Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

NARRATIVE DESIGN REPORT

Enhanced Natural Recovery/Activated Carbon Pilot Study

Lower Duwamish Waterway

FINAL

Prepared for:

The U.S. Environmental Protection Agency
Region 10
Seattle, Washington

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ABBREVIATIONS AND ACRONYMS

AC	activated carbon
AIRFA	American Indian Religious Freedom Act
AOC	Administrative Order on Consent (for Remedial Investigation/Feasibility Study for the Lower Duwamish Waterway)
ARAR	applicable or relevant and appropriate requirement
AWQC	ambient water quality criteria
BE	biological evaluation
BMP	best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
CQAPP	construction quality assurance project plan
DMMP	Dredged Materials Management Program
DOSH	Division of Occupational Safety and Health
Ecology	Washington State Department of Ecology
EFH	essential fish habitat
ENR	enhanced natural recovery
ENR+AC	enhanced natural recovery amended with activated carbon
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
GAC	granular activated carbon
HASP	health and safety plan
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
MTCA	Model Toxics Control Act
NAGPRA	Native American Graves Protection and Repatriation Act
NHPA	National Historic Preservation Act
NOAA Fisheries	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
Order Amendment	Second Amendment (July 2014) to the Administrative Order on Consent for Remedial Investigation/Feasibility Study for the Lower Duwamish Waterway
OSHA	Occupational Safety and Health Administration

ABBREVIATIONS AND ACRONYMS (Continued)

PCB	polychlorinated biphenyl
PCE	primary constituent element
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RI	remedial investigation
ROD	record of decision
SMC	Seattle Municipal Code
SMS	Sediment Management Standards
SPI	sediment profile imagery
SPME	solid-phase microextraction
SQS	sediment quality standards
TMC	Tacoma Municipal Code
TOC	total organic carbon
TSCA	Toxic Substances Control Act
U.S.C.	United States Code
WAC	Washington Administrative Code
WCCA	Washington Clean Air Act
WQMP	water quality monitoring plan

NARRATIVE DESIGN REPORT
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1.0 INTRODUCTION

The Lower Duwamish Waterway Group (LDWG) will conduct a pilot study of an innovative sediment technology in the field to evaluate the potential effectiveness of the technology in the Lower Duwamish Waterway (LDW). The study will determine whether Enhanced Natural Recovery (ENR) amended with granular activated carbon (AC) can be successfully applied to reduce the bioavailability of polychlorinated biphenyls (PCBs) in remediated contaminated sediment in the LDW. The study will compare the effectiveness of ENR with added AC (ENR+AC) with that of ENR without added AC in three areas (called "plots") in the LDW, which are referred to as the intertidal plot, subtidal plot, and scour plot. For the purposes of this project, ENR involves the placement of a thin layer of clean material (sand or gravelly sand) over subtidal or intertidal sediments. ENR+AC involves the placement of a thin layer of clean material augmented with AC over subtidal or intertidal sediments. The purpose of the ENR and ENR+AC treatments is to reduce the exposure of aquatic organisms to contaminants of concern. The locations in which the pilot study will be conducted are shown in Figure 1.

A pilot study was specified under the Second Amendment (July 2014) to the Administrative Order on Consent (Order) for Remedial Investigation/Feasibility Study for the Lower Duwamish Waterway (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. 10-2001-0055, issued on December 20, 2000). The Second Amendment to the AOC, referred to as the Order Amendment, includes a statement of work for the pilot study, including a general overview of the work to be performed, a list of study steps/tasks, and a schedule for deliverables.

1.1 SCOPE AND PURPOSE OF STUDY

The general project goal of the pilot study is to place ENR material and ENR+AC over separate plots of the bottom sediments of the LDW to evaluate the performance of ENR+AC compared to ENR over a 3-year monitoring period.

The goals of the pilot study, as stated in the Order Amendment, are the following:

- Verify that ENR+AC can be successfully applied in the LDW by monitoring physical placement success (uniformity of coverage and percentage of carbon in a placed layer).

- Evaluate the performance of ENR+AC compared to ENR alone in locations with a range of PCB concentrations.
- Assess potential impacts on the benthic community in ENR+AC compared to ENR alone.
- Assess changes in bioavailability of PCBs in ENR+AC compared to ENR alone.
- Assess the stability of ENR+AC in scour areas (such as berthing areas).

1.2 PLOT DESIGN, LOCATIONS, AND SUMMARY OF CONDITIONS

The selection of the specific plot locations is described in the plot selection memorandum, which is included as Appendix A. These locations were approved by the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) on February 11, 2015. The three plots are shown in Figure 1 and described in the following subsections. The plot selection memorandum provides the sediment results for all contaminants of concern in the LDW, a physical description of each plot, and the rationale for its selection.

The selection of these plots for the pilot study met the study goal to evaluate performance of ENR+AC compared to ENR alone in locations with a range of PCB concentrations.

1.2.1 Subtidal Plot (River Mile 1.2)

The subtidal plot represents typical subtidal conditions in the LDW Superfund site. The location and bathymetry of the subtidal plot, the layout of its two subplots, and the surface-sediment PCB concentrations are shown in Figure 2. This plot is divided into two longitudinal subplots called the East Lane and the West Lane, for the ENR and ENR+AC applications, respectively.

1.2.2 Scour Plot (River Mile 0.1)

The scour plot is representative of areas throughout the site that may experience scour in berthing areas. The location and bathymetry of the scour plot, the layout of its two subplots, and the surface-sediment PCB concentrations are shown in Figure 3. This plot is divided into two almost square subplots called the upstream and downstream subplots, for the ENR and ENR+AC applications, respectively.

1.2.3 Intertidal Plot (River Mile 3.9)

The intertidal plot represents intertidal conditions throughout much of the site. Consistent with previous documents, the intertidal area in the LDW is defined as sediments above -4 feet mean lower low water. The location and bathymetry of the intertidal plot, the layout of its two subplots, and the surface-sediment PCB concentrations are shown in Figure 4. The plot is divided into two

rectangular upstream and downstream subplots; ENR and ENR+AC applications, respectively. The two plots are separated by approximately 100 feet to avoid three shoreline outfalls and an area of debris.

1.3 DATA QUALITY OBJECTIVES

This section summarizes the data quality objectives (DQOs) for the pilot study monitoring program. Additional details for the DQOs are presented in the QAPP. The DQO process defines criteria that will be used to establish the final data collection design (U.S. EPA, 2006). Based on the study goals listed in Section 1.1, the DQOs were developed to support the selection of sampling and analysis methods and an overall study design that leads to data appropriate to answer the study questions.

The DQOs were developed with the recognition that ENR (and ENR+AC) are technologies that inherently work with processes that are ongoing in the LDW surface sediments. These include vertical mixing by bioturbation, redistribution and vertical mixing of surface sediments by waves and currents, sedimentation and minor erosion, and minor anthropogenic disturbances such as small boat anchors. ENR is not an engineered containment layer and the placed ENR layer is expected to physically change over time as a result of these riverine processes.

1.3.1 DQO-1: Verify the Placement of the ENR and ENR+AC Materials

This DQO verifies whether the ENR and ENR+AC layers can be placed in the subtidal, intertidal, and scour plots within the targeted specifications. This first DQO establishes the initial physical conditions of the ENR and ENR+AC layers immediately after placement and is used to support subsequent monitoring. This DQO addresses the thickness and evenness of the ENR and ENR+AC layers, the constructed AC content in the ENR+AC layer, and the distribution of carbon in the ENR+AC layer.

Investigative methods to measure the thickness and evenness of the layers will include physical assessment using tools such as bathymetric surveys, breakaway stakes, visual observation by divers, sediment profile imagery (SPI), and collection, logging, and analysis of shallow cores. The quality assurance/control (QA/QC) requirements are described in the monitoring Quality Assurance Project Plan (QAPP) and the Construction Quality Assurance Project Plan (CQAPP).

The achieved application rate of AC will be based on measures of post placement carbon content using methods for both total organic carbon (TOC) and AC. The general distribution of AC within the ENR+AC layer will be based on visual observations using diver-collected cores and SPI.

1.3.2 DQO-2: Evaluate the Stability of ENR and ENR+AC Materials

The second DQO addresses the long term stability (over the 3-year study period) of the ENR materials and the stability of the AC material in the ENR matrix in the scour plot. Loss of ENR and ENR+AC materials may occur as a result of erosional forces, such as propeller wash and high river flows. Depending upon the nature of the turbulence in the berthing areas, there is also the potential for the propwash currents to increase or decrease ENR processes (e.g., deposition of riverine sediments or mixing of the ENR and ENR+AC layers into the underlying sediment) compared to areas without propwash effects. Changes in ENR+AC stability at all the pilot study plots will be evaluated during post placement monitoring events using visual observations (diver survey and SPI) and/or diver-collected cores.

1.3.3 DQO-3: Assess Changes in Bioavailability in ENR+AC Compared to ENR Alone

This DQO assesses the potential changes in PCB bioavailability in ENR+AC compared to ENR alone. For the purposes of the pilot study, changes in bioavailability will be based on measurements of the bioavailable fraction of PCBs as represented by the PCB concentrations in porewater. Porewater PCB concentrations will be measured using solid-phase microextraction (SPME). Secondary measurements supporting the interpretation of bioavailability will include measurements of grain size, carbon content, and bulk sediment PCB congeners. In addition, an addendum to the pilot study QAPP will be prepared that will describe a tissue study to further assess changes in bioavailability.

1.3.4 DQO-4: Assess the Potential Impacts of AC on Benthic Communities

This DQO addresses the potential impacts of AC on benthic communities in the LDW. Although laboratory and field studies have generally shown few adverse effects on benthic organisms after the application of AC to contaminated sediments, effects have been associated with the use of small particle sizes (powdered activated carbon) or higher applications rates (generally greater than 5 percent AC).

To determine whether the use of AC, as proposed in the pilot study, could adversely affect the benthic communities in the LDW, a benthic macroinvertebrate survey will be conducted in Year 3. The benthic communities established in each of the ENR+AC subplots of the subtidal, intertidal, and scour plots will be compared to the benthic communities in their respective ENR subplots.

1.4 PROJECT SCHEDULE

All in-water construction work for ENR and ENR+AC placement is planned to be conducted during the authorized 2016–2017 in-water work window for the LDW, when salmonid species listed under

the Endangered Species Act are least likely to be present. The construction is expected to occur in December 2016, after the completion of the Muckleshoot Indian Tribe's net fishery season. The baseline sampling (as described in the QAPP [Appendix E]), which is scheduled to precede placement by 60 to 90 days, would occur in September or October 2016, and the Year 0 (post placement) event would occur in January or February 2017. The Years 1, 2, and 3 monitoring events are anticipated to occur in the spring (March to May) of 2018, 2019, and 2020.

