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DRAFT WORK PLAN

PORTLAND HARBOR PRE-REMEDIAL DESIGN INVESTIGATION STUDIES PORTLAND HARBOR SUPERFUND SITE

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LIST OF ACRONYMS AND ABBREVIATIONS

μm	micrometer
95UCL	95% upper confidence limit
AECOM	AECOM Technical Services
Alt F Mod	Alternative F Modified
ARARs	applicable or relevant and appropriate requirements
ASAOC	Administrative Settlement and Agreement Order on Consent
ASTM	American Society of Testing Materials
BAZ	biologically active zone
BERA	baseline ecological risk assessment
BHHRA	baseline human health risk assessment
bml	below mudline
BMPs	best management practices
CDM Smith	CDM Smith, Inc.
cfs	cubic feet per second
COCs	contaminants of concern
COPCs	contaminants of potential concern
CRD	Columbia River Datum
CSM	Conceptual Site Model
cy	cubic yards
D/F	dioxins/furans
D/U Reach	the Downtown Reach and the Upstream Reach
DDx	sum of dichlorodiphenyltrichloroethane and its derivatives
DQMP	Data Quality Monitoring Plan
DQOs	data quality objectives
DUOs	data use objectives
EIM	Environmental Information Management
ENR	enhanced natural recovery
EPA	United States Environmental Protection Agency
ERDC	Engineer Research and Development Center

ESD	Explanation of Significant Differences
FC	Field Coordinator
FWM	food web model
Geosyntec	Geosyntec Consultants, Inc.
Germano	Germano and Associates
GSI	GSI Water Solutions, Inc.
Hart Crowser	Hart Crowser, Inc.
HSP	Health and Safety Plan
ICs	Institutional Controls
L	liter
LSS	Legacy Site Services
LWG	Lower Willamette Group
MDL	method detection limit
MNA	monitored natural attenuation
MNR	monitored natural recovery
NELAP	National Environmental Laboratory Accreditation Program
NPL	National Priorities List
NWIS	National Weather Information System
ODEQ	Oregon Department of Environmental Quality
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCI	Participation and Common Interest
PDI	pre-remedial design investigation
PES	polyethersulfone
PHSS	Portland Harbor Superfund Site
PII	Personal Identification Information
Pre-RD	Pre-Remedial Design
PRP	potentially responsible party

PTW	Principal Threat Waste
PVC	polyvinyl chloride
QA	quality assurance
QAPPs	quality assurance project plans
QC	quality control
RALs	Remedial Action Levels
RAOs	Remedial Action Objectives
RI/FS	Remedial Investigation/Feasibility Study
RM	river mile
ROD	Record of Decision
SAP	Sampling and Analysis Plan
Site	Portland Harbor Superfund Site
SMA	sediment management area
SMB	smallmouth bass
SOW	Statement of Work
SWACs	surface weighted average sediment concentrations
TOC	total organic carbon
TSS	total suspended solids
TZW	transition zone water
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS) to delineate and better refine the sediment management area (SMA) footprints, refine the Conceptual Site Model (CSM), determine baseline conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017).

The pre-remedial design investigation (PDI) study is intended to meet many of the ROD objectives and to support the allocation process. Table 1 lists the data that will be collected to satisfy these objectives. This PDI scope of work focuses on Site-wide studies that will more thoroughly define the remedial actions to support the 30% design, including refining the surface delineation of the SMAs, reevaluating technology assignments throughout the Site, evaluating the horizontal and vertical extent of the dredging and capping areas; and refining the extent of active versus passive remedial actions at the Site. It also re-baselines the Site and achieves many of the baseline dataset objectives outlined in the ROD. The Work Plan does not include SMA-specific design-level sampling, nor source control evaluations, which could be conducted during future remedial design. The data collected as part of this scope of work are not intended to provide final conclusions for the Site. Additional data collection as a part of separate scopes of work will be needed to support future remedial design efforts.

This Work Plan, prepared by Geosyntec Consultants, Inc. (Geosyntec) and AECOM Technical Services (AECOM), is a focused and foundational step in what will likely be a multi-phase effort to bring current the collection of data over the past 15 years. It provides an overview of studies that will be prepared for pre-remedial design investigation at the PHSS located in Portland, Oregon. The Work described in this Work Plan will be conducted by a group of industrial parties called the Pre-Remedial Design Investigation (Pre-RD) Group. This Work Plan was prepared in general accordance with the Superfund Remedial Design and Remedial Action Guidance document (EPA 1985).

1.1 Site Description

The Site extends from river mile (RM) 1.9 near the mouth of the Willamette River to RM 11.8 (Figure 1). The Willamette River is a dynamic waterbody that originates within Oregon in the Cascade Mountain Range and flows approximately 187 miles north to its confluence with the Columbia River. Its average flow rate is 33,000 cubic feet per second (cfs), with high season rates of 200,000 cfs or higher (EPA 2016a).

The Site includes a water-dependent, highly industrialized area, which contains a multitude of facilities and both private and municipal outfalls. Land use along the Lower Willamette River in the Portland Harbor includes marine terminals, manufacturing and other commercial and municipal operations, and public facilities, parks, and open spaces (EPA 2016a). The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upstream Reach extending from RM 16.6 to RM 28. For purposes of the PDI, the Work Plan is focusing on RM 11.8 to RM 20 for data collection to assess incoming contaminant loads to the Site. Collectively, the Downtown Reach and Upstream Reach are referred to as the Upriver Area for purposes of this PDI.

The shorelines along most of the Portland Harbor area have been developed for industrial, commercial, and municipal operations; the Portland Harbor area serves as a major shipping route for containerized and bulk cargo. In addition, the Portland Harbor area has historically received, and currently receives, discharges from industrial and municipal sources including point- and non-point sources that discharge to the Lower Willamette River. Common shoreline features within the harbor include constructed bulkheads, piers, wharves, buildings extending over the water, and steeply-sloped banks armored with riprap or other fill materials. Site background and other site characteristics are described in detail in the Final Remedial Investigation (RI) Report (EPA 2016a).

On 1 December 2000, the Site was listed on the National Priorities List (NPL) by EPA mainly due to concerns about contamination in the sediments and the potential risks to human health and the environment from consuming fish. The most widespread contaminants found at the Site include, but are not limited to, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), dichlorodiphenyltrichloroethane and its derivatives (DDx), and dioxins/furans (D/F). A remedial investigation and feasibility study (RI/FS) was initiated in 2001 by a small subset of potentially responsible parties (PRPs) known as the Lower Willamette Group (LWG), and completed by EPA in 2017 (EPA 2017).

In June 2017, the Pre-RD Group developed and offered a pre-remedial design scope of work focused on defining current conditions for specific media and refining delineation of active remedial areas to EPA. Over the next two months, EPA and the Pre-RD Group held several scoping meetings to negotiate study objectives, data collection activities, and data interpretation; the scope was expanded to address several baseline study elements desired by EPA. In September 2017, the EPA entered into an Administrative Settlement and Agreement Order on Consent (ASAOC) with the Pre-RD Group to conduct the agreed upon Work at the Site. This Work Plan supports the Statement of Work (SOW) which is an attachment to the ASAOC, and describes the specific field investigation activities, data analyses, schedule, and deliverables for the PDI. The Work Plan is included as an attachment to the SOW.

