books, which will consist of bound, numbered pages. All on-site activities, including health and safety entries, and field observations will be documented in these log books. All entries will be made in indelible ink. The field log books are intended to provide sufficient data and observations to enable readers to reconstruct events that occurred during the sampling period. The field log books will include clear information concerning any modifications to the details and procedures identified in this Second Phase PDI FSP. Surface sediment sample, sediment core, and soil boring collection log sheets will be completed for each sampling location (sample log sheets are presented in Attachment A).

Logs and field notes of all samples will be maintained as samples are collected and correlated to the sampling location map. The following information will be included as part of this documentation:

- Percent recovery and factors used to determine the recovery (for cores)
- Coordinates of each location as determined by DGPS
- Date and time of collection of each sample
- Names of field supervisor and personnel collecting and logging in the sample
- Observations made during sample collection, including presence of PTW-NAPL per the site-specific definition provided in Section 3.1, weather conditions, complications, ship traffic, and other details associated with the sampling effort
- Sample location number
- Length and/or depth intervals of each core/boring section, surface sediment grab sample, or riverbank soil grab sample
- Qualitative notation of apparent resistance of sediment/soil column when coring/boring
- Any deviation from the approved Combined DSR-PDIWP and Second Phase PDI FSP
- Additional photographic documentation will be provided to EPA during completion of the Combined DSR-PDIWP vessel sampling activities. The specific content for this documentation will be determined in coordination with EPA.

4.2 Sample Handling

This section describes the sample containers, sample handling and storage, chain-of-custody forms, and sample shipping for all sediment sampling activities.

4.2.1 Sample Containers for Analysis

All sample containers received from the analytical laboratory will be pre-cleaned and certified. Prior to shipping, the analytical laboratory will add preservative, where required. Sample container types are listed in Table G4-1.

Prior to filling, each container will be clearly labeled with the name of the project, sample number, type of analysis, date, time, and initials of the person preparing the sample.

4.2.2 General Sample Handling and Storage

The guidelines for sample handling and storage for collected samples are provided in Table G4-1. Sample containers, instruments, working surfaces, technician protective gear, and other items that may come into contact with environmental media must meet high standards of cleanliness. All equipment and instruments used to remove sediment from the sampler will be made of glass, stainless steel, or polytetrafluoroethylene and will be decontaminated prior to each day's use and between sampling or homogenization events.

All working surfaces and instruments will be thoroughly cleaned, decontaminated (following the protocols in Section 4.3), and covered with aluminum foil to minimize outside contamination between sampling events. Disposable gloves will be discarded after processing each location and replaced prior to handling decontaminated instruments or work surfaces. Sample containers will be kept in packaging as received from the analytical laboratory until use; a sample container will be withdrawn only when a sample is to be collected and returned to a cooler containing completed samples.

4.2.3 Sample Transport and Chain-of-Custody Procedures

All containerized samples will be delivered to the designated analytical laboratories by courier after preparation is completed. Specific sample shipping procedures will be as follows:

- 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.
- Individual sample containers will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- Glass jars will be separated in the shipping container by shock-absorbent material (e.g., bubble wrap) to prevent breakage.

- Ice (in separate, sealed plastic bags) will be placed in the cooler to maintain a storage temperature of approximately 4°C.
- A sealed envelope containing chain-of-custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- The cooler lids will be secured by wrapping the coolers in strapping tape.
- Signed and dated chain-of-custody seals will be placed on all coolers prior to shipping.
- Each cooler or container containing the sediment and soil samples for analysis will be picked up at the Gasco facility by courier daily.

Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample container will sign the chain-of-custody form. Upon receipt of samples at the laboratory, the shipping container seal will be broken, and the receiver will record the temperature and condition of the samples and cross-check the sample inventory with the chain-of-custody form. Chain-of-custody forms will be used internally in the laboratory to track sample handling and final disposition.

4.3 Field Equipment Decontamination

To prevent sample cross contamination, sampling and processing equipment in contact with the environmental media will undergo the following decontamination procedures prior to and between collection activities in accordance with EPA protocols (EPA 2001). Between samples, all sampling equipment that will come in contact with the sample media will be decontaminated prior to use by the following procedures:

- Rinse with river water and wash with a scrub brush until free of sediment.
- Wash with phosphate-free detergent (e.g., Alconox).
- Visually inspect the sampler and repeat the rinse-and-scrub step, if necessary. If scrubbing and rinsing with Alconox is insufficient to remove visually observable tar- or oil-related contamination on sampling equipment, the equipment will be scrubbed and rinsed using acetone (or similar type solution) until all visual signs of contamination are absent.
- Rinse with deionized water three times.

All sample homogenizing equipment (e.g., spoons and bowls) will be decontaminated prior to and between processing cores/borings at each location using the same procedures detailed in this section.

4.4 Management of Investigation-Derived Waste and Surface Water Sheens

Information regarding the management of IDW and incidental surface water sheens produced during sampling are detailed in Sections 4.4.1 and 4.4.2.

4.4.1 Management of Investigation-Derived Waste

IDW, including excess sediments remaining following chemical and physical subsampling, purge water, fluids used for decontamination of sampling equipment, and disposable wastes (e.g., gloves, paper towels, or aluminum foil) will be placed into appropriate containers and staged on site for disposal. Consistent with the EPA-approved First Phase FSP (Anchor QEA 2020a), excess surface sediments will not be considered IDW and will be returned to the river at the approximate sampling location if the sediments do not contain visible sheens or PTW-NAPL.

Sediments and soil remaining after collection and processing will be placed into sealable containers (55-gallon open-top drums). Disposable wastes will be placed into two heavy-duty plastic bags (i.e., double-bagged). All solid waste will be disposed of off site at an appropriate Resource Conservation and Recovery Act (RCRA)-permitted solid waste disposal facility.

Excess sediment and soil IDW resulting from core processing will be characterized by collecting and analyzing one 5-part composite sample per drop box and one composite sample per every five to ten 55-gallon drums. Samples will be tested for total concentrations of the following analytes, hazardous characteristics, and free liquids:

- Free liquids
- VOCs
- Diesel- and oil-range hydrocarbons
- Gasoline-range hydrocarbons
- RCRA eight metals (total)
- Total cyanide
- Semivolatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs)
- Ignitability
- Corrosivity

All sediment and soil IDW will be screened against toxicity characteristic (TC) values consistent with Code of Federal Regulations (CFR) Title 40, Chapter I, Subchapter I, Part 261, Subpart C, §261.24 to determine suitable waste disposal options. TC values are based on results from testing analytes by toxicity characteristic leaching procedure (TCLP) methodology. TC screening values (milligrams per liter [mg/L] TCLP) will be multiplied by 20 for comparison to total concentrations (milligrams per kilogram) reported by the laboratory to account for attenuation related to the leaching process.

After laboratory results have been compiled and screened as required, NW Natural will prepare a profile package addressed to its transportation and disposal (T&D) contractor requesting transport and disposal of the material. The profile package will include a cover letter, tabulated analytical results and screening TC values (where available), laboratory reports, and a completed waste profile for the proposed final disposition (disposal facility) of the waste. T&D will be coordinated with the T&D contractor.