A draft Construction Report will be submitted to EPA and Ecology with the Draft Year 1 Monitoring Report per the Order. However, a courtesy copy of the construction sections of the Draft Year 1 Monitoring Report will be submitted to EPA and Ecology within 6 months of the completion of construction. The Year 3 Monitoring Report will include the results of the Year 2 monitoring.

Validated sampling data from the baseline event and Years 0, 1, and 2 sampling event will be provided to EPA and Ecology within 75 days after completion of the sampling event and Year 3 validated sampling data will be provided within 90 days.

1.5 REPORT ORGANIZATION

This narrative design report is laid out to present the approach for design, construction, and monitoring of the pilot study, which addresses Task 2 of the AOC (Prepare the Design Package). The main body of this report is intended to summarize the various deliverables required by Task 2 of the AOC.

- Section 2.0 provides the basis of design and general approach to the construction of the pilot plots and summarizes the construction quality assurance project plan (CQAPP) and the plans and specifications.
- Section 3.0 summarizes the quality assurance project plan (QAPP) for the pilot study.
- Section 4.0 is an overview of the water quality monitoring plan (WQMP) for the pilot study.
- Section 5.0 is an overview of the health and safety plan (HASP) for the pilot study.
- Section 6.0 provides a project cost estimate and project schedule.
- Section 7.0 provides an analysis of the substantive compliance of the pilot study with applicable environmental regulations.
- Section 8.0 summarizes the biological evaluation (BE) prepared for the pilot study.
- Section 9.0 provides a list of the references cited in the narrative design report.

All of the design documents specified in the Order are provided in the appendices: the CQAPP (Appendix C), construction plans and specifications (Appendix D), the QAPP (Appendix E), the WQMP (Appendix F), the HASP (Appendix G), the cost estimate and project schedule (Appendix H), and the BE (Appendix B), all of which are summarized in the following sections.

2.0 DESIGN AND CONSTRUCTION

As outlined in Section 1.1, the goals of the pilot study include verifying that ENR and ENR+AC can be successfully applied over the LDW bottom sediments and evaluating the performance of ENR+AC compared to ENR.

The AC has a specific gravity similar to that of water and may be resuspended and sorted from the heavier sand and gravel ENR materials during placement. The criteria for the design and construction of the ENR and ENR+AC are the following:

- Place material in a manner intended to limit mixing with underlying river sediments.
- Limit segregation of the placed materials during placement.
- Limit winnowing/loss of the AC during placement.
- Place the materials accurately within the target areas at the target thickness.

Because this project is a pilot study comparison of ENR and ENR+AC, the 3-year monitoring program after material placement is intended to monitor performance over time. As a result, the design and placement of materials in the LDW in the three plots must meet the criteria stated above and be as consistent as possible throughout the plots and subplots. Since the placement objectives are critical to the long-term evaluation of this effort, the overall design considered how to best manage various aspects of placement to ensure the achievement of these criteria. Because this project is a pilot study with 3 years of monitoring of the subplots and because of the small size of the subplots, this design uses means and methods to ensure the highest degree of consistency in terms of the materials placed in the subplots within one plot. The exact construction approach and equipment used for the pilot study may not be the same as that typically used for a full-scale ENR+AC project in which the project scale would influence the selection of equipment and methods. However, this pilot study was designed to evaluate factors to be considered in designing placement methods for use in a full-scale ENR+AC project.

It should also be noted that there are limitations associated with the placement of material below the water surface in the tidally influenced LDW that result from the variability of the physical and chemical parameters in the waterway, the capability of the contractor and the contractor's equipment, and inherent difficulties related to placing materials with differences in specific gravities

(i.e., AC and sand and gravel). Consequently, the thickness of the placed material will have some variability and the need for some level of adaptive management during construction is expected as a normal part of the pilot study, as described in Section 2.1.

2.1 BASIS OF DESIGN

The pilot study will be conducted with three separate plots, each consisting of approximately 1 acre in the LDW: one in an intertidal area, one in a subtidal area, and one in a subtidal area of potential scour (Figures 1 through 4). Each of the three plots will be divided into two subplots, each consisting of approximately ½ acre. Within each plot, one of the subplots will be treated with ENR material only and the other will be treated with ENR+AC. To evaluate the performance of ENR+AC compared to ENR alone, these plots will be monitored for 3 years after their construction.

For the monitoring program to be effective, the design of the plots and the placement of materials must limit the potential for overlap or mixing of materials between the subplots to the extent reasonably practicable using conventional construction equipment and marine contractors. Monitoring of the subplots has been designed with an internal buffer zone between the area to be sampled in each subplot and adjacent subplot in case of any significant crossover of AC into the ENR subplot (see Figures 2 through 4). The area to be sampled in each subplot has been sized to leave a 5-foot-wide buffer around the edge of each subplot and, when the subplots are adjacent, a 15-foot-wide buffer between the ENR and ENR+AC subplots.

2.1.1 Material Thickness Criterion

The placement of ENR and ENR+AC materials under water using the available equipment will result in variability in material thickness. Based on industry experience, a 3-inch tolerance in placement thickness is the best that can be planned for and measured. Because of this anticipated variability, the material placement has been designed using the volume of material equivalent to a 9-inch-thick placement, with a goal for a thickness value of between 6 and 9 inches for 80% of a plot and with a minimum thickness of 4 inches over 100 percent of the plot. The design is based on a sound technical approach and a construction process that uses adaptive management to adjust the approach to varying in-water conditions.

2.1.2 ENR Materials

The proposed material for the ENR and ENR+AC will consist of sand for the subtidal plot and gravelly sand for the scour and intertidal plots. Figures 2 through 4 show the locations of the ENR and ENR+AC subplots. Sand has traditionally been used as ENR material; however, the locations of the intertidal and scour plots are anticipated to result in material movement as a result of boat wakes, wind-generated waves, propeller wash, sloping river bottoms, and currents. This can

cause winnowing of AC in the ENR+AC subplots with loss of AC from the upper layer and transport of the AC out of the subplot. Therefore, a gravelly sand mix has been selected for use in the intertidal and potential scour plots to reduce the potential for movement of the ENR and ENR+AC material by waves and currents. Reducing movement of the placed materials is critical to reducing loss of the AC from the ENR+AC subplots and reducing the potential for any effects of the AC on the adjacent ENR subplots. Such transport is not an environmental concern per se, but may affect sample results and the interpretation of the study results.

A gravelly sand mix has been approved by the Natural Resource Trustees for use as a habitat substrate in restoration/creation projects on the LDW. For example, the backfill used in the Boeing sediment cleanup on the Duwamish Waterway required a gravelly mix in portions of the intertidal and scour areas to prevent erosion of the backfill. In areas where groundwater upwelling was occurring, even larger material sizes were required to prevent erosion.

In addition, the Port of Seattle is planning construction of a habitat restoration project along a portion of the South Park shoreline as part of a settlement with the Natural Resource Trustees where the shoreline slopes will be covered with a similar gravely sand mix.

A similar material was used for the pocket beach that was constructed at the Olympic Sculpture Park along the Elliott Bay shoreline. Post-construction monitoring was conducted over several years and shows that the pocket beach with gravelly substrate had high densities of harpacticoid copepods, amphipods, and overall epibenthic invertebrates (Toth el al., 2012).

Additional locations in the LDW where gravely sand has been used as a habitat substrate include the Slip 4 Early Action cleanup and the Duwamish/Diagonal sediment remediation project.

The gravelly sand used in the intertidal plot and the scour plot will consist of sand and rounded gravel with the following grain size characteristics:

- 100 percent passes a 1.5-inch sieve,
- 50 to 60 percent passes a No. 4 sieve, and
- less than 2 percent passes a No. 230 sieve.

For the sand used in the subtidal plot, 100 percent will pass through a No. 4 sieve, and it should contain less than 2 percent fines.

The source of carbon for the AC will be granular activated carbon (GAC), and it will be virgin (i.e., not regenerated carbon) from coconut fiber.

The AC gradation should be relatively well graded across the grain size range of 200 to 1000 microns and will be tested for PCBs and grain size before the material is accepted for use in the pilot study.

The ENR material must be approved for use by the EPA; therefore, chemical testing of the borrow source will be implemented per the requirements in the CQAPP. Materials acquired for use in the pilot study will be verified in terms of their gradation and chemistry before they are loaded onto the barge.

2.1.3 Target Percentage of Activated Carbon for ENR+AC Material

For the ENR+AC subplots, GAC will be blended with the sand or gravelly sand to result in approximately 4 percent AC by weight as described in Specification 02221 (Appendix D). The AC material grainsize specification will be relatively well graded across the grain size range of 200 to 1000 microns. The design AC concentration is based on previous studies which were designed to decrease bioavailability of PCBs without impacting benthic communities (see Section 6.7.2 of the Biological Evaluation [Appendix B]) but will be evaluated in the monitoring phase of this study. The target concentration is based on the dry weight of GAC and ENR material. To achieve the approximately 4 percent target concentration, 80 pounds of GAC will be required for every ton of ENR material. It should be noted that the range of AC percentage in the blended material can vary as a result of potential segregation such that although the overall average is approximately 4 percent, the percentage within any subsample can be variable.

The specific gravity of AC is very close to that of water and, therefore, some AC loss will occur during and after placement, resulting in a range of carbon percentages in the placed material.

It is expected that the pilot study will require approximately 7,100 tons (4,200 cubic yards) of ENR material and approximately 150 tons of AC. Details on the weights/volume of material are provided in Specification 02221 (Appendix D). Details on assessing the carbon content of the ENR+AC material prior to placement are provided in Specification 02221.

2.1.4 Material Preparation

Blending of GAC with the ENR material will be completed either at the borrow facility or on a barge, depending on the capabilities of the borrow facility. The blended material (ENR+AC) will be loaded onto a suitable clean, water-tight barge. Upon arrival at the plot, the blended material will be presoaked by flooding the barge with Duwamish River water for a minimum of 12 hours before material placement. The presoaking will wet the AC particles and reduce the amount of air in the AC pore spaces, and thus reduce the difference in density between the AC and the ENR material. The blended material will be kept saturated at all times before placement. The ENR material may

be presoaked similar to the ENR+AC material. Water remaining on the barge after the blended material has been removed will be discharged back to the river after filtration of the water through a 1 micron bag filter.

