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July 3, 2014

Via E-Mail

Sean Sheldrake
U.S. Environmental Protection Agency
1200 Sixth Avenue, Suite 900
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Sheldrake.sean@epa.gov

Re: Supplemental RI/FS Work at the River Mile 11E Project Area
Portland Harbor Superfund Site
Transmittal of the Field Sampling and Data Report

Dear Mr. Sheldrake:

The Field Sampling and Data Report for the River Mile (RM) 11E Project Area is enclosed for your review. The report was prepared by GSI Water Solutions, Inc. on behalf of Cargill, Inc.; CBS Corporation; City of Portland; DIL Trust; Glacier Northwest, Inc.; and PacifiCorp, collectively referred to as the RM11E Group. The report presents the field sampling procedures and analytical results as outlined in the Supplemental Remedial Investigation/Feasibility Study Work Plan. The scope of work included groundwater monitoring well installation, subsurface soil sampling, groundwater sampling and elevation monitoring, surface (bank) soil sampling, and surface sediment sampling.

We are e-mailing you a copy of the main report with tables and figures merged into a single PDF. Due to the size of some of the appendices, we are transmitting those to you through a link to the **HIGHTAIL** File Delivery Service that also includes a pdf of the main report.

Please let me know if you or any of your partners would like to receive a copy of the report on a CD.

Sincerely yours,

Jacqueline Thiell Wetzsteon
RM11E Project Coordinator

Enclosures

ec: River Mile 11E Respondents
AOC Notice Recipients (Paragraph 97.c through m)
Paul Fuglevand

Supplemental Remedial Investigation/ Feasibility Study Field Sampling and Data Report

River Mile 11 East
Portland, Oregon

July 2014

Prepared for

RM11E GROUP

Prepared by

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Abbreviations and Acronyms

µg/kg	microgram(s) per kilogram
ADCI	Association of Diving Contractors International
ALS	ALS Environmental
AOPC	area of potential concern
ASTM	American Society for Testing and Materials
bgs	below ground surface
BMC	Ballard Marine Construction, Inc.
Cargill	Cargill, Inc.
Cascade Drilling	Cascade Drilling, LP
City	City of Portland
cm	centimeter
COC	contaminant of concern
com	voice communications equipment
DEA	David Evans and Associates, Inc.
DEQ	Oregon Department of Environmental Quality
dGPS	differential global positioning system
DOF	Dalton, Olmsted & Fuglevand, Inc.
EDD	electronic data deliverables
EPA	U.S. Environmental Protection Agency
FD	Field Director

FS	feasibility study
ft/bgs	feet/below ground surface
Glacier NW	Glacier Northwest, Inc.
GSI	GSI Water Solutions, Inc.
HPAH	high molecular weight PAH
HSP	Health and Safety Plan
ID	identification
IDW	investigation-derived waste
LPAH	low molecular weight PAH
LWG	Lower Willamette Group
MDL	method detection limits
mg/kg	milligram(s) per kilogram
MRL	method reporting limits
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NTU	nephelometric units
ODOT	Oregon Department of Transportation
OF	outfall
OHW	ordinary high water
OVM	organic vapor monitor
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD/F	polychlorinated dibenzo-p-dioxins/furans
PCE	tetrachloroethylene
PEF	potency equivalent factors
PID	photoionization detector
PM	Project Manager
Portland Harbor	Portland Harbor Superfund Site
ppm	parts per million
PVC	polyvinyl chloride
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
QA/QC Solutions	QA/QC Solutions, LLC
RA	risk assessment

RAL	remedial action level
RG	registered geologist
RI	remedial investigation
RI/FS	remedial investigation and feasibility study
RM	river mile
RM11E	River Mile 11 East
RM11E Group	Cargill, Inc., CBS Corporation, City of Portland, DIL Trust, Glacier Northwest, Inc., and PacifiCorp
ROD	Record of Decision
RSS	Research Support Services, Inc.
SAC	Sampling and Analysis Coordinator
SAP	sampling and analysis plan
SOP	standard operating procedure
SOW	scope of work
SVOC	semivolatile organic compound
TCE	trichloroethylene
TEF	toxicity equivalency factors
TEQ	toxic equivalent
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USGS	U.S. Geological Survey
VOC	volatile organic compound
Willamette CRA	Willamette Cultural Resources Associates, LTD
Work Plan	Supplemental Remedial Investigation/Feasibility Study Work Plan

SECTION 1

Introduction

This Field Sampling and Data Report, prepared by GSI Water Solutions, Inc. (GSI), for the River Mile 11 East (RM11E) Project Area is submitted by Cargill, Inc. (Cargill); CBS Corporation; City of Portland (City); DIL Trust; Glacier Northwest, Inc. (Glacier NW); and PacifiCorp, collectively referred to as the RM11E Group. This report provides the results of the surface sediment, bank soil, upland (subsurface) soil, and groundwater sampling efforts described in the EPA-approved Final Supplemental Remedial Investigation and Feasibility Study (RI/FS) Work Plan (Work Plan; GSI and DOF, 2013). This work is being conducted pursuant to the Statement of Work (SOW) contained within the Administrative Settlement Agreement and Order on Consent (EPA Region 10, CERCLA Docket No. 10-2013-0087). These investigations are supplementary to and consistent with, investigations conducted for the RI/FS of the Portland Harbor Superfund Site (Portland Harbor) and required by EPA to facilitate selection and design of a final remedy at the RM11E Project Area.

The RM11E Project Area is shown in Figure 1-1, and lies between approximately river mile (RM) 10.9[1] and RM 11.6 along the east bank of the Willamette River and includes Area of Potential Concern (AOPC) 25 (from the Draft FS for the Portland Harbor [Anchor QEA et al., 2012]) and the riverbank area to the top of the bank.

1.1 Background

Existing data for RM11E were inventoried, reviewed, and summarized in Section 3 of the Work Plan. The existing data set was reviewed to identify additional information or data gaps that would be needed to support characterization, remedy selection, and remedial design within the RM11E Project Area. RM11E was not originally included in the initial study area (RM 3.5 to RM 9.2) investigated by the Lower Willamette Group. To fill these data gaps, the RM11E Group and EPA identified a set of supplemental RI/FS investigations that will inform remedy selection and expedite the final remedial design following issuance of the site-wide Portland Harbor Record of Decision (ROD). The identified data gaps are described in Section 6 of the Work Plan.

The data presented in this report will be used in the forthcoming Recontamination Assessment and Implementability Study Reports, which are described in Sections 2.8 and 2.9 of the SOW and Section 9 of the Work Plan.

1.2 Purpose and Objective

As described in the Work Plan, this report compiles supplemental environmental data collected to date under the SOW. The RM11E Supplemental RI/FS investigation completed

[1] The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).

to date consisted of multiple sampling efforts, which are detailed in the Upland Groundwater and Bank Soil Sampling and Analysis Plan (SAP; Appendix B of the Work Plan) and the Surface Sediment SAP Addendum (Appendix C of the Work Plan). This report documents field activities and analytical results from each of those tasks, and describes deviations from the associated SAPs.

The results of a porewater investigation scheduled to be conducted in late summer, early fall of 2014 will be reported in a separate data report. Interpretation and discussion of all the data collected under the SOW will be contained in the Recontamination Assessment Report and Implementability Study Report.

1.2.1 Upland Groundwater and Bank Soil SAP

The purpose of the work described in the Upland Groundwater and Bank Soil SAP was to gain a sufficient understanding of the extent of contaminants of concern (COCs) in bank soils and upland groundwater within the RM11E Project Area to support the Recontamination Assessment and Implementability Study and meet the following objectives:

- Evaluate groundwater as a potential recontamination pathway by characterizing the physical (soil characteristics and groundwater levels) and chemical components (polychlorinated biphenyls [PCBs] and other COCs) of the groundwater system feeding into the RM11E Project Area. Groundwater monitoring sites were located slightly landward along the top of the river bank adjacent to and upgradient of the potential sediment management areas Figure 1-2 identified in the Draft FS Report for Portland Harbor (Anchor QEA et al., 2012). Newly collected data will be used to: (1) characterize groundwater quality and flow conditions (spatially and temporally); (2) assess whether groundwater is a significant pathway for consideration in the Recontamination Assessment, and; (3) evaluate groundwater's effect, if any, in the Implementability Study.

- Complete an evaluation of the recontamination potential from potentially erodible surface soils (from zero to 1 foot[2] below ground surface [bgs]) along the riverbank through the collection of supplemental bank soil samples. These data will be used to evaluate whether bank erosion or overland flow is a significant pathway for consideration in the Recontamination Assessment and evaluate potential implementability considerations associated with the riverbank areas.

Following approval of the Work Plan, a fifth well adjacent to the northern end of the RM11E Project Area was added as a condition of EPA's approval of the Work Plan (see Appendix A1 for related correspondence). . The objective of this well was to evaluate potential impacts associated with the former Albina Engine and Machine Works shipyard and operating area.

[2] For consistency with the previous RM11E Focused Sediment Characterization, "surface soil" is defined using the same depth parameters as "surface sediment." namely it includes soils collected between zero and 1 foot (approximately 30 centimeters [cm]) bgs. This is consistent with the Draft Final RI for the Portland Harbor, which defines the "surface sediment" interval as 30 cm (Integral et al., 2011).

1.2.2 Surface Sediment SAP Addendum

The purpose of the work described in the Surface Sediment SAP Addendum was to: (1) further characterize the extent of PCB concentrations north of the Fremont Bridge, and; (2) collect under-dock surface sediment samples to support the Implementability Study and meet the following objectives:

- Measure and further delineate PCB concentrations in surface sediment between RM 10.9 and RM 11.0 within and adjacent to locations where PCBs previously were detected in surface sediment (see Figure 1-2).
- Measure and delineate PCB levels in surface sediment beneath the main Glacier NW and Cargill docks.

After approval of the Work Plan, and in response to EPA's directive to conduct further analysis of dioxins and furans, two additional objectives were added (see Appendix A2 for related correspondence):

- Evaluate dioxin/furan concentrations in select locations as described in Section 6.1 of this report.
- Assess any changes in PCB concentrations by re-occupying six sediment sampling locations where elevated PCB concentrations previously were reported.

The Quality Assurance Project Plan (QAPP) Addendum (Appendix A of the Work Plan) describes the quality assurance/quality control (QA/QC) procedures that were used to determine concentrations of selected chemicals in environmental media that were collected as part of this RM11E Supplemental RI/FS investigation. Deviations from the QAPP Addendum, including the addition of the dioxin/furan analysis, are described in this report.

1.3 Document Organization

This report presents the field and laboratory procedures and analyses of the RM11E surface sediment, bank soil (i.e., surface soil), subsurface soil, and groundwater quality monitoring efforts. The investigative approach and sampling procedures are fully described in the Work Plan, QAPP Addendum, Upland Groundwater and Bank Soil SAP, and Surface Sediment SAP Addendum. This report summarizes the analytical data collected during the field sampling efforts, the procedures laid out in the project QAPP Addendum and SAPs, and presents any deviations from the proposed sampling efforts.

This report is organized into the following sections:

Section 1 – Provides an introduction to the project and objectives.

Section 2 – Summarizes the project team and schedule.

Section 3 – Summarizes upland groundwater monitoring well drilling, construction, and development activities. It also includes a description of the subsurface soil sample collection methodology for samples collected from the monitoring well borings.

Sections 4 through 6 – Summarizes sampling approaches, station positioning, field documentation, and sampling procedures for groundwater, surface bank soils, and surface sediment, respectively.

Section 7 – Summarizes field QA/QC samples and equipment decontamination procedures, sample handling, documentation and transport procedures, including cultural resource monitoring efforts.

Section 8 - Describes the laboratory analysis program, including laboratory QA/QC protocols and data validation procedures.

Section 9 – Summarizes data management procedures.

Section 10 – Presents analytical results.

Section 11 - Presents references.

Supporting information including field documentation, photographs, laboratory and data validation reports, the cultural resources monitoring report, and data files are provided in Appendices A through J.

SECTION 2

Project Organization

This section summarizes the organizational structure, health and safety requirements, and schedule for the RM11E Supplemental RI/FS investigation.

2.1 Team Organization

Field sampling activities were overseen and coordinated by GSI, under contract to Dalton, Olmsted & Fuglevand, Inc. (DOF). GSI staff fulfilled the following roles, as identified and discussed in detail in the SAPs, GSI Health and Safety Plan (HSP; Appendix D of the Work Plan), and QAPP Addendum:

- Project Manager
- Technical Project Lead
- Field Director (FD)/Health and Safety Officer
- Sampling and Analysis Coordinator
- QA Manager
- Data Manager

Additional support was provided by the following subcontractors:

- **ALS Environmental (ALS) –** Courier and analytical service provider for all sampling activities.
- **Applied Professional Services, Inc**. – Private utility locater at all drilling locations.
- **Ballard Marine Construction, Inc. (BMC) –** Vessel operator and dive contractor for manual sediment sampling activities in limited access locations.
- **Cascade Drilling, LP (Cascade Drilling) –** Upland groundwater monitoring well driller and investigation-derived waste (IDW) management.
- **David Evans and Associates, Inc. (DEA) –** Surveyor of the groundwater monitoring wells and bank soil sample locations.
- **Research Support Services, Inc. (RSS) –** Vessel operator for power-grab sediment sampling.
- **QA/QC Solutions, LLC (QA/QC Solutions) –** QA review and validation of the analytical data
- **Willamette Cultural Resources Associates, LTD (Willamette CRA) –** Archaeological/cultural resources oversight during sediment sampling and drilling activities.

Project staffing did not deviate from that described in the SAPs and QAPP Addendum, with one exception, BMC performed the diver-collected sediment sampling services, including vessel operations, rather than RSS.

2.2 Health and Safety

Field activities were completed in compliance with Hazardous Waste Operations and Emergency Response regulations under Chapter 29 Code of Federal Regulations 1910.120. GSI developed a project-specific HSP to ensure the safety of GSI personnel working onsite and compliance with relevant regulations and standards. The HSP covered all identified field and inwater hazards associated with the tasks necessary to complete the investigation activities. Subcontractors prepared their own HSPs and were responsible for monitoring and compliance with their plans. A diver-specific HSP was prepared by the diving contractor and reviewed and approved by EPA before implementation.

2.3 Project Schedule

A summary of the field activity schedule completed as part of the RM11E Supplemental RI/FS investigation is provided in Table 2-1. Surface power-grab sediment sampling was conducted from October 30 to October 31, 2013. Groundwater well installation, subsurface soil sampling, and bank soil sampling were conducted on October 31 and from November 18 to 22, 2013. The first round of groundwater monitoring samples was collected from December 4 to 10, 2013, and the second round was collected on April 14 and 15, 2014. The limited-access surface sediment samples were collected manually by divers on May 1 and 2, 2014. Interim validated results were provided to EPA in the December 2013, January 2014, and May 2014 monthly progress reports as further described in Section 1 of the Work Plan.

The forthcoming Recontamination Assessment and Implementability Study Reports are scheduled to be submitted to EPA 60 days after submission of the Final Porewater Characterization Report as outlined in a June 4, 2014 e-mail to Sean Sheldrake from Jackie Wetzsteon on behalf of the RM11E Group.

SECTION 3

Monitoring Well Drilling, Installation, and Subsurface Soil Sampling

This section describes the procedures that were used for drilling, construction, well development, and completion of five groundwater monitoring wells. The monitoring well locations are shown in Figure 1-2 with coordinates and well construction details provided in Table 3-1. Depth-discrete soil sample collection is discussed in this section while groundwater monitoring activities are discussed in Section 4. EPA provided oversight for all phases of the monitoring well drilling and installation and DEQ representatives were onsite to observe a portion of the drilling and borehole logging activities. Unless otherwise noted, these activities were conducted in accordance with the EPA-approved Upland Groundwater and Bank Soil SAP.