Decontamination fluids and other water generated during the investigation will be stored in sealed 55-gallon drums. One representative sample will be collected for each 500 to 1,000 gallons of fluid generated. The resulting samples of fluids will be tested for the following analytes:

- VOCs
- Diesel- and oil-range hydrocarbons
- Gasoline-range hydrocarbons
- RCRA eight metals (total)
- Total cyanide
- SVOCs, including PAHs
- Ignitability
- Corrosivity

All contained fluids will be screened against TC values consistent with CFR Title 40, Chapter I, Subchapter I, Part 261, Subpart C, §261.24 to determine suitable waste disposal options. TC screening values (mg/L) will compared to total concentrations (mg/L) reported by the laboratory.

After laboratory results have been compiled and screened as required, NW Natural will prepare a profile package addressed to its T&D contractor, requesting transport and disposal of the material. The profile package will include a cover letter, tabulated analytical results and screening TC values (where available), laboratory reports, and a completed waste profile for the proposed final disposition (disposal facility) of the waste. T&D will be coordinated with the T&D contractor.

4.4.2 Management of Surface Water Sheens

There is potential for surface water sheens to develop while implementing the second phase PDI sampling. Sheens observed may be the result of natural processes or investigation methods. To ensure that any sheen observed is managed appropriately, the following protocols will be followed:

- Sheens resulting from the disturbance of sediments during the second phase PDI will be handled using the following procedures:
  - Sorbent booms will be deployed to capture any significant sheen observed on the water surface during sediment grab or subsurface core collection.
  - If necessary, the sorbent booms will be deployed and managed by a small support vessel to allow the sampling vessel to operate without interruption.
  - Depending on the size of the sheen observed, the National Response Center (800-424-8802) may be contacted to advise on additional mitigation measures and

appropriate agency notifications, if necessary. The EPA project manager will also be notified under this scenario.

5 Chemical and Physical Testing

This section summarizes the target physical and chemical analyses for the various media sampled. Sample analyses will be conducted in accordance with EPA-approved methods (where available) and the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP). Prior to analysis, all samples will be maintained according to the appropriate holding times and temperatures for each analysis (Table G4-1). Chemical and physical testing analytes are summarized in Table G5-1. The methods for each of the chemical and physical analyses are described in the Second Phase PDI QAPP.

Prior to the chemical analysis of the samples, the laboratories will calculate method detection limits for each analyte of interest, where applicable. Method detection limits will be below the values specified in the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP) if technically feasible. To achieve the required detection limits, some modifications to the specified analytical methods may be necessary. These modifications will be provided by the laboratories at the time of establishing the laboratory contract.

Sediment chemical and physical testing will be conducted by the following laboratories as identified in the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP):

- Apex Laboratories, LLC
- Enthalpy
- Analytical Resources, Inc.
- ALS Environmental
- GeoTesting Express

All chemical and physical testing will adhere to SW-846 QA/QC procedures and analysis protocols (EPA 1986) or follow the appropriate ASTM or standard method. All the analytical laboratories will prepare detailed reports in accordance with the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP).

Sediment will be submitted for analysis as described in the following sections. Analytical methods and QA/QC requirements are discussed in the Second Phase PDI QAPP (Appendix H of the Combined DSR-PDIWP). The anticipated sampling intervals for the chemical and physical testing are shown in Table G3-4.

Note that polychlorinated biphenyl (PCB) congeners will be analyzed for all surface sediment samples (0 to 1 foot), and PCB Aroclors will be analyzed for all DOC samples.

5.1 Surface Sediment Chemical and Physical Testing

Details regarding the sampling scheme for surface sediment are presented in this section. Total organic carbon (TOC) and total solids (TS) will be analyzed in all surface sediment samples.

Geotechnical index parameters will be analyzed in a small percentage (not more than 20%) of the surface sediment samples. The density, location, and number of geotechnical parameters will be determined based on field lithology.

Surface sediment grab samples collected for SMA refinement and additional surface sediment data density will be submitted for the following analyses:

- ROD Table 21 COCs with RALs and highly toxic PTW thresholds (as described in Section 6.2.1 of the EPA-approved PDIWP [Anchor QEA 2020b], chlorobenzene will not be analyzed)
  - PAHs (including alkylated PAHs and total petroleum hydrocarbons [TPH] at all locations)
  - PCB congeners
  - Dioxins/furans
  - DDx (the sum of dichlorodiphenyltrichloroethane, dichlorodiphenyldichloroethane, and dichlorodiphenyldichloroethylene)
- TOC and TS
- Geotechnical index parameter testing (approximately 20% at select locations to be identified during sampling)
  - Moisture content
  - Specific gravity
  - Grain size
  - Atterberg Limits

As mentioned in this list, supplemental PAH analysis for alkylated PAHs and TPH will be analyzed at all locations. These locations are identified in Table G3-1.

5.2 Subsurface Sediment Chemical and Physical Testing

DOC will be determined via chemical and physical testing of subsurface sediment cores. Details regarding the sampling scheme are presented in this section. Table G3-4 identifies the different sampling intervals associated with each core. Geotechnical index parameters (moisture content, specific gravity, grain size, and Atterberg Limits) will be analyzed in a small percentage (not more than 20%) of these subsurface sediment samples. The density, location, and number of geotechnical parameters will be determined based on field lithology.

5.2.1 Depth of Contamination Testing

Sediment cores samples for DOC identification will be collected and analyzed using the following protocols:

- Samples will be collected in 1-foot intervals from each DOC core beginning at the mudline to the bottom of the core recovery depth (Table G3-4).

- If no visual indication of contamination is observed, submit for chemical analysis a minimum of four 1-foot intervals, starting at the mudline (0- to 1-foot interval) and proceeding downward in the core to the 3- to 4-foot interval.
  - It should be noted that at a single location (USMPDI-088) immediately offshore of USMPDI-056, which has a DOC of 6 feet, the first six consecutive 1-foot intervals would be submitted for chemical analyses (Table G3-4).
- All other 1-foot interval samples below these (to the maximum depth of core penetration) will be archived.
- Samples will be analyzed for ROD Table 21 COCs with RALs and PTW-highly toxic thresholds, including the following (as described in Section 6.2.1 of the PDIWP [Anchor QEA 2020b], chlorobenzene will not be analyzed):
  - PAHs (including alkylated PAHs and TPH at all locations)
  - PCB Aroclors
  - Dioxins/furans
  - DDx
  - Collect one archive sample for potential additional analysis
- As mentioned in this list, supplemental PAH analysis for alkylated PAHs and TPH will be analyzed at all locations. These locations are identified in Table G3-4.
- If there is a fraction of a foot greater than 0.5 foot (e.g., core recovery of 14.8 feet) below the bottom whole 1-foot interval collected for analysis, an archive sample will be collected of this material. If the fraction of a foot is less than 0.5 foot (e.g., core recovery of 14.3 feet) below the bottom whole 1-foot interval collected for analysis, then, due to sample volume requirements, no archive sample will be collected.
- Geotechnical index parameter testing (approximately 20% at select locations to be identified during sampling) will include moisture content, specific gravity, grain size, and Atterberg limits.
- If either of the bottom two samples from the initially analyzed intervals exceeds ROD Table 21 RALs and PTW-highly toxic thresholds, the DOC will be considered unbounded and deeper archived samples will be analyzed.
- If both of the bottom two samples are below the ROD Table 21 RALs and PTW-highly toxic thresholds, the deepest interval with COC concentrations that are above ROD Table 21 RALs and PTW-highly toxic thresholds will be designated the DOC.