2.1.5 Equipment and Material Placement

The ENR and ENR+AC materials will be placed using a fixed-arm excavator equipped with a sealed (relatively leak proof to the extent practicable) 3- to 6-cubic-yard clamshell bucket. The clamshell bucket will be in good condition, with overlapping side plates. The side plates and cutting edges will be replaced as necessary to limit leakage. Before placement of the ENR and ENR+AC materials, a test will be conducted to develop the optimal bucket placement grid, bucket overlap, and bucket fill factor. The test will consists of a trial placement of the material in designated demonstration areas within the intertidal zone of the Duwamish Waterway as described in the CQAPP (Appendix C; Specification 02221).

The ENR and ENR+AC materials will be placed to achieve a minimum thickness of 4 to 6 inches by placing a volume equivalent to a 9-inch lift that is spread as uniformly as practicable over the subplot area. To adjust for the variation in resulting thickness across the bucket footprint, the material will be placed in two lifts, using an offset grid bucket pattern, so that 80% of the plot will be 6 to 9 inch in thickness and 100% of the ENR and ENR+AC is at least 4 inch in thickness. To achieve a relatively uniform placement of material, the bucket volume and placement area covered upon release of the bucket contents will be known and adjusted as necessary to achieve an approximately 4.5-inch-thick lift over as much of the bucket footprint as practicable based on the bucket characteristics. Some portions of the placement area will be at least 4 inches thick, and some portions may be considerably thicker, especially near the center of the bucket footprint.

It is one of the goals of the pilot study to place the ENR or ENR+AC material placement thickness within the 6- to 9-inch target range, to the extent practicable based on the planned and approved placement method. In addition, the intent is to have no more than 12 inches of fill, to the extent possible given the limitations of the placement technology. However, placement thickness greater than the 6- to 9-inch target may result in some small localized areas due to a variety of factors including:

- existing site bathymetric features such as steeper slopes, localized depressions, or erosion channels;
- areas of debris; and
- localized areas of greater thickness resulting from variation in placement thickness from the volume of material placed by a single bucket (material placed by bucket is

anticipated to vary in thickness from the center of bucket [thicker placement from single bucket] out to the edge of the bucket [thinner placement from single bucket]).

Any localized areas of greater thickness are expected to be reduced by natural processes such as tides and currents following placement.

As is typical with the placement of materials at or near the mudline, the resulting placement surface will be uneven and hummocky immediately after placement. In addition, in areas where the existing bed of the waterway slopes, potentially thicker placements are expected near the toe of the slope due to the movement of the material down the slope. Neither of these occurrences is expected to adversely affect the performance of the ENR and ENR+AC applications or the ability to monitor their performance. Material from areas where the placement is too thick will only be relocated if it encroaches upon the existing Federal authorized navigation depth and thereby poses a hazard to navigation as determined in consultation with the U.S. Army Corps of Engineers.

The lift placement will be monitored by an electronic navigation and positioning system on the excavator arm and bucket that will be capable of the following:

- Accurately determining position of clamshell bucket (or similar equipment) to +/-4-inch accuracy in X, Y, and Z axes, relative to project datum, in real time. Accuracy will be verified at the beginning and end of every shift, at a minimum.
- Tracking bucket rotation/orientation.
- Tracking bucket open/close position.
- Displaying project area and features, bathymetry, water level, barge and/or dredge or work platform location and clamshell bucket (or similar equipment) in both plan and cross-sectional views in real time.
- Accounting for any effects of river current on clamshell bucket position underwater compared to position of navigation equipment above water and displaying proper position in real time relative to project specific datum.
- Recording actual bucket opening location (X, Y, and Z axes) for each bucket of material placed.

During the placement operations, a spud barge capable of holding equipment in place is expected to be used. To avoid disturbance of the ENR and ENR+AC material, the spuds, anchors, wires, chains, etc. will be prevented from coming in contact with the plots themselves once the material has been placed. In addition, tug maneuvering with the potential for disturbing the placed material will be avoided to the extent practicable.

At each plot location, material will be placed in the ENR+AC subplot before the material is placed in the corresponding ENR subplot to minimize potential migration of the low-density AC onto the surface of the ENR subplot.

A clamshell bucket (or similar equipment) will be used to remove material from material barge and quickly lower the bucket below the water surface to the appropriate horizontal position set approximately 2 feet above the riverbed. The bucket will not contact the riverbed at any time during material placement.

During placement, any excess ENR or ENR+AC material remaining on the barge after construction of the subplot is completed may be placed around the perimeter of the subplot as appropriate to slightly increase the plot area.

In the unlikely event that over placement of material occurs within a plot, at a thickness greater than the target placement thickness to such a degree that it may impact navigation, some of the placed material will be moved using the clamshell bucket and relocated to the perimeter of the appropriate subplot.

Water used to flood the material barge will be discharged to the Duwamish Waterway after the water has been passed through a 1 micron filter media. If for any reason the water cannot be discharged through a 1 micron bag filter, EPA will be consulted to determine if any monitoring beyond that already conducted at the early warning and compliance stations is required.

2.1.6 Placement Verification

Placement verification will be a multistep process, starting with test placement and development of a placement pattern and volume per bucket, followed by in-place measurements to verify the placed thickness. The placement verification process is outlined in the CQAPP developed for the pilot study (summarized in Section 2.1.8). The Amec Foster Wheeler consulting team (consulting team) will provide a full-time engineer (Field Engineer) on the floating plant to oversee placement. A King County project representative (engineer) will be on-site as necessary. As outlined in the CQAPP, EPA and Ecology will be involved in verification of all construction activities including placement of material.

2.1.7 Work Hours and Duration

Since the test plots will be constructed in winter of 2015/2016, work will likely be conducted during daylight and non-daylight hours with approval of EPA and Ecology. It is not practicable to limit work to daylight hours only due to time of year, available daylight hours, and need to inspect intertidal test placements at low tide.

2.1.8 Construction Quality Assurance Project Plan

The CQAPP developed for use during implementation of the pilot study is included in this report as Appendix C. It presents an overview of the pilot study, the components of the construction quality management, and the objectives of the CQAPP. It describes the organizations and key personnel involved in construction quality management, as well as their responsibilities/authorities. The CQAPP describes the QA activities for different elements of the construction work and discusses the procedure for tracking construction deficiencies, from the identification of a deficiency through the accepted corrective action. The CQAPP also presents the procedures for managing meeting and construction documentation and reporting and for revising the Contractor Quality Control Plan and CQAPP.

The CQAPP describes the personnel, procedures, and activities required to ensure that the construction work satisfies the engineering design and regulatory requirements and that reliable, accurate, and verifiable construction data are recorded during construction. Construction quality management consists of quality control (QC) by the contractors and QA by the construction oversight team. QA performed by the construction oversight team will consist of conducting specific measurements, along with monitoring and audits to verify that the contractor follows the applicable QC programs, verify the effectiveness of the QC programs, and provide assurance and documentation that the completed construction work satisfies the quality requirements specified in the construction contracts. The construction will be managed by King County, with engineering support provided by the consulting team, primarily Dalton, Olmsted & Fuglevand, Inc. Construction oversight will be provided by the Project Representative, the Field Engineer, and support staff. The CQAPP details personnel roles for both the construction oversight team and the contractor team.

2.2 CONSTRUCTION PLANS AND SPECIFICATIONS

The construction plans and specifications are included in this report as Appendix D. The construction plans and specifications have been developed to meet King County design and construction standards for public works construction bidding.

3.0 QUALITY ASSURANCE PROJECT PLAN

The Order Amendment requires the development of a QAPP for monitoring, which is included in this report as Appendix E. The QAPP details the sampling approach, the sample handling and custody protocols during the 3-year monitoring period of the pilot study, and the QA/QC process for data generation and acquisition. Finally, the QAPP describes the compliance assessments and oversight responsibilities for that portion of the project, including response actions for field

sampling and corrective actions for laboratory analysis, and discusses the data validation and usability assessment of laboratory data.

The QAPP describes the monitoring program developed for the pilot study on the basis of the DQOs discussed in Section 1.3. Monitoring as described in the QAPP will be conducted during a baseline sampling event before construction of the plots, during a Year 0 sampling event after the plot construction, and during a sampling event in Years 1 through 3 after construction. In addition, a tissue study to further assess PCB bioavailability will be developed and presented in an addendum to this QAPP.

4.0 WATER QUALITY MONITORING PLAN

The WQMP for the pilot study is included in this report as Appendix F. It is assumed that water quality monitoring will be required during all in-water construction activities as a condition of the Clean Water Act (CWA) Section 401 water quality memo to be issued by the EPA.

Because the pilot study will involve the placement of only clean material, water quality monitoring for turbidity will be conducted during the in-water placement of the ENR and ENR+AC. Water samples will not be collected for chemical analysis because the ENR material will be obtained from a clean quarry source, and its quality will have been confirmed by chemical testing.

The objectives of the water quality monitoring and management activities are as follows:

- Ensure that the water quality performance criteria prescribed by the Section 401 water quality memo are met during implementation.
- Establish contingency measures and corrective action in the unlikely event that unacceptable conditions are detected.

These monitoring and management objectives will be achieved by means of the following activities, as described in the WQMP:

- The consultant team will conduct water quality monitoring during placement of material.
- Monitoring stations will be selected to evaluate compliance with the water quality objectives.
- If exceedances occur, corrective actions will be taken as outlined in Section 2.0 of the WQMP.
- Written reports documenting compliance with the performance standards will be prepared by the project team for submittal to the EPA as required by the Section 401 water quality memo.

Compliance with performance criteria will be evaluated using data from the compliance stations and a corresponding ambient station for each plot area. The ambient station will be located outside the area of influence of the construction activities. Details of the monitoring are provided in the WQMP (Appendix F).

5.0 HEALTH AND SAFETY PLAN

A site-specific HASP has been developed to address the health and safety practices and controls that will be implemented by teams performing construction oversight and various monitoring and sampling activities as part of the pilot study. The site-specific HASP is included in this report as Appendix G.

Because of the specialized nature of the many different site evaluation and construction activities that will be conducted at the pilot plots, each contractor involved in the work will develop and implement its own HASP and provide activity safety analyses that address the tasks that they are responsible for. Therefore, it should be stressed that the health and safety directives discussed in the site-specific HASP in Appendix G apply only to construction oversight management personnel engaged in the oversight activities mentioned in the previous paragraph.