3.1 Monitoring Well Locations and Utility Clearance

Four new monitoring wells (RM11E-MW001, -MW002s, -MW003d, and –MW004) were proposed in the Work Plan that was submitted to EPA on October 3, 2013, to complement two existing monitoring wells (MULT 1007 and MULT 89881). EPA's approval of the Work Plan was conditional upon the addition of a new well in the vicinity the former Albina Engine and Machine Works shipyard operations in the northern portion of the current Glacier NW property. Accordingly, the RM11E Group added a fifth shallow monitoring well (RM11E-MW005). The location of the five new and two existing wells are shown in Figure 1-2. Correspondence between the regulatory agencies and the RM11E Group regarding this additional well is provided in Appendix A1.

Before commencement of fieldwork, the target monitoring well locations were sited and staked by GSI following consultation with the property owners and drilling contractors and review of site utility documents. Some well sites were shifted slightly from the target locations specified in the SAP because of site constraints, such as heavy traffic (i.e., RM11E-MW001), the presence of fences (i.e., RM11E-MW002s and -MW003d), and overhead features (i.e., RM11E- MW004). The actual and proposed monitoring well locations are provided in Appendix B1. Table B1 lists the monitoring well coordinates while Figure B1 shows their relative positions on a map.

After staking the monitoring well locations, a utility locate was requested and completed within a 50-foot radius of each staked location through the Oregon Utility Notification Center (One Call Locates). GSI staff members met the utility locators from the City of Portland and Level3 Communications to ensure adequate set-backs from stormwater, public drinking water, and fiber optic infrastructure. A private utility locator, Applied Professional Services, Inc., also was subcontracted to perform private utility locates at all drilling locations.

After completion of the utility locates, each borehole location was pre-excavated by air-knife and vacuum excavation to a depth of 5 feet by Cascade Drilling to confirm that no shallow underground utilities would be impacted by drilling. To provide for alternative drilling locations in the event of refusal (i.e., depth or point at which borehole drilling cannot be advanced to target depth), one or two extra locations within 20 feet of the target station also were air-knifed. To facilitate drilling activities, these locations were positioned parallel to the orientation of the drill rig, such that they could back up to the next hole should refusal be encountered. To create a safe working area, unused points were covered temporarily, using steel plates or heavy rubber mats. At the completion of the well installations, any unused points were filled and abandoned properly by Cascade Drilling. Excavated soils for utility clearance were drummed and managed as IDW (see Section 3.8).

3.2 Monitoring Well Drilling and Equipment Decontamination

In November 2013, the five new groundwater monitoring wells were drilled using rotosonic drilling methods. The wells were drilled, constructed, and developed by an Oregon-licensed driller (Cascade Drilling) under the direction of an Oregon registered geologist (RG) from GSI.

Each monitoring well was drilled with a 6-inch-nominal-diameter boring core to maintain an annular space of 2 inches between the borehole wall and the 2-inch-nominal-diameter well casing. The borehole cores were advanced at 5-foot intervals, rather than longer 10- or 20-foot runs to enhance core sample recovery. Greater sample recovery allowed for more comprehensive characterization of lithology with depth and improved stratigraphic control.

Drilling and well development equipment was decontaminated with a high-pressure steam cleaner and pressure washer before each use. Decontamination water was captured and placed in properly labeled drums and stored in a secure location for disposal with other IDW (see Section 3.8).

3.3 Field Screening and Methane Monitoring

Field screening for health and safety and potential contaminant characterization was completed using a MiniRAE 3000 organic vapor monitor-photoionization detector (OVM-PID) and a Solaris Multigas Detector-MSHA. Health and safety screening was done on the work platform of the drill rig, inside the steel drill casings, and inside the plastic bags holding the soil cores. Additional readings for potential contamination were completed by placing soil aliquots from each 5-foot core interval for all of the well borings into a sealable plastic bag, disaggregating the sample, and after several minutes, inserting the OVM-PID probe in the airspace in the bag above the soil.

No detections of combustible gases, hydrogen sulfide, carbon monoxide, or volatile organic compounds (VOCs) were made within the breathing zones, working spaces, or equipment of the drilling crews. Similarly, there were no detections of any combustible gases, hydrogen sulfide, or carbon monoxide in the plastic bags containing the soil samples.

Additionally, the PID did not detect any VOCs in the soil samples collected from boreholes for RM11E-MW001 and RM11E-MW003d. Low-level VOC detections were observed in the borehole soils from RM11E-MW002s (0.2 to 0.4 parts per million [ppm]), RM11E-MW004

(0.1 ppm), and RM11E- MW005 (0.1 ppm). These detections are considered to be insignificant because the PID responds to a number of influences including temperature, humidity, soil moisture content, and operational conditions. Complete instrument readings for the soil samples are provided in the soil logs in Appendix B2.

3.4 Borehole Logging

The soil cores were photographed and logged in the field by an Oregon RG in general accordance with American Society for Testing and Materials (ASTM) D2488 – Standard Practice for Description and Identification of Soils (Visual/Manual Procedure). These classifications are based on a visual examination of the soil and a determination of the predominant fractions of soil (e.g., gravel, sand, silt, and clay). Approximate physical or textural soil characteristics (e.g., color, odor, coarseness, gradation, particle shape and roundness, soil moisture conditions, and consistency) were recorded on field boring logs. Appendix B2 includes drafted copies of the logs. Appendix B3 includes photographs of soil cores from each well arranged in sequential order from ground surface to the total borehole depth.

3.5 Subsurface Soil Sampling

Soil samples were collected throughout the overlying artificial fill and underlying upper 5 feet of native alluvium material. The contact between the artificial fill and the native alluvium was determined by the RG based on field observations, such as changes in grain size, color, anthropogenic debris, and degree of cementation. Soil borings and horizon boundaries were photographed and logged to document such determinations and are provided in Appendices B2 and B3.

For each 5-foot core, a soil sample was collected representing the full recovery length of each 5-foot core interval: soil was obtained from the core center using a decontaminated stainless-steel spoon, homogenized in a decontaminated stainless-steel bowl and transferred into laboratory-provided soil sample jars. These core samples were collected from each 5-foot core interval until at least 5 feet below the base of the artificial fill. A composite sample of the artificial fill was also collected by placing equal volumes of soil from core intervals representing the full length of the artificial fill and homogenizing this soil as above. This composite sample and the sample of upper 5 feet of native alluvium were submitting to ALS for analysis of PCBs and other potential COCs as described in Section 8. All other samples were submitted to ALS for frozen archival.

The SAP indicated that composite samples representing the unsaturated and saturated portions of the artificial fill would be collected. However, at the time of well installation and soil sampling in the four new shallow monitoring wells (RM11E-MW001, -MW002s, -MW004, and –MW005), the full thickness of the artificial fill was found to be unsaturated and as a result no samples for saturated artificial fill were collected. In the deep monitoring well (RM11E-MW003d), the full thickness of the artificial fill also was found to be unsaturated. Because this well is co-located with RM11E-MW002s, a soil sample of the unsaturated artificial fill was collected for archiving.

Scoops, spoons, mixing bowls, and other equipment used to collect samples were decontaminated using the multi-step process described in the SAP and Section 7 of this report. All decontamination fluids and remnant soils from logging and sampling were placed in properly labeled drums dedicated to each borehole as described in Section 3.8.

3.6 Well Construction

Summaries of well completion details are provided in Table 3-1. The well construction and soil logs are provided in Appendix B2. The monitoring wells were constructed of 2-inch-diameter Schedule 40, flush-threaded, polyvinyl chloride (PVC) well casing and completed with a 0.010-inch milled slot screen and 10-20 Colorado silica sand filter pack. The filter pack was placed within the 2-inch annular space from the bottom of the tailpipe to 2 feet above the top of the screen.

The four shallow monitoring wells (RM11E-MW001, -MW002s, -MW004, and -MW005) were completed and screened across the base of the fill to account for seasonal and tidal groundwater level fluctuations. Completed total depths of the shallow wells ranged between approximately 36 and 43 feet below ground surface (ft bgs), including a 5-foot tailpipe sump. A deeper well (RM11E-MW003d) was drilled in a paleochannel to a depth of 106 ft bgs, penetrating into Troutdale Formation Gravels at 103.5 feet bgs. The well was completed within the paleochannel deposits with the screen interval set between 90 to 100 ft bgs.

All wells were drilled and completed as described in the SAP or as agreed to based on subsequent regulatory agency communication, with a few minor exceptions that will not affect the quality of data:

- Given the fine-grained, continuous, silt (ML) encountered below the base of the artificial fill at RM11E-MW002s, a 20-foot (versus 15-foot) well screen was installed to increase recharge to the well and the likelihood of obtaining a groundwater sample from this low-permeability confining unit.

- The tailpipe sumps attached to the bottom of each well screen were 5 feet long versus the 3-foot lengths identified in the SAP. The tailpipes were threaded by the manufacturer on the top and bottom so they could be attached to the base of the well screen and be fitted with an end cap at its base. Fashioning a 3-foot tailpipe would have required trimming off the bottom threads and using PVC solvent cement or epoxy resin to attach the end cap, potentially introducing contaminants into the completed well.

3.7 Well Development

After a minimum of 24 hours had passed since the surface seal was installed, well development was conducted to remove fine-grained material from the filter pack and borehole, thereby improving the hydraulic connection between the well and the water-bearing zone(s). The five new monitoring wells and the two existing wells were developed by the drilling contractor and GSI staff members using a combination of surging, bailing, and pumping in general accordance with the well development sequence specified in the

SAP until groundwater parameters stabilized and turbidity dropped to acceptable levels (5 to 10 nephelometric units [NTUs]).

At the completion of development, the turbidity in six of the wells ranged from 0.28 NTU in MULT 89881 to 4.38 NTU in RM11E- MW003d. The stabilized field parameters and total volume purged during development of the wells and before collecting groundwater samples are provided in Section 4. Well development water was stored in Department of Transportation (DOT)-approved 55-gallon drums and disposed of as nonhazardous waste following characterization as described in the next section.

3.8 Investigation-Derived Waste

Soil cuttings from well installation and water from development, equipment decontamination, and groundwater sampling were placed into DOT-approved 55-gallon drums for each borehole. Each drum was labeled with the project name, description of contents, generation date, and contact information. The drums were stored in secured locations within the locked facilities at the Glacier NW and Cargill sites.

Analytical results obtained from each borehole and groundwater results from the first monitoring event were used to profile the drummed IDW for disposal. A generator's waste profile was completed for Cascade Drilling by Burlington Environmental and the drums were picked up and disposed of as nonhazardous waste by PES Environmental Services after the second round of groundwater monitoring was completed.

3.9 Location/Elevation Survey

The location and elevation of each of the seven monitoring wells were surveyed by an Oregon-licensed land surveyor using an established datum. The surveyor measured the latitude, longitude (northings and eastings), and elevation at the top of the well casing and ground surface next to each well monument. Horizontal coordinates were established to the closest 0.1 foot and referenced to the North American Datum of 1983 (NAD83), State Plane Coordinate System, Oregon North Zone. Elevations were established to an accuracy of 0.01 foot and referenced to North American Vertical Datum of 1988 (NAVD88).

SECTION 4

Groundwater Sample Collection and Elevation Monitoring

This section summarizes the approach and procedures associated with the groundwater level and groundwater quality monitoring events. Unless otherwise noted, the groundwater sampling was in accordance with the EPA-approved Upland Groundwater and Bank Soil SAP. EPA provided oversight for both groundwater sampling events.

4.1 Groundwater Monitoring Approach and Schedule

Two rounds of groundwater monitoring were conducted to characterize the physical and chemical components in the groundwater system beneath and adjacent to the RM11E Project Area. Groundwater levels measurements and groundwater quality samples were collected from the RM11E monitoring well network, which consists of the five newly drilled wells and the two existing wells shown in Figure 1-2.

As noted in the SAP, both groundwater monitoring events were intended to target a sampling time when seasonal and diurnal fluctuations in river level (stage) were at their lowest or near-lowest levels to ensure to the extent possible that the samples were representative of groundwater and not infiltrating river water. Historically, the Willamette River level stage is generally lowest during the late-summer through early-fall (September through early November) and late-winter through early-spring (February to mid-March), and thus those were the targeted sampling periods. In addition, both sampling events were designed to target periods when the anticipated Willamette River stage was below 12 feet NAVD88.

The new monitoring well locations were approved and installed by November 22, 2013. Well development was conducted primarily between November 21 and 25 and the wells were left to recover and reach equilibrium for up to two weeks prior to the first groundwater sampling event. Additional well development time was needed at RM11E-MW001 to improve the well's hydraulic connection with the aquifer. After development, RM11E-MW001 was allowed to recover and reach equilibrium for one day prior to sampling. The fall groundwater sampling event occurred from December 4 through 10, 2013. The fall sampling event was conducted when the Willamette River stage was less than 12 feet NAVD88 and the gradient was toward the river, as intended. Because of an abundance of rain in February and March 2014, the Willamette River levels were atypically high during this period, and therefore, the second sampling event was postponed to comply with the objectives stated in the SAP. The river stage declined to levels near 12 feet NAVD88 in April 2014, and the RM11E Group and EPA agreed that as long as the river levels were below 13.5 feet NAVD88 before the sampling event, then the groundwater gradient could be expected to be flowing toward the river and sampling could be conducted (see Appendix

A2). The second round of samples was collected between April 14 and 15, 2014, and targeted the lower tidal periods of the day when the river stage dropped below 12 feet NAVD88.

Given the low recharge rates associated with the shallow monitoring wells and attempts to avoid sampling during periods of high tide, each of the groundwater sampling events spanned a period of 2 or 3 days rather than 1 day, as originally anticipated.

Groundwater samples were analyzed for the RM11E COCs, conventional analytes, and VOCs as discussed in Section 5 of the Work Plan and Section 8 of this report. The RM11E COCs include analytes from the following chemical groups: PCBs, total petroleum hydrocarbons, polycyclic aromatic hydrocarbon (PAHs), pesticides, metals, phthalates, and semivolatile organic compounds (SVOCs). To assess potential impacts from the Tarr property[3] plume, groundwater was analyzed for VOCs (including tetrachloroethylene [PCE] and trichloroethylene [TCE]).

4.2 Groundwater Elevation Monitoring

Groundwater levels were collected manually using an electronic water-level probe during the two groundwater monitoring events. Additional water levels were collected manually on three occasions: January 17, 2014; March 11, 2014; and April 8, 2014. The water level in each well was measured from the surveyed top of the inner casing to the nearest 0.01 foot. Water level measurements and surveyed measuring point elevations were used to compute groundwater elevations and are presented in Table 4-1.

In addition to the manual water level measurements, two monitoring wells (RM11E-MW002s and -MW003d) were equipped with automated, vented pressure transducers with internal data loggers on December 9, 2013. The transducers were factory-calibrated before installation and will remain deployed for up to 12 months. Data from these transducers were downloaded in conjunction with the other groundwater monitoring events. The last download was conducted on April 15, 2014.

The transducer readings and surveyed measuring point elevations were used to generate a continuous record of groundwater elevation at the two wells containing transducers. This continuous data, as well as the manual water level measurements from all seven wells, daily precipitation, and Willamette River stage data, are plotted together versus time in Figure 4-1 to further evaluate the hydraulic gradient between groundwater and the river.

4.3 Groundwater Quality Sampling

Groundwater quality samples were collected from the seven monitoring wells located along and near to the east bank of the Willamette River (Figure 1-2). As discussed above, two rounds of groundwater sampling and analyses were conducted during December 2013 and April 2014. Both events targeted periods when seasonal and diurnal fluctuations in river stage were near their lowest levels to ensure the samples were representative of groundwater and not infiltrating river water.

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[3] As discussed in Section 6.2.2 of the Work Plan, one known contaminant plume has been identified in the RM11E Project Area. A chlorinated solvent plume originating at the Tarr property (ECSI #1139) has migrated in a westerly direction and has the potential to discharge to the river in the RM11E Project Area. Tarr, Inc. is not involved in the RM11E Group.