1.2 Remedy of Record

The remedy selected in the ROD (EPA 2017), called Alternative F Modified (Alt F Mod), identified 394 acres of engineered remediation with a combination of remedial technologies (Figure 2). The remedy includes 365.4 acres of capping and dredging contaminated sediment above Remedial Action Levels (RALs) and 28.2 acres of enhanced natural recovery (ENR) within the Site. The RALs are listed in Table 2. Alt F Mod addresses all areas where contaminant concentrations exceed the cleanup levels (Table 3) through a combination of dredging, capping, ENR, monitored natural recovery (MNR), and Institutional Controls (ICs). The ROD indicates that EPA expects 215.2 acres of sediment will be dredged to varying depths and 140.1 acres will be capped, or partially dredged and capped. Additionally, 23,305 lineal feet of riverbank are assumed to be excavated and covered with either an augmented reactive cap or an engineered cap using beach mix or vegetation after excavating. Under Alt F Mod, approximately 3,017,000 cubic yards (cy) of contaminated sediment and 123,000 cy of soil were estimated by EPA to be removed and transported to off-site disposal facilities. About 1,774 acres are designated for MNR (EPA 2017).

The SMAs represent areas which EPA considered to have contaminant concentrations in surface sediment where natural recovery is not occurring or is not likely to be effective in reducing concentrations of contaminants of concern (COCs) within a reasonable time frame (EPA 2017). Additionally, EPA used the presence of Principal Threat Waste (PTW) as defined in its FS (EPA 2017), and used in-situ treatment areas for PTW to delineate SMAs.

The ROD states that the in-river construction duration for Alt F Mod will be approximately 13 years at a pre-engineering estimated cost of $1.7 billion (non-discounted). The remedy will likely change somewhat during the remedial design and be adapted during the multi-year construction process. Changes to the remedy will be documented using a technical memorandum in the Administrative Record, an Explanation of Significant Differences (ESD), or ROD amendment (EPA 2017).

The remedial actions identified in the ROD address nine narrative remedial action objectives (RAOs) that EPA developed for the Site for environmental media of interest and exposure pathways, including exposure routes and receptors. The ROD defined numeric, concentration-based cleanup levels to achieve these RAOs for each exposure route (and tissue targets for seafood consumption RAOs). The cleanup levels considered conservative risk assessments, applicable or relevant and appropriate requirements (ARARs-based), and background concentrations (background-based). Achieving the RAOs relies on the remedy's ability to meet cleanup levels or tissue targets. Fish tissue targets will be used to update fish advisories, assess whether the remedy will achieve RAOs, make adjustments to best management practices (BMPs); their uses will be further defined in the monitoring plans. Table 3 presents the COCs for the Site and respective cleanup levels by media as presented in the ROD. Site-specific cleanup levels were developed for each RAO for the following media: sediment (including beaches) and riverbank soil, surface water, and groundwater (EPA 2017).

1.3 Pre-Remedial Design Data Use Objectives

The Pre-RD Group proposes to conduct a comprehensive 2018 synoptic sampling program of surface sediment, select sediment cores, fish tissue, surface water, background porewater, and bathymetry/fish tracking studies. These investigation activities are focused on achieving the following goals:

1. Implement investigation baseline sampling to update existing site-wide data;
2. Gather data to be used as part of a long-term trend analysis;
3. Define more clearly the remedial actions that will be performed at the Site, including further delineation of SMAs, reevaluation of technology assignments throughout the Site, refinement of the horizontal and vertical extent of the dredging and capping areas and the scope and extent of active remedial actions at the Site;
4. Collect data to facilitate completion of the third-party allocation amongst PRPs;

5. Collect additional data regarding upstream conditions and contaminant loading into the Site; and
6. Update the baseline human health risk and refine understanding of the food web model (FWM) using new 2018 data.

Table 1 lists the data that will be collected to achieve these goals. The Pre-RD 2017/2018 data will be used to determine current SWACs, human health risks, and background concentrations associated with both upriver and Site conditions. This sampling program provides a technically sound and robust balance of: (i) near-term initiation of field work; (ii) prioritizing field data collection of studies that provide informative updates to the Site baseline; and (iii) supporting the Participation and Common Interest (PCI) Allocation Team's need to reduce remedy uncertainty.

This Work is further supported by the ROD and the goal of considering new data. As stated in Section 2.7.3 of the ROD Responsiveness Summary (EPA 2017), "*EPA agrees with the importance of considering new data during decision making and that decisions should have built in flexibility to accommodate an updated understanding of site conditions. However, it is important to have a representative data set that establishes 'baseline conditions' prior to initiating a response action.*" And "*EPA expects remedial footprints to be refined based on data collected during remedial design.*" Also, "*Pre-design sampling will be used to ensure that the natural recovery is factored into the design and implementation of the sediment remedy and post construction monitoring will be used to evaluate natural recovery following remedy implementation.*"

2. SITE BACKGROUND

This section provides a summary of Site physical conditions, risks above protective levels, COCs, and Site investigations completed after the data cut-off for completion of the RI/FS.

2.1 Physical Conditions

The lower Reach of the Willamette River extending from RM 0 to approximately RM 26.5 is a shallow segment that is tidally influenced with river flow reversals occurring during low-flow periods as far upstream as RM 15. The portion of the river where the federal navigation channel is maintained at -40 feet Columbia River Datum (CRD) defines Portland Harbor and extends upstream from the Columbia River (RM 0) to the Broadway Bridge (RM 11.7) (EPA 2017). The Willamette River channel, from the Broadway Bridge (RM 11.6) to the mouth (RM 0), varies in width from 600 to 1,900 feet.

The high tide can influence Willamette River levels by up to 3 feet in Portland Harbor when the river is at a low stage. Tidal fluctuations during low river stage can result in short-term flow reversals (i.e., upstream flow) in late summer to early fall. Low water typically occurs during the regional dry season from August to November. The winter (November to March) river stage is relatively high, but variable, due to short-term changes in precipitation levels in the Willamette basin. Finally, a distinct and persistent period of relative high water occurs from late May through June when the Willamette River flow into the Columbia River are slowed during the spring freshet by the high-water stage in the Columbia River (EPA 2016a).

Factors controlling river flow dynamics, sediment deposition and erosion, and riverbed character appear to be the river cross-sectional area, thalweg location, and navigation channel width. The upstream boundary of the Site to Willamette Falls is narrower, more confined by bedrock outcrops, and faster flowing than the Portland Harbor Reach. The river widens as it enters the Site and becomes increasingly depositional, most notably in the western portion of the river, until RM 7. From approximately RM 5 to RM 7, the river and navigation channel narrow; this Reach is dominated by higher energy environments with little deposition. From RM 5 to approximately RM 2, the river widens again and becomes depositional, particularly in the eastern portion.

Long-term net sedimentation rates based on time-series bathymetric surveys show patterns of general shoaling in wider reaches. Wide areas of deposition occur in the channel and along channel margins in the broader sections of the river (RM 1.5 to 3 [eastern margin], RM 4 to 5, and RM 7 to 10). These areas are known to be long-term sediment accumulation areas based on historical dredging records. Shoaling is the dominant change observed, with 26% of the riverbed surveyed showing net accretion (January 2002 to January 2009) exceeding 1 foot (30 centimeters), whereas net erosion exceeding 1 foot is noted in only 5% of the riverbed overall.

Downstream of the Site, the river narrows as it turns and converges with the Columbia River. The Multnomah Channel exits at RM 3, reducing direct discharge to the Columbia River. From 1973 through 2007, average annual mean flow in the Willamette River was approximately 33,800 cfs at the Morrison Bridge (near RM 12.8) (http://waterdata.usgs.gov/or/nwis/sw) (EPA 2016a).

2.2 Summary of Site Contaminants and Risks

The baseline human health risk assessment (BHHRA, Kennedy/Jenks 2013a) and the baseline ecological risk assessment (BERA, Windward 2013) concluded that contamination within the Site poses potential unacceptable risks to human health and the environment from numerous contaminants of potential concern (COPCs) in surface water, groundwater, sediment, and fish tissue. The RI/FS reduced the list of COPCs to COCs, as presented in Table 17 of the ROD.