Activities performed under this site-specific HASP will comply with applicable sections of Washington Administrative Code, Chapter 296-843 (WAC 296-843) for hazardous waste site work and all other relevant general occupational health regulations and construction safety standards established by the state Division of Occupational Safety and Health (DOSH). When appropriate, specific DOSH standards are referenced in the site-specific HASP to highlight additional health and safety requirements that are not otherwise discussed. These standards will be available on site by means of an Internet connection with the Washington State Occupational Safety and Health Administration (OSHA) Web site.

6.0 COST ESTIMATE AND PROJECT SCHEDULE

The cost estimate for the construction and monitoring of the pilot study and construction schedule are provided in Appendix H.

7.0 REGULATORY AND PERMIT REQUIREMENTS

The ENR/AC pilot study is under the jurisdiction of EPA Region 10 and Ecology; therefore, it must comply with any applicable or relevant and appropriate requirements (ARARs). ARARs are promulgated federal and stricter state environmental or facility siting laws and regulations that are either (1) applicable requirements, or (2) relevant and appropriate requirements. The EPA in

conjunction with Ecology, as set forth in the National Oil and Hazardous Substances Contingency Plan (40 CFR 300), is required to identify ARARs that will be met during the implementation of the remedial action. The potential ARARs for the pilot study were developed by the EPA as part of the final record of decision (ROD) for the LDW Superfund site (U.S. EPA, 2014); they are summarized in the following subsections.

For CERCLA actions such as this pilot study, regulatory permits are not required for on-site actions, but on-site actions must be conducted in a manner that meets the substantive provisions of applicable regulatory requirements. Actions that take place off site are subject to all applicable requirements, including any administrative requirements (e.g., permit approval or reporting).

7.1 FEDERAL REQUIREMENTS

This section presents the federal ARARs that potentially apply to the pilot study.

7.1.1 Resource Conservation and Recovery Act, Subtitle C (Hazardous Waste)

The Resource Conservation and Recovery Act (RCRA) applies to the identification, generation, transportation, and disposal of any hazardous wastes generated by a project (42 U.S.C. §§ 6901–6992K; 40 CFR 260–273). The pilot study will not involve dredging or the generation of solid waste. Unanticipated circumstances could necessitate compliance with other hazardous/dangerous waste requirements. Based on the remedial investigation (RI) of the LDW (Windward, 2010) and the sampling results from the candidate plots for the pilot study (Windward, 2015), LDW sediments, should they be excavated and become a waste, are not expected to be characterized as hazardous/dangerous waste. In the unforeseen event that dangerous/hazardous waste is generated, the pilot study would comply with the state generator rules for accumulating or managing such waste on site for up to 90 days (40 CFR 262; WAC 173-17-202). State dangerous waste is defined more broadly than federal hazardous waste.

7.1.2 Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) establishes prohibitions of and requirements for the manufacture, processing, distribution in commerce, use, cleanup, storage, and disposal of PCBs after January 1, 1978 (15 U.S.C. § 2605; 40 CFR 761.61[c]). TSCA regulations for PCBs apply to materials containing concentrations of PCBs equal to or greater than 50 parts per million. The EPA evaluates the form and concentration of PCBs “as found” at the site, which is subject to disposal requirements (40 CFR 761.60[a][2]–761.60[a][5]) and storage requirements (40 CFR 761.65).

Dredging will not be a component of the pilot study, but based on the LDW RI and the sampling results from the candidate plots for the pilot study, encountering materials at the site with PCB remediation waste as defined in 40 CFR 761.3 is not expected. Any such material will be subject to the EPA-approved plans for all cleanup activities, including any sampling, as well as all on-site disposal-related activities. Risk-based disposal of PCB remediation wastes must not pose unreasonable risk of injury to human health or the environment. Written EPA approval is required for any off-site disposal of PCB remediation waste.

7.1.3 Solid Waste Disposal Act

Congress enacted the Solid Waste Disposal Act of 1965 to address the growing quantity of solid waste generated in the United States and to ensure its proper management (42 U.S.C. §§ 6901–6992K; 40 CFR 257–258). Subsequent amendments to the Solid Waste Disposal Act, such as RCRA, have substantially increased the federal government's involvement in solid waste management. The term solid waste, as defined by the statute, is very broad, including not only the traditional nonhazardous solid wastes, such as municipal garbage and industrial wastes, but also hazardous wastes. Hazardous waste, a subset of solid waste, is regulated under RCRA Subtitle C.

The pilot study will comply with the substantive requirements for nondangerous or nonhazardous waste that it generates, unless the wastes qualify for recycling or other exemptions.

7.1.4 Clean Water Act

The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters (33 U.S.C. § 1251 et seq. [1972]). The basis of the CWA, which was enacted in 1948, was called the Federal Water Pollution Control Act, but the act was significantly reorganized and expanded in 1972. Under the CWA, the EPA has implemented pollution control programs such as setting wastewater standards for industry and developing water quality standards for all contaminants in surface waters.

This section discusses the various parts of the CWA that constitute ARARs for the pilot study.

7.1.4.1 Ambient Water Quality Criteria

Section 304(a) of the CWA establishes ambient water quality criteria (AWQC) for the protection of aquatic organisms and human health (33 U.S.C. § 1314[a]; National Toxics Rule [40 CFR 131.36{b}{1})] as applied to Washington [40 CFR 131.36{d}{14}]). AWQC developed under the CWA are guidelines that identify protective concentrations of various chemical constituents in surface waters. Surface water criteria will be at least as stringent as all of the following: (1) all

water quality standards in WAC 173-201A; (2) AWQC, unless it can be demonstrated that such criteria are not relevant and appropriate for the LDW or for a specific hazardous substance; and (3) the National Toxics Rule (see WAC 173-340-730[3][b], consistent with Sections 121[d][2][A][ii] and [B][i] of CERCLA and 40 CFR 300.430[e]).

Monitoring for relevant AWQC will occur during construction and will be addressed as part of the Section 401 water quality memo, as described in Section 4.0.

Best management practices (BMPs) are described in the WQMP (Appendix F) and the CQAPP (Appendix C). These BMPs primarily focus on reducing turbidity, which is the parameter that has the highest potential for exceeding the water quality criteria due to implementation of the pilot study.

7.1.4.2 Discharge of Dredged/Fill Material into Navigable Waters of the United States – Clean Water Act, Sections 401 and 404

Sections 401 and 404 of the CWA establish requirements for water quality certification and for dredging and placing fill materials in the waters of the United States, respectively (33 U.S.C. §§ 1341 and 1344; 40 CFR 121.2, 230, and 232; 33 CFR 320, 323, and 328–330). Sections 401 and 404 apply to the in-water actions of the pilot study. Because the proposed action will involve the placement of fill on site, the requirements of these laws and implementing regulations apply.

Compliance with Section 401 will be addressed as part of the water quality memo, as described in Section 4.0. The EPA will issue the equivalent of state certification assuring that the water quality standards will not be violated by remedial action discharges along with necessary conditions including any mixing zone parameters consistent with WAC 173-201A-400.

Section 404(b)(1) of the CWA instructs the EPA to promulgate guidelines for evaluating proposed projects involving such discharges, which are called the Section 404(b)(1) Guidelines (40 CFR 230). Under these guidelines, discharges of dredged or fill material may be permitted if there is no practicable alternative to the proposed discharge that would have a less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. The term “practicable” is defined in CWA regulations as “available and capable of being done after taking into consideration cost, existing technology, and logistics, in light of overall project purposes.” The Section 404(b)(1) Guidelines require demonstration that the placement of fill material (ENR and ENR+AC) will not do any of the following:

- Cause or contribute to violations of any applicable state water quality standard

- Violate any applicable toxic effluent standard or prohibition under Section 307 of the CWA
- Jeopardize the continued existence of any endangered or threatened species or contribute to the destruction or modification of any critical habitat for such species
- Contribute to significant degradation of the waters of the United States

The placement of fill material will avoid, to the fullest extent practicable, adverse effects on human health, aquatic ecosystems, and recreational, aesthetic, and economic values. The Section 404(b)(1) Guidelines also maintain that degradation or destruction of special aquatic sites represents an irreversible loss of valuable aquatic resources that should be avoided.

The EPA Region 10's Decision Framework for Determining Clean Water Act Section 404 Compliance at Superfund Sites (EPA 2000) requires that information be provided to address several findings. The findings and information related to them are presented below which demonstrate compliance with the substantive provisions of Sections 401 and 404 of the Clean Water Act.

1. **There are no other practicable alternatives that will result in less impact to the aquatic environment.**

   The pilot study is being conducted in areas contaminated with PCBs and other hazardous substances at concentrations determined in EPA's 2014 ROD to be harmful to human health and the environment. Under EPA's ROD, active remediation (ENR, capping, dredging, or partial dredging and capping) is required to remediate sediment contamination in these areas. Other remedial options (capping, dredging, or partial dredging and capping) would have more impact to the aquatic environment than the ENR and ENR+AC pilot. The construction of the study has been designed to minimize, to the extent practicable, the impacts on the aquatic environment. The proposed placement method of releasing the ENR and ENR+AC material within a few feet of the bottom will reduce impacts to adjacent aquatic habitats due to migration of material outside of the pilot study plots and will also reduce suspension of ENR and AC material into the water column as compared to alternate placement methods. Alternative placement methods would likely increase the footprint of the ENR and ENR+AC pilot plots due to migration of the placed material outside of the proposed boundaries of the study plots and increase the amount of material suspended in the water column.

2. **The discharge will not cause or contribute to violations of water quality standards or toxic effluent standards, jeopardize an endangered or threatened species, or destroy or adversely modify critical habitat, or impair a protected marine sanctuary.**

   As described above, the proposed construction methods are designed to minimize the potential for exceedances of ambient water quality as compared to alternate construction methods. Water quality monitoring will be conducted under an EPA approved Water Quality Monitoring Plan (Appendix F) to ensure compliance with relevant water quality standards during construction. The Water Quality Monitoring Plan has been developed in consultation with EPA and is designed to be consistent with the 401 memo to be issued by EPA. There are no toxic effluents associated with the construction or long-term monitoring of the project. All in-water construction work for ENR and ENR+AC placement is planned to be conducted during the authorized 2016–2017 in-water work window for the LDW, when salmonid species listed under the Endangered Species Act are least likely to be present. Based on concurrence by NOAA Fisheries and US Fish and Wildlife Service with the Biological Evaluation that was submitted to the services by EPA, the proposed action will not destroy or adversely modify critical habitat.

3. **The discharge will not result in significant degradation to waters of the United States.**

   As described above, the proposed construction methods are designed to minimize the potential for exceedances of ambient water quality as compared to alternate construction methods. Water quality monitoring will be conducted under an EPA approved Water Quality Monitoring Plan to ensure compliance with relevant water quality standards during construction as outlined in Appendix F.