Before collecting groundwater samples, the monitoring wells were purged using a low-flow pump, an electronic pump, or a bailer, depending upon the water levels and well recharge rates. Field parameters were monitored during purging. Purge water was conveyed through a flow-through cell, and monitored for pH, water temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, and turbidity. The field parameters, including water level, were measured at regular intervals (e.g., approximately every well volume or every 3 to 5 minutes, depending on the sampling method used) and recorded on separate groundwater sampling forms for each well. Sample collection began after three successive readings reached stabilization, according to the stabilization criteria listed in the Purging and Sampling Procedure in Attachment 2 of the SAP. Water quality sensors used for field parameter monitoring were field-calibrated daily according to manufacturer instructions. A summary of the stabilized field parameters, total volume purged, and purge technique is provided for in the December 2013 and April 2014 groundwater sampling events in Tables 4-2 and 4-3, respectively. Copies of the Well Sampling Field Logs are provided as Appendix B4.

With the exception of the December 2013 sample from RM11E-MW001, all other groundwater samples were collected using the Low-Stress (Low-Flow)/Minimal Drawdown method (as described in Attachment 2 of the SAP), using Teflon or Teflon-lined polyethylene tubing. Because of the low-recovery nature of monitoring well RM11E-MW001, EPA approved a Field Change Request Form (see Appendix A1) and the well was sampled with a bailer rather than the low-flow technique during the December 2013 sampling event. On December 4 and 9, 2013, approximately 8 gallons of water were removed from that well by bailing it dry in an attempt to clear the water and increase the recharge rates before sampling. On December 10, 2013, groundwater samples were collected from the well with a bailer even though fine silts were still present in the well that produced a turbidity measurement of 82.5 NTU (laboratory measurement). This well was re-evaluated on March 11, 2014, when GSI staff members used a peristaltic pump to attempt additional clearing. Four gallons of water were removed from the well with little drawdown and lower levels of turbidity when compared to December's samples. The well was sampled on April 14, 2014, with stable water-level and field parameters and a turbidity of 0.18 NTU (laboratory measurement) at the time of sampling.

Groundwater quality samples were placed in appropriate, analytical laboratory-supplied pre-cleaned and preserved containers. Separate containers were provided for total and dissolved metals and TOC. Laboratory filtering was performed before dissolved analysis of these constituents. As described in the SAP, glass vials for VOC analyses were filled so that there was a meniscus at the top of the vial and no bubbles or headspace present in the vial after it was capped. Groundwater quality and field QC sample bottles were placed on ice in coolers with padding for transfer to ALS following the procedures in Section 7.

Groundwater sampling equipment reused between monitoring locations (e.g., pump system, flow-through cell) was decontaminated between uses, as described in the SAP. Sample tubing was dedicated to a single monitoring well to eliminate the need for decontamination.

Pending receipt of the groundwater monitoring results to determine appropriate disposal, purge and decontamination water was temporarily stored onsite in a secure location in DOT-approved 55-gallon drums labeled as nonhazardous waste (see Section 3.8).

SECTION 5

Surface Soil Sample Collection

This section summarizes the sampling approach, station positioning, field documentation, and sampling procedures associated with surface soil sample collection. Unless otherwise noted, the surface soil sampling was conducted in accordance with the EPA-approved Upland Groundwater and Bank Soil SAP. EPA provided oversight for the surface soil sampling events.

5.1 Surface Soil Sampling Approach and Schedule

Surface soil samples were collected to characterize potentially erodible surface soils along the riverbank above the ordinary high water (OHW) level and to further characterize shallow soil in the upper portions of a cove located at RM 11.4. The top of the bank samples were collected concurrent with well installation (Section 3) between November 19 and 22, 2013. Two samples were collected along the upper portions of the cove in conjunction with the surface sediment sampling event (Section 6) on October 31, 2013.

Samples collected from the bank soil sampling sites were analyzed for the RM11E COCs discussed in Section 5 of the Work Plan and Section 8 of this report. The RM11E COCs include analytes from the following chemical groups: PCBs, hydrocarbons, PAHs, pesticides, metals, phthalates, and SVOCs. In addition to the project COCs, surface soil samples were analyzed for TOC. Additional soil volumes also were collected and archived at ALS for potential further analyses.

5.2 Surface Soil Station Locating

A handheld differential global positioning system (dGPS) unit was used to locate the targeted location of bank soil samples set forth in the SAP. These proposed sample locations then were modified by an RG to: (1) accommodate onsite access or obstructions that limited sample accessibility, or; (2) target potential areas of runoff, if present, observed near the proposed sample location. A map showing the actual and proposed surface soil locations is provided in Figure C1 in Appendix C1; the coordinates and rationale for modifications greater than 30 feet are provided in Table C1 in Appendix C1.

After the samples were collected, the approximate centroid of each multi-point composite sample location was staked, and the location and elevation were surveyed by an Oregon-licensed land surveyor using established datum. The surveyor measured the latitude, longitude (northings and eastings), and elevation at the ground surface next to each stake. Horizontal coordinates were established to the closest 0.1 foot and referenced to the NAD83, State Plane Coordinate System, Oregon North Zone. Elevations were established to an accuracy of 0.01 foot and referenced to vertical datum NAVD88.

The actual bank surface soil sample locations are shown in Figure 5-1 and sample coordinates and collection details are provided in Table 5-1.

5.3 Surface Soil Sampling Procedures

Bank soil samples were collected from nine locations (Figure 5-1) located along the east bank of the Willamette River using the multi-point composite sampling procedure described in Section 5.5.1 of the SAP. Specifically, seven composite samples were collected from locations on the top of the bank where exposed soils were observed to have the potential for erosion to the river, with a focus on unarmored areas with finer grain-sized materials. Two additional composite samples were collected from riverbank surface soils (zero to 1 foot depth [30 cm]) in the upper portion of the cove located on the east bank at RM 11.4. Photographs showing the arrangement of the multi-point composites are provided in Appendix C2.

The exposed bank soil material along the top of the bank was sampled using a decontaminated hand auger. Sample locations (RM11E-SL035 and -SL036) were sampled using a hand shovel because of the presence of debris and gravel in the cove area. Equal volumes of soil were collected from approximately the upper 12 inches (30 cm) at each of the individual sampling positions and placed in a decontaminated stainless-steel bowl for characterization and homogenizing. The penetration depth of each individual sample, the number of samples in each composite, a description of the sampling area, and the physical descriptions of the samples, as recorded by an RG, are included on the surface soil grab sample description forms (Appendix C3). The average penetration depth for each sample is provided in Table 5-1.

Organic materials, such as twigs and leaves, landscaping mulch, and any loose surface rocks or gravel, were carefully removed by hand before sampling. Samples then were homogenized and transferred directly to sample jars in accordance with the procedures described in the SAP. Additional detail on sample analysis is provided in Section 8.

The excess soil not used for samples was used to backfill the sample holes; as such, no IDW was generated. All sampled locations were restored to pre-sampling conditions.

SECTION 6

Surface Sediment Sample Collection

This section summarizes the sampling approach, station positioning, field documentation, and sampling procedures associated with surface sediment sample collection. Unless otherwise noted, the surface sediment sampling was conducted in accordance with the EPA-approved Surface Sediment SAP Addendum. All surface sediment sampling activities were conducted under direct EPA oversight.

6.1 Surface Sediment Sampling Approach

A total of 22 surface sediment samples were collected in the RM11E Project Area, as shown in Figure 6-1 and Table 6-1. Twelve of those samples were collected using a pneumatic power-grab sampler (Power Grab in Figure 6-1) in October 2013 and 10 samples were manually collected (Manual Grab in Figure 6-1) by divers in May 2014. The rationale for sample collection is described in Section 1.2.2 and summarized below.

- Eight surface sediment samples were collected downstream of the Fremont Bridge between RM 10.9 and RM 11.0 to confirm and further characterize sediments around two historical sampling stations (LW3-G771 and WLCDRD05PG06363; see Figure 10-1b) where PCBs previously were detected at estimated (i.e., 'J'-flagged) concentrations of 95 micrograms per kilogram (µg/kg) and 200 µg/kg, respectively.

- Six sediment sampling locations upstream of the Fremont Bridge where elevated PCB concentrations previously were reported were resampled to assess any changes in PCB concentrations (RM11E-G009 [2,900 µg/kg], RM11E-G017 [410 µg/kg], LW3-UG02 [6,000 µg/kg], LWG-UG03 [1,200 µg/kg], RM11E-G036 [1,300 µg/kg], and RM11E-G064 [1,600 µg/kg]).

- Three samples from underneath the main Glacier NW dock and two from underneath the Cargill dock were collected to assess PCB levels in surface sediment beneath these structures.

- Three new diver-assisted manual surface sediment samples (RM11E-G087, -G088, and –G089[4]) were added at the request of EPA (see Appendix A2) to evaluate dioxin/furan concentrations in the vicinity of existing sediment sample RM11E-G039 (RM 11.4 to 11.5) and downstream of the previous sediment sample location RM11E-C003 (RM 11.1 to 11.2).

As described in Section 8, all sediment samples were analyzed for PCB Aroclors, TOC, total solids, and grain-size distribution. Samples from several re-occupied stations also were analyzed for organochlorine pesticides, as discussed in Section 3.1 of the QAPP Addendum.

[4] Per agreement with EPA, sample was held for potential dioxin/furan analysis pending the results at RM11E-G088. Dioxin/furan analysis was not conducted at this location based on RM11E-G088 concentrations being below EPA's proposed RALs (agency communication provided in Appendix A2).

At EPA's direction, several samples, including two archived samples downstream of the Fremont Bridge, were also analyzed for dioxins and furans.

Additional sediment from each sample location was archived frozen (at -20°C).

6.2 Surface Sediment Station Positioning

6.2.1 Power-Grab Station Positioning

RSS mobilized the vessel *Carolyn Dow* to conduct power-grab sampling on October 30 and 31, 2013. The target sample coordinates were pre-loaded into the on-board navigation system and qualitatively checked by the FD using aerial photographs and site knowledge upon arrival at each station.

After the sampling equipment had been deployed, the latitude and longitude coordinates were obtained when the equipment was on the river bottom, using the high-resolution dGPS mounted on the A-frame directly above the power-grab sampler. The standard projection method used during field activities is NAD83, State Plane Coordinate System, Oregon North Zone, in feet. A map showing the actual and proposed surface sediment locations is provided in Figure D1 of Appendix D1, and the sample coordinates and rationale for modifications greater than 30 feet are provided in Table D1 of Appendix D1. With two exceptions, all samples were collected within 30 feet of the target, with an average separation of 6.8 feet. A gravelly substrate and the presence of debris downstream of the Fremont Bridge made it difficult to collect power-grab samples in this area. After three or more attempts were made within 30 feet of the target coordinates for samples RM11E-G068 and –G075, a field change request was submitted to EPA on October 30, 2013, and approved by EPA on October 31, 2013 (see Appendix A3). At EPA's request, additional attempts were made by moving 50 feet upstream for samples RM11E-G068 and –G075. Those samples were collected within 2 feet of the new target locations.

Given water depths greater than 30 feet and the river current, vertical depth measurement using a lead line was determined to be inaccurate because of drift. Therefore the electronic fathometer reading on the sampling vessel was recorded to the nearest tenth of a foot by the FD as soon as the sampling equipment was on the river bottom at each station. This fathometer depth was recorded as the water depth at each of the power-grab surface sample collection locations.

6.2.2 Diver-Assisted Manual Grab Station Positioning

The collection of sediment samples underneath and behind the docks was deferred while addressing EPA's issues regarding diver certification and practices as well as Standard Operating Procedures (SOP). Final resolution and approval required changing marine contractors for the diver-assisted sampling efforts. BMC from Washougal Washington was selected as the diving contractor for this portion of the project. The final SOP was provided to EPA on April 17, 2014. This SOP and the agency communication are in Appendix A4.

BMC mobilized a landing-craft-style dive vessel and a 30-foot support barge to conduct the diver-assisted manual grab sampling on May 1 and 2, 2014. The target sample coordinates

were pre-loaded into the on-board navigation system and qualitatively checked by the FD using aerial photographs and site knowledge upon arrival at each station.

Station positioning was accomplished in conformance with the SOP for diver-collected sediment samples to locate samples within areas of softer (yet representative) sediment and minimal debris:

- Diver moved to the general sample location with care not to disturb the river bottom.
- The FD on the vessel viewed the general sample location on video, looking for areas of soft sediment and minimal debris.
- GSI and the Dive Captain coordinated with the diver via voice communications equipment (com) and video to direct the diver to a specific sample location.

The sample location was established by dGPS, using the standard projection system of NAD83, State Plane Coordinate System, Oregon North Zone, in feet. In areas where adequate satellite coverage was restricted, the sample locations were established by measurement off of fixed points (e.g., pilings or known coordinates). A map showing the actual and proposed surface sediment locations is provided in Figure D1 of Appendix D1 and the sample coordinates and rationale for moving sample RM11E-G087 more than 30 feet from target are provided in Table D1 of Appendix D1. All other diver-assisted manual grab samples were collected within 30 feet of the target location in accordance with the SOP.

Vertical positioning was established using a pneumofathometer. The method involves a hose connected to the umbilical of the diver's dry suit and an on-board air distribution manifold. When the diver was at depth at the sampling location, the dive supervisor instructed the diver to hold position, applied air to the hose, and the differential pressure was read through the on-board manifold gauge, moments later. The pressure readings then were converted into depth readings using standard pressure/depth correction tables. As required by Association of Diving Contractors International (ADCI) standards, BMC calibrates all of its gauges every 6 months, and retains certification documents. Where the sample location was accessible from the sampling platform, a lead line measurement was collected.

To establish the elevation of the mudline at each surface sediment sampling station, the water depth measurements were subtracted from the nearest corresponding river stage elevation[5]. The sample coordinates, water depths, and mudline elevations for all successful surface sediment samples are provided in Table 6-1.

[5] Willamette River stage data are recorded on a 15-minute basis from U.S. Geological Survey (USGS) station number 14211720 (USGS, 2014), the datum of which is 1.55 ft above the National Geodetic Datum of 1929. This station is located on the upstream side of the Morrison Bridge (RM 12.8). River stage elevation data reported by USGS are corrected to NAVD88 at RM 11 by adding 5.05 feet to the USGS reading.

6.3 Surface Sediment Sampling Procedures

6.3.1 Power-Grab Sampling Procedures

Twelve surface sediment samples were collected in accordance with the power-grab sampling procedures described in the Surface Sediment SAP Addendum. These procedures generally followed those developed by the Lower Willamette Group (LWG) and approved by EPA for the Portland Harbor RI/FS.

Sediment recovered by the power-grab sampler was reviewed for acceptance by the FD upon retrieval. If the power-grab sampler was visibly empty or was not completely closed upon breaking the water surface it was photographed (Appendix D2) but denoted as 'rejected' in the field notes and a subsequent attempt was made. When the power-grab sampler was closed and appeared to contain sediment, it was brought on to the vessel and secured in its stand for closer inspection by the FD. The penetration depth was measured in one or more locations within the power-grab sampler using a stainless-steel ruler to determine if the grab sample would be retained. If the sample had acceptable penetration depth, it was photographed (Appendix D2) and a representative aliquot of sediment was collected from the portion of the grab sampler that contained the greatest amount of intact sediment. The representative penetration associated with each retained sample is provided in Table 6-1. Care was taken to avoid collecting sediment in contact with the sides of the sampler. Organic materials, such as twigs and leaves, and any rocks or gravel greater than 2 inches in diameter, were removed from the sampling bowl before homogenization. The physical characteristics of the sediment were described and recorded on the grab sample description logs (Appendix D3). Additional detail on sample analysis is provided in Section 8.

The target depth for sample collection was 30 centimeters (cm) below the mudline[6]; with a minimum acceptable penetration of 20 cm. Multiple attempts were required at many locations to obtain an acceptable power-grab sample. Figure D1 in Appendix D shows the target and actual sample locations and Table D1 in Appendix D provides the coordinates for power-grab target and actual samples. Appendix D3 describes the various attempts (retained and rejected) made for each sample location. In two instances (RM11E-G070 and –G075), 20-cm penetration could not be attained within three attempts and a sample with a lesser penetration depth was collected. As noted in Section 6.2.1, two stations (RM11E-G068 and –G075) were relocated 50 feet from target because of rocky substrate in the target areas that precluded closure of the power-grab sampler.

Between stations, the sediment grab samplers were washed with potable water and Liquinox, and then rinsed with potable water before sampling a new station. Excess sediment from each station was lowered back carefully to the river bottom and released in accordance with the SAP Addendum. No IDW was generated during the surface sediment sampling activities.