5.2.2 Dredged Material Haul Barge Dewatering (Standard Elutriate Testing)

These methods are consistent with methods presented in the EPA-approved *Pre-Remedial Design Data Gaps Field Sampling Plan* (Appendix A of the *Revised Pre-Remedial Design Data Gaps Work Plan* [Anchor QEA 2019b]) and the *Revised Final Pre-Remedial Design Data Gaps Data Summary Report* (Anchor QEA 2022) for the Gasco Sediments Site.

To estimate the chemical concentrations of excess water in the dredged material haul barge in contact with dredge sediments and support water quality treatment evaluations based on these concentrations, dredge elutriate tests will be conducted using the following protocols (the method is a modified version of ASTM D6586):

- Consistent with and co-located with dredged material disposal suitability testing in Section 5.3.1 of the Combined DSR-PDIWP, locations in the navigation channel/future maintenance dredge regions will be sampled from the mudline to the bottom DOC identified in nearby cores to simulate removal of the full DOC at these locations. Samples collected from the shallow and intermediate regions would be collected from 0 to 5 feet unless the DOC is only marginally deeper than 5 feet. Locations within the shallow and intermediate regions that have a DOC slightly deeper than 5 feet will be sampled from the mudline to the DOC because the final technology assignment in these areas will likely show that full removal is more cost-effective and environmentally protective than dredging and capping a thin interval of contaminated sediment. The sampled intervals are presented in Table G3-2. This entire depth of sediment will be vertically composited and homogenized to create a single sample.
- River water will be collected at a single location approximately 3 feet above the mudline at the approximate center point of the proposed dredged material haul barge dewatering locations.
- The composited, homogenized sediment samples and river water will be sent to the Waste Stream Technology laboratory for dredge elutriate analyses of metals, PCBs, pesticides, SVOCs, VOCs, dioxins/furans, herbicide, organotin, pH, and total suspended solids (TSS).

Dredge elutriate testing involves mixing site sediment and site water in a specified ratio, followed by agitation of the slurry mixture for a specified period, settling or filtration of solids, and analysis of the resulting water column. Standard elutriate tests will be conducted in accordance with national dredged material disposal guidelines (EPA and USACE 1991).

The standard elutriate test procedure is as follows:

- Site sediment and river water are mixed in the laboratory at a 1:4 sediment-to-water ratio, by volume.
- The sediment-water mixture is vigorously agitated for 30 minutes, then allowed to settle for 1 hour.
- A sample of the supernatant is siphoned off the water column.
- Sufficient elutriate water will be withdrawn to prepare both unfiltered (total) and filtered (dissolved) samples (only unfiltered samples for TSS); the untreated total and dissolved fractions will be submitted to the analytical laboratory for initial chemical analyses.

Based on the initial untreated dredged material elutriate concentrations, the elutriate will be treated through the following series of steps to optimize a cost-effective water treatment process for those constituents that require treatment prior to discharge:

- Prepare four separate 1-liter decanted elutriate samples.
- Use polymer cup test to establish an optimal polymer dosage.
- Dose the samples with four different dosages[3] of ferric sulfate solution: 20 mg/L, 40 mg/L, 60 mg/L, and 80 mg/L; the range of anticipated dosages is based on experience at other sites.
- Apply the optimal polymer dosage to each of the four elutriate samples.
- Filter all samples through 1-micron filters and analyze for total and dissolved metals on a 1-day turnaround time.
- Retain the remainder of the filtered samples.
- Using the best results, pump the flow through specially configured pipettes containing granular activated carbon (GAC) in a procedure known as the rapid, small-scale column test, which is a method developed by Sevenson based on ASTM D6586 to establish the performance of GAC on dissolved organic COCs (ASTM 2014).
- Treatment processes will be identified based on percent reduction.

5.2.3 Dredged Material Disposal Suitability Testing

Samples for waste characterization and disposal suitability testing will be collected and analyzed using the following protocols:

- Sample intervals were determined as described in Section 5.2.2 and are presented in Table G3-2. This entire depth of sediment will be vertically composited and homogenized to create a single sample.
- Bulk sediment samples will be collected and analyzed for the following:
  - RCRA waste characteristics of ignitability and corrosivity using test methods ASTM D93, SW-849, and EPA 9045D, respectively
  - TCLP analytes (RCRA eight metals, VOCs, SVOCs, pesticides, and herbicides)
  - Conventionals (pH and TSS)

[3] As stated in the *Revised Final Pre-Remedial Design Data Gaps Data Summary Report* (Anchor QEA 2022), "During laboratory analysis, Waste Stream Technology determined through qualitative observations and professional judgment that a dose of 40 mg/L of ferric sulfate was optimal for coagulation and did not proceed with additional sample dosages." Only one dosage will be used if the laboratory determines, based on professional judgement, that additional dosages are not needed to meet the sampling objective of informing potential barge dewatering treatment requirements during remedial design to support discharge of the treated fluids back to the river in the construction area.

5.2.3.1 Toxicity Characteristic Leaching Procedure Testing

TCLP testing will follow SW-846 test method 1311, which involves tumbling a specified volume of sediment in a buffered extraction fluid to generate a simulated leachate, which is then analyzed for organic and inorganic constituents specified in the regulations (EPA 1993).

A separate aliquot for volatiles analysis is required; however, this aliquot will be collected after homogenization to mimic the conditions that would occur during sediment removal (e.g., mixing and air exposure).

Initially, the TCLP samples will be run without any dewatering amendments added. If the TCLP concentrations are less than the TCLP criteria, no additional TCLP testing will be performed. If these samples exceed the TCLP criteria, TCLP tests will be performed on sediment samples that have been amended and cured using the optimized sediment stabilization process, as described in Section 5.2.4.

5.2.4 Dredged Material Stabilization Testing

For any unamended samples that fail the disposal suitability criteria (i.e., RCRA, TCLP), the samples will be stabilized with amendments and re-tested for the failed disposal suitability criteria. Stabilization will be performed using a variety of amendment types and dosages. Several amendments will be evaluated using various dosages to determine how to optimally and cost-effectively stabilize dredge material so it meets the applicable transport and disposal facility material strength requirements. Optimum dosage ratios will be evaluated through paint filter testing, percent solids analysis, and visual observations of physical characteristics (e.g., flocculation or coagulant formation, rapid separation of solids and liquid release, and clarity) at specified cure periods (e.g., 24 hours, 48 hours, and 72 hours). Dosage ratios will also be monitored for weight change.