   The ENR material sand and gravelly sand, will be “clean” quarry materials and the AC will be virgin; however, chemical analysis of the all quarry import and AC material will be conducted prior to placement to ensure that the initial physical and chemical composition and quality of the samples are known prior to placement. Once construction is complete, there will be no significant degradation of waters as a result of the project.

4. **Potential adverse impacts to the aquatic ecosystem are minimized to the extent practicable and appropriate.**

   As stated above, the construction methods are designed to minimize the impacts to the aquatic environment during placement. In addition, the grain-size and amount of AC that will be placed is not expected to have a long-term impact on benthic biota as described in

the Biological Evaluation (Appendix B). The only unavoidable impact is that placement of ENR and ENR+AC materials will temporarily reduce the populations of the benthic and epibenthic invertebrate community by the burial and smothering of the benthic substrate in the pilot plot areas. It is expected that ENR and ENR+AC materials placed in the pilot plots will be rapidly recolonized by benthic fauna from adjacent areas.

7.1.5 Rivers and Harbors Appropriations Act, Section 10

Section 10 of the Rivers and Harbors Appropriations Act prohibits the unauthorized obstruction or alteration of any navigable waters of the United States (33 U.S.C. § 403), which includes all three of the project plots. Section 10 requires prior authorization from the U.S. Army Corps of Engineers (Corps) for structures and work in or affecting navigable waters of the U.S. Navigable waters of the U.S. are those waters that are subject to the ebb and flow of the tide or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Procedures set forth by the Corps require an examination of the impact of the action (33 CFR 320 and 322), in this case the placement of ENR and ENR+AC.

Partial obstruction of portions of the navigational channel in the LDW may occur during placement of the ENR and ENR+AC due to the presence of boats and barges required for implementation; however, it is expected that there will be sufficient space within the federal navigation channel of the LDW to allow commercial and recreational vessels to maneuver around vessels during active placement of the ENR and ENR+AC. Operations will be coordinated and scheduled to reduce interference with commercial vessel traffic using the waterway.

Of the three proposed plots, only the subtidal plot will be located within the federal navigation channel of the LDW. Once in place, the subtidal plot will be approximately rectangular, 100 feet wide, 400 feet long, and an average of 9 inches (0.75 foot) thick. The surface of the pilot study will be similar to existing sediment in its material size gradation and hydraulic resistance to flow. The elevation of the ENR and ENR+AC will be at or below the authorized depth of the LDW federal navigation channel, such that the ENR and ENR+AC will not interfere with or hinder commercial and recreational traffic within the LDW. A memorandum has been prepared for the US Army Corps of Engineers that evaluates substantive compliance per requirements of 33 USC § 408 (Section 408) for the construction of an Enhanced Natural Recovery/Activated Carbon pilot study plot.

The intertidal plot will be located along the east bank of the LDW south of the Boeing Plant 2 facility. An evaluation was performed by Windward (2003) of available bathymetric surveys conducted by the Corps and other parties in the LDW. This review suggested that intertidal benches along the LDW appeared to be relatively stable over time with changes in bed elevations of less than 2 feet. The thickness of the ENR and ENR+AC at the intertidal plot will be between

about 0.5 foot and 1.0 foot, with an average thickness of about 0.75 foot, a thickness that is within the normal range of elevation changes as reported by Windward (2003). Therefore, placement of ENR and ENR+AC at the intertidal plot is not expected to interfere with or hinder commercial or recreational vessel traffic within the LDW.

The scour plot will be located on the east shoreline of the LDW near the south end of Harbor Island and outside of the federal navigation channel. As with the other two pilot plot areas, the thickness of the ENR and ENR+AC at the scour plot will be between about 0.5 foot and 1.0 foot, with an average thickness of about 0.75 foot. The elevation of the scour plot is expected to be within the normal range of variability of sediment aggradation and scour at this location. In addition, changes in elevation from placement are not anticipated to interfere with operational use of this area. Therefore, placement of ENR and ENR+AC at the scour plot is not expected to interfere with or hinder commercial or recreational vessel traffic within the LDW.

7.1.6 Endangered Species Act

The Endangered Species Act (ESA) of 1973 is designed to protect critically imperiled species from extinction and the ecosystems upon which they depend (16 U.S.C. §§1531 and 1544; 50 CFR 17, 222–224, 226.212, and 402). The ESA forbids federal agencies from authorizing, funding, or conducting actions that may jeopardize endangered species or their critical habitats. Federal agencies must confer with the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) and the U.S. Fish and Wildlife Service (collectively referred to as the Services) regarding any action that may impact listed species or their critical habitats.

Potential adverse effects of the proposed project on threatened and endangered species occupying the LDW, as well as conservation measures intended to prevent the adverse effects, were assessed in the BE that was performed for the ESA Section 7 consultation (Section 8.0 and Appendix B). No threatened or endangered resident species are expected to occupy the LDW in the project area; however, anadromous salmonids use the LDW as a migratory corridor and for foraging.

The project team, on behalf of the EPA, prepared a Biological Evaluation (BE) for the Services assessing the potential effects of the pilot study on listed species and their critical habitats. The BE concluded that the pilot study would not likely adversely affect federally listed ESA species or designated critical habitat. The EPA requested concurrence with the determination of the BE from the Services, who then conducted an Informal Section 7 Consultation and concurred with EPA that the pilot study is not likely to adversely affect federally listed ESA species or designated critical habitat (NMFS, 2015 and USFWS, 2015).

7.1.7 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act is not identified as an ARAR in the ROD but is included in this report because it is a requirement of the ESA consultation process. The Magnuson-Stevens Act and its implementing regulations require consideration of the effects of federal actions on essential fish habitat (EFH) for covered species, including salmon (16 U.S.C. § 1801 et seq.; 50 CFR 600). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." "Waters" include "aquatic areas and their associated physical, chemical, and biological properties that are used by fish." They may include aquatic areas historically used by fish. "Substrate" includes "sediment, hard bottom, structures underlying the waters, and associated biological communities." The Magnuson-Stevens Act requires federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH. Projects that must also undergo Section 7 consultation under the ESA (see Section 7.1.6) can incorporate an EFH assessment as an attachment to the BE that is submitted for Section 7 consultation. Salmonid species covered under the Magnuson-Stevens Act occur in the LDW where the pilot study will be conducted; therefore, the act applies. The BE prepared for the pilot study includes an assessment of EFH.

7.1.8 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests (16 U.S.C. §§ 703–712; 50 CFR 10 and 21). Section 703 of the Act makes it a crime to 'take' protected birds, a very large group of species, which are identified at 50 CFR Section 10.13, without regard to the species' rarity or viability (in contrast to bird species protected under the federal Endangered Species Act and equivalent state statutes as endangered or threatened). While the Act does not define "take," the rules implementing the Act define the term as conduct in which a person "pursues, hunts, shoots, wounds, kills, traps, captures or collects "(See 50 CFR Section 10.12). The proposed action is not expected to produce conditions in the LDW that would result in a take as defined under the MBTA. The proposed action will be consistent with other permitted activities occurring in the LDW (e.g., commercial shipping, dredging, industrial activities). A biological evaluation has been prepared for the project to address potential project impacts on ESA-listed species using the LDW. Based on information presented in the biological evaluation, project activities are anticipated to be consistent with the MBTA.

7.1.9 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA) of 1940 protects the bald eagle and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds (16 U.S.C. § 668; 50 CFR 22). "Take" under the BGEPA includes both

direct taking of individuals and take due to disturbance where “disturb” is defined as: “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.” (50 CFR 22.3). “In addition to immediate impacts, this definition also covers impacts that result from human-caused alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagles return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering.” (USFWS, 2007).The 1972 amendments increased penalties for violating provisions of the act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to the arrest and conviction of individuals for violation of the act. There is no known golden eagle habitat within central Puget Sound (Watson and Davies 2009).

A search of the Washington Department of Fish and Wildlife’s Priority Habitat and Species (PHS) web site (http://wdfw.wa.gov/mapping/phs/) was conducted to identify bald eagle habitats (e.g., nests, roosts, and forage) near the project site. A bald eagle nest was identified within 0.5 miles west of the Scour Plot site near Harbor Island on the bluff overlooking the west shoreline of the West Waterway.

The U.S. Fish and Wildlife Service (USFWS) in its 2007 National Bald Eagle Management Guidelines recommends distance buffers from bald eagle nest trees for different activities. As an example, for construction of multistory buildings, a buffer of 660 feet is recommended, whereas, for on-water activities such as the operation of motorized watercraft, a buffer zone of 330 feet is recommended. Because the nearest nest tree is located over 2,640 feet from the project site, the proposed action is considered to be compliant with the BGEPA.

7.1.10 Floodplain Management Procedures

The Floodplain Management Procedures (40 CFR 6, Appendix A, Section 6) and Executive Order 11988, entitled “Floodplain Management” and dated May 24, 1977, require federal agencies to evaluate the potential effects of actions that may take place in a floodplain to avoid adversely affecting floodplains wherever possible, to ensure that their planning programs and budget requests reflect consideration of flood hazards and floodplain management, including the restoration and preservation of such land areas as natural undeveloped floodplains, and to prescribe procedures to implement the policies and procedures of the executive order. Guidance for implementation of the executive order has been provided by the U.S. Water Resources Council (1978).

There are no anticipated impacts to floodplains due to construction of the pilot study. The elevation of the subtidal plot will be at or below the authorized navigation channel depth. Any changes in water surface elevation due to construction, will be within the range of the water surface elevations that would be expected from natural deposition of sediments within the navigation channel. The elevation of the scour and intertidal plots, as described in Section 7.1.5, will be within the range of elevations that are expected to occur through natural riverine processes.

7.1.11 Clean Air Act

The Clean Air Act was established in 1970, with major revisions in 1977 and 1990 (42 U.S.C. §§ 7401–7671q; 40 CFR 50). The Clean Air Act requires the EPA to establish national ambient air quality standards for certain common and widespread pollutants based on the latest science. The EPA has set air quality standards for six common "criteria pollutants": particulate matter (also known as particle pollution), ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead.

States are required to adopt enforceable plans to achieve and maintain air quality meeting the air quality standards. State plans also must control emissions that drift across state lines and degrade air quality in downwind states.