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[6] For consistency with the previous RM11E Focused Sediment Characterization and the Draft Final RI for the Portland Harbor (Integral et al., 2011), "surface sediment" is defined as sediment collected between zero and 1 foot (approximately 30 cm) below mudline.

6.3.2 Diver-Assisted Manual-Grab Sampling Procedures

Ten surface sediment samples were collected in general accordance with the diver-assisted sediment sampling procedures described in the final version of the SOP. These sampling procedures, including any deviations, are summarized below.

With two exceptions (RM11E-G085 and –G086) described below, the diver-assisted surface sediment samples from the limited access areas were collected manually by divers using 4-inch-diameter aluminum tubing equipped with a new 4-inch polycarbonate sleeve and a clean core catcher. The outside of the sampling assembly was marked with tape such that the diver could advance the sampler 1 foot, 1.5 feet, or 2 feet beyond the core catcher. Once on station, the diver advanced the sampling assembly to at least the first target depth (1 foot beyond the core catcher) using a fence-post-type driver. The diver communicated via com with the Dive Captain and FD to determine and record the appropriate penetration depth and to record a water depth using the pneumofathometer at each successful sample location. When the target depth was reached, the diver capped the top of the aluminum tubing, extracted it using a large wrench, and took care to keep the sampler oriented in a vertical position as he brought it to the surface and handed it to support staff on the vessel for processing.

The retained sample depth associated with each successful sample is provided in Table 6-1. With two exceptions, noted below, all accepted samples met the minimum recovery goal of 20 cm, as specified in the SAP. The upper foot of material or full penetration length (if less than 1 foot were recovered) was removed from the polycarbonate sleeve and placed into a decontaminated stainless steel bowl for homogenization and sampling. The physical characteristics of the sediment were described and recorded on the grab sample description logs (Appendix D3).

This sampling method (which is consistent with Method B in the Diver-Assisted Surface Sediment SOP) was unsuccessful at two stations because of the presence of gravel, cobbles, and large woody debris, which prevented adequate penetration of the sampling assembly. After at least three failed attempts at each station and communication with the PM, the samples were collected using Method C, which involved using a trowel to collect the upper 5 to 8 cm of sediment from an approximately 5-foot radius. The diver filled two 32-ounce, wide-mouth jars at each station, capping them to maintain sample integrity before bringing the jars to the surface and handing them to GSI staff on the research vessel for processing. Both jars of sediment from each station were homogenized in a steel bowl. The physical characteristics of the sediment were described and recorded on the grab sample description forms (Appendix D3).

Organic materials, such as twigs and leaves, and any rocks or gravel greater than 2 inches in diameter, were carefully removed by hand before sampling. Samples then were homogenized and transferred directly to sample jars in accordance with the procedures described in the Surface Sediment SAP Addendum. Additional detail on sample analysis is provided in Section 8.

The small amount of excess material at each station was released back into the water at the actual sampling location. No IDW was generated during the surface sediment sampling activities.

SECTION 7

Sample Handling and Field QC Procedures

This section summarizes the sample identification, handling, transport, and custody for all media collected during the RM11E Supplemental RI/FS investigation, as described in Sections 3 through 6. It also addresses QC samples collected in the field, sampling equipment decontamination procedures, and the cultural resource monitoring efforts.

7.1 Sample Identification

All samples were assigned a unique identification (ID) based on the sample designation scheme described in the associated SAP. Sample IDs consist of two to four components separated by dashes or underscores. The first component, RM11E, identifies the data as belonging to the RM11E sampling event. The second component contains a one- to three-letter abbreviation for the sample type followed by a unique station ID or monitoring well number. The following abbreviations for sample types were used:

- MW = groundwater quality sample from a monitoring well
- MWS = monitoring well borehole soil sample
- SL = bank soil sample
- G = grab surface sediment sample

The third component is used to code the sample depth for soil sampling intervals or the date for the groundwater sampling event. The sampling intervals include the start and end depth in feet with an underscore between them (e.g., 24_29, for 24 to 29 ft bgs). The trailing depth abbreviations (e.g., ft or cm) were not included in the sample ID, but these units are shown in the tables of this report and associated data file. For groundwater samples, the month and year that the sample was collected were added as the third component and were separated by a dash (e.g., 04-2014, for April 2014).

As specified in the associated SAPs, the sample identification for field QC samples was assigned sequential numbers starting with 500 or 900 for field duplicates (splits) and equipment rinsate blanks, respectively.

Discrepancies in the sample names in the electronic laboratory deliverables were corrected before inclusion in the report tables, project database, and data files.

7.2 Field Quality Control Samples

Field QC samples are used to evaluate the effectiveness of sample homogenization and within-sample variability (e.g., splits), evaluate potential sources of sample cross-contamination (e.g., rinsate and trip blanks), or confirm proper shipping/storage conditions (e.g., temperature blanks and trip blanks).

The types of QC samples that were collected as part of these RM11E Supplemental RI/FS investigation sampling events include the following:

- **Split samples (field duplicate samples) –** for soil and sediment were homogenized in the field using the same procedures as those employed at stations where field splits were not collected. Namely, a GSI scientist homogenized the samples in a stainless steel bowl manually using a stainless steel spoon until the sample reached visible uniformity (a homogenous mixture of color, texture, density, and particle density that is free of any clay clasts). Prior to homogenization, large gravel (greater than about an inch), twigs, and debris were carefully removed from the sample bowl. Due to the site conditions and the sample collection and processing techniques, the sample aliquots sent to ALS may over-represent the percentage of fine-grained materials in the bulk sediment matrix. Once homogenized, the sample material was placed into separate jars for the parent sample and the field split and assigned unique sample ID's as noted in Section 7.1. Groundwater field splits were collected in a manner identical to that of the parent sample and were also assigned a unique sample ID. All subsequent sample handling and transport, and analytical procedures for field splits were identical to those employed for all other samples and consistent with those used by the LWG during the Portland Harbor RI.

- **Rinsate blanks –** were collected by carefully pouring lab provided DI water into the decontaminated stainless steel bowl containing the decontaminated stainless steel spoon(s) and pouring that water into lab provided jars for analysis. Samples were labeled with unique sample ID's as noted in Section 7.1 and all subsequent sample handling, transport, and analytical procedures were identical to those employed for other water samples.

- **Trip blanks –** were provided by the laboratory and traveled in the same coolers as the voa vials (used to sample for VOCs and gasoline range hydrocarbons) throughout the groundwater sampling events and chain-of-custody process.

- **Temperature blanks –** were included in each cooler provided by the laboratory and traveled with the other field samples throughout each sampling event and the full chain-of-custody process.

These QC samples are described in Section 2.2 of the QAPP Addendum. The number and type of QC samples that were collected during the sampling event are summarized in Table 7-1 and are consistent with the expectations set forth in the project SAPs and QAPP Addendum.

7.3 Equipment Decontamination Procedures

Equipment that came in direct contact with samples, such as scoops, spoons, and mixing bowls, was decontaminated in the following manner before use at each station and between field splits:

- Rinse with potable water.

- Wash with brush and Liquinox or other phosphate-free detergent.

- Double rinse with distilled water.
- Rinse with 0.1 percent N nitric acid.
- Rinse with deionized water.
- Rinse with methanol or ethanol.
- Rinse with deionized water.

Sample handling equipment was wrapped in aluminum foil following decontamination and before sampling. To minimize sample contamination, a fresh pair of nitrile gloves was used before using the sampling equipment and collecting sample aliquots.

To the extent practical, decontamination of sampling equipment was conducted in an onshore office to minimize the use of chemicals on the vessel or job site and to facilitate sample collection. In addition to the phosphate-free detergent that was used to clean the power-grab sampler, limited volumes of 10 percent nitric acid and ethanol were used to decontaminate the hand auger and other sampling equipment.

Any probes or sensors that came into contact with the sample media (e.g., groundwater level probes) were decontaminated before each use using a rinse-wash-rinse sequence of clean potable water, phosphate-free detergent, and distilled water. The sensors or probes were wrapped in aluminum foil when transported between monitoring locations.

All disposable materials used in sample collection and processing, such as paper towels and disposable gloves, were placed in heavyweight garbage bags before disposal as municipal waste. Liquid and solid waste generated from RM11E Supplemental RI/FS investigation activities was managed as specified in the Upland Groundwater and Bank Soil SAP and the Surface Sediment SAP Addendum and as described in Sections 3 through 6 of this report.

7.4 Sample Handling, Transport, and Custody

Samples collected during the RM11E Supplemental RI/FS investigation sampling event were tracked from the time of sample collection through laboratory and data analysis using standard chain-of-custody forms and procedures as described in the project SAPs. Samples were stored in coolers with “blue ice,” which was refreshed as necessary to maintain a target temperature of 4°C. The chain-of-custody forms were adhered to the inside of the cooler lids and three custody seals were attached to each cooler before relinquishment to the ALS courier. Copies of the chain-of-custody forms are provided with the laboratory reports in Appendix E.

7.5 Cultural Resource Monitoring

Sampling procedures to protect and address cultural resources were consistent with those presented in the approved Inadvertent Discovery Plan that was included as an attachment to the Upland Groundwater and Bank Soil SAP and the Surface Sediment SAP Addendum. Willamette CRA was retained to oversee potential cultural resources found at the RM11E Project Area during surface sediment sampling and groundwater monitoring well installation activities. The results of Willamette CRA monitoring are presented in the

Archaeological Monitoring Report provided in Appendix F. As noted in that report, no evidence of cultural material (i.e., archeological deposits) was observed during the sampling events.

SECTION 8

Laboratory Analysis, QA/QC Procedures, and Data Validation and Usability

This section summarizes the physical and chemical analyses that were performed on samples collected during the RM11E Supplemental RI/FS investigation. Procedures for chemical analysis and laboratory QA and QC conformed to the EPA-approved project QAPP Addendum unless otherwise noted. The laboratory QC and data validation protocols were followed to ensure that data quality and representation are in accordance with method requirements and that data usability is appropriately assessed for project objectives.

8.1 Physical and Chemical Analyses

Prior to analysis, sediment and soil samples were mixed thoroughly by the lab chemist using an inert spatula, stirring rod or other implement. Foreign objects such as sticks, leaves, and rocks were then discarded and the sample was loosened from the sides of container and mixed until no segregation of the sample by aggregate size was visible. A subsample was then taken from this homogenate for extraction.

The specific analyses that were conducted on each groundwater, bank soil, subsurface soil, surface sediment, and associated field QC samples are summarized in Table 8-1. The analytical approach is consistent with the QAPP Addendum with the following additions:

- Dioxin and furan analysis via EPA Method E1613B was added to four samples (RM11E-G072, -G075, -G087, and –G088) at the direction of EPA as noted in Section 1.2.2 and the regulatory agency communication provided in Appendix A2.
- ALS inadvertently analyzed sample RM11E-G089 for PCBs, TOC and total solids. Those results are included in this report.
- PCB analysis was requested on sample RM11E-SL031 for completeness.
- Hexachlorobenzene was reported via the high-resolution pesticide method (EPA 1699M: HRGC/MS/MS) instead of the low-level SVOC method (EPA 8270D LL) for the following reasons:
    - The detection limits listed for hexachlorobenzene in the QAAP Addendum were by GC/MS/MS.
    - Hexachlorobenzene detection limits are much lower for both soils and aqueous samples as reported by GC/MS/MS.

In some instances, ALS used different, but equivalent, methods than those that were cited in the QAPP Addendum. Methods used by ALS that were different than those cited in the

QAPP Addendum are EPA-approved methods as identified in the Data Validation Report (Appendix G1).

Laboratory method detection limits (MDLs) and method reporting limits (MRLs) for all target analytes are summarized in the QAPP Addendum. ALS elevated the MDLs and MRLs in some samples to account for matrix interference issues and the need for dilution. All sediment and soil sample results were reported on a dry-weight basis.

8.2 Laboratory QA/QC Procedures

Laboratory QA/QC was maintained through the use of standard EPA methods and other accepted methods and standard analytical procedures for the target analytes. The method-specific and other analytical and laboratory QC procedures and protocols followed are detailed in the QAPP Addendum. These procedures incorporated the collection and analysis of the following laboratory QA/QC components:

- Internal QC samples
- MRL checks
- Method blanks
- Matrix spike (MS) and matrix spike duplicate (MSD) samples
- Laboratory blank spikes
- Surrogate spikes
- Calibration check samples
- Laboratory replicates

Analytical QC measurements were performed exclusively on sample matrices from the RM11E Supplemental RI/FS investigation and samples from other projects were not mixed with the RM11E sample analyses.

8.3 Data Review, Verification, and Validation Procedures

Field and laboratory data were subjected to a formal verification and validation process in accordance with EPA guidance documents as described in the QAPP Addendum and associated SAPs. A document summarizing the data validation procedures and findings was prepared and is provided in Appendix G1 of this report.

QA/QC Solutions performed the data validation to determine the usability of the data for meeting project objectives. An abbreviated validation review (i.e., a summary review of the results reported) was performed on all the data and a more comprehensive validation review was performed on a subset of the data as described in Appendix G1. Among the laboratory data deliverables reviewed for the data validation, were results for the equipment rinsate blank and trip blank samples. The results of these field QC samples are included in Appendices G2 and G3.

Data qualifiers were assigned during data validation to the electronic data deliverables (EDD) when applicable QA/QC limits were not met and the qualification was warranted following guidance specified by EPA (2002, 2005, 2008, and 2010), QC requirements specified in the RM11E SAP, and method-specific QC requirements, as applicable. Final, qualified (as necessary) laboratory results were transmitted in EDDs for data management, further evaluation, and reporting as described in Section 9.

8.4 Data Quality and Usability

After verification and validation of the field and laboratory data as described above and in Appendix H, data completeness was calculated by comparing the total number of acceptable data (non-rejected data) to the total number of data points generated. Overall, completeness for the RM11E Supplemental RI/FS investigation dataset is 100 percent (i.e., no data were rejected). Detailed discussion regarding the qualification and usability of the data can be found in the data validation summary in Appendix G1.

SECTION 9

Data Management

Data generated as part of the RM11E Supplemental RI/FS investigation were documented and managed as described in previous sections and in accordance with the methods described in Section 7 of the Work Plan. These techniques incorporate data management protocols used for the Portland Harbor RI/FS and were implemented to provide consistent, accurate, and defensible documentation of data quality. Significant deviations from the data management methods described in the Work Plan and project SAPs are described in this section.

9.1 Field Data Management

Field data consisted of field logbooks, sample description logs, photographs, and the creation of electronic logs as described in Sections 3 through 6 of this report with supporting information provided in the tables and appendices. The electronic record provided with this report (i.e., monitoring well soil logs, soil grab sample logs, and sediment grab sample logs) are compilations of the handwritten field logbooks and field data sheets, and are provided with this report for legibility. Electronic data sheets have been reviewed by the FD for accuracy and completeness. Field logbooks and data sheets will be retained by GSI in the project file as part of the permanent record.

As noted in Section 7.4, all samples were logged into chain-of-custody forms to document sample possession and handling from the time of collection through sample transfer and management at ALS and copies of the COCs are provided with the laboratory reports in Appendix E.

9.2 Electronic Data Management

Following the data validation review described in Section 8.3, the validated EDDs, containing the appropriate data validation qualifiers were provided to GSI for data reduction and inclusion in the project database (Microsoft Access format).

Before inclusion in the project database, GSI created a copy of the validated EDDs and checked them for potential errors, such as date and time formats, text field lengths, and that QA/QC data have matching parent samples. A subset of the validated electronic data was double-checked against the hard copy laboratory results for accuracy and completeness before entry in the Microsoft Access project database.

9.3 Data Reduction and Handling

Data reduction and handling were conducted in accordance with the data management rules described in Section 7 of the EPA-approved Work Plan and are based on procedures followed in other Portland Harbor RI sediment investigations (Integral et al., 2011; Integral, 2008; Kennedy/Jenks, 2004).