Potential amendment types that may be tested to determine their suitability for stabilizing the dredged sediments could include the following:

- Portland cement (e.g., Type I, Type I/II, or Type II)
- Calciment
- Lime kiln dust

Based on the results of the bench scale treatability testing performed during the early removal action characterization, it is anticipated that each of these amendments will be added to the test sediments using between 5% to 15% by weight. The goal is to determine the most optimum combination of amendment, dosage ratio, and cure time to allow the stabilized end product to pass the paint filter test and meet the minimum structural strength required by the disposal facility. Amendments to be used will be provided by the manufacturer based on what is anticipated to be readily available for full-scale application during construction of the final remedy. Manufacturer-provided specification sheets will be included in the final treatability test report. A pocket penetrometer will be used to evaluate the strength of the amended sediments, and the moisture content of the amended samples will also be analyzed.

At locations that failed the TCLP screening, detailed in Section 5.2.3, additional TCLP analyses will be performed on a composited, homogenized archived sediment sample from that location. The archive sample will be stabilized using the optimized amendment and dosage identified at that location.

Upon opening of the archived sample volume containers (anticipated to be a 5-gallon bucket for non-volatile compounds and a zero-headspace container for volatile compounds analyses), any standing water in each container will be mixed into the sediment using either a spoon or hand drill with mixer paddle attachment. The mixed sediment will then be weighed out separately for the nonvolatile and volatile containers, and the appropriate amount by weight of admixture will be added and mixed separately into these containers.

TCLP testing will be conducted separately on the resulting non-volatile and volatile sediment-admixture sample following the methods described in Appendix D of the *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual (*USACE 2003). Additional testing to determine the ability to remove free liquid or meet bearing strength requirements of potential disposal facilities may also be performed on the mixed sediment.

6 Field Sampling Schedule

The second phase PDI sampling program is projected to begin as soon as possible after EPA approval of the Combined DSR-PDIWP and associated documents. The first mobilization of the field sampling program is expected to be completed within 30 working days. As stated in the Combined DSR-PDIWP, a second mobilization will be required in the spring to collect data from nearshore locations that cannot be accessed in late summer/early fall. The actual start and end dates for the sampling event will depend on EPA approval of the project plans and coordination with subcontractors. Other conditions that may affect the sampling schedule are weather, contractor availability, and equipment availability.

7 References

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Tables

Table G3-1

Proposed Second Phase PDI Surface Sediment Sampling Locations

Sample Location	Purpose	Easting (X)[1]	Northing (Y)[1]
USMPDI-084	Collect additional surface sediment data to support refinement of the surface-derived SMAs. These locations are co-located with depth of contamination subsurface sediment cores as presented in Table G3-4.	7623212.98	706439.11
USMPDI-085		7622955.87	706531.28
USMPDI-086		7622737.14	706738.14
USMPDI-087		7622584.84	706880.50
USMPDI-088		7622465.97	706989.96
USMPDI-089		7622104.07	707325.81

Notes:

1. Coordinates are in North American Datum of 1983 (HARN91) Oregon State Plane North, International Feet.

HARN91: High Accuracy Reference Network 91

PDI: pre-design investigation

SMA: sediment management area

Table G3-2

Proposed Second Phase PDI Dredge Material Barge Dewatering Treatment and Stabilization Evaluation Sampling Locations

Sample Location	Purpose	Easting (X)[1]	Northing (Y)[1]	Nearest First Phase PDI Sample Location	Nearest First Phase PDI DOC	ROD-Identified Region	Proposed Sampling Interval
USMPDI-102	Inform potential barge dewatering treatment requirements during remedial design to support discharge of the treated fluids back to the river in the construction area; determine the most optimum combination of amendment, dosage ratio, and cure time to allow any stabilized dredge materials to pass the paint filter test and meet the minimum structural strength required by the disposal facility.	7622154.41	707021.41	USMPDI-009	5 ft	NAV/FMD	Mudline to the bottom DOC (0 - 5 feet)
USMPDI-103		7622014.45	707149.29	USMPDI-004	7 ft	Intermediate	Mudline to the bottom DOC (0 - 7 feet)
USMPDI-104		7622887.63	706190.74	USMPDI-050	Unbounded[2]	Intermediate	0-5 ft
USMPDI-105		7622958.49	706313.18	USMPDI-044	Unbounded	Intermediate	0-5 ft
				USMPID-048	14 ft		0-5 ft
USMPDI-106		7622760.37	706447.46	USMPDI-038	Unbounded	Intermediate	0-5 ft
USMPDI-107		7622592.46	706626.39	USMPDI-026	11 ft	Intermediate	0-5 ft
USMPDI-108		7622418.62	706824.84	USMPDI-018	7 ft	Intermediate	Mudline to the bottom DOC (0 - 7 feet)
USMPDI-109		7622158.86	706818.72	USMPDI-015	Unbounded	Shallow	0-5 ft
USMPDI-110		7621993.24	707274.70	USMPDI-001	1 ft	Intermediate	0-5 ft
				USMPDI-002	Unbounded		0-5 ft
USMPDI-111		7623117.29	706292.40	USMPDI-054	7 ft	NAV/FMD	Mudline to the bottom DOC (0 - 7 feet)
USMPDI-112		7622446.53	706556.72	USMPDI-024	Unbounded	Shallow	0-5 ft
USMPDI-113		7622573.99	706321.12	USMPDI-031	Unbounded	Shallow	0-5 ft
				USMPDI-036	Unbounded		0-5 ft
				USMPDI-037	Unbounded		0-5 ft

Notes:

1. Coordinates are in North American Datum of 1983 (HARN91) Oregon State Plane North, International Feet.
2. If either of the bottom two samples exceeds ROD Table 21 RALs and PTW-highly toxic thresholds, the DOC will be considered unbounded.

DOC: depth of contamination
First Phase PDI: First Phase Pre-Design Investigation
FMD: future maintenance dredge
HARN91: High Accuracy Reference Network 91
NAV: navigation channel
PDI: pre-design investigation
PTW: principal threat waste
RAL: remedial action level
ROD: *Record of Decision – Portland Harbor Superfund Site, Portland, Oregon*

Table G3-3

Proposed Second Phase PDI Subsurface Sediment Waste Disposal Characterization Sampling Locations

Sample Location	Purpose	Easting (X)[1]	Northing (Y)[1]
USMPDI-102	Pre-characterize wastes associated with dredging to determine appropriate dredged sediment waste handling and transport options and to complete the waste disposal classification evaluation.	7622154.41	707021.41
USMPDI-103		7622014.45	707149.29
USMPDI-104		7622887.63	706190.74
USMPDI-105		7622958.49	706313.18
USMPDI-106		7622760.37	706447.46
USMPDI-107		7622592.46	706626.39
USMPDI-108		7622418.62	706824.84
USMPDI-109		7622158.86	706818.72
USMPDI-110		7621993.24	707274.7
USMPDI-111		7623117.29	706292.4
USMPDI-112		7622446.53	706556.72
USMPDI-113		7622573.99	706321.12

Notes:

1. Coordinates are in North American Datum of 1983 (HARN91) Oregon State Plane North, International Feet.

HARN91: High Accuracy Reference Network 91

PDI: pre-design investigation

Table G3-4

Proposed Second Phase PDI Depth of Contamination Subsurface Sediment Sampling Locations and Intervals

Sediment Core Location	Purpose	Easting (X)[1]	Northing (Y)[1]
USMPDI-084	Samples will be collected in 1-foot intervals from each DOC core beginning at the mudline to the bottom of the core recovery depth. If no visual indication of contamination is observed, submit for chemical analysis a minimum of four 1-foot intervals, starting at the mudline (0 to 1-foot interval) and proceeding downward in the core to the 3 to 4-foot interval.	7623212.98	706439.11
USMPDI-085		7622955.87	706531.28
USMPDI-086		7622737.14	706738.14
USMPDI-087		7622584.84	706880.50
USMPDI-088[2]		7622465.97	706989.96
USMPDI-089		7622104.07	707325.81

Notes:

1. Coordinates are in North American Datum of 1983 (HARN91) Oregon State Plane North, International Feet.
2. USMPDI-088 is immediately offshore of USMPDI-056, which has a DOC of 6 feet. The first six consecutive 1-foot intervals will be submitted for chemical analyses.