Reasonable precautions must be taken to (1) prevent the release of air contaminants; (2) prevent fugitive dust from becoming airborne, and (3) maintain and operate the source to minimize emissions (RCW 70.94; WAC 173-400-040). The ENR material will be obtained from an upland source and washed to remove fine soil particles before delivery to the site. The washing will remove most of the small particles that would have the greatest potential to cause fugitive dust; therefore, the pilot study is expected to comply with the Clean Air Act. The pilot study design calls for the blended ENR+AC material to be presoaked before placement, which will reduce the amount of any dust generated from the AC amendment.

7.1.12 Native American Graves Protection and Repatriation Act and American Indian Religious Freedom Act

The Native American Graves Protection and Repatriation Act (NAGPRA) and implementing regulations are intended to protect Native American graves from desecration by the removal and trafficking of human remains and "cultural items," including funerary and sacred objects (25 U.S.C. § 3001 et seq., 43 CFR 10; 42 U.S.C. § 1196 et seq.). To protect Native American burials and cultural items, the regulations require that if such items are inadvertently discovered during excavation, the excavation must cease, and the affiliated tribes must be notified and consulted.

The American Indian Religious Freedom Act (AIRFA) is a federal law and a joint resolution of Congress that was passed in 1978. It was created to protect and preserve the traditional religious

rights and cultural practices of American Indians, Eskimos, Aleuts, and Native Hawaiians. These rights include, but are not limited to, access of sacred sites; repatriation of sacred objects held in museums; freedom to worship through ceremonial and traditional rites, including within prisons; and use and possession of objects considered sacred. AIRFA required policies of all governmental agencies to eliminate interference with the free exercise of Native religion, based on the First Amendment, and to accommodate access to and use of religious sites to the extent that the use is practicable and is not inconsistent with an agency's essential functions.

Executive Order 13007 requires federal agencies to avoid physical damage to tribal sacred sites, and interference with the access of tribes thereto. Compliance with Executive Order 13007 will be maintained throughout project implementation. No excavation or dredging will occur as a result of the pilot study; therefore, it is expected to be substantively compliant with both NAGPRA and AIRFA.

7.1.13 National Historic Preservation Act, Section 106

If Native American or other cultural materials are unearthed during project activities, the National Historic Preservation Act (NHPA) and implementing regulations will apply (16 U.S.C. § 470f; 36 CFR 60, 63, and 800). They require that federal agencies consider the possible effects of projects on historic sites. If an agency finds a potential adverse effect on historic sites or structures, the agency must evaluate alternatives to "avoid, minimize, or mitigate" the impact, in consultation with the State Historic Preservation Officer. Sediment-disturbing activities must cease should such materials be observed, and the appropriate agencies must be notified.

King County conducted a King County Historic Preservation Program Cultural Resources Review (08/27/15). The results of the review indicated that the project area has a low probability of containing intact archaeological sites because it is in an artificial river channel that has previously been dredged and because project-related ground disturbance will be relatively shallow. Although there is a low probability of disturbing any archaeological material, an Inadvertent Discovery Plan (IDP) has been prepared that details the actions that the contractor or monitoring personnel will take if potential archaeological resources are discovered.

Because sediment disturbance during the pilot study will be minimal (e.g., anchor/spud deployment), the plots do not contain any known historic sites or structures, and potential discoveries will be addressed through the IDP, the pilot study is expected to be substantively compliant with the NHPA and will be addressed by the IDP that has been developed for the pilot study.

7.2 STATE LAWS AND REGULATIONS

This section presents the state ARARs that apply to the pilot study.

7.2.1 Model Toxics Control Act Regulations and Sediment Management Standards

Washington's hazardous waste cleanup law, the Model Toxics Control Act (MTCA) mandates that site cleanups protect the state's citizens and environment (RCW 70.105D; WAC 173-340-440). To implement this statutory mandate, Ecology has established cleanup standards and requirements for the cleanup of hazardous waste sites (cleanup actions). The pilot study must comply with the MTCA regulations and, as such, MTCA is an ARAR for the pilot study.

The Sediment Management Standards (SMS) criteria are used to "reduce and ultimately eliminate adverse effects on biological resources and significant health threats to humans from surface sediment contamination" (RCW 70.105D; WAC 173-204). The pilot study has been designed to reduce exposures of aquatic organisms from contaminants in sediments. The ENR material will not exceed the lowest cleanup levels for metals and PCBs shown in the Lower Duwamish Waterway Record of Decision (U.S. EPA 2014) Tables 19 and 20.

The pilot study design requires the use of imported "clean" material, which will be tested before placement in the plots. The ENR material will be required to have nondetectable concentrations of PCBs at or below 2 µg/kg dry-weight (the lowest LDW cleanup goal for PCBs) as measured by congeners). All ENR materials will be sampled and submitted for chemical analyses before it is authorized for use.

7.2.2 Water Pollution Control Act, Water Quality Standards, and Aquatic Life Criteria

The Washington State Water Pollution Control Act authorizes the state to maintain the highest possible standards to ensure the purity of all waters of the state consistent with public health and public enjoyment; the propagation and protection of wildlife, birds, game, fish, and other aquatic life; and the industrial development of the state (RCW 90.48). The state requires the use of all known available and reasonable methods by industries and others to prevent and control pollution of the waters of Washington.

Washington's water quality standards (WAC 173-201A) and numerical aquatic life criteria (WAC 173-201A-240) for surface waters establish water quality standards that are consistent with public health and public enjoyment of the waters and the propagation and protection of fish, shellfish, and wildlife, pursuant to the provisions of Chapter 90.48 RCW. The pilot study has the potential to intermittently alter water quality in the LDW on a short-term basis during construction and,

therefore, must demonstrate compliance with the state water quality standards. Under CERCLA, the EPA will issue a Section 401 water quality memo. A WQMP has been prepared for the pilot study and will be implemented during in-water construction activities to ensure that project-related activities are conducted in such a way as to be consistent with the state's water quality standards.

The surface water criteria will be at least as stringent as all of the following: (1) all of the water quality standards in WAC 173-201A; (2) the ambient water quality criteria, unless it can be demonstrated that such criteria are not relevant and appropriate for the LDW or for a specific hazardous substance; and (3) the National Toxics Rule.

BMPs are described in the WQMP (Appendix F) and the CQAPP (Appendix C). These BMPs primarily focus on reducing turbidity, which is the parameter that has the highest potential for exceeding the water quality criteria.

7.2.3 Solid Waste Management Act

The Solid Waste Management Act regulations govern the disposal of nonhazardous waste generated during removal activities. The Solid Waste Management Act sets minimum functional performance standards for the proper handling and disposal of solid waste, identifies functions necessary to ensure effective solid waste handling at both the state and local level, and establishes priorities for the management of solid waste (RCW 70.95; WAC 173-350).

The pilot study will not be a removal action; however, small quantities of solid waste (i.e., residual sediments collected as part of sediment sampling) may be generated during post placement monitoring. Residual sediments collected as part of post placement monitoring are expected to be nonhazardous wastes and will be disposed in a manner consistent with the Solid Waste Management Act. Therefore, the pilot study is expected to be substantively compliant with the Solid Waste Management Act.

7.2.4 Dangerous Waste Management

The Dangerous Waste Management regulations establish a comprehensive statewide framework for the planning, regulation, control, and management of hazardous waste that will prevent land, air, and water pollution and conserve the natural, economic, and energy resources of the state (RCW 70.105; WAC 173-303). State dangerous waste is defined more broadly than federal hazardous waste.

Dredging or generation of solid waste, with the exception of small volumes of sediment generated during post placement monitoring, will not be components of the pilot study. Based on the LDW RI and the sampling results from the candidate plots for the pilot study, hazardous/dangerous waste is

not expected in LDW sediments. If it is encountered, the pilot study will comply with the state generator rules for accumulating or managing such waste on site for up to 90 days (40 CFR 262; WAC 173-303-17-202). Unanticipated circumstances could necessitate compliance with other hazardous/dangerous waste requirements.

7.2.5 Construction Projects in State Waters and Hydraulics Project Approval Regulations

Regulations governing construction in state waters below the ordinary high water mark are established by RCW 77.55, Construction Projects in State Waters, and by the Hydraulic Code regulations (RCW 77.65; WAC 220-110). These regulations protect fish and shellfish during in-water construction. The requirements are being addressed by the conservation measures and BMPs that will be incorporated into the pilot study. The conservation measures and BMPs are described in the CQAPP (Appendix C), the WQMP (Appendix F), and the BE (Appendix B).

7.2.6 Dredged Materials Management Program

The Dredged Materials Management Program (DMMP) is an interagency program that oversees the disposal and beneficial use of sediments dredged from the waters of Washington (RCW 79.105.500; WAC 332-30-166). The program exists to facilitate navigation and maritime commerce, while guaranteeing the protection of Washington's aquatic environment.

Although listed as an ARAR in the ROD for the LDW Superfund site (U.S. EPA, 2014), dredging will not be a component of the pilot study; therefore, the DMMP will not apply for the pilot study. (Dredging is not an expected part of the pilot study except for potential material movement in the event of material over placement that interferes with navigation. In such case, recently placed material in excess of project activities would be relocated to the perimeter of the appropriate subplot.)

7.2.7 Bald Eagle Protection Rules

The purpose of the Bald Eagle Protection Rules is to protect the habitat and maintain the population of the bald eagle so that the species is not classified as threatened, endangered, or sensitive in Washington (RCW 77.12.655; WAC 232-12-292). This is accomplished by promoting cooperative efforts for managing eagle habitat needs by a process that is sensitive to the goals of the landowner.

Taking or harming eagles, their eggs, nests, or young is prohibited; the substantive requirements for the protection of bald eagle habitat including nesting, perching, and roosting sites will be met

during implementation of the pilot study. The pilot study is not expected to have adverse impacts to bald eagles as described in Section 7.1.9.

7.2.8 Shoreline Management Act; City of Seattle Master Plan; City of Tukwila Master Plan

The Shoreline Management Act (SMA) manages appropriate uses and developments along shorelines of the state by means of state-monitored, locally administered permitting programs (RCW 90.58 and related rules). The act establishes preferences for water-dependent uses, protection of shoreline ecological resources, and public access within the shoreline jurisdiction, defined as aquatic areas and lands within 200 feet of the ordinary high water mark. Consistent with state Enrolled Senate Bill 1653, shoreline critical areas are regulated under the local Shoreline Master Program regulations (City of Seattle [SMC 23.60] and City of Tukwila [TMC 18.44]).

As stated in the beginning of this section, for CERCLA actions such as the pilot study, regulatory permits are not required for on-site actions, but on-site actions must be conducted in a manner that meets the substantive provisions of applicable regulatory requirements.