9.3.1 Data Summation Rules

Two sets of rules for summing data and retaining or modifying qualifiers were used consistent with the Portland Harbor RI/FS - (1) RI data set summation rules (RI Calc), and (2) Risk Assessment/background data rules used in the FS (FS Calc). The summation rules, which are described in detail in Section 7 of the Work Plan, apply to select analytical groups, such as PCB Aroclors and PAHs. The "RI data rules (RI Calc)" are intended for site characterization and generally use zero to represent non-detect values while the "RA/background data rules (FS Calc)" are intended for RA and determination of background preliminary remediation goals and generally use one-half the MDL to represent non-detect values. The RA/background data rules result in higher values than with the RI data rules, especially for low concentration samples. Data from the RM11E Supplemental RI/FS investigation are reported in the Section 10 tables using both sets of data rules, but have been mapped and presented in the data file using the RA/background data rules and denoted as 'FS Calc', which are the more conservative set of rules that have been carried forward to the Portland Harbor FS (see Appendix A2).

The RI data set summation rules are as follows:

- Calculated totals are the sum of all detected concentrations, with non-detected concentrations are treated as zero.
- If all analytes for a total are not detected, then the highest MDL is used for the summation.

The RA and background data set summation rules are as follows:

- Calculated totals are the sum of all detected concentrations, with non-detected results included in the summation at one-half the MDL.
- If all analytes for a total are not detected, then the highest MDL is used for the summation.

Data qualifiers were carried through the summation procedure. If all of the analytes were not detected, a "U" qualifier was carried through to indicate that all results were reported as undetected. All calculated totals were flagged with a "T" indicating they were mathematically derived values.

The data guidelines also specify summation rules for select analytical groups, which include the same individual constituents regardless of which data rules are being used. Specifically:

- Total PCBs Aroclors were calculated as the sum of individual Aroclors.
- Total low molecular weight PAHs (LPAH) were calculated using the concentrations for 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. Total high molecular weight PAHs (HPAH) were calculated using the concentrations for benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzofluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3,-cd)pyrene, and pyrene. Total PAHs were calculated by summing the LPAH and HPAH values. Total carcinogenic PAH (cPAH) is the sum

of benzo(a)pyrene (BaP) equivalent (BaPEq) concentrations, calculated by multiplying the cPAHs by their respective potency equivalent factors (PEFs). cPAHs are benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, and dibenzo(a,h)anthracene. PEFs were assigned according to EPA (1993).

- Total DDx values were calculated with the concentrations of the six DDx compounds: 2,4′-DDD; 4,4′-DDD; 2,4′-DDE; 4,4′ DDE; 2,4′-DDT; and 4,4′-DDT. Total DDD values are calculated with 2,4′-DDD and 4,4′-DDD; total DDE values are calculated with 2,4′-DDE and 4,4′-DDE; and total DDT was calculated by summing 2,4′-DDT and 4,4′-DDT.
- Total chlordanes were calculated as the sum of the following compounds: cis-chlordane, trans-chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor.
- Total polychlorinated dibenzo-p-dioxin/furan (PCDD/Fs) were calculated as the sum of individual PCDD/F compounds (on a dry weight basis).
- Dioxin and furan TCDD toxic equivalents (TEQs) were calculated using the 2005 World Health Organization consensus toxicity equivalency factors (TEF) relative 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD or TCDD) values for mammals, as described in Appendix A3 of the Draft Final RI Report for the Portland Harbor (Integral et al., 2011). TEQs were calculated as the sum of each congener concentration (or MDL for non-detects) multiplied by the corresponding TEF value. When all of the congeners were not detected in a given sample, then the reported TEQ value was the highest congener detection limit multiplied times the TEF value.
- Total fines were calculated as the sum of silt and clay.

9.3.2 Data Averaging

Analytical results for field QC split samples are presented in Appendix H. Only the averaged values of field splits are used in the data analysis, analyte concentration maps, and results presented in Section 10.

The averaging rules that were applied are consistent with those used in the Portland Harbor RI/FS when addressing these three general combinations of detected and non-detected results:

- If the analyte was detected in two or more samples, only the detected results were averaged (the non-detected results are ignored).
- If the analyte was detected in only one sample, the detected value was reported as the average (the non-detected results are ignored).
- If the analyte was not detected in any samples, the lowest MDL was reported as the average.

Data validation qualifiers also were assigned in accordance with the guidelines used on the Portland Harbor RI/FS. If all results, including the calculated average, have the same

qualifier, then that qualifier was applied to the calculated average. If one or more of the results is qualified as estimated (J - flagged), then the calculated average was similarly qualified (J). A "T" qualifier was added to results that are mathematically derived, including averaged and summed results.

9.3.3 Data Replacement

Nine of the surface sediment sampling locations (RM11E-G071, -G073, -G076, -G077, -G079, -G082, -G083, -G085, and –G088) were re-occupied to assess the any changes in PCB concentrations since previous rounds of sampling. Similarly, one sample, RM11E-G088 (former sample RM11E-G039), was collected to re-test and assess a single elevated dioxin/furan result paired with a low PCB result observed in this location in 2009. Sediment from several of the re-occupied stations also was analyzed for organochlorine pesticides by the high resolution GC/MS/MS method to assess the degree of bias in the conventional GC/ECD organochlorine pesticide results in these locations using a more accurate analytical method.

Analytical results for the resampled stations are presented for a side-by-side comparison in Appendix I with the replacement values highlighted where applicable. As noted in Section 7 of the Work Plan, the most recent data from the most accurate laboratory method was used when replacing the data previously collected at the same location and only the new results were carried forward for use in the analyte concentration maps and data evaluation. Both sets of data are included in the project database and the Microsoft Excel data file presented in Appendix J.

9.3.4 Significant Figures

The data guidelines used in the Portland Harbor RI/FS were followed in generating and maintaining the RM11E data file. The number of significant figures provided by ALS was maintained in the RM11E database and a minimum of two significant figures was assumed for all results. The significant figures were maintained during calculations, such as averaging splits and summing totals. The final results of these calculations were rounded to the smallest number of significant figures for the values included in the calculations.

SECTION 10

Results

10.1 Supplemental RI/FS Data

Table 10-1 presents results of the December 2013 and April 2014 groundwater monitoring events. Table 10-2, Table 10-3, and Table 10-4 present the results of the subsurface soil samples, surface soil samples, and surface sediment samples, respectively. As noted previously, the analytical results for field QC rinsate blank and trip blank samples are provided in Appendix G with the field QC split samples and averages provided in Appendix H.

10.2 Existing Data

Existing data for RM11E were inventoried and reviewed and are summarized in Section 3 of the Work Plan. To create an updated data file that includes all relevant sediment and soil data collected in the vicinity of the RM11E Project Area, a RM11E project database was developed that built upon the information contained in Section H 3.0 of Appendix H of the August 29, 2011, Draft Final RI Report for Portland Harbor (Integral et al., 2011). Beginning with the updated SCRA database entitled 'RI_BERA20110727+RA-SummedParams_SCRA', which was provided as Attachment H2 of Appendix H the Draft Final RI Report, the project database was compiled using the following guidelines:

- Includes sample locations with river mile (RM) designations ranging from 10.0 to 12.0. Note that while some of these data were collected outside of the RM11E Project Area, the broader 2-mile river stretch was included for the purpose of generating maps and improving the accuracy of mapping interpolation techniques (e.g., natural neighbor).
- Includes only sediment (sample matrix code 'SE'), soil (sample matrix code 'SO'), or sediment trap (sample matrix of 'SEIRT'). Note that this file does not include existing bank debris, fish tissue, or surface water information.
- Excludes analytical results from sample locations that have been subsequently dredged or capped. Note that while samples marked as "capped" are excluded from the 'surface sediment' figures, these data may be retained for further evaluation as part of the Implementability Study.
- Per RI data selection rules, includes data that had a quality assurance approval code indicating a Category 1-level of data quality and either a level of validation of "QA1" or "QA2" (see Section 2.1 of Integral et al., 2011).

Using the established format of the SCRA database, the following data were normalized for upload and inclusion in the project database:

- The bank soil and re-analyzed sediment results from the City's 2013 Supplemental Data Report (GSI, 2013). Note that the high-resolution pesticide results from the archived sample stations replaced the results obtained via the standard method in 2009.

- The final reduced RM11E Supplemental RI/FS results for all media. This included addition of the new groundwater data (assigned a sample matrix code of 'GW').

Once the new dataset was compiled, a 'sample description' was assigned to the data to designate it based on the sample matrix and sample elevation. For consistency with the Portland Harbor FS Sediment Database, a 13.0 ft NAVD88 elevation benchmark was used to distinguish 'sediment' from 'soil'. Data with an elevation of less than or equal to 13.0 feet NAVD88 was classified as sediment and data collected above that elevation was classified as soil. Note that the 2009 bank soil samples collected below ordinary high water had been assigned an elevation of 10 ft NAVD88 and unlike the FS Sediment Database, are included in the project database with a sample description of either 'surface sediment' or 'subsurface sediment' and mapped accordingly (as described in Section 10.3).

All sediment samples with a start depth of zero and an end depth of less than or equal to 40 cm are categorized as 'surface sediment' for consistency with the Portland Harbor FS Sediment Database. All other bedded sediment samples are categorized as subsurface sediments. Note that since most samples in the Portland Harbor were collected as part of the RI, which defined surface sediment as the upper foot (approximately 30 cm); most of the surface samples are indicative of those depths. The FS Sediment Database expanded that depth interval to 40 cm and required a start depth of zero. For consistency, those guidelines were followed for the RM11E Supplemental RI/FS investigations.

Once the relevant Portland Harbor RI/FS data were uploaded into the RM11E project database, the analyte group totals were calculated for the combined dataset according to the FS rules described in Section 9.3. This data file provides the most updated and accurate reference for data mapping and evaluation between RM 10 and 12.

Appendix J contains the Excel data files for all surface, subsurface, and sediment trap data collected between RM 10 and RM 12. It also includes the upland monitoring well and soil data collected as part of this study. Data collected as part of the RM11E Supplemental RI/FS investigation have been given the task code 'RM11E_SupRIFS' to distinguish them from other sampling events. A description of the task codes for samples collected between RM10 and RM12 is provided as a separate tab in Appendix I. Figure 10-1a shows the location of all samples in the vicinity of the RM11E Project Area. Sample location names are labeled in Figure 10-1b, Figure 10-1c, and Figure 10-d for reference.

10.3 Updated Contaminant Distribution Maps

The Draft FS Report, submitted to EPA in March 2012, described the development and evaluation of remedial alternatives and identified sediment management areas (SMAs) (Anchor QEA et al., 2012). The SMAs in the Draft FS report were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations of bounding COCs (PCBs, BaPEq, DDD, DDE, DDT, and PCDF). These groupings were classified across a scale of progressively conservative remedial action levels (RALs) and subsequently

presented as FS Alternatives B through F[7]. The RAL concentrations from the Draft FS are presented in Table 10-5a. In addition to the combined RAL footprints for the bounding COCs, Table 10-5a also includes areas identified as posing potentially unacceptable benthic risk via multiple contaminants at Year 10 for Alternative B and at Year 0 for all other alternatives. The combination of the RALs and benthic risk areas make up the combined SMA footprints are shown in Figure 1-2. The resulting SMAs define areas where active remediation will be considered necessary by EPA under remedial alternatives B through F.

Following submission of the Draft FS, EPA provided the LWG with new RALs for two COCs and new directions for incorporating benthic risk areas in developing SMAs:

- New Total DDx RALs were provided to use in place of the individual total DDD, DDE, and DDT RALs in the Draft FS.
- The 2,3,4,7,8-PeCDF RALs were replaced with new total dioxin/furan TCDD TEQ RALs, as noted in the correspondence provided in Appendix A2.
- The LWG was instructed to use the Year 0 comprehensive benthic risk areas for all Alternatives (rather than a reduced footprint for Alternative B).

The current bounding COCs and the associated RALs and benthic risk areas for FS Alternatives B through F, are shown in Table 10-5b. The cells in Tables 10-5a and 10-5b where the RALs presented in the Draft FS differ from EPA's current proposed RALs are highlighted for reference.

Using the updated data set described in Section 10.2 of this report, which combines all applicable existing data with the new Supplemental RI/FS data, an updated series of figures was prepared to visualize the distribution of EPA's FS RAL chemicals in surface sediment and soil in the vicinity of the RM11E Project Area. The RAL footprints shown for the bounding COCs (PCBs, BaPEq, DDx, and DFTEQ) in Figures 10-2 through 10-5 were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment[8] concentrations in a manner consistent with that used by the LWG in the Draft FS for the Portland Harbor (and shown in Figure 1-2.) Due to the site conditions and the sample collection and processing techniques, the sample results and RAL footprints may be overly conservative.

[7] Alternative A is not included in Table 10-5 because it represents the No Action Alternative. Note that the EPA had also suggested evaluation of a more conservative Alternative G; however this alternative was screened out of the FS prior to the detailed evaluation of the remedial alternatives. As stated in Section 2 of the EPA-approved RM11E Work Plan, the RM11E Group determined that it would use FS Alternative F as the most conservative footprint for the alternatives analysis pending finalization of the Portland Harbor FS.

[8] As described in Section 10.2 of this report, the 'surface sediment' classification now includes bank soils collected below 13 ft NAVD88, whereas these samples noted as having a soils matrix were not included in the SMA maps in the Draft FS.

SECTION 11

References

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Table 2-1
Supplemental RI/FS Sampling Schedule

RM11E Supplemental RI/FS Sampling Activity	Dates Conducted
Surface Sediment Power-Grab Sampling	October 30 and 31, 2013
Surface Soil Sampling	October 31 and November 18 and 22, 2013
Subsurface Soil Sampling (Monitoring Well Drilling and Installation)	November 19, 20, 21, and 22, 2013 with additional development on RM11E-MW001 on December 4, 6, and 9, 2013
Well Development	November 21, 22, and 25
1st Round Groundwater Sampling	December 4, 5, 6, and 10, 2013
2nd Round Groundwater Sampling	April 14 and 15, 2014
Surface Sediment Manual-Grab Sampling	May 1 and 2, 2014

Table 3-1
Monitoring Well Locations and Construction Summary

Station ID	Station Coordinates[1]		Measuring Point Elevation[2] (ft NAVD88)	Ground Surface Elevation[2] (ft NAVD88)	River Mile	Well Construction Details										
									Well Screen				Filter Pack			
	Northing	Easting				Well Tag No.	Well Diameter (inches)	Completed Well Depth (ft bgs)	Depth to Top (ft bgs)	Depth to Bottom (ft bgs)	Length (ft)	Slot Size (inches)	Depth to Top (ft bgs)	Depth to Bottom (ft bgs)	Length (ft)	Gradation Sizing
RM11E-MW001	689361.1	7644323.0	33.4	33.9	11.3	L114004	2.0	37.0	17	32	15	0.010	14.8	33	18.2	10-20
RM11E-MW002s	689208.5	7644647.0	36.0	36.3	11.3	L114002	2.0	42.5	17.5	37.5	20	0.010	15.5	39	23.5	10-20
RM11E-MW003d	689217.9	7644642.3	35.6	36.1	11.3	L114001	2.0	105.0	90	100	10	0.010	88	101	13	10-20
RM11E-MW004	688981.0	7644765.3	35.9	36.6	11.4	L114003	2.0	40.0	20	35	15	0.010	18	36	18	10-20
RM11E-MW005	689919.8	7643614.8	35.0	35.5	11.1	L114005	2.0	36.5	16.5	31.5	15	0.010	14.5	33	18.5	10-20
RM11E-MULT1007	689726.0	7643823.9	35.8	34.1	11.2	NA	4.0	37.0	20	37	17	0.020	18	37	19	8-16
RM11E-MULT89881	690064.8	7643915.9	34.7	35.0	11.1	L89405	1.0	55.0	45	55	10	0.010	43	55	12	10-20

Notes:
bgs = below ground surface.
NA = Not applicable
[1] Northing and easting coordinates exist in the following coordinate system: North American Datum of 1983 (NAD83), Oregon State Plane North Zone, in units of feet.
[2] Elevations exist in the following coordinate system: North American Vertical Datum of 1988 (NAVD88) in units of feet.