DOC: depth of contamination
HARN91: High Accuracy Reference Network 91
PDI: pre-design investigation

Table G3-5

Proposed Second Phase PDI Seepage Meter Sampling Locations

Sample Location	Purpose	Easting (X)[1]	Northing (Y)[1]
USMPDI-091	Support buried contamination evaluation chemical fate and transport modeling.	7622251.09	706885.12
USMPDI-092		7622584.49	706622.97
USMPDI-093		7622921.32	706316.36
USMPDI-094		7622802.46	706446.05
USMPDI-095		7622291.69	706700.24
USMPDI-096		7622433.04	706553.22
USMPDI-097		7621970.09	707144.38
USMPDI-098		7622615.14	706318.34
USMPDI-099		7623006.57	706143.27
USMPDI-100		7622401.79	706743.53
USMPDI-101		7622890.74	706190.03

Notes:

1. Coordinates are in North American Datum of 1983 (HARN91) Oregon State Plane North, International Feet.

HARN91: High Accuracy Reference Network 91

PDI: pre-design investigation

Table G4-1
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	
Cyanide	50 g		14 days	Cool < 6°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	Enthalpy
			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	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	Enthalpy
			1 year after extraction		

Table G4-1
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		
Dioxins/Furans	1L	2 x 1 L Amber glass	1 year to extraction	Cool 2 to 6°C	Enthalpy
			1 year after extraction	Freeze < -10°C; store in the dark	
Tributyltin	300 mL	2 x 500 mL Amber glass	14 days until extraction	Cool 2 to 6°C	ARL
			40 days after extraction		
Herbicides	1L	2 x 1 L Amber glass	14 days until extraction	Cool 2 to 6°C	ALS
			40 days after extraction		

Notes:

1. Container size, type, and sample size required may change based on program and laboratory guidance.

ALS: ALS Environmental
Apex: Apex Laboratories, LLC
ARI: Analytical Resources, Inc.
ASAP: as soon as possible
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

Table G5-1
Chemical and Physical Analytes by Sampling Task

Chemical and Physical Analyses		Surface Sediments	Subsurface Sediments		
Analyte Group	**Analytes**	**Surface Grabs**	**DOC**	**Dredged Material Haul Barge Dewatering (Standard Elutriate Testing)**	**Dredged Material Disposal Suitability Testing (TCLP)**
Geotechnical	Analytes vary by sampling task—see Second Phase QAPP Table H-2 for complete analyte lists	X			
Conventionals	Analytes vary by sampling task—see Second Phase QAPP Tables H-2, H-3, H-4, and H-5 for complete analyte lists	X	X	X	X
Metals/RCRA Metals	Analytes vary by sampling task—see Second Phase QAPP Tables H-4 and H-5 for complete analyte lists			X	X
VOCs/TCLP VOCs	Analytes vary by sampling task—see Second Phase QAPP Table H-5 for complete analyte lists			X	X
PAHs and Alkylated PAHs	See Second Phase QAPP Tables H-2 and H-3 for analyte list; see Table G3-1 and G3-2 for locations	X	X		
SVOCs/ TCLP SVOCs	Analytes vary by sampling task—see Second Phase QAPP Tables H-4 and H-5 for complete analyte lists			X	X
PCB	PCB-001 209	X			
PCB Aroclors	Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, and 1268—see Second Phase QAPP Table H-3 for analyte list		X	X	
Dioxin/furans	Analytes vary by sampling task—see Second Phase QAPP Tables H-2, H-3, and H-5 for complete analyte lists	X	X	X	
Low-resolution pesticides/TCLP Pesticides	Six DDx congeners	X	X	X	X
TPH	Aliphatic Hydrocarbons C10-C12		X		
	TPH-Diesel				
Herbicides/TCLP Herbicides	Analytes vary by sampling task—see Second Phase QAPP Tables H-4 and H-5 for complete analyte lists			X	X
Organotins	Tributyltin			X	

Notes:
DDx: 2,4′ and 4,4′-DDD, -DDE, -DDT
DOC: depth of contamination
EPA: U.S. Environmental Protection Agency
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
RCRA: Resource Conservation and Recovery Act
Second Phase QAPP: Second Phase Quality Assurance Project Plan
SVOC: semivolatile organic compound
TCLP: Toxicity Characteristic Leaching Procedure
TPH: total petroleum hydrocarbons
VOC: volatile organic compound