As stated in Section 10.1 of the ROD, "The COCs used to define the SMA boundaries encompassed most of the spatial extent of contaminants posing the majority of the risks as identified in the baseline risk assessments. However, since it is difficult to design a range of alternatives for multiple COCs that have different distributions in various media throughout the Site, the FS alternatives were developed using COCs that were the most widespread and posed the greatest risk, called focused COCs." "*These focused COCs, were developed by evaluating colocation of all COCs, their toxicity, and significance in the risk assessments, as well as other factors outlined in the RI.*"

The focused COCs are:

- PCBs;
- DDx;

- total PAHs; and
- Dioxins/Furans.

The remedial footprint of the focused COCs encompasses the majority of the COCs at the Site (EPA 2017). To establish 2017/2018 baseline conditions at the Site, this Work will develop a representative data set by including the full list of sediment COCs presented in Table 3 for surface sediment, surface water, and fish tissue for the initial round of sampling. The data will also be evaluated for purpose of potentially reducing the list of COCs for future monitoring events.

The environmental media contaminated by Site-related contaminants include surface sediment (0 to 30 centimeters depth below mudline [bml]), subsurface sediment (>30 bml), suspended sediment, surface water, groundwater, biota, and riverbanks. The surface sediment sample interval (0 to 30 centimeters) is the point of compliance for the RAOs and cleanup levels, as it represents the biologically active zone (BAZ) and the active mixing zone depth, which is the portion of the sediment column that has the potential to be disturbed or transported under typical conditions (EPA 2017).

Several locations within the Site have relatively high surface sediment concentrations of more than one contaminant. Overall, the patterns of contaminant distribution are as follows:

- Nearshore areas have greater sediment contaminant concentrations than sediments offshore and in the navigation channel;
- Subsurface sediments have greater organic contaminant concentrations than surface sediments;
- Some contaminants, such as DDx and PAHs, have higher concentrations and are more commonly found in the downstream portion of the Site;
- Sediment grain size and concentrations of certain metals are correlated; and
- Multiple contaminants are co-occurring, that is they are co-located with other COCs with respect to horizontal and vertical distribution in the river/sediments (EPA 2016a).

2.3 Summary of Data Collected Since the RI/FS

From 2008 to 2016, eight environmental studies relevant to this Work Plan have been conducted since the RI/FS data were collected. Environmental media included surface sediment grabs, subsurface sediment cores, and smallmouth bass (SMB) fish tissue samples for various COCs. Several studies focused on mainly PCBs. The eight studies are summarized in Appendix A and include the following:

- Downtown Portland Sediment Characterization Phase I and II (GSI Water Solutions, Inc. [GSI] and Hart Crowser, Inc. [Hart Crowser] 2010);
- Smallmouth Bass Tissue Sampling (GSI 2011);
- Smallmouth Bass Tissue Study (Kennedy/Jenks 2013b);
- Sediment Profile Imaging (Germano and Associates [Germano] 2014);
- Final Supplemental RI/FS Study, River Mile 11 East (GSI 2014);
- Sediment Sampling Data Report (Kleinfelder 2015);
- Concentrations and Character of PAH in Sediments in Area of River Miles 5 to 6, (NewFields 2016); and
- Sediment Sampling Data Report, Swan Island Lagoon (Geosyntec 2016).

Recent surface sediment sampling results compared to RI/FS data indicate that newly deposited sediments are covering and/or mixing with the older surface sediments and that natural recovery is occurring in many areas of the Site (Geosyntec 2016; Germano 2014; Henderson 2015). The Oregon Department of Environmental Quality (ODEQ) Downtown Reach investigation found that COCs were much lower than those found in the Site and ODEQ believes the Downtown Reach is not a significant ongoing upstream source (ODEQ 2011).

Analysis of SMB tissue sampling results found that the mean 2012 tissue concentrations were lower than the mean concentrations of the combined 2002 and 2007 SMB data that were used in the RI/FS and statistical comparisons of the two data sets on a Study Area-wide scale. Total PCB congener concentrations in whole body SMB tissue show a statistically significant decrease from the 2002 and 2007 data (Kennedy/Jenks 2013b, Legacy Site Services [LSS] 2015). The 2012 SMB data support that natural recovery is occurring on a system-wide scale. Among these studies, data that have been properly validated will be incorporated into the project database.

3. SCOPE OF WORK TASKS

Each task and field study included in the Work is briefly summarized below and in Table 3. Project goals for each component of the Work are provided in Table 4. Many of the field data will serve multiple data use objectives (DUOs), as shown in Table 5. Table 6 lists the Work studies including media, sample counts, and analyses. Figures 4, 5, and 6 show the approximate sampling locations for sediment, tissue, and surface water, respectively. The surface sediment sample plan shown in Figure 4 reflects an earlier draft of the sampling plan[1]. The final sample design for surface sediment will be depicted in the Sampling and Analysis Plan (SAP) for sediment sampling and follow the approach described in Appendix B.

3.1 Task 1: Quality Assurance Project Plans (QAPP, SAP, DQMP)

Details regarding these sampling efforts will be further refined in quality assurance project plans (QAPPs) to be prepared following this work plan. These documents will include a QAPP, SAP, and Data Quality Monitoring Plan (DQMP), and will be prepared in accordance with EPA standards and previously-approved RI documents for the Site. A health and safety plan (HASP) will also be prepared. These PDI project plans will be focused and targeted plans, or addendums; they will appropriately reference the RI plans as source documents and then describe and document any changes relevant to the PDI scope of work.

The QAPP will address all sample collection activities as well as sample analysis and data handling regarding the Work. The QAPP will be developed in accordance with *EPA Requirements for Quality Assurance Project Plans, QA/R-5, EPA/240/B-01/003* (March 2001, reissued May 2006); *Guidance for Quality Assurance Project Plans.*, QA/G-5, EPA/240/R 02/009 (December 2002); and *Uniform Federal Policy for Quality Assurance Project Plans*, Parts 1 3, EPA/505/B-04/900A though 900C (March 2005).

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[1] The earlier plan (as shown in Figure 4) indicated 345 unbiased surface sediment samples. The revised plan will consist of 428 unbiased samples, placed randomly according to the procedures detailed in Appendix B. The final arrangement of the 428 unbiased sediment samples and additional 212 surface sediment samples for SMA delineation will be provided in the SAP.

A FSP, incorporated as a subsection of the QAPP, will provide objectives and minimum sampling requirements. The FSP will include guidelines for sediment, surface water, porewater, and SMB tissue sampling.

The DQMP will include analytical laboratory Quality Assurance Plans and internal data validation procedures, along with standard quality assurance/quality control (QA/QC) procedures. All chemical analysis will be performed by a National Environmental Laboratory Accreditation Program (NELAP) accredited lab. Analytical laboratories will conduct QA/QC as detailed by their respective laboratory quality control procedures and manuals. Standard method and operating procedures, calibration, internal QC, and preventative maintenance are examples of QA/QC processes to improve accuracy and precision. All laboratory QC analysis results will be reported with the final data report. Failure of any QC samples to meet QC criteria will be noted and the data which corresponds to these samples will be adequately qualified in the final report. Records of QA/QC will be maintained for review as needed. Field QA/QC procedure will include the collection of field duplicate samples which will be analyzed for the same set of physical and chemical analyses, along with equipment blank and field blank samples as appropriate. It will be the responsibility of the analytical laboratories to provide accurate results in electronic and hard copy formats, along with Level III Data Validation packages consistent with laboratory Quality Assurance Plans. Data provided by the laboratory will undergo data validation by a third party. Data validation is analyte- and sample-specific, and extends the evaluation of data beyond method, procedural, or contractual compliance to determine the analytical quality of a data set. Data will be validated and qualified as outlined in project specific QAPPs.