There are three basic policy areas to the SMA: shoreline use, environmental protection and public access. The SMA emphasizes accommodation of appropriate uses that require protection of shoreline environmental resources and protection of the public's right to access and use the shorelines. Under environmental protection, the SMA is intended to protect shoreline natural resources, including "...the land and its vegetation and wildlife, and the water of the state and their aquatic life..." against adverse effects (RCW 90.58.020). All allowed uses are required to mitigate adverse environmental impacts to the maximum extent feasible and preserve the natural character and aesthetics of the shoreline.

The pilot study will evaluate the effectiveness of ENR+AC compared to ENR alone as a remedial sediment cleanup action in three areas of the LDW in which sediments are contaminated with polychlorinated biphenyls (PCBs). The proposed action is expected to reduce exposure to PCBs in aquatic biota within the LDW over a total area of three acres. The intent and expected results of the pilot study will be consistent with the SMA, as well as the Shoreline Master Programs (SMP) of the cities of Seattle and Tukwila by:

- Protecting "…the water of the state and their aquatic life...";
- Protecting shoreline resources; and
- Not adversely affecting shoreline use or public access adjacent to the three plot areas.

7.2.9 Washington Clean Air Act

The Washington Clean Air Act (WCAA) was enacted to protect and enhance the air quality for current and future generations (RCW 70.94; WAC 173-400). The intent of the WCAA is to secure and maintain levels of air quality that protect human health and safety, including the most sensitive members of the population; to comply with the requirements of the federal Clean Air Act; to prevent injury to plants, animal life, and property; to foster the comfort and convenience of Washington's inhabitants; to promote the economic and social development of the state; and to facilitate the enjoyment of the natural attractions of the state.

Reasonable precautions must be taken to (1) prevent the release of air contaminants, (2) prevent fugitive dust from becoming airborne, and (3) maintain and operate the source to minimize emissions. The BMPs implemented as part of the pilot study, are expected to result in compliance with the WCAA.

7.2.10 Noise Control Act and City of Seattle and City of Tukwila Noise Ordinances

The Noise Control Act of 1974 controls noise levels that adversely affect the health, safety, and welfare of the people, the value of property, and the quality of the environment (RCW 70.107; WAC 173-60-040-050). Under this act, anti-noise measures have expanded efforts statewide to abate and control noise, considering the social and economic impact on the community and the state.

Maximum noise levels at specified times for specified durations have been established (WAC 173-60-040) and are subject to exemptions specified in WAC 173-60-050, including Section 050(3)(a) (sounds originating from temporary construction sites as a result of construction activity) and Section (3)(f) (sounds created by emergency equipment and work necessary in the interests of law enforcement or for health, safety, or welfare of the community).

During the construction of the pilot plots, noise monitoring is not expected to be conducted. Given the location of the pilot study in the heavily industrialized LDW, the construction of the plots is not expected to generate noise levels that are out of compliance with the Noise Control Act, the City of Seattle Noise Ordinance (SMC 25.08), or the City of Tukwila Noise Ordinance (TMC 8.22). In addition, work will likely take place on weekdays during daylight hours, further reducing the need for noise monitoring.

7.3 OTHER CONSIDERATIONS

7.3.1 Environment Justice

Environmental justice is defined by the EPA as "…the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development,

implementation, and enforcement of environmental laws, regulations, and policies." Through stakeholder engagement process, the EPA and Ecology will facilitate the involvement of Georgetown and South Park, which are environmental justice communities potentially affected by the pilot study. By means of stakeholder engagement, these communities and the public will have a forum to participate in decisions about the construction and monitoring associated with the pilot study.

7.3.2 Tribal Treaty Rights

Tribal rights are being respected by means of EPA consultation, stakeholder engagement, and additional coordination that is typical of King County construction projects within tribal usual and accustomed harvest areas. The Muckleshoot Indian Tribe and the Suquamish Tribe are members of the stakeholder group and have been involved in meetings with the EPA, Ecology, and LDWG. The construction and long-term monitoring associated with the pilot study will be coordinated with the Muckleshoot Indian and Suquamish Tribes to reduce impacts on tribal fishers. The contractor will not be allowed to perform in-water work associated with the placement of ENR and ENR+AC materials while tribal fishers are conducting netfishing activities in the LDW that are granted by treaty and they will be notified in advance of any construction activities at each plot.

8.0 BIOLOGICAL EVALUATION

A BE has been conducted for the pilot study; it is included in this report as Appendix B. The BE assessed potential effects of the pilot study on existing environmental conditions in the LDW, listed species using the LDW, and the critical habitats of listed species in the LDW. The BE included an assessment of potential impacts of the pilot study on EFH, which is described in an attachment to the BE.

The pilot study is not expected to substantially alter existing environmental conditions within the LDW. Potential impacts on existing environmental conditions in the action area defined for the BE are the following:

- Placement of ENR and ENR+AC may result in temporary and localized increases in water column turbidity.
- Physical (grain size) and organic carbon sediment characteristics of sediments within the three plots, covering a total of approximately 3 acres, may be altered in the short term when compared to those of the surrounding sediments. In the long term, these characteristics of the sediment are expected to return to current conditions by means of natural riverine processes and deposition.
- ENR and ENR+AC will reduce exposure of aquatic organisms to 3 acres of PCB-contaminated sediments.

- The ENR and ENR+AC materials placed during the pilot study will be approximately 6 to 9 inches thick and are not expected to substantially alter the bathymetry in the pilot plots.
- Placement of ENR and ENR+AC will bury 3 acres of benthic habitat; however, two of the pilot plots are located subtidally in areas unlikely to provide preferred foraging habitat for juvenile salmonids. Therefore, the temporary reduction in foraging opportunities for juvenile salmonids is expected to be restricted to just 1 acre at the intertidal plot.
- The pilot study will have no effect on access and refugia; flow, current patterns, and saltwater-freshwater mixing; marine macroalgae and macrophytes; forage fish; or ambient noise.

The pilot study **may affect, but is not likely to adversely affect** Puget Sound Chinook salmon, Coastal/Puget Sound bull trout, and Puget Sound steelhead trout. The **continued existence of Dolly Varden will not be jeopardized** by the pilot study. The pilot study will have **no effect** on three species of listed rockfish.

The pilot study **may affect, but is not likely to adversely affect** some of the primary constituent elements (PCEs) of the critical habitats for Puget Sound Chinook salmon, Coastal/Puget Sound bull trout, and Puget Sound steelhead trout, while having **no effect** on the remaining PCEs for the critical habitats of those species.

9.0 REFERENCES

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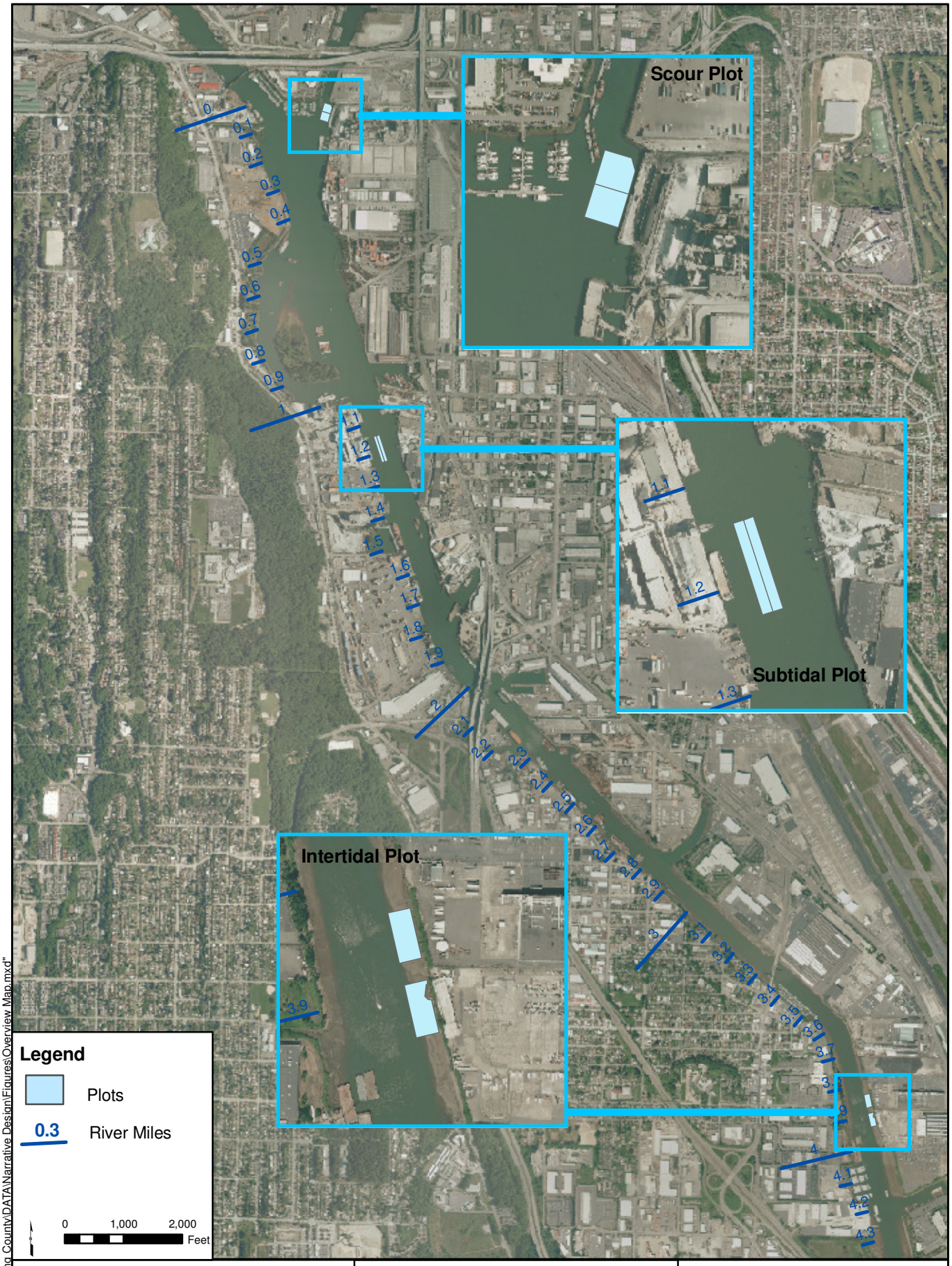
FIGURES



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Lower Duwamish Waterway Group

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ENR/AC Pilot Study
Narrative Design Report