Figures

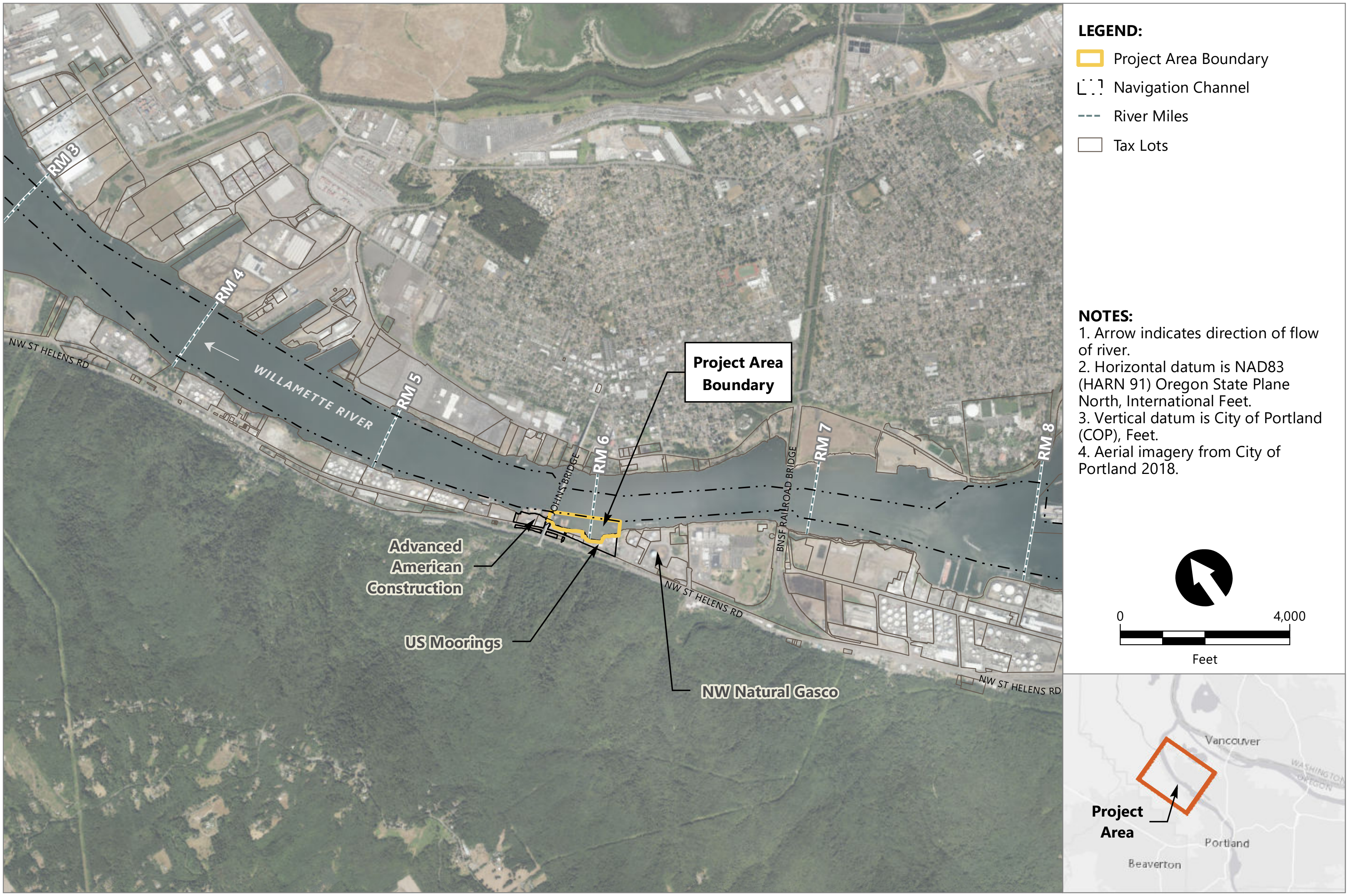

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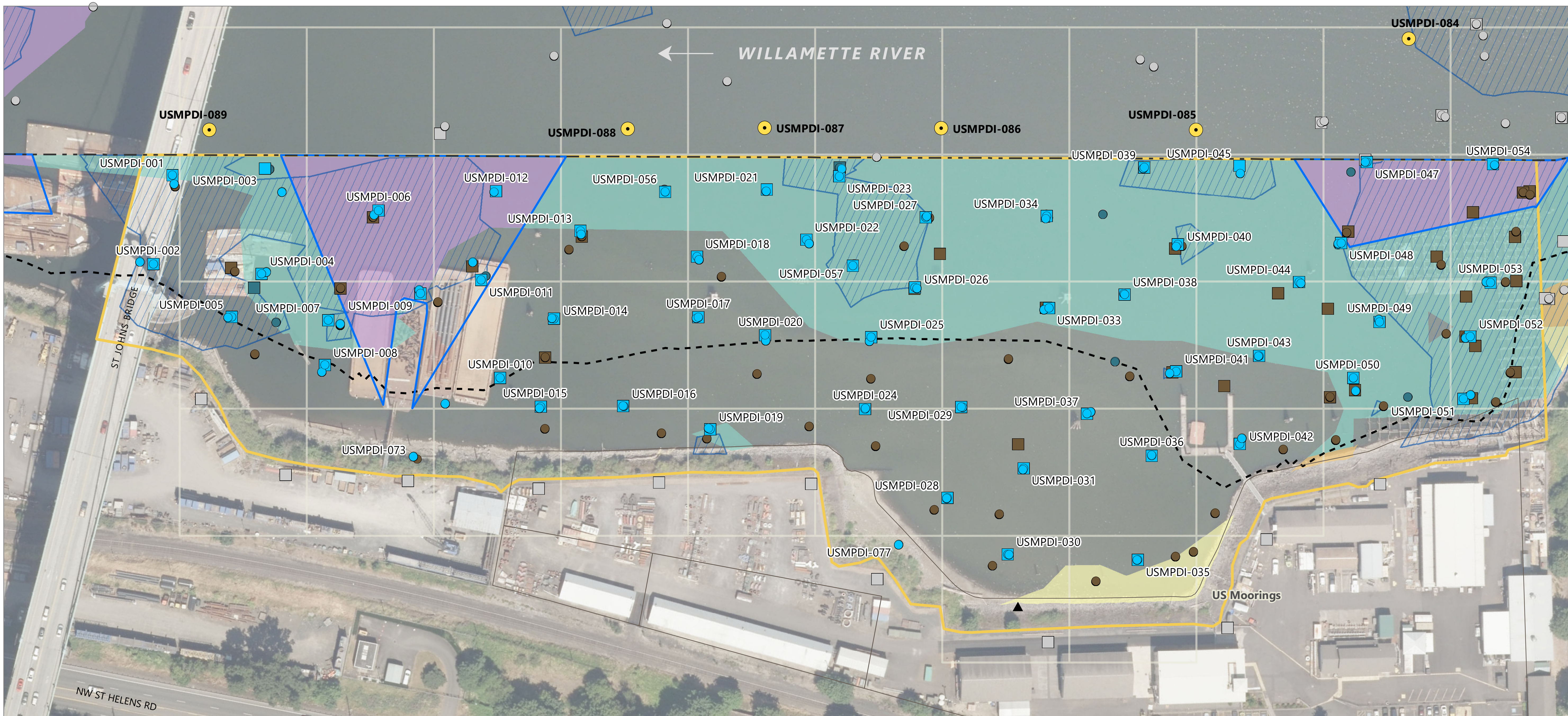
Figure G1-1
Vicinity Map

Second Phase Pre-Design Investigation Field Sampling Plan
US Moorings Project Area



LEGEND:

Project Area Boundary
Navigation Channel
US Moorings Property Boundary
Post-ROD SMAs + First Phase PDI Data[5]
Future Maintenance Dredging Area
Approximate Shallow/Intermediate Zone Boundary

Locations Outside Project Area
Surface Sediment Location
Subsurface Sediment Location

ROD SMA Technology
Cap
Dredge
Dredge in Nav-FMD
Dredge with Cap

Locations Inside Project Area
Pre-RD Group Data Inside Project Area
Surface Sediment Location
Subsurface Sediment Location
ROD Data Inside Project Area
Surface Sediment Location
Subsurface Sediment Location
Seep Sample Location

PDI Data Inside Project Area
First Phase PDI Surface Sediment Location
First Phase PDI Subsurface Sediment Location
Proposed Second Phase PDI Surface Sediment Sample Location

NOTES:
1. Arrow indicates direction of flow of river.
2. Horizontal datum is NAD83 (HARN 91) Oregon State Plane North, International Feet.
3. Vertical datum is City of Portland (COP), Feet.
4. Aerial imagery from City of Portland 2018.
5. Sediment management areas developed using surface sediment data consistent with the ROD-identified methods using the post-ROD data set identified in the Pre-Design Investigation Work Plan and first phase PDI results. Following the second phase PDI, the sediment management areas will be revised to include subsurface sediment data.
6. Sediment management areas include the revised 1,2,3,4,7,8-HxCDF PTW-highly toxic threshold of 0.4 µg/kg per EPA Errata #3 dated September 7, 2022.
7. Shown grid is in 150-foot by 150-foot dimensions to support remedial design