The HASP will describe all activities to be performed to protect onsite personnel and area residents from physical, chemical, and all other hazards posed by the Work. The HSP will be developed in accordance with EPA's Emergency Responder Health and Safety and Occupational Safety and Health Administration (OSHA) requirements under 29 C.F.R. §§ 1910 and 1926.

A few notable details relevant to these Project Plans include:

- Surface sediment will be collected from the 0- to 30-centimeter interval, which is the point of compliance throughout the Site and incorporates the BAZ and the active mixing zone depth;

- Chemical analyses for surface sediment, surface water, and fish tissue will include the full list of COCs for each media [excluding PAHs in tissue] as presented in Table 6;
- Chemical analyses for subsurface sediment will include the focused COCs (PCBs, PAHs, D/F, and DDx) which have corresponding RALs;
- A DUO for surface sediment and tissue is to establish baseline Site-wide and segment-wide 95% upper confidence limit on the mean (95UCL) concentrations or SWACs for the focused COCs;
- The sampling program of synoptically-collected surface sediment, SMB tissue, and surface water data collected from the Site is a substantial baseline study effort (further described in Section 3);
- Sediment and SMB tissue data collected from the Upriver Area will be evenly distributed between the Downtown Reach and the Upstream Reach; and sampling locations will target fine-grained sediment; the PDI objective is to evaluate background concentrations of COCs coming into the Site;
- The home range of SMB will be evaluated over a year-long study in collaboration with the United States Army Corps of Engineers (USACE);
- The Site-wide bathymetry survey is intended to refresh and update the surface bed elevations to current conditions and fill-in no coverage areas (especially nearshore) to support the 30% design; and
- Background concentrations of naturally-occurring metals in porewater will be evaluated for arsenic and manganese; sampling locations will be developed in collaboration with EPA.

3.2 Task 2: Sampling and Analysis

The DUOs, sampling design, and analytical methods for the PDI are discussed below. The PDI includes the following tasks involving several multi-media sampling and analytical testing activities:

- Site-wide bathymetry survey;
- Surface sediment sampling;

- Fish tissue sampling;
- Surface water sampling;
- Sediment coring;
- Fish tracking study;
- Camera survey;
- Downtown/Upstream Reaches (Upriver) background study;
- Background porewater study; and
- Reporting

3.2.1 Bathymetry Survey

A bank-to-bank bathymetry survey throughout the Site will document current bed elevations relative to the remedial technology assignment requirements (per the ROD decision tree) and to assess changes in elevation/sedimentation over the past 15 years and to evaluate mudline elevations. Multibeam sonar will be used to collect high-resolution data with up to 100% coverage of the riverbed. The Site-wide multibeam bathymetry survey will be supplemented with lead-line measurements along the shoreline banks and difficult-to-access areas for better coverage than provided by multi-beam alone.

This survey will produce an up-to-date bathymetric data set with a high level of detail and accuracy. The multibeam bathymetric data will be used to create a digital terrain model of the riverbed morphology from which hill-shade images will be generated. Results may also serve as a line of evidence relevant for the evaluation of riverbed slope conditions, natural recovery, and bed stability (e.g., erosional versus depositional areas).

The most recent bathymetry survey was performed in 2002. The new bathymetry data will also be used to help identify target areas for surface sediment sampling, refine the elevation clearances for dredging and capping, and adjust the estimated dredge volumes (to reduce uncertainty for allocation associated with the extent of the active remedial footprint and remedial technologies assigned to them). The anticipated schedule for the bathymetry survey is the end of 2017 (December 2017).

3.2.2 Surface Sediment Sampling

Many of the surface sediment data for the Site are over 10 years old. The goals of new surface sediment data collection are to: re-baseline the river bed to establish current conditions and SWACs, refine the active remedial SMA footprints, and evaluate natural recovery changes since 2004. Because Portland Harbor is part of a dynamic river system, current concentrations for all COCs are expected to be different than the data set used in the RI. The synoptic surface sediment sampling, fish tissue, and surface water samples (discussed below) data will provide an empirical and statistically valid dataset for re-baselining the river and evaluating the CSM.

Nine Segments

Previous analyses (Wolf 2015a; Wolf 2015b; and Toll et al. 2015) found that the river is spatially and chemically unique and can be properly stratified into five river segments including the Swan Island Lagoon, each about 2 to 3 miles long. The Pre-RD Group will divide the Site into five segments spanning the length of the Site for evaluation of surface concentrations and SWACs, based on physical features, river flow dynamics, contaminant distributions, and fish home ranges (Figure 3). Four of the five segments will be further divided down the center of the navigation channel into two segments each, east and west, thereby forming eight segments. A ninth segment is between RM 8 and RM 9 at Swan Island Lagoon. The nine segments from upstream to downstream (as shown in Figure 3) are: Segment 1 E&W (RM 11.8 to 9), Segment 2 E&W (RM 9 to 7.5), Segment 3 E&W (RM 7.5 to 5), Segment 4 E&W (RM 5 to 1.9), and Segment 5 (Swan Island Lagoon).

A key use of the new data (along with the fish tracking results and determination of SMB home ranges) will be to confirm the representativeness of these segment delineations, then estimate SWACs Site-wide and other spatial scales.

GeoStatistics

Several stratified/random/equal allocation methods of statistical analysis were used to estimate the appropriate sample size within the Site needed to satisfy the DUOs described above. A summary of the geostatistical analysis, approach, and findings is summarized in Appendix B. As detailed in Appendix B, the sample count was determined by considering the number of surface sediment samples needed in each segment to maintain or improve upon the level of variability in the SWACs generated using the 2004 data, and, in most areas and assessment segments, enable the design to statistically detect differences (α = 0.05) between 2004 SWACs and current SWAC estimates with an approximate 80% level of statistical power. Based on this analysis, an estimated 640 discrete surface sediment samples are needed to yield a statistically-robust new data set for calculating SWACs, with 428 unbiased locations within the Site and 212 additional samples specifically located for accurate SMA delineation. This new dataset will replace older RI/FS data for the purposes of refining the SMA footprints and technology selections described in the ROD.

Sampling Methods

Surface grab samples will be collected with a hydraulic power grab sampler from 640 locations (Figure 4). The surface sediment sample locations presented in Figure 4 reflects an earlier draft of the sampling plan, are shown in this document for example purposes only, and do not reflect final placement and numbers of the final design. The final sample design for surface sediment sampling will be depicted in the SAP and follow the approach detailed in Appendix B. The final sampling effort will include approximately 108 stations co-located with previously analyzed stations in the RI/FS. The hydraulic power grab sampler will collect sediment from the upper 0 to 30 centimeters of sediment at three sampling points at each sample location (without adjusting vessel location), and homogenized into a three-point composite sample for chemical analysis of the full list of sediment COCs, total organic carbon (TOC), and grain size. The three-point composite sample will be collected within a relatively small footprint around the anchored sampling vessel. For example, grab #1 will be deployed, accepted, and processed on the deck of the vessel. The sampling vessel's overhead winch may pivot 5 to 10 feet from the original sample location, and the process will be repeated until there is an equal volume of sediment from the three grabs. The volume will be homogenized until uniform in color and texture, then processed (described in QAPP/FSP).

For consistency purposes, surface sediment grab samples will be collected using the RI data collection protocols. The anticipated schedule for the surface sediment sampling is the first quarter of 2018.