Figure 1
Overview Map of Pilot Plot Areas

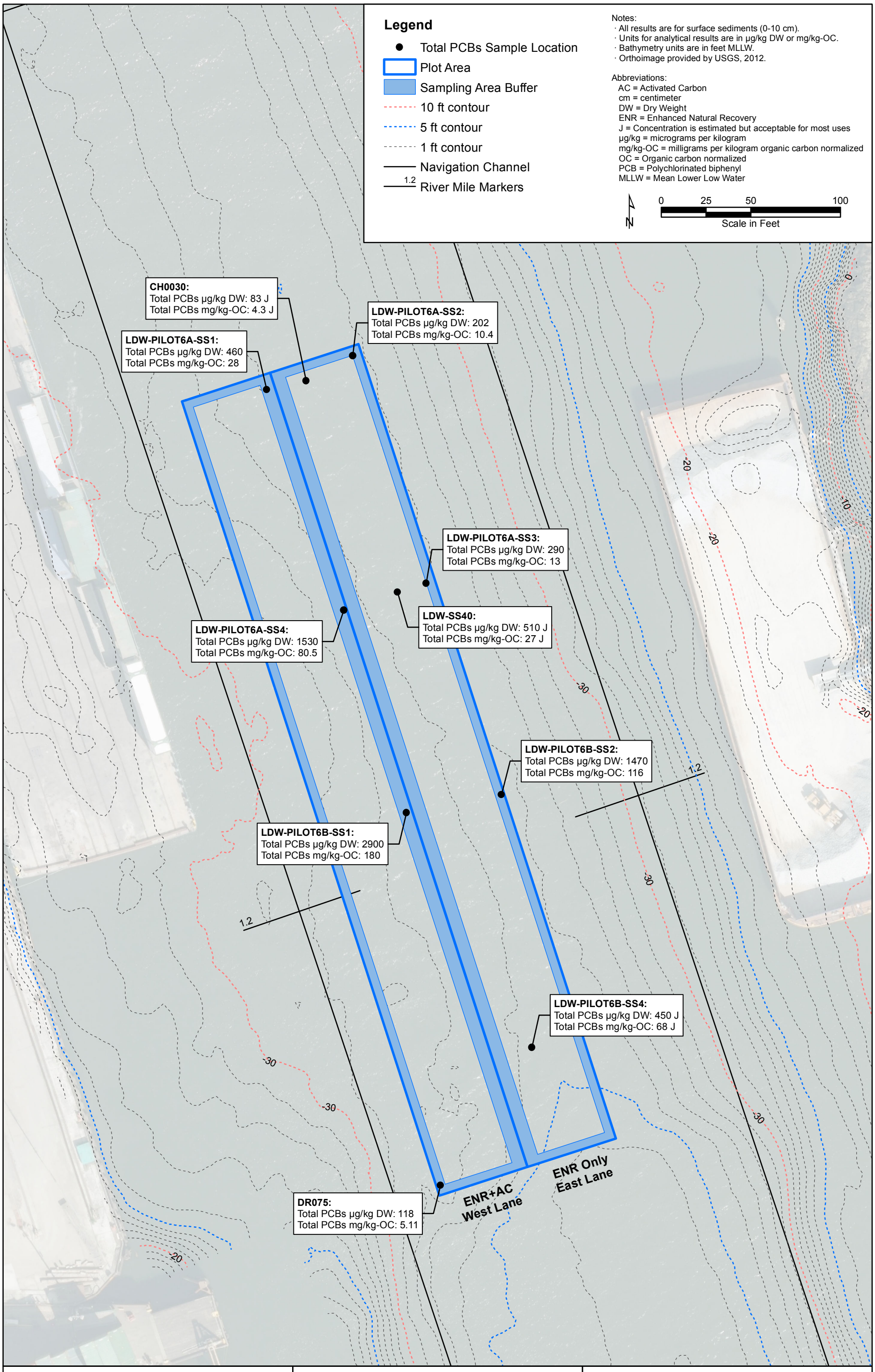

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Figure 2
Subtidal Plot

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Legend

- Total PCBs Sample Location
- Plot Area
- Sampling Area Buffer
- Berthing Area
- 10 ft contour
- 5 ft contour
- 1 ft contour

Notes:
· All results are for surface sediments (0-10 cm).
· Units for analytical results are in µg/kg DW or mg/kg-OC.
· Bathymetry units are in feet MLLW.
· Orthoimage provided by USGS, 2012.

Abbreviations:
AC = Activated Carbon
cm = centimeter
DW = Dry Weight
ENR = Enhanced Natural Recovery
J = Concentration is estimated but acceptable for most uses
µg/kg = micrograms per kilogram
mg/kg-OC = milligrams per kilogram organic carbon normalized
OC = Organic carbon normalized
PCB = Polychlorinated biphenyl
MLLW = Mean Lower Low Water

N

0 25 50 100

Scale in Feet

LDW-PILOT1A-SS1:
Total PCBs µg/kg DW: 208
Total PCBs mg/kg-OC: 14.6

LDW-PILOT1A-SS2:
Total PCBs µg/kg DW: 440
Total PCBs mg/kg-OC: 26

LDW-SS6:
Total PCBs µg/kg DW: 1920
Total PCBs mg/kg-OC: 183

LDW-PILOT1A-SS3:
Total PCBs µg/kg DW: 239
Total PCBs mg/kg-OC: 6.81

LDW-PILOT1A-SS4:
Total PCBs µg/kg DW: 172
Total PCBs mg/kg-OC: 6.83

LDW-PILOT1B-SS1:
Total PCBs µg/kg DW: 225
Total PCBs mg/kg-OC: 23.3

LDW-PILOT1B-SS2:
Total PCBs µg/kg DW: 260
Total PCBs mg/kg-OC: 7.6

LDW-SS7:
Total PCBs µg/kg DW: 240
Total PCBs mg/kg-OC: 8.82

LDW-SS305:
Total PCBs µg/kg DW: 590 J
Total PCBs mg/kg-OC: 20 J

LDW-PILOT1B-SS3:
Total PCBs µg/kg DW: 260
Total PCBs mg/kg-OC: 9.2

LDW-PILOT1B-SS4:
Total PCBs µg/kg DW: 213
Total PCBs mg/kg-OC: 9.42

ENR+AC Downstream Subplot

ENR Upstream Subplot

-20 -30 -20 -10 0 -20 -30 -10 -20 -30 -10 -20 -30

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Figure 3
Scour Plot

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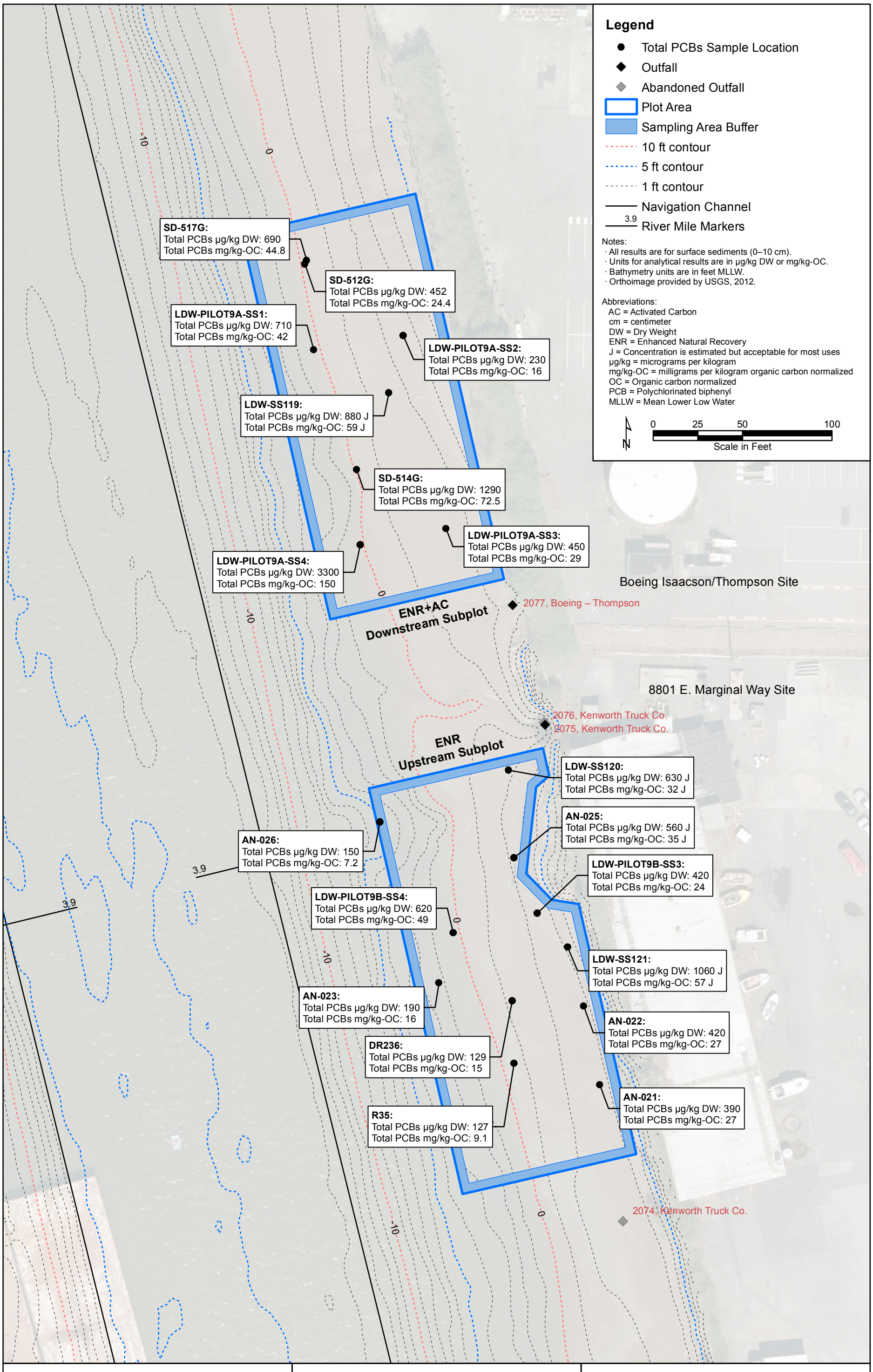

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Figure 4
Intertidal Plot

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APPENDIX A

Plot Selection Memorandum and U.S. Environmental Protection Agency Approval

APPENDIX B

Biological Evaluation

APPENDIX C

Construction Quality Assurance Project Plan

APPENDIX D

Construction Plans and Specifications

APPENDIX E

Quality Assurance Project Plan

APPENDIX F

Water Quality Monitoring Plan

APPENDIX G

Health and Safety Plan

APPENDIX H

Cost Estimate and Project Schedule