Table 4-1
Groundwater Elevations

Station I.D.	Date	Depth to Water[1] (ft)	Measuring Point Elevation[2] (ft NAVD88)	Water Level Elevation[2] (ft NAVD88)
RM11E-MW001	11/25/2013	23.50	33.44	9.94
	12/6/2013	22.48	33.44	10.96
	12/9/2013	22.94	33.44	10.50
	12/10/2013	23.09	33.44	10.35
	1/7/2014	22.79	33.44	10.65
	3/11/2014	16.26	33.44	17.18
	4/14/2014	20.55	33.44	12.89
RM11E-MW002s	11/25/2013	21.12	35.95	14.83
	12/9/2013	21.02	35.95	14.93
	12/10/2013	21.42	35.95	14.53
	1/17/2014	20.55	35.95	15.40
	3/11/2014	18.93	35.95	17.02
	4/15/2014	20.31	35.95	15.64
RM11E-MW003d	12/5/2013	23.41	35.63	12.22
	12/9/2013	24.43	35.63	11.20
	1/17/2014	24.10	35.63	11.53
	3/11/2014	19.61	35.63	16.02
	4/15/2014	22.87	35.63	12.76
RM11E-MW004	11/25/2013	24.02	35.91	11.89
	12/5/2013	23.48	35.91	12.43
	12/10/2013	23.73	35.91	12.18
	1/7/2014	23.60	35.91	12.31
	3/11/2014	18.42	35.91	17.49
	4/15/2014	22.41	35.91	13.50
RM11E-MW005	11/25/2013	25.51	35.02	9.51
	12/4/2013	24.33	35.02	10.69
	12/5/2013	23.87	35.02	11.15
	1/17/2014	24.85	35.02	10.17
	3/11/2014	17.88	35.02	17.14
	4/14/2014	23.35	35.02	11.67
RM11E-MULT1007	11/25/2013	26.60	35.81	9.21
	12/4/2013	24.66	35.81	11.15
	12/6/2013	24.49	35.81	11.32
	1/17/2014	25.02	35.81	10.79
	3/11/2014	19.36	35.81	16.45
	4/14/2014	23.06	35.81	12.75
RM11E-MULT89881	11/25/2013	24.44	34.72	10.28
	12/4/2013	22.90	34.72	11.82
	1/17/2014	44.42 [3]	34.72	--
	3/11/2014	18.72	34.72	16.00
	4/15/2014	21.76	34.72	12.96

Notes:

-- Signifies that data was not processed.

[1] Depth to water is collected from the top of the well casing using an electronic water level indicator.

[2] Elevations exist in the following coordinate system: North American Vertical Datum of 1988 (NAVD88) in units of feet.

[3] Small inside diameter of the well (0.75-inches) is believed to have interfered with collection of an accurate measurement. This point is clearly erroneous and was not included in Figure 4-1.

Table 4-2

December 2013 Development and Groundwater Monitoring Summary

Station ID	Water Temperature (°C)	pH (SI units)	Specific Conductance (µS/cm)[1]	Dissolved Oxygen (mg/L)[2]	Oxidation-Reduction Potential (mV)[3]	Turbidity (NTU)[4]	Total Purge Volume (gal)[5]	Notes/Comments
RM11E-MW001	13.6	6.60	494	2.50	83.8	NC[6]	15.7	very cloudy; brown
RM11E-MW002s	12.8	6.46	1,258	0.33	-29.8	4.38	27.7	clear; very slightly yellow
RM11E-MW003d	14.6	6.94	334	0.11	-91.7	4.14	156.2	clear; colorless
RM11E-MW004	11.7	6.42	478	0.52	68.8	0.74	47.5	clear; colorless
RM11E-MW005	12.9	6.20	398	0.72	-51.7	0.48	155.5	clear; colorless
RM11E-MULT1007	15.9	6.31	322	3.67	125.9	2.80	72	clear; colorless
RM11E-MULT89881	13.1	6.14	304	5.78	119.7	0.28	18.5	clear; colorless

Notes:

Well development continued until water quality parameters stabilized and turbidity dropped to below 5 to 10 nephelometric units (NTU). Values displayed in this table are final readings recorded before groundwater sample collection.

NC = field measurement was not collected

[1] electrical conductivity in micro-Siemens per centimeter

[2] milligrams of dissolved oxygen per liter

[3] millivolts of electrical potential

[4] nephelometric units of turbidity

[5] total gallons of purge water removed during well development

[6] The field turbidity measurement was not collected in this well but the water was noted as being clear at the beginning of the sampling event and slightly cloudy and yellowish at the end of the sampling event.

Table 4-3
April 2014 Groundwater Monitoring Summary

Monitoring Well	Water Temperature (°C)	pH (SI units)	Specific Conductance (µS/cm)[1]	Dissolved Oxygen (mg/L)[2]	Oxidation-Reduction Potential (mV)[3]	Turbidity (NTU)[4]	Total Purge Volume (gal)[5]	Notes/Comments
RM11E-MW001	16.1	6.16	547	2.99	102.2	1.8	3.5	clear/colorless
RM11E-MW002s	15.2	6.63	1,662	0.32	-66.6	3.96	3.5	clear/yellow
RM11E-MW003d	14.9	6.39	336	0.44	-52.8	1.44	15.8	clear/colorless
RM11E-MW004	14.6	6.35	530	0.24	78.4	0.9	4.8	clear/colorless
RM11E-MW005	15.7	6.14	403	0.36	-50.2	1.19	8.7	very slightly cloudy/colorless
RM11E-MULT1007	16.7	6.03	369	0.72	89.9	2.60	9	clear/colorless
RM11E-MULT89881	13.8	6.34	298	6.68	147.4	0.36	3.7	clear/colorless

Notes:

[1] electrical conductivity in micro-Siemens per centimeter
[2] milligrams of dissolved oxygen per liter
[3] millivolts of electrical potential
[4] nephelometric units of turbidity
[5] total gallons of purge water removed sampling event

Table 5-1
Surface Soil Sample Locations and Collection Details

Station ID	Sample Date	Sample Time	Station Coordinates[1]		Ground Surface Elevation (ft NAVD88[2])	River Mile	Number of Sample Increments	Sample Depth (cm)	
			Northing	Easting				Start Depth	End Depth
RM11E-SL028	11/22/13	13:00	689925.8	7643540.4	33.5	11.1	5	0	30
RM11E-SL029	11/22/13	14:00	689680.2	7643862.8	32.9	11.2	5	0	28
RM11E-SL030	11/22/13	14:25	689500.5	7644105.5	32.5	11.2	5	0	30
RM11E-SL031	11/22/13	9:15	689321.9	7644361.9	33.1	11.3	5	0	23
RM11E-SL032	11/18/13	12:50	689232.5	7644583.0	28.6	11.3	5	0	27
RM11E-SL033	11/18/13	14:45	689040.0	7644664.9	35.9	11.4	5	0	29
RM11E-SL034	11/18/13	15:45	688793.0	7644828.4	35.9	11.4	4	0	29
RM11E-SL035	10/31/13	13:50	689171.8	7644555.0	13.1	11.3	5	0	20
RM11E-SL036	10/31/13	15:20	689125.2	7644587.0	13.5	11.3	5	0	30

Notes:

[1] Northing and easting coordinates exist in the following coordinate system: North American Datum of 1983 (NAD83), Oregon State Plane North Zone, in units of feet.

[2] Elevations exist in the following coordinate system: North American Vertical Datum of 1988 (NAVD88) in units of feet.

Table 6-1
Surface Sediment Sample Locations and Collection Details

Station ID	Sample Collection Technique	Sample Date	Sample Time	Station Coordinates[1]		Sample Depth (cm)		River Mile	Water Depth (ft)	Measurement Source[2]	Willamette River Elevation[3,4] (ft NAVD88)	Mudline Elevation[4] (ft NAVD88)
				Northing	Easting	Start Depth	End Depth					
RM11E-G068	power-grab	10/31/2013	18:00	690626.74	7642451.72	0	26	10.9	47.3	fathometer	8.6	-38.7
RM11E-G069	power-grab	10/30/2013	10:23	690716.68	7642497.15	0	24	10.8	41.0	fathometer	6.2	-34.8
RM11E-G070	power-grab	10/30/2013	14:15	690570.31	7642502.94	0	8	10.9	48.1	fathometer	8.5	-39.6
RM11E-G071	power-grab	10/30/2013	13:13	690611.58	7642549.02	0	24	10.9	43.1	fathometer	7.3	-35.8
RM11E-G072	power-grab	10/30/2013	14:40	690636.16	7642670.48	0	26	10.9	16.4	lead line	8.9	-7.5
RM11E-G073	power-grab	10/30/2013	15:32	690509.92	7642709.40	0	22	10.9	34.0	fathometer	9.0	-25.0
RM11E-G074	power-grab	10/30/2013	16:47	690441.71	7642646.52	0	26	10.9	46.2	fathometer	8.6	-37.6
RM11E-G075	power-grab	10/31/2013	16:55	690378.43	7642793.06	0	17	10.9	44.0	fathometer	9.3	-34.7
RM11E-G076	power-grab	10/31/2013	9:30	689723.51	7643543.73	0	25	11.1	48.6	fathometer	6.6	-42.0
RM11E-G077	power-grab	10/31/2013	10:12	689452.98	7643673.35	0	22	11.2	46.8	fathometer	6.4	-40.4
RM11E-G078	manual	5/2/2014	8:59	689443.24	7644016.49	0	30.5	11.2	37.0	pneumofathometer	14.2	-22.9
RM11E-G079	power-grab	10/31/2013	15:43	689302.84	7644009.50	0	23	11.2	49.7	fathometer	9.5	-40.2
RM11E-G080	manual	5/2/2014	9:55	689349.73	7644133.33	0	30.5	11.3	37.0	pneumofathometer	14.0	-23.0
RM11E-G081	manual	5/2/2014	11:20	689283.56	7644212.26	0	30.5	11.3	33.0	pneumofathometer	13.8	-19.2
RM11E-G082	power-grab	10/31/2013	12:02	689107.13	7644280.41	0	20	11.3	41.2	fathometer	6.1	-35.2
RM11E-G083	manual	5/1/2014	12:00	688912.32	7644627.91	0	24	11.4	41.0	pneumofathometer	14.1	-26.9
RM11E-G084	manual	5/1/2014	11:17	688882.69	7644712.28	0	20	11.4	10.7	bathymetry[5]	14.2	3.5
RM11E-G085	manual	5/2/2014	13:50	688676.70	7644828.13	0	8[6]	11.4	13.3	bathymetry[7]	13.3	0.0
RM11E-G086	manual	5/2/2014	12:55	688647.88	7644803.34	0	8[6]	11.4	33.0	pneumofathometer	13.4	-19.6
RM11E-G087	manual	5/2/2014	15:10	689889.20	7643448.79	0	26	11.1	32.0	lead line	13.0	-19.0
RM11E-G088	manual	5/1/2014	14:40	688801.84	7644746.36	0	21.5	11.4	21.7	lead line	13.7	-8.0
RM11E-G089	manual	5/1/2014	13:50	688773.91	7644718.25	0	24	11.4	41.0	pneumofathometer	13.9	-27.1

Notes:

[1] Northing and easting coordinates exist in the following coordinate system: North American Datum of 1983 (NAD83), Oregon State Plane North Zone, in units of feet.

[2] Various methods for calculating sample elevation were performed and the selected representative method is displayed in the table.

[3] Willamette River stage data are recorded on a 15-minute basis from U.S. Geological Survey (USGS) station number 14211720 (USGS, 2014). This station is located on the upstream side of the Morrison Bridge (RM 12.8). River stage elevation data reported by USGS are corrected to NAVD 88 at RM 11 by adding 5.05 feet to the USGS reading.

[4] Elevations exist in the following coordinate system: North American Vertical Datum of 1988 (NAVD88) in units of feet.

[5] Lead line measurement of 20.8 ft was collected at the buoy location after sampling was completed. However the buoy had clearly shifted prior to collection of the lead line elevation so the bathymetry elevation associated with the actual sampling coordinates was used in place of this field measurement.

[6] Method C: Top 5-8 cm of sediment was scooped into a wide mouth jar.

[7] The water depth was not measured in the field so the bathymetry elevation associated with the actual sampling coordinates was used to represent the mudline elevation.

Table 7-1
Summary of Field QC Samples

Sample Type and Analyte Group	Sample Count			
	Analyzed Field Samples	Field QC Splits	Field Rinsate Blanks	Total Number of Field Samples
Groundwater				
PCB Aroclors	14	2	0	16
Total Organic Carbon	14	2	0	16
High-Resolution Pesticides	14	2	0	16
SVOCs (including Phenols, PAHs, and Phthalates)	14	2	0	16
Hydrocarbons	14	2	0	16
Metals	14	2	0	16
VOCs[1]	14	2	0	16
Conventionals	14	2	0	16
Subsurface Soils				
PCB Aroclors	8	1	1	10
Total Organic Carbon	8	1	1	10
Total Solids	8	1	0	9
Grain Size	8	1	0	9
High-Resolution Pesticides	8	1	1	10
Dioxin/Furan Analysis	8	1	1	10
SVOCs (including Phenols, PAHs, and Phthalates)	8	1	1	10
Hydrocarbons	8	1	1	10
Metals	8	1	1	10
Surface Soils				
PCB Aroclors	9	1	1	11
Total Organic Carbon	9	1	1	11
Total Solids	9	1	0	10
Grain Size	0	0	0	0
High-Resolution Pesticides	9	1	1	11
Dioxin/Furan Analysis	0	0	0	0
SVOCs (including Phenols, PAHs, and Phthalates)	9	1	1	11
Hydrocarbons	9	1	1	11
Metals	9	1	1	11
Surface Sediment				
PCB Aroclors	22	2	2	26
Total Organic Carbon	22	2	2	26
Total Solids	22	2	2	26
Grain Size	22	2	2	26
High-Resolution Pesticides	5	0	0	5
Dioxin/Furan Analysis	4	0	0	4

Note:
[1] A trip blank was included in every cooler containing groundwater samples to be analyzed for VOCs and TPH-Gx.