3.2.3 Fish Tissue Sampling

The primary objectives of the fish tissue sampling study include collecting the data needed to:

- Characterize current levels of selected COCs in resident fish tissue (SMB) on a Site-wide basis and smaller spatial scale (pending results of the fish tracking study);
- Characterize upriver background concentrations in resident fish tissue (SMB);
- Update statistically-based evaluations of PCB differences and changes in fish tissue; and
- Evaluate the bioaccumulation model used to relate sediment and tissue concentrations (input new SWACs, fish tissue, and surface water concentrations into the model).

The study includes collection of synoptic SMB data to re-baseline resident fish tissue concentrations in the river, evaluate MNR changes, refine the understanding of the FWM, and update human health fish consumption risks. The scope includes collection of 95 whole body discrete (non-composited) samples from the Site, plus 20 from the Downtown Reach and 20 from the Upstream Reach (D/U Reach). While 95 SMB samples within the Site and 40 SMB samples from the D/U Reach will be targeted, the number collected will be to the extent sufficient numbers or fish are present. The overall sample design is consistent with the approved 2012 SMB sample design.[2] The sample design targets 20 to 30 samples in each of the 4 segments (described previously), including 5 samples in Swan Island Lagoon (Figure 5). A statistical analysis of the 2012 SMB data indicates that replicating the 2012 program sample size will allow detections of statistically significant ($p<0.05$) concentration differences for PCBs in SMB. A summary of the statistical power analysis performed for fish tissue sample size is provided in Appendix C. Within the D/U Reach, the 40 samples will be collected from locations throughout the Reach. Consistent with the 2012 sampling, SMB that are 225 to 355 millimeters in total length (approximately 9 to 14 inches) will be targeted.

All fish tissue samples will be analyzed for lipids and the COCs presented in Table 6 (with the exception of PAHs). Samples will be analyzed as individual whole-body

[2] The design is also consistent with the 2011 SMB study performed by EPA, the State of Oregon, and the City of Portland (GSI 2011). The analytical laboratory contracted by EPA incorrectly prepared 75% of the samples as skin-off fillets, discarding the remainder of the carcass instead of processing the whole fish. Thus, tissue chemistry results from the 2011 sampling effort are limited.

specimens, and fillet concentrations will be estimated using the SMB whole body to fillet ratios presented in the final Feasibility Study (EPA 2016b), as supported by analysis of the Round 3B SMB tissue data (see Appendix D). Collection methods will include hook and line with electroshock back-up if needed. The anticipated schedule for the fish tissue sampling is late summer of 2018, consistent with previous tissue sampling events.

3.2.4 Surface Water Sampling

The objective of surface water sampling is to re-baseline river conditions with synoptic data (sediment, fish tissue, surface water), evaluate surface water current conditions and changes, and provide 2017/2018 data to update current risks. Surface water will be collected from seven transect locations over three sampling rounds. Figure 6 presents the locations of the transects, located at approximately:

- RM 1.8 at the downstream boundary (within the Site, Segment 4);
- Downstream boundary in Multnomah Channel; entrance to channel is near RM 3;
- RM 4;
- RM 7;
- RM 8.8;
- RM 11.8, just upstream of Site, near Upstream boundary; and
- RM 16.2, further upstream, near the Downtown Reach/Upstream boundary.

These locations will effectively characterize the four segments of the Site RM 1.9 to 5 (Segment 4); RM 5 to 7.5 (Segment 3); RM 7.5 to 9 (Segment 2); and RM 9 to 11.8 (Segment 1).

The purpose of sampling is to characterize the flow and quality of surface water passing through the river's cross section at each location. These locations were targeted to provide spatial coverage and analyze physical changes in the river dynamics.

One composited sample will be collected per transect (similar to the RI/FS data use approach). The sample will be vertically-composited and horizontally-composited along the transect. Composite samples will be collected by sampling equal volumes from three locations (east shore, navigation channel, and west shore) and at three depths per location

– upper (three feet below water surface), near bottom (three feet above sediment surface) and middle (equal distance between upper and bottom). The objective of the composite sample design is equal volume across the cross-sectional area of the segment. The target volume will be collected from nine discrete subsample locations across the transect. However, if the nearshore areas have shallow water depths (i.e., less than 10 feet), fewer subsamples may be collected. Volumes will be adjusted such that equal volume of surface water is collected from the east shore, navigation channel, and west shore.

Surface water sampling will be conducted over three events targeting different months and flow conditions to capture seasonal variability of surface water conditions. For PDI investigations, sampling will target three seasonal events: (i) August, during summer low flow conditions; (ii) January/February, during winter high flow conditions; and (iii) November/December, targeted for storm flood-influenced conditions and consistency with previous sampling events. For the PDI effort, the time of year for sampling will be the primary factor (coverage throughout the year) and the water level/river flow will be a secondary consideration factor for selecting when to sample.

During the RI, two sets of sampling events occurred: one during Round 2A and one during Round 3A (EPA 2016a). Each set of sampling events targeted a low-flow, high-flow, and stormwater-influenced condition. Low-flow events occurred throughout the year in November 2004, March 2005, July 2005, and September 2006. For all low-flow events, the average flow was less than 19,400 cfs. High flow events occurred in January 2006 and January 2007, during which average flow was greater than 59,800 cfs. One stormwater influenced event occurred in November 2006, during which average flow was 23,000 cfs.

Flood conditions will be checked relative to the United States Geological Survey (USGS) Real Time National Weather Information System (NWIS) Database for the Morrison Bridge station 14211720. Consistent with the RI, high river flow events will be characterized as >50,000 to 100,000 cfs and low flow events will be characterized as within or less than historic average flows (15,400-24,700 cfs from 1998 to 2003). Surface water average monthly discharge, velocity, height, and rainfall are shown in Figure 7 for 2010 through the most recent data available in 2016.

Surface water data will be collected using a high-volume pumping system connected to a XAD-2 resin filter and column (hydrophobic polyaromatic resin) to collect hydrophobic organic compounds for analysis by ultra-low detection limit analytical methods (consistent with RI/FS approaches and methods). Surface water will be pumped through a Teflon lined polypropylene tubing, 140-micrometer (µm) stainless-steel pre-filter, 0.5-µm glass fiber filter cartridges, and XAD-2 resin beads packed inside stainless-steel canisters. A target volume of 300 liters (L) of water will be pumped through the system from three discrete vertically composited locations per transect for a single composite sample per transect as described above. XAD sampling is expected to result in method detection limits (MDLs) for DDx, Chlordanes, PCBs, and PAH that are at or below ARARs, and MDLs for Aldrin and D/F that are equivalent to those achieved in the RI.

Surface water samples will also be collected using a peristaltic pump for the analysis of semi-volatile organic compounds (SVOCs), metals, and non-chemical parameters (e.g. total suspended solids [TSS]). Surface water samples collected via peristaltic pump will be collected in accordance with RI procedures. In brief, surface water will be drawn through pre-cleaned acid washed Teflon tubing, following purging of at least 5 times the required sample volume. Surface water from each vertically-integrated location will be combined in a laboratory provided container. Once all locations on a single transect have been sampled, surface water will be homogenized, filtered as needed and allocated to individual laboratory sample containers for analysis. Peristaltic pump samples are expected to reach MDLs at or below ARARs for all metals with the exception to arsenic. Select organics measured via peristaltic pump are expected to achieve MDLs similar to those in the RI; however, some remain above ARARs. SVOCs will not be analyzed via XAD sampling due to analytical interferences and to remain consistent with RI methods. However, lower MDLs than those listed in Table 6 may be achievable in coordination with the selected lab.