0 150
Feet

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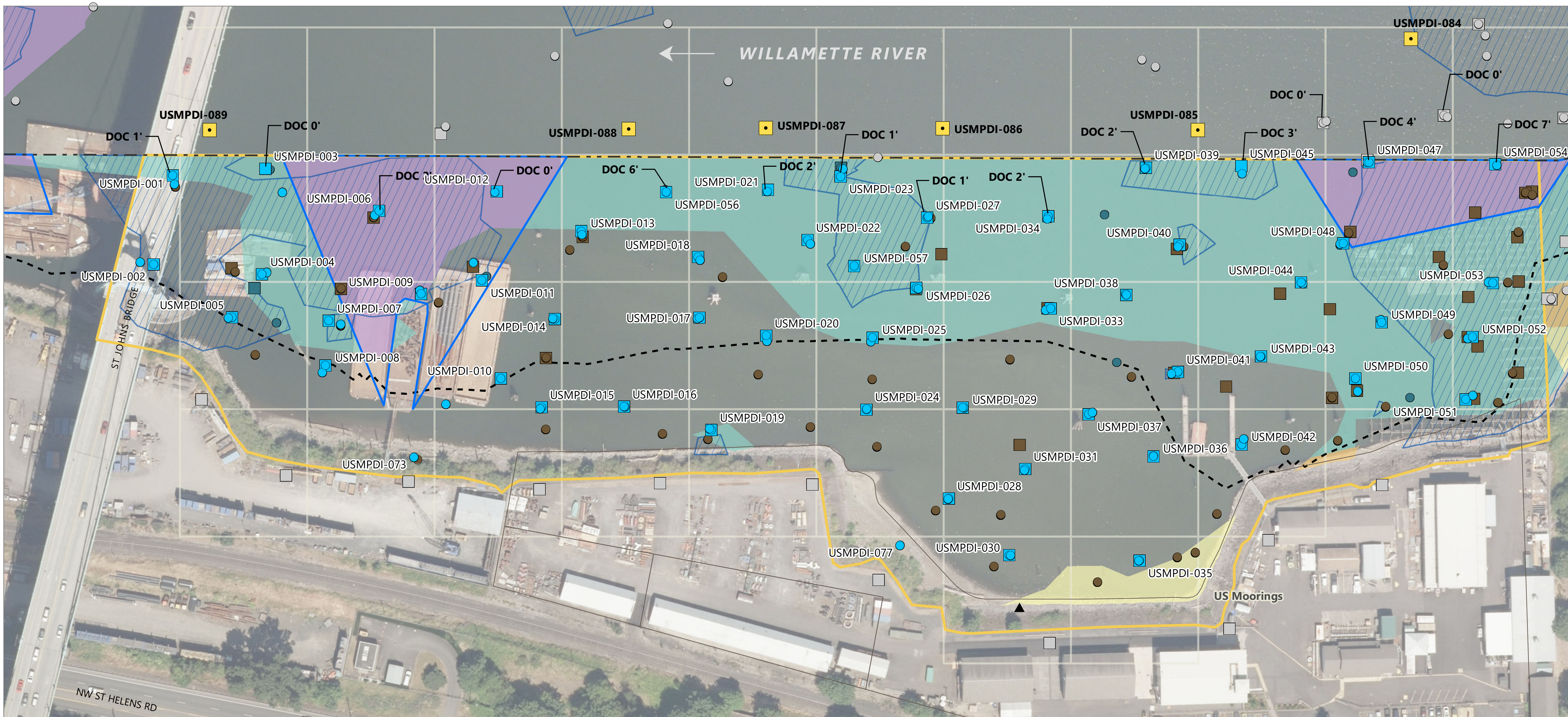
Figure G3-1
Proposed Second Phase PDI Surface Sediment Sampling Locations
Second Phase Pre-Design Investigation Field Sampling Plan
US Moorings Project Area



LEGEND:

- Project Area Boundary
- Navigation Channel
- US Moorings Property Boundary
- Post-ROD SMAs + First Phase PDI Data[5]
- Future Maintenance Dredging Area
- Approximate Shallow/Intermediate Zone Boundary

Locations Outside Project Area

- Surface Sediment Location
- Subsurface Sediment Location

ROD SMA Technology

- Cap
- Dredge
- Dredge in Nav-FMD
- Dredge with Cap

Locations Inside Project Area

Pre-RD Group Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location

ROD Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location
- Seep Sample Location

PDI Data Inside Project Area

- First Phase PDI Surface Sediment Location
- First Phase PDI Subsurface Sediment Location
- Proposed Second Phase PDI Subsurface Sediment DOC Sample Location

NOTES:

1. Arrow indicates direction of flow of river.
2. Horizontal datum is NAD83 (HARN 91) Oregon State Plane North, International Feet.
3. Vertical datum is City of Portland (COP), Feet.
4. Aerial imagery from City of Portland 2018.
5. Sediment management areas developed using surface sediment data consistent with the ROD-identified methods using the post-ROD data set identified in the Pre-Design Investigation Work Plan and first phase PDI results. Following the second phase PDI, the sediment management areas will be revised to include subsurface sediment data.
6. Sediment management areas include the revised 1,2,3,4,7,8-HxCDF PTW-highly toxic threshold of 0.4 µg/kg per EPA Errata #3 dated September 7, 2022.
7. Shown grid is in 150-foot by 150-foot dimensions to support remedial design data density determinations.

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Feet

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Figure G3-2
Proposed Second Phase PDI Subsurface Sediment DOC Sampling Locations
Second Phase Pre-Design Investigation Field Sampling Plan
US Moorings Project Area

USMS0038242

LEGEND:

- Project Area Boundary
- Navigation Channel
- US Moorings Property Boundary
- Post-ROD SMAs + First Phase PDI Data[5]
- Future Maintenance Dredging Area
- Approximate Shallow/Intermediate Zone Boundary

Locations Outside Project Area

- Surface Sediment Location
- Subsurface Sediment Location

ROD SMA Technology

- Cap
- Dredge
- Dredge in Nav-FMD
- Dredge with Cap

Locations Inside Project Area

Pre-RD Group Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location

ROD Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location
- Seep Sample Location

PDI Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location
- Proposed Second Phase PDI Barge Dewatering Treatment and Stabilization Evaluation Sample Location

NOTES:

1. Arrow indicates direction of flow of river.
2. Horizontal datum is NAD83 (HARN 91) Oregon State Plane North, International Feet.
3. Vertical datum is City of Portland (COP), Feet.
4. Aerial imagery from City of Portland 2018.
5. Sediment management areas developed using surface sediment data consistent with the ROD-identified methods using the post-ROD data set identified in the Pre-Design Investigation Work Plan and first phase PDI results. Following the second phase PDI, the sediment management areas will be revised to include subsurface sediment data.
6. Sediment management areas include the revised 1,2,3,4,7,8-HxCDF PTW-highly toxic threshold of 0.4 µg/kg per EPA Errata #3 dated September 7, 2022.
7. Shown grid is in 150-foot by 150-foot dimensions to support remedial design data density determinations.