Table 8-1
Supplemental RI/FS Sampling and Analytical Summary

Sample ID	Sample Date	Sample Time	Sample Depth			Lab Sample ID (s)	*Samples submitted to ALS for the following analysis*												Field Parameters [10]	Groundwater Level [11]
			Start	End	Units		Archival (Frozen) [1]	PCB Aroclors [2]	Total Organic Carbon	Total Solids [3]	Grain Size	High-Resolution Pesticides [4]	Dioxin/Furan Analysis	SVOCs (including Phenols, PAHs, and Phthalates) [5]	Total Petroleum Hydrocarbons [6]	Metals [7]	VOCs [8]	Conventionals [9]		
Groundwater - December 2013																				
RM11E-MW001-12-2013	12/10/2013	16:00	17	32	ft	K1313401-001	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MW002s-12-2013	12/5/2013	14:00	17.5	37.5	ft	K1313248-004	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MW003d-12-2013	12/5/2013	14:50	90	100	ft	K1313248-005	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MW004-12-2013	12/5/2013	17:00	20	35	ft	K1313248-002	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MW005-12-2013	12/5/2013	10:40	16.5	31.5	ft	K1313248-001	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MULT1007-12-2013	12/6/2013	11:30	20	37	ft	K1313248-003	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MULT89881-12-2013	12/4/2013	12:50	45	55	ft	K1313208-001	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-5MULT89881-12-2013	*12/4/2013*	*13:00*	*45*	*55*	*ft*	*K1313208-002*	--	*X*	*X*	--	--	*X*	--	*X*	*X*	*X*	*X*	*X*	*X*	*X*
RM11E-TB01-12-2013	*12/4/2013*	*12:50*	*NA*	*NA*	*NA*	*K1313208-003*	--	--	--	--	--	--	--	--	--	--	*X*	--	--	--
RM11E-TB02-12-2013	*12/5/2013*	*14:00*	*NA*	*NA*	*NA*	*K1313248-006*	--	--	--	--	--	--	--	--	--	--	*X*	--	--	--
RM11E-TB03-12-2013	*12/10/2013*	*16:00*	*NA*	*NA*	*NA*	*K1313401-002*	--	--	--	--	--	--	--	--	--	--	*X*	--	--	--
Groundwater - April 2014																				
RM11E-MW001-04-2014	4/14/2014	13:00	17	32	ft	K1403697-001	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MW002s-04-2014	4/15/2014	14:50	17.5	37.5	ft	K1403697-008	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MW003d-04-2014	4/15/2014	15:25	90	100	ft	K1403697-006	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MW004-04-2014	4/15/2014	17:25	20	35	ft	K1403697-009	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MW005-04-2014	4/14/2014	16:45	16.5	31.5	ft	K1403697-003	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MULT1007-04-2014	4/14/2014	15:40	20	37	ft	K1403697-002	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MULT89881-04-2014	4/15/2014	11:25	45	55	ft	K1403697-007	--	X	X	--	--	X	--	X	X	X	X	X	X	X
RM11E-MW505-04-2014	*4/14/2014*	*16:45*	*45*	*55*	*ft*	*K1403697-004*	--	*X*	*X*	--	--	*X*	--	*X*	*X*	*X*	*X*	*X*	*X*	*X*
RM11E-TB01-04-2014	*4/14/2014*	*00:00*	*NA*	*NA*	*NA*	*K1403697-005*	--	--	--	--	--	--	--	--	--	--	*X*	--	--	--
RM11E-TB02-04-2014	*4/15/2014*	*00:00*	*NA*	*NA*	*NA*	*K1403697-010*	--	--	--	--	--	--	--	--	--	--	*X*	--	--	--
Subsurface Soils																				
RM11E-MWS003d-5_10'	11/19/2013	10:50	5	10	ft	K1312731-001	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS003d-10_15'	11/19/2013	11:00	10	15	ft	K1312731-002	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS003d-15_20'	11/19/2013	12:40	15	20	ft	K1312731-003	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS003d-20_25	11/19/2013	12:50	20	25	ft	K1312731-004	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS003d-25_30'	11/19/2013	13:00	25	30	ft	K1312731-005	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS003d-30_35	11/19/2013	14:00	30	35	ft	K1312731-006	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS003d-5_18.7'	11/19/2013	12:10	5	18.7	ft	K1312731-007	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS003d-18.7_23.7'	11/19/2013	12:30	18.7	23.7	ft	K1312731-008	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS002s-5_10'	11/20/2013	13:40	5	10	ft	K1312803-001	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS002s-10_15'	11/20/2013	13:50	10	15	ft	K1312803-002	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS002s-15_20'	11/20/2013	14:05	15	20	ft	K1312803-003	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS002s-20_25'	11/20/2013	14:40	20	25	ft	K1312803-004	X	X	X	X	X	X	--	X	X	X	--	--	--	--
RM11E-MWS002s-5_20'	11/20/2013	14:45	5	20	ft	K1312803-005	X	X	X	X	X	X	--	X	X	X	--	--	--	--
RM11E-MWS002s-25_30'	11/20/2013	14:50	35	30	ft	K1312803-006	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS001-5_10'	11/21/2013	15:00	5	10	ft	K1312857-001	X	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 8-1
Supplemental RI/FS Sampling and Analytical Summary

Sample ID	Sample Date	Sample Time	Sample Depth			Lab Sample ID (s)	*Samples submitted to ALS for the following analysis*												Field Parameters [10]	Groundwater Level [11]
			Start	End	Units		Archival (Frozen) [1]	PCB Aroclors [2]	Total Organic Carbon	Total Solids [3]	Grain Size	High-Resolution Pesticides [4]	Dioxin/Furan Analysis	SVOCs (including Phenols, PAHs, and Phthalates) [5]	Total Petroleum Hydrocarbons [6]	Metals [7]	VOCs [8]	Conventionals [9]		
RM11E-MWS001-10_15'	11/21/2013	15:15	10	15	ft	K1312857-002	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS001-15_20'	11/21/2013	15:30	15	20	ft	K1312857-003	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS001-20_24'	11/21/2013	16:40	20	24	ft	K1312857-004	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS001-5_24'	11/21/2013	16:10	5	24	ft	K1312857-005	X	X	X	X	X	X	--	X	X	X	--	--	--	--
RM11E-MWS001-24_29'	11/21/2013	16:25	24	29	ft	K1312857-006	X	X	X	X	X	X	--	X	X	X	--	--	--	--
RM11E-MWS001-29_34'	11/22/2013	8:15	29	34	ft	K1312857-007	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS004-5_10'	11/22/2013	9:50	5	10	ft	K1312857-008	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS004-10_15'	11/21/2013	10:00	10	15	ft	K1312857-009	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS004-15_20'	11/21/2013	10:55	15	20	ft	K1312857-010	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS004-20_25	11/21/2013	11:00	20	25	ft	K1312857-011	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS004-5_24'	11/21/2013	11:20	5	24	ft	K1312857-012	X	X	X	X	X	X	--	X	X	X	--	--	--	--
RM11E-MWS004-24_29'	11/21/2013	11:30	24	29	ft	K1312857-013	X	X	X	X	X	X	--	X	X	X	--	--	--	--
RM11E-MWS004-30_35'	11/21/2013	12:45	30	35	ft	K1312857-014	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS004-25_30'	11/21/2013	12:25	25	30	ft	K1312857-015	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS504-24_29'	*11/21/2013*	*11:15*	*24*	*29*	ft	*K1312857-016*	*X*	*X*	*X*	*X*	--	*X*	--	*X*	*X*	*X*	--	--	--	--
RM11E-MWS904-24_29'	*11/21/2013*	*11:45*	*NA*	*NA*	*NA*	*K1312857-017*	--	*X*	*X*	--	--	*X*	--	*X*	*X*	*X*	--	--	--	--
RM11E-MWS005-5_10'	11/22/2013	11:00	5	10	ft	K1312857-018	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS005-10_15'	11/22/2013	11:15	10	15	ft	K1312857-019	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS005-15_20'	11/22/2013	11:35	15	20	ft	K1312857-020	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS005-20_25	11/22/2013	12:00	20	25	ft	K1312857-021	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS005-25_30'	11/22/2013	11:55	25	30	ft	K1312857-022	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS005-30_35'	11/22/2013	12:15	30	35	ft	K1312857-023	X	--	--	--	--	--	--	--	--	--	--	--	--	--
RM11E-MWS005-5_21'	11/22/2013	11:45	5	21	ft	K1312857-024	X	X	X	X	X	X	--	X	X	X	--	--	--	--
RM11E-MWS005-21_26'	11/22/2013	11:50	21	26	ft	K1312857-025	X	X	X	X	X	X	--	X	X	X	--	--	--	--
Surface Soils																				
RM11E-SL035	10/31/2013	13:50	0	30	cm	K1311918-004	X	X	X	X	--	X	--	X	X	X	--	--	--	--
RM11E-SL036	10/31/2013	15:20	0	28	cm	K1311918-005	X	X	X	X	--	X	--	X	X	X	--	--	--	--
RM11E-SL028	11/22/2013	13:00	0	30	cm	K1312857-027	X	X	X	X	--	X	--	X	X	X	--	--	--	--
RM11E-SL029	11/22/2013	14:00	0	23	cm	K1312857-028	X	X	X	X	--	X	--	X	X	X	--	--	--	--
RM11E-SL030	11/22/2013	14:25	0	27	cm	K1312857-029	X	X	X	X	--	X	--	X	X	X	--	--	--	--
RM11E-SL031	11/22/2013	9:15	0	29	cm	K1312857-026 K1400182-001*	X	X	X	X	--	X	--	X	X	X	--	--	--	--
RM11E-SL032	11/18/2013	12:50	0	29	cm	K1312655-002	X	X	X	X	--	X	--	X	X	X	--	--	--	--
RM11E-SL033	11/18/2013	14:45	0	20	cm	K1312655-004	X	X	X	X	--	X	--	X	X	X	--	--	--	--
RM11E-SL034	11/18/2013	15:45	0	30	cm	K1312655-005	X	X	X	X	--	X	--	X	X	X	--	--	--	--
RM11E-SL532	*11/18/2013*	*13:00*	*0*	*29*	*cm*	*K1312655-003*	*X*	*X*	*X*	*X*	--	*X*	--	*X*	*X*	*X*	--	--	--	--
RM11E-SL932	*11/18/2013*	*12:10*	*NA*	*NA*	*NA*	*K1312655-001*	--	*X*	*X*	--	--	*X*	--	*X*	*X*	*X*	--	--	--	--
Surface Sediment																				
RM11E-G068	10/31/2013	18:00	0	26	cm	K1311918-008	X	X	X	X	X	--	--	--	--	--	--	--	--	--

Table 8-1
Supplemental RI/FS Sampling and Analytical Summary

Sample ID	Sample Date	Sample Time	Sample Depth			Lab Sample ID (s)	*Samples submitted to ALS for the following analysis*												Field Parameters [10]	Groundwater Level [11]
			Start	End	Units		Archival (Frozen) [1]	PCB Aroclors [2]	Total Organic Carbon	Total Solids [3]	Grain Size	High-Resolution Pesticides [4]	Dioxin/Furan Analysis	SVOCs (including Phenols, PAHs, and Phthalates) [5]	Total Petroleum Hydrocarbons [6]	Metals [7]	VOCs [8]	Conventionals [9]		
RM11E-G069	10/30/2013	10:23	0	24	cm	K1311862-001	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G070	10/30/2013	14:15	0	8	cm	K1311862-002	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G071	10/30/2013	13:13	0	24	cm	K1311862-003	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G072	10/30/2013	14:40	0	26	cm	K1311862-004 K1404419-003*	X	X	X	X	X	--	X	--	--	--	--	--	--	--
RM11E-G073	10/30/2013	15:32	0	22	cm	K1311862-005	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G074	10/30/2013	16:47	0	26	cm	K1311862-006	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G075	10/31/2013	16:55	0	17	cm	K1311918-007 K1404419-004*	X	X	X	X	X	--	X	--	--	--	--	--	--	--
RM11E-G076	10/31/2013	9:30	0	25	cm	K1311918-001	X	X	X	X	X	X	--	--	--	--	--	--	--	--
RM11E-G077	10/31/2013	10:12	0	22	cm	K1311918-002	X	X	X	X	X	X	--	--	--	--	--	--	--	--
RM11E-G078	5/2/2014	8:59	0	30.5	*cm*	K1404420-001	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G079	10/31/2013	15:43	0	23	cm	K1311918-006	X	X	X	X	X	X	--	--	--	--	--	--	--	--
RM11E-G080	5/2/2014	9:55	0	30.5	*cm*	K1404420-002	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G081	5/2/2014	11:20	0	30.5	*cm*	K1404420-003	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G082	10/31/2013	12:02	0	20	cm	K1311918-003	X	X	X	X	X	X	--	--	--	--	--	--	--	--
RM11E-G083	5/1/2014	12:00	0	24	*cm*	K1404420-004	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G084	5/1/2014	11:17	0	20	*cm*	K1404420-005	X	X	X	X	X	X	--	--	--	--	--	--	--	--
RM11E-G085	5/2/2014	13:50	0	8	*cm*	K1404420-006	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G086	5/2/2014	12:55	0	8	*cm*	K1404420-007	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G087	5/2/2014	15:10	0	26	*cm*	K1404420-008 K1404419-002*	X	X	X	X	X	--	X	--	--	--	--	--	--	--
RM11E-G088	5/1/2014	14:40	0	21.5	*cm*	K1404420-009 K1404419-001*	X	X	X	X	X	--	X	--	--	--	--	--	--	--
RM11E-G089	5/1/2014	13:50	0	24	*cm*	K1404420-010	X	X	X	X	X	--	--	--	--	--	--	--	--	--
RM11E-G578	*5/2/2014*	*9:20*	*0*	*30.5*	*cm*	*K1404420-011*	--	*X*	*X*	*X*	*X*	--	--	--	--	--	--	--	--	--
RM11E-G579	*10/31/2013*	*15:43*	*0*	*23*	*cm*	*K1311918-010*	--	*X*	*X*	*X*	*X*	--	--	--	--	--	--	--	--	--
RM11E-G978	*5/2/2014*	*8:15*	*NA*	*NA*	*NA*	*K1404420-012*	--	*X*	*X*	*X*	*X*	--	--	--	--	--	--	--	--	--
RM11E-G979	*10/31/2013*	*14:47*	*NA*	*NA*	*NA*	*K1311918-009*	--	*X*	*X*	*X*	*X*	--	--	--	--	--	--	--	--	--

Table 8-1
Supplemental RI/FS Sampling and Analytical Summary

Notes:

[1] Archived samples will be retained by the primary contract laboratory until approval of disposal is granted by the Project Manager.

[2] Includes: Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, Aroclor 1262, and Aroclor 1268. Total PCBs is the sum of the Aroclor concentrations.

[3] Total solids was analyzed for on sediment and soil samples only (not groundwater).

[4] Includes: (1) Dieldrin, (2) Total DDx (sum of 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT), (3) Gamma-Hexachlorocyclohexane (Lindane), (4) Total Chlordanes, and (5) Heptachlor Epoxide. Total Chlordanes are calculated as the sum of the following compounds: cis-chlordane, trans-chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor.

[5] Includes: Hexachlorobenzene and Pentachlorophenol, Bis(2-Ethylhexyl) Phthalate, (1) total low molecular weight PAHs (LPAHs), (2) total high molecular weight PAHs (HPAHs), (3) total PAHs (sum of total LPAH and total HPAH concentrations), and (4) total carcinogenic PAHs (cPAHs). Total LPAHs are calculated using the concentrations for 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene, and Phenanthrene. Total HPAHs are calculated using the concentrations for Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3,-cd)pyrene, and Pyrene. Total cPAHs are calculated using the concentrations of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, and Indeno(1,2,3-cd)pyrene multiplied by the relative potency factor describing the carcinogenic potential relative to Benzo(a)pyrene equivalents (BaP-EQ).

[6] Includes: (1) NWTPH-Dx (C-10 to C-12 aliphatic/aromatic) and (2) NWTPH-Gx (C4-C6 aliphatic, C6-C8 aliphatic, and C8-C10 aliphatic). NWTPH-Dx was analyzed in soil and groundwater samples. NWTPH-Gx analysis was conducted in groundwater samples only.

[7] For soil and groundwater samples, metals include: Antimony, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, and Zinc. Groundwater samples were also analyzed for the following metals: Barium, Beryllium, Cobalt, Iron, Magnesium, Manganese, Potassium, Sodium, and Vanadium.

[8] Includes: Benzene, Carbon disulfide, Chlorobenzene, Chloroethane, Chloroform, 1,2-Dichlorobenzene, 1,4-Dichlorobenzene, 1,1-Dichloroethene, cis-1,2-Dichloroethene, Ethylbenzene, Isopropylbenzene, 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, Toluene, Trichloroethene, o-Xylene, m-Xylene, p-Xylene, and total Xylene.

[9] Conventionals include pH, Specific conductance, Oxidation-reduction potential, Turbidity, Hardness, Ferrous iron, Dissolved organic carbon, Calcium, Chloride, Bicarbonate, and Sulfate.

[10] Field parameters consisted of pH, Temperature, Dissolved oxygen, Specific conductance, Oxidation-reduction potential, and Turbidity.

[11] High-frequency groundwater levels were obtained at RM11E-MW002s and RM11E-MW003d using automated pressure transducers. Manual readings collected using an electronic water-level probe were obtained at all new and existing monitoring wells.