Each sample will be analyzed for suspended solids in the water column (TSS), particle size distribution, and chemical testing for the COCs presented in Table 6. XAD analytes (PCB congeners, DDx, PAHs,[3] and D/F) will be reported as dissolved and particulate phase results. Filtered peristaltic pump samples will be analyzed for dissolved metals and dissolved organic carbon; unfiltered samples will be analyzed for total metals, select organics (see Table 6), tributyltin, and conventionals. Field parameters will include temperature, pH, dissolved oxygen, oxidation-reduction potential (ORP), flow rate velocity, and conductivity. Field parameters will be measured real-time in situ at each

[3] Surface water PAH samples may be collected by peristaltic pump method pending additional review of previous data.

location using a YSI Multiprobe Water Quality Meter or equivalent. Water quality meters will be calibrated per manufacturer's specifications each day prior to sampling.

The anticipated schedule for the surface water sampling is winter 2017 through summer 2018. A total of 15 water samples (7 total, 7 dissolved, and 1 quality assurance/quality control [QA/QC]) will be analyzed per event, for a total of 45 samples.

3.2.5 Subsurface Sediment Sampling

Subsurface sediment (core) sampling will be conducted in targeted areas within or along the boundaries of SMAs that have limited data coverage to refine the active footprint boundaries of the Alt F Mod SMA footprints. The goal of this study is to refine the horizontal and vertical extent of contamination at concentrations greater than the RALs at depth for the purpose of supporting the 30% design, to confirm the CSM, and to refine the dredge volumes for 30% design cost estimation.

A total of 90 core locations are planned based on visual distribution of subsurface contamination, using 250- to 300-foot distance as a general guide to the next nearest coring location. In some cases, stations will be reoccupied to determine the vertical extent of contamination where previous cores did not "tag bottom", and in other cases, a new core will be collected in an active footprint area where none previously existed.

Core locations, rationale, target depths, and analytes are provided in Table 7a. Table 7b presents the rationale for the core placement location and target depth. Target depths were based on the vertical extent of contamination observed in surrounding cores, anticipated depth of native material, or an additional 2- to 4-foot sample depth if previous cores did not reach the bottom of contamination ("tag bottom"). Cores will be advanced using a vibracore, impact core, diver push core, or similar device from a floating platform with an experienced subcontractor and field collection team. The QAPP/FSP will provide more details.

Cores will be visually logged using American Society of Testing Materials (ASTM) and RI procedures (e.g., correcting for compaction), then subsampled into 2-foot increments unless stratigraphy indicates otherwise. Planned coring locations (Figure 4) may be adjusted after the SMA footprints have been revised based on 2018 surface sediment sampling results. Subsurface sediment samples will be analyzed for focused COCs, TOC, and grain size as outlined in Table 7a. Deeper intervals will be archived frozen pending the chemical results (> RALs) of selected intervals.

Geotechnical characterization of subsurface sediment will include index testing (e.g., moisture content, grain size, and TOC) and relevant field parameters (field torvane test as a measure of shear strength).

3.2.6 Fish Acoustic Tracking Study

An acoustic fish tracking study is planned to capture fine-scale temporal and spatial movement of SMB at the Site, pending pilot study results. A pilot study conducted in June 2017 involved deployment of an array of acoustic receivers from two vendors in two different types of environments within the river system (quiescent and active). Willamette Cove was selected as the more quiescent location, and RM 11.5 East as the more active location (Figures 8 and 9). The acoustic receivers were mounted on the bottom of the river and deployed for one week (13 through 19 June 2017). The pilot test included mobile and stationary testing of acoustic tags to evaluate the range of reception and position accuracy of both vendor's systems.

Preliminary analysis of pilot study results supports the technical feasibility of a Site-wide study that will provide data on SMB movement in the Lower Willamette River. A properly designed array of acoustic receivers can provide fine-scale and presence/absence data that can be used to understand SMB movement in the Study Area. The full-scale study will be conducted over a one-year period to capture seasonal home range patterns. Using a more refined acoustic telemetry approach than the historical (2000-2003) radiotracking study (Freisen 2005), the results will re-evaluate where and to what extent SMB stay within the 1-mile exposure areas assumed in the risk assessments and FWM.

The results will be used to: (i) inform the fish tissue sampling plan scheduled for late summer 2018; (ii) refine the SWAC segments used to evaluate changes in surface sediment concentrations; (iii) refine understanding of the FWM and reduce uncertainty about remedy effectiveness for fish tissue recovery; and (iv) help inform a future ICs plan. The anticipated schedule for the full-scale fish tracking study is fourth quarter 2017 through 2018. The work will be performed in collaboration with Dr. Karl Gustavson, EPA Office of Superfund Remediation and Technology Innovation (formerly USACE) and experienced staff from USACE Engineer Research and Development Center (ERDC).

3.2.7 Camera Survey of Anglers

A camera survey of anglers is planned to collect data on the location and frequency of people fishing along the river. The results will provide an empirical line of evidence on frequency and duration of angler trips over a year-long period that can be used to support the development of ICs (e.g., targeted locations and seasons for messaging). During the fish tracking pilot study, wildlife cameras were field-tested to assess their suitability and effectiveness for monitoring activity at the river. Four ZenNutt High Definition wildlife cameras were installed to provide coverage of the two offshore areas where fish tracking equipment was deployed (two cameras per location) (Figures 8 and 9). The motion-activated cameras were deployed for the one-week duration of the pilot study, and captured images with clear definition, color, and contrast. The results of the camera pilot study indicate that this type of field camera would be suitable for a larger program in the Study Area.

The camera survey program will consist of photographic documentation of human activity using a network of cameras in the Site. The scope includes installation of 12 stationary cameras at select locations that are known or suspected to be used by anglers or are popular points of access to the river based on prior studies and angler knowledge. Cameras will be pre-set to take photos at 30-minute intervals during daylight hours. This time interval is anticipated to be less than the average amount of time it would take for an angling activity to begin and end within the field of view.

The survey will be conducted over a one-year period to account for seasonal variation in use. Photographs will be uploaded monthly to digital photographic software for visual review and tagging with descriptors (e.g., date, location, time, number of individuals), and stored in a project database. Photographs will be reviewed and facial features redacted to protect privacy. Camera data will be processed and provided to EPA with all Personal Identification Information (PII) removed.

The anticipated schedule for the camera survey is fourth quarter 2017 through 2018.

3.2.8 Downtown/Upstream Reach (Upriver) Study

The Downtown Reach is immediately south (upstream) of the Site between RM 11.8 and RM 16.6 (as defined by EPA). According to EPA, it is bounded between the Site (RM 1.9 to RM 11.8) and the Upstream Reach (RM 16.6 to RM 28.4) and located in the heart of the downtown Portland urban center. It has historically had a higher level of contamination than the Upstream Reach and is in immediate proximity to the Site (EPA 2017); remedial actions have been completed in this area during the last decade. The Upstream Reach was selected as the reference area for evaluating background sediment concentrations in the RI. This area extends from the upstream end of Ross Island Lagoon to approximately 2.5 miles above the Willamette Falls, which was considered generally representative of upstream sediment loading to Portland Harbor. Early (2006) memoranda describe the background Reach from RM 15.5 (upper end of Ross Island) to RM 26 (Willamette Falls), although this was revised to RM 15.3 to RM 28.4 in the Draft RI (in 2009). The upstream extension was to capture the EPA West Linn and Blue Heron Sediment Investigation data from 2007, located upstream of Willamette Falls. The lower boundary changed from RM 15.5 to RM 15.3 due to additional samples collected downstream of RM 15.5.