0 150
Feet

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Figure G3-3

Proposed Second Phase PDI Dredge Material Barge Dewatering Treatment and Stabilization Evaluation Sampling Locations

Second Phase Pre-Design Investigation Field Sampling Plan
US Moorings Project Area

LEGEND:

- Project Area Boundary
- Navigation Channel
- US Moorings Property Boundary
- Post-ROD SMAs + First Phase PDI Data[5]
- Future Maintenance Dredging Area
- Approximate Shallow/Intermediate Zone Boundary

Locations Outside Project Area

- Surface Sediment Location
- Subsurface Sediment Location

ROD SMA Technology

- Cap
- Dredge
- Dredge in Nav-FMD
- Dredge with Cap

Locations Inside Project Area

Pre-RD Group Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location

ROD Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location
- Seep Sample Location

PDI Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location
- Proposed Second Phase PDI TCLP/RCRA Sample Location

NOTES:

1. Arrow indicates direction of flow of river.
2. Horizontal datum is NAD83 (HARN 91) Oregon State Plane North, International Feet.
3. Vertical datum is City of Portland (COP), Feet.
4. Aerial imagery from City of Portland 2018.
5. Sediment management areas developed using surface sediment data consistent with the ROD-identified methods using the post-ROD data set identified in the Pre-Design Investigation Work Plan and first phase PDI results. Following the second phase PDI, the sediment management areas will be revised to include subsurface sediment data.
6. Sediment management areas include the revised 1,2,3,4,7,8-HxCDF PTW-highly toxic threshold of 0.4 µg/kg per EPA Errata #3 dated September 7, 2022.
7. Shown grid is in 150-foot by 150-foot dimensions to support remedial design data density determinations.

0 150
Feet

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Figure G3-4
Proposed Second Phase PDI Waste Suitability Characterization Sampling Locations
Second Phase Pre-Design Investigation Field Sampling Plan
US Moorings Project Area

LEGEND:

- Project Area Boundary
- Navigation Channel
- US Moorings Property Boundary
- Post-ROD SMAs + First Phase PDI Data[5]
- Future Maintenance Dredging Area
- Approximate Shallow/Intermediate Zone Boundary

Locations Outside Project Area

- Surface Sediment Location
- Subsurface Sediment Location

ROD SMA Technology

- Cap
- Dredge
- Dredge in Nav-FMD
- Dredge with Cap

Locations Inside Project Area

Pre-RD Group Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location

ROD Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location
- Seep Sample Location

PDI Data Inside Project Area

- Surface Sediment Location
- Subsurface Sediment Location
- Proposed Second Phase PDI Seepage Meter Sample Location
- Proposed Second Phase PDI Seepage Meter Spring Only Sample Location

NOTES:

1. Arrow indicates direction of flow of river.
2. Horizontal datum is NAD83 (HARN 91) Oregon State Plane North, International Feet.
3. Vertical datum is City of Portland (COP), Feet.
4. Aerial imagery from City of Portland 2018.
5. Sediment management areas developed using surface sediment data consistent with the ROD-identified methods using the post-ROD data set identified in the Pre-Design Investigation Work Plan and first phase PDI results. Following the second phase PDI, the sediment management areas will be revised to include subsurface sediment data.
6. Sediment management areas include the revised 1,2,3,4,7,8-HxCDF PTW-highly toxic threshold of 0.4 µg/kg per EPA Errata #3 dated September 7, 2022.
7. Shown grid is in 150-foot by 150-foot dimensions to support remedial design data density determinations.

0 150
Feet

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Figure G3-5
Proposed Second Phase PDI Seepage Meter Sampling Locations
Second Phase Pre-Design Investigation Field Sampling Plan
US Moorings Project Area

Attachment A
Field Forms

ANCHOR QEA

Sediment Core Collection Log

Job: ____________________ **Station ID:** ____________________

Job No: ____________________ **Attempt No.** ____________________

Field Staff: ____________________ **Date:** ____________________

Contractor: ____________________ **Logged By:** ____________________

Vertical Datum: ____________________ **Horizontal Datum:** ____________________

Field Collection Coordinates:

Lat/Northing: ____________________ Long/Easting: ____________________

A. Water Depth

DTM Depth Sounder: ____________________

DTM Lead Line: ____________________

B. Water Level Measurements

Time: ____________________

Tide Height: ____________________

Source: ____________________

C. Mudline Elevation

____

Recovery Measurements (prior to cuts)

Core Collection Recovery Details:

Core Accepted: Yes / No

Core Tube Length: ____________________

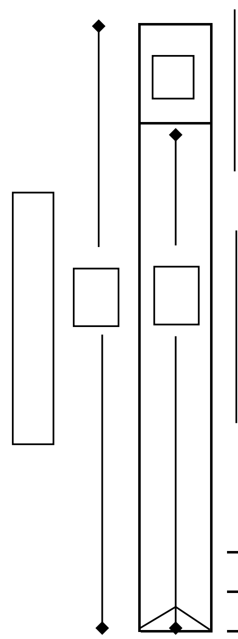
Drive Penetration: ____________________

Headspace Measurement: ____________________

Recovery Measurement: ____________________

Recovery Percentage: ____________________

Total Length of Core To Process: ____________________



Drive Notes:

Sections To Process:

A: ____________________

B: ____________________

C: ____________________

D: ____________________

Core Field Observations and Description:	Sediment type, moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Notes:

Sediment Core Processing Log

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Job:	Station ID:
Job No.	Date/Time:
No. of Sections:	Core Logged By:
Drive Length:	Attempt #:
Recovery:	Type of Core ☐ Mudmole ☐ Vibracore ☐ Diver Core
% Recovery:	Diameter of Core (inches)
Notes:	Core Quality ☐ Good ☐ Fair ☐ Poor ☐ Disturbed

Recovered Length (ft)	Size % Gravel	Size % Sand	Size % Fines	**Classification and Remarks** (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	Recovered Length (ft)	PID	Sample	Summary Sketch

USMS0038248

Surface Sediment Field Log

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Job:	Station:
Job No:	Date:
Field Staff:	Sample Method:
Contractor:	Proposed Coordinates: Lat.
Horizontal Datum:	Long.

Water Height
DTM Depth Sounder: ____________

DTM Lead Line: ____________

Tide Measurements
Time: ________
Height: ________

Sample Acceptability Criteria:
1) Overlying water is present
2) Water has low turbidity
3) Sampler is not overfilled
4) Surface is flat
5) Desired penetration depth

Mudline Elevation (lower low water-large tides): calculated after sampling

Notes: ____________

Grab #	Time	Confirmed Coordinates (datum)		Sample Accept (Y/N)	Recovery Depth (in)	Comments: jaws close, good seal, winnowing, overlying water, surface intact, etc
		WGS 84 (N)	WGS 84 (E)			

Sample Description: surface cover, (density), moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Sample Containers:

Analyses:

USMS0038249