This component of the Work focuses on the Downtown Reach and Upstream Reach to characterize incoming background loads to the Site. For purposes of this PDI, it is collectively referred to as the "Upriver Area" extending from RM 11.8 to RM 20 and encompasses the Downtown Reach and part of the Upstream Reach. Figure 10a presents the distribution of fine-grained sediment based on historic samples. Sampling of this area includes surface water, surface sediment, sediment traps, and fish tissue sampling in the D/U Reach (Figure 10b), and samples will be collected assuming sufficient fined-grained sediment and fish availability. Half of the targeted surface sediment samples will be collected from the Downtown Reach and the other half will be collected within the Upstream Reach. Data collected during the Work will be used to: (i) better characterize the concentration of COCs immediately upstream of the Site; (ii) better characterize the concentrations of COCs entering the Site in surface water and suspended sediments to assess potential recontamination post-remedy; (iii) refine background concentrations of COCs in surface sediments reflective of an urban background; and (iv) reset achievable remedy targets/ actions.

Surface Sediment

An additional 60 surface sediment samples will be collected from the D/U Reach, with locations targeting fine grain sediments to characterize the mobile sediments likely to be deposited throughout the Site. While a total of 60 surface sediment samples from the D/U Reach will be targeted, the number collected will be to the extent reasonably or technically practicable, based on sufficient fine-grained sediment presence. A desktop study and reconnaissance survey will be conducted in the D/U Reach to identify areas with fine grain sediments prior to sampling. The desktop study will research previous sediment study available grain size data and bathymetry data to select target areas. A reconnaissance survey will be performed to further identify target areas and ground truth results from the desktop study. Figure 10 shows 30 random, locations in the Downtown Reach and 30 locations in the Upstream Reach (locations to be confirmed pending grain size evaluation) with about 25% of the dataset as re-occupied stations (n = 5 and n = 5 from Downtown and Upstream, respectively). Surface sediment samples will be collected as described in Section 2.3.2 and analyzed for the full list of COCs. All validated and acceptable data will be considered in data evaluation (i.e., the topic of potential outliers associated with system errors will be handled by the Peer Review Panel if not resolved by the project team) to fully characterize potential upstream sources. Grain size and organic carbon content will be considered when comparing samples from the Downtown and Upstream Reaches to Site concentrations.

Fish Tissue

An additional 40 SMB samples will be collected from the D/U Reach. Fish tissue samples will be collected as described in Section 2.3.3 and will include whole-body analysis of the COCs presented in Table 6 (with the exception of PAHs). Fish tissue sample locations are presented on Figure 10b.

Surface Water

As noted in Section 2.3.4, two upstream transects for surface water sampling will be included – one in the Downtown Reach at RM 11.8 and one in the Upstream Reach at RM 16.2. Surface water samples will be collected as described in Section 2.3.4 and analyzed for the surface water COCs presented in Table 6. Analysis of total and dissolved analytes via XAD and filtered/unfiltered peristaltic pump samples will match Site surface water sampling as described Section 3.2.4.

Sediment Traps

Sediment traps will be deployed to provide a line of evidence on incoming sediment load to the Site that targets fine-grained, more mobile suspended sediment, and higher-TOC material that is more likely to move downstream and be deposited at the Site. Consistent with methods in the RI, sediment traps will consist of four glass tubes approximately 10 centimeters in diameter and 55 centimeters long.[4] Tubes will be placed inside protective polyvinyl chloride (PVC) sleeves, which will be attached together and secured to a rebar post driven into the sediment floor by divers. The diver will affix the sediment trap assembly to the rebar so that the open tops of the cylinders are 3 feet above the mudline elevation. Two sediment traps will be deployed along each transect (total of four traps). Settling particulate material will be collected in the glass tubes of the sediment trap. For recovery, a diver will cover the tops of each glass tube with foil, detach the trap assembly from the rebar, and the trap will be raised to the surface with the vessel's winch. The glass tubes will be removed from the assembly, kept upright, and allowed to resettle, if needed. The thickness of accumulated sediment will be measured at multiple points around each tube to account for sloping of sediment within the tube. Overlaying water will then be siphoned or pumped off, sediments collected in a stainless-steel mixing container, homogenized until uniform color and consistency is achieved, and placed in the appropriate laboratory provided sample jars. Sediments will be analyzed for the full list of sediment COCs, TOC, and grain size (Table 6). Sediment traps will be sampled in coordination with the surface water sampling program (three events over one year, coordinated with the surface water sampling program).

3.2.9 Background Porewater Sampling

Background metals concentrations in porewater were not defined during the RI, and the focus of a background porewater characterization would be naturally-occurring metals. Background metals porewater concentrations should be developed and cleanup levels adjusted accordingly. Metals, especially arsenic and manganese, are present in relatively high concentrations in volcanic rocks, which are the primary source of Willamette River sediment. Porewater concentrations above ROD cleanup levels may occur in the transitional zone water (TZW) near the mudline, as a result of the geochemistry which favors dissolution of these metals from the mineral components of the sediment.

This component of the Work is intended to place dialysis equilibrium passive porewater samplers (referred to as peepers) in the sediment bed in areas that are representative of background metals in porewater (during periods of low redox, target July/August). Peepers include a glass or polyethylene vial covered with a 0.45-µm polyethersulfone (PES) membrane (see photograph in Figure 11). The interior of a peeper vial consists of

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[4] Note: the top of the trap is oriented parallel to mudline and perpendicular to the direction of flow; need to check with EPA, as their approach as described in the 6 June 2017 scoping plan may be different.

rows of chambers that are filled with distilled deionized water prior to deployment. During deployment, the deionized water approaches diffusive equilibrium with the porewater, over a 2- to 4-week period; the peepers are then retrieved.

Porewater peepers will be deployed in triplicate (for three-point composite samples) at eight locations in upstream areas, or other relevant areas from within the Site. Ideally, these stations would be co-located with surface sediment stations. Locations for porewater sampling will be selected to be representative of redox conditions and variation in source. In general, these areas will include thicker sediment zones, areas downgradient of wetlands or buried lakes, and will consider Columbia and Willamette River provenance. Sample locations will be pre-screened to ensure sediment concentrations are similar to background and redox potential is low. Two potential locations have been identified – adjacent to Port of Portland Terminal 5 at approximately RM 1.8 and adjacent to Miller Creek at the mouth of the Multnomah Channel.

Porewater peeper samples will be deployed from a vessel using a push pole deployment device, and will be deployed with a marker and weighted retrieval line. Porewater samples will be retrieved following two to four weeks of deployment, and porewater will be analyzed for freely-dissolved arsenic and manganese. Porewater results from passive samplers could be compared to laboratory-derived porewater samples from the upstream bulk sediment surface grab locations. A total of 8 samples (3 subsamples will be composited into 1 sample per location) will be collected from a one-time event during low flow conditions.

3.3 Task 3: Data Evaluation

Data collected as part of the Work will be summarized and analyzed to meet several DUOs (see Table 5). Table 8 outlines the data evaluation and interpretation plan. Following completion of field work and chemical analyses, data analyses will be completed and a PDI Evaluation Report will be submitted to EPA. The PDI Evaluation Report will include the following elements:

- Summary of the investigations performed;
- Summary of investigation results and identification of existing conditions;
- Summary of validated data (i.e., tables and graphics);
- Data validation reports (Tier II) and laboratory data reports;

- Photographs documenting the work;
- Angler survey information processed to eliminate all PII;
- Evaluation of current sediment/biota conditions along with background loading to refine active remedy and monitored natural attenuation (MNA) areas;
- Use of bathymetry data to refine the elevation requirements of the active remedy footprint, especially in the intermediate and shallow areas;
- Refinement of the CSM and understanding of current conditions;
- Refinement of sediment recovery curves based on empirical data changes (and confirm RALs);
- Re-calculation of Site-wide and segment-wide surface sediment SWACs using new data; may also consider other spatial scales;
- Evaluation of fish tracking results to refine the extent and segmenting of the river (for calculation of SWACs) and assess fish home ranges used in the FWM;
- Update the surface sediment, fish tissue, and surface water data based on the validated 2017/2018 information obtained during this investigation;
- Assessment of new bathymetry for bed stability and fish/sediment data for monitored natural recovery potential;
- Evaluation of current (2017/2018) upstream background concentrations;
- Update the active remedial footprint by running the new data through the ROD decision tree for assigning remedial technologies,
- Evaluation of the new ROD COC data for purpose of reducing the list of COCs for future monitoring rounds;
- Use of new data to refine our understanding of the FWM and reduce uncertainty about remedy effectiveness for fish tissue recovery and update calculations of baseline fish consumption risks; and
- Support and advance PCI allocation.

Technology assignments will be identified based on sampling data in all areas of the river, as indicated by the decision tree described in the ROD (2017 ROD Figure 28, Appendix I). The decision tree provides detail regarding how design data will influence design and construction and future maintenance dredging. The decision tree allows caps to be used in dredge areas if RALs are not achieved or if PTW remains. This is based on area-specific analysis (EPA 2017). The ROD decision tree describes four compliance regions (ROD Figure 28):

- Navigation Channel and Future Maintenance Dredge area;
- Intermediate Region (outside the navigation channel to -2 feet CRD);
- Shallow Region (-2 feet CRD to shore); and
- Riverbank Region (top of bank down to the river).

The riverbank areas are currently being evaluated under ODEQ-led investigations.

One important component of re-baselining the Site is to evaluate the extent of natural recovery processes as measured by changes in concentrations since the RI. As stated in the ROD (responsiveness summary), "*EPA concurs that natural recovery is occurring within Portland Harbor and that it should be utilized in sediment remedies, as evidenced by the fact that MNR represents the response action assigned to between 64 and 90 percent of the total area of the Site for all alternatives carried through the detailed analysis in the June 2016 feasibility study. However, the rate of natural recovery is expected to vary by location. Pre-design sampling will be used to ensure that the natural recovery is factored into the design…*".

The Work sampling program will be statistically robust to support calculation of Site-wide SWACs and assess spatial patterns without reliance on older data. Figure 12 presents a summary of the PDI field sampling tasks.

3.4 Task 4: Data Compilation

The purpose of this task is to identify, review, compile, and summarize Site and upstream data collected since the RI/FS that are relevant to the Work. This task includes compilation of data collected after 2008, including data collected as part of the Work. These data will be incorporated into the project database. A summary of investigations from 2008 to 2017 are included as Appendix A.

The data collected since the RI/FS will be compiled and uploaded into the project database and include the following:

- Site data – sediment, porewater, fish (SMB) tissue, and bank soil data collected from 2008 to 2015;
- Downtown/Upstream data – sediment and tissue data collected from 2008 to 2015; and
- PDI data – sediment, fish tissue, surface water, and porewater data collected as part of this study.

Available data will be acquired from LWG, ODEQ's Environmental Information Management (EIM) database, and participating parties. Site data (i.e., sediment, tissue, surface water, and porewater data) will undergo a data quality review to determine if they meet data quality objectives (DQOs) consistent with those developed for the RI/FS using Superfund guidance. If so, the data will be summarized, compiled in the project database, and determined acceptable for all uses. If data do not meet DQOs, they will be summarized, compiled in the Site database, and flagged for conditional use. For example, data from the EIM database did not meet DQOs because QC backup was not available. Data (including surface and subsurface sediment and porewater data) collected at locations that were subsequently dredged or remediated will also be excluded from the compilation as these no longer represent current conditions.

3.5 Task 5: Reporting

Reporting and deliverable are discussed in Section 5.

4. WORK MANAGEMENT STRATEGY

The following information generally describes the duties, responsibilities of personnel and firms involved in the Work; project organization; reporting relationships; lines of communication; and management authorities.

4.1 Roles and Responsibilities

4.1.1 EPA

EPA is the lead agency overseeing the Work. EPA has the authority to review and approve this PDI work plan, supporting FSP and QAPP documents, and reporting deliverables. EPA will be assisted in the review of technical documents by oversight contractor CDM Smith, Inc. (CDM Smith). In addition, Karl Gustavson, from EPA headquarters and EPA Office of Superfund Remediation and Technology Innovation and Contaminated Sediments Technical Advisory Group, will continue to provide regulatory and technical support throughout the project. A peer review process will be followed per the ASAOC.

4.1.2 Participating Parties

Those participating in the PDI studies being performed by Pre-RD Group and its contractors will be determined at a later date. Once the participating parties are determined, they collectively will be responsible for implementing the studies.

4.1.3 Selected Contractor

Geosyntec is coordinating activities including management of all subcontractors, field sampling, analysis, and reporting scoping tasks in preparation of this Work Plan. The contractor to lead the field sampling will be determined at a later date.

The Project Manager will be responsible for overall project coordination and providing oversight on planning and coordination, work plans, all project deliverables, and performance of the administrative tasks needed to ensure timely and successful completion of the project. Geosyntec will also be responsible for coordinating with Pre-RD Group and EPA on schedule, deliverables, and other administrative details.

The Field Coordinator (FC) will be responsible for managing field activities and general field QA/QC oversight. The selected FC will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and oversee delivery of environmental samples to the designated laboratory for chemical analyses. Deviations from this QAPP/FSP will be reported to the Project Manager for consultation. Significant deviations from the QAPP/FSP will be further reported to representatives of the Pre-RD Group and EPA.

The lead subcontractor will oversee data management to ensure that analytical data are incorporated into the PDI database with appropriate qualifiers following acceptance of the data validation. QA/QC of the database entries will ensure accuracy for use in the PDI study. The testing laboratories (TBD) and field contractors (TBD) all play supporting roles.

4.1.4 Peer Review Panel

To be determined.

4.2 Communication Strategy

To be determined.

5. SCHEDULE AND DELIVERABLES

5.1 Schedule

The goal is to complete the Work by June 2019. Figure 13 presents an example project schedule through 2019 (to be updated). The field schedule for the Work includes time for development of QAPP and other project plans in 2017 and completion of field investigation activities by the end of 2018. The PDI scope of work is planned for completion by June 2019 and the draft PDI Evaluation Report is targeted for delivery to EPA by June 2019.

5.2 Deliverables

Laboratories will provide all data for field investigations in electronic format and QA/QC reports, including a narrative of the standard QA/QC protocols. Data validation of laboratory results will be performed by the lead contractor. Following data validation, all data, supplementary information, and validator qualifiers will be compiled into an SQL Server database for the project. Data summary files will be provided to EPA as they become available after data validation and database management. Deliverables include:

- FSP, QAPP, and DQMP describing how the work will be conducted;
- HASP describing worker safety for hazards posed by the Work;
- Monthly Progress Reports;
- Pre-RD Remedial Footprint Report; and
- PDI Evaluation Report.

Deliverables for the PDI Evaluation Report will include data summary tables, data graphics such as box-and-whisker plots, maps depicting the spatial distribution of sediment chemistry for selected analytical parameters, a comparison of Site conditions to the active Alt F Mod remedial footprint, analysis of differences and changes, and new SMA boundary maps.

This document comprises the total work scope agreed upon by the Pre-RD Group and EPA.

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TABLES

FIGURES

APPENDIX A.

Summary of Data Collected Since the RI/FS

APPENDIX B.

Approach for Sampling of Surface Sediment

APPENDIX C

Power Analysis of Fish Tissue Sample Size

APPENDIX D

Calculation of Whole Body – Fillet Ratios for Focused Chemicals of Concern in Smallmouth Bass Tissue