-- = Not applicable; TBD = to be determined based on screening of Q3 results; TOC = total organic carbon; PAH = polycyclic aromatic hydrocarbon; VOC = volatile organic compound; SVOC = semi-volatile organic compound

Table 10-1
Analytical Results of Groundwater

Analyte	Sample ID	RM11E-MW001		RM11E-MW002s		RM11E-MW003d		RM11E-MW004		RM11E-MW005		RM11E-MULT1007		RM11E-MULT89881	
	Unit	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014
Conventionals															
Dissolved organic carbon	mg/l	2.90	2.15	12.4	11.8	0.38 U	1.51	0.86 U	4.22	0.98 U	1.12 T	0.36 U	1.43	0.3 JT	1.36
Total organic carbon	mg/l	2.8	2.13	12.6	14.9	0.60 U	0.62	1.21 U	3.11	0.97 U	1.15 T	0.56 U	1.56	2 JT	0.25 J
PCBs															
Aroclor 1016	ug/l	0.0026 U	0.0011 U	0.0013 U	0.0011 U	0.00099 U	0.0011 U	0.0011 U	0.0011 U	0.0014 U	0.00098 UT	0.00097 U	0.0070 U	0.0011 UT	0.0011 U
Aroclor 1221	ug/l	0.0011 U	0.0011 U	0.00098 U	0.0011 U	0.00099 U	0.0055 U	0.0011 U	0.0011 U	0.0019 U	0.00098 UT	0.00097 U	0.0030 U	0.0024 UT	0.0011 U
Aroclor 1232	ug/l	0.0033 U	0.0011 U	0.0032 U	0.0011 U	0.0028 U	0.0029 U	0.0039 U	0.0011 U	0.0029 U	0.00098 UT	0.0026 U	0.012 U	0.0031 UT	0.0011 U
Aroclor 1242	ug/l	0.0020 U	0.0012 NJ	0.0017 U	0.0011 U	0.0013 U	0.0013 U	0.0011 U	0.0011 U	0.0015 U	0.00098 UT	0.00097 U	0.0088 U	0.0011 UT	0.0011 U
Aroclor 1248	ug/l	0.0025 U	0.0011 U	0.0011 U	0.0011 U	0.00099 U	0.0020 U	0.0011 U	0.0011 U	0.00098 U	0.00098 UT	0.0019 U	0.0088 U	0.0011 UT	0.0011 U
Aroclor 1254	ug/l	0.0086	0.0023 NJ	0.0016 U	0.0011 U	0.00099 U	0.0056 U	0.0023 U	0.0044 NJ	0.00098 U	0.00098 UT	0.00097 U	0.024 U	0.0012 UT	0.0011 U
Aroclor 1260	ug/l	0.0075 U	0.0011 U	0.00098 U	0.0011 U	0.00099 U	0.0057 U	0.0011 U	0.0013 NJ	0.00098 U	0.00098 UT	0.00097 U	0.0092 NJ	0.0011 UT	0.0011 U
Aroclor 1262	ug/l	0.0011 U	0.0011 U	0.00098 U	0.0011 U	0.00099 U	0.0011 U	0.0011 U	0.0011 U	0.00098 U	0.00098 UT	0.00097 U	0.0030 U	0.0011 UT	0.0011 U
Aroclor 1268	ug/l	0.0011 U	0.0011 U	0.00098 U	0.0011 U	0.00099 U	0.0011 U	0.0011 U	0.0011 U	0.00098 U	0.00098 UT	0.00097 U	0.0030 U	0.0011 UT	0.0011 U
Total PCBs (FS Calc)	ug/l	0.019 T	0.0074 NJT	0.0032 UT	0.0011 UT	0.0028 UT	0.0057 UT	0.0039 UT	0.0096 NJT	0.0029 UT	0.00098 UT	0.0026 UT	0.044 NJT	0.0031 UT	0.0011 UT
Total PCBs (RI Calc)	ug/l	0.0086 T	0.0035 NJT	0.0032 UT	0.0011 UT	0.0028 UT	0.0057 UT	0.0039 UT	0.0057 NJT	0.0029 UT	0.00098 UT	0.0026 UT	0.0092 NJT	0.0031 UT	0.0011 UT
Dissolved Metals															
Antimony	ug/l	0.125 J	0.791	0.099 U	0.024 U	0.005 U	0.005 U	0.106 U	0.624	0.005 U	0.005 UT	0.044 U	0.054	0.05 UT	0.069
Arsenic	ug/l	1.5	0.9	0.8	0.8	1.1	2.2	1.9	1.2	1.4	2.6 T	0.8	0.2 J	1.7 T	1.5
Barium	ug/l	97.9	81.4	130	58.6	21.4	25.0	66.1	54.9	28.5	29.4 T	15.9	18.0	20.3 T	21.3
Beryllium	ug/l	0.015 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.007 J	0.006 U	0.006 JT	0.006 U	0.006 U	0.006 UT	0.006 U
Cadmium	ug/l	0.054 U	0.059	0.008 J	0.008 J	0.005 U	0.005 U	0.036	0.073	0.005 U	0.005 U	0.005 U	0.018 J	0.134 T	1.40
Calcium	ug/l	54200	91900	139000	175000	26800	25600	50200	81100	33000	32550 T	36400	42200	35050 T	32900
Chromium	ug/l	0.09 U	0.60	0.13 J	0.27	0.02 U	0.05 J	0.61	0.10 J	0.26	0.1 JT	1.15	0.08 J	1.34 T	1.17
Cobalt	ug/l	8.310	0.183	18.0	7.830	1.410	0.131	1.290	1.690	1.100	1.12 T	2.400	0.585	0.089 T	0.088
Copper	ug/l	1.72	1.27	0.64	0.88	0.15	0.51	0.51	2.68	0.17	0.36 T	0.50	0.63	2.27 T	2.50
Iron	ug/l	10.8 J	3.7 U	92.7	25000	7510	12800	3.0 U	16.9 U	12300	16050 T	3.0 U	17.0 J	3 UT	4.4 U
Lead	ug/l	0.013 U	0.007 J	0.015 U	0.018 J	0.005 U	0.018 J	0.005 U	0.033	0.005 U	0.014 JT	0.015 U	0.033	0.005 U	0.005 U
Magnesium	ug/l	18300	12400	51100	75700	11300	11600	25400	10900	14500	15300 T	14300	15900	13050 T	12900
Manganese	ug/l	13100	10.9	7720	7360	1140	926	319	215	3760	3520 T	5.220	483	3.1 T	0.478
Mercury	ug/l	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 T	0.02 U	0.02 U	0.02 U	0.02 U
Nickel	ug/l	8.84	1.58 J	10.0	3.59 J	1.09	0.87 J	3.06	2.81 J	0.78	0.84 JT	2.51	3.76 J	1.1 T	1.00 J
Potassium	ug/l	5120	6520	4060	4080	3170	3520	3590	6030	2930	2855 T	3080	3330	3115 T	2860
Sodium	ug/l	20000	12000	47700	53700	10400	11400	16000	21500	9830	10300 T	8730	13500	8405 T	8430
Vanadium	ug/l	1.82	5.90	0.15 J	0.25	0.03 U	0.03 U	15.4	6.65	0.03 U	0.03 UT	7.24	2.00	9.45 T	8.42
Zinc	ug/l	4.0	16.9 J	4.4	2.0 J	2.1	24.8 J	1.8	33.1 J	0.4 J	1.1 JT	10.7	10.8 J	12.4 T	10.3 J
Total Metals															
Antimony	ug/l	0.147 J	0.788	0.123 U	0.034 U	0.005 U	0.010 U	0.106 U	0.642	0.005 U	0.01 U	0.054 U	0.109	0.148 UT	0.062
Arsenic	ug/l	7.6	0.8	1.1	3.2	2.7	3.5	1.8	1.3	5.4	6.3 T	1.2	1.2	1.7 T	1.6
Barium	ug/l	170	82.3	174	153	38.9	40.8	67.2	55.9	49.0	51.6 T	17.1	20.9	20 T	21.3
Beryllium	ug/l	0.283	0.007 J	0.019 U	0.020	0.008 J	0.008 J	0.013 U	0.006 J	0.006 U	0.006 U	0.006 U	0.006 U	0.006 UT	0.006 U
Cadmium	ug/l	0.114	0.054	0.012 U	0.018 J	0.005 U	0.005 U	0.028	0.089	0.005 U	0.005 UT	0.005 U	0.023	0.153 T	1.44
Calcium	ug/l	55600	92300	136000	161000	27600	25800	51800	80700	33600	33100 T	36200	42700	35550 T	33300
Chromium	ug/l	19.3	0.75	0.94	1.71	2.07	0.84	0.62	0.20 J	0.06 U	0.15 JT	2.87	1.49	1.37 T	1.19
Cobalt	ug/l	12.6	0.195	15.8	8.800	2.330	0.148	1.290	1.670	1.130	1.135 T	2.820	0.682	0.1 T	0.091
Copper	ug/l	13.4	1.37	1.29	0.76	0.47	0.23	0.47	2.27	0.08 U	0.12 T	0.55	1.06	2.35 T	2.56
Iron	ug/l	17000	6.7 U	11000	77700	19900	18200	9.2 U	98.8	27200	28250 T	476	1550	3 UT	8.3 U

Table 10-1
Analytical Results of Groundwater

Analyte	Sample ID	RM11E-MW001		RM11E-MW002s		RM11E-MW003d		RM11E-MW004		RM11E-MW005		RM11E-MULT1007		RM11E-MULT89881	
	Unit	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014
Lead	ug/l	6.860	0.026	0.156	0.185	0.111	0.061	0.015 U	0.055	0.005 U	0.005 UT	0.068 U	1.34	0.005 UT	0.006 J
Magnesium	ug/l	19700	12600	50800	68700	11800	11500	26300	11000	14700	15300 T	14300	16300	13150 T	12900
Manganese	ug/l	13600	10.9	6940	6840	1160	942	328	210	3720	3565 T	25.7	511	3.19 T	0.653
Mercury	ug/l	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 UT	0.02 U	0.02 U	0.02 U	0.02 U
Nickel	ug/l	13.7	1.49 J	11.1	3.66 J	1.28	1.00 J	3.20	2.74 J	0.65	0.84 JT	2.47	4.12 J	1.08 T	1.01 J
Potassium	ug/l	5580	6520	4180	4140	3300	3500	3690	6070	3000	2895 T	3130	3410	3100 T	2850
Sodium	ug/l	20000	12200	46300	44900	10800	11200	16500	21800	9940	10350 T	8710	14100	8445 T	8390
Vanadium	ug/l	39.2	6.22	1.34	1.36	0.19 J	0.10 J	15.6	6.85	0.21	0.23 T	8.70	7.27	9.78 T	9.19
Zinc	ug/l	20.7	17.1 J	5.8	11.8 J	3.6	84.0 J	1.8	33.0 J	0.4 J	0.5 JT	15.7	16.7 J	12.6 T	10.3 J
PAHs															
2-Methylnaphthalene	ug/l	0.029 U	0.028 U	0.029 U	0.027 U	0.029 U	0.029 U	0.030 U	0.027 U	0.027 U	0.027 UT	0.027 U	0.066 J	0.028 UT	0.027 U
Acenaphthene	ug/l	0.028 U	0.027 U	0.028 U	0.026 U	0.028 U	0.028 U	0.029 U	0.026 U	0.026 U	0.026 UT	0.026 U	0.027 U	0.027 UT	0.026 U
Acenaphthylene	ug/l	0.016 U	0.016 U	0.016 U	0.015 U	0.016 U	0.016 U	0.017 U	0.015 U	0.015 U	0.015 UT	0.015 U	0.016 U	0.016 UT	0.015 U
Anthracene	ug/l	0.026 U	0.025 U	0.026 U	0.024 U	0.026 U	0.026 U	0.027 U	0.024 U	0.024 U	0.024 UT	0.024 U	0.025 U	0.025 UT	0.024 U
Benzo(a)anthracene	ug/l	0.019 U	0.019 U	0.019 U	0.018 U	0.019 U	0.019 U	0.020 U	0.018 U	0.018 U	0.018 UT	0.018 U	0.019 U	0.019 UT	0.018 U
Benzo(a)pyrene	ug/l	0.033 U	0.032 U	0.033 U	0.031 U	0.033 U	0.033 U	0.034 U	0.031 U	0.031 U	0.031 UT	0.031 U	0.032 U	0.032 UT	0.031 U
Benzo(b)fluoranthene	ug/l	0.018 U	0.018 U	0.018 U	0.017 U	0.018 U	0.018 U	0.019 U	0.017 U	0.017 U	0.017 UT	0.017 U	0.018 U	0.018 UT	0.017 U
Benzo(g,h,i)perylene	ug/l	0.14 J	0.020 U	0.021 U	0.019 U	0.021 U	0.020 U	0.021 U	0.019 U	0.019 U	0.019 UT	0.019 U	0.020 U	0.02 UT	0.019 U
Benzo(k)fluoranthene	ug/l	0.026 U	0.025 U	0.026 U	0.024 U	0.026 U	0.026 U	0.027 U	0.024 U	0.024 U	0.024 UT	0.024 U	0.025 U	0.025 UT	0.024 U
Chrysene	ug/l	0.030 U	0.029 U	0.030 U	0.028 U	0.030 U	0.030 U	0.031 U	0.028 U	0.028 U	0.028 UT	0.028 U	0.029 U	0.029 UT	0.028 U
Dibenzo(a,h)anthracene	ug/l	0.19 J	0.018 U	0.018 U	0.017 U	0.018 U	0.018 U	0.019 U	0.017 U	0.017 U	0.017 UT	0.017 U	0.018 U	0.018 UT	0.017 U
Fluoranthene	ug/l	0.021 U	0.021 U	0.022 U	0.028 J	0.022 U	0.021 U	0.022 U	0.020 U	0.020 U	0.02 UT	0.020 U	0.029 J	0.021 UT	0.020 U
Fluorene	ug/l	0.029 U	0.028 U	0.029 U	0.027 U	0.029 U	0.029 U	0.030 U	0.027 U	0.027 U	0.027 UT	0.027 U	0.028 U	0.028 UT	0.027 U
Indeno(1,2,3-cd)pyrene	ug/l	0.022 U	0.022 U	0.023 U	0.021 U	0.023 U	0.022 U	0.023 U	0.021 U	0.021 U	0.021 UT	0.021 U	0.022 U	0.022 UT	0.021 U
Naphthalene	ug/l	0.023 U	0.023 U	0.071 J	0.026 J	0.049 J	0.032 J	0.071 J	0.040 J	0.048 J	0.022 UT	0.048 J	0.023 U	0.068 JT	0.054 J
Phenanthrene	ug/l	0.023 U	0.023 U	0.024 U	0.022 U	0.024 U	0.023 U	0.024 J	0.022 U	0.022 U	0.022 UT	0.022 U	0.023 U	0.023 UT	0.022 U
Pyrene	ug/l	0.020 U	0.020 U	0.021 U	0.019 U	0.021 U	0.020 U	0.021 U	0.019 U	0.019 U	0.019 UT	0.019 U	0.028 J	0.02 UT	0.019 U
Total LPAH (FS Calc)	ug/l	0.029 UT	0.028 UT	0.15 JT	0.097 JT	0.13 JT	0.11 JT	0.16 JT	0.11 JT	0.12 JT	0.027 UT	0.12 JT	0.14 JT	0.14 JT	0.12 JT
Total HPAH (FS Calc)	ug/l	0.42 JT	0.032 UT	0.033 UT	0.13 JT	0.033 UT	0.033 UT	0.034 UT	0.031 UT	0.031 UT	0.031 UT	0.031 UT	0.15 JT	0.032 UT	0.031 UT
Total PAH (FS Calc)	ug/l	0.51 JT	0.032 UT	0.26 JT	0.22 JT	0.24 JT	0.22 JT	0.28 JT	0.22 JT	0.23 JT	0.031 UT	0.23 JT	0.29 JT	0.25 JT	0.23 JT
Total cPAH (BaPeq) (FS Calc)	ug/l	0.21 JT	0.032 UT	0.033 UT	0.031 UT	0.033 UT	0.033 UT	0.034 UT	0.031 UT	0.031 UT	0.031 UT	0.031 UT	0.032 UT	0.032 UT	0.031 UT
Total LPAH (RI Calc)	ug/l	0.029 UT	0.028 UT	0.071 JT	0.025 JT	0.049 JT	0.032 JT	0.095 JT	0.040 JT	0.048 JT	0.027 UT	0.048 JT	0.066 JT	0.068 JT	0.054 JT
Total HPAH (RI Calc)	ug/l	0.33 JT	0.032 UT	0.033 UT	0.017 JT	0.033 UT	0.033 UT	0.034 UT	0.031 UT	0.031 UT	0.031 UT	0.031 UT	0.029 JT	0.032 UT	0.031 UT
Total PAH (RI Calc)	ug/l	0.16 JT	0.032 UT	0.014 JT	0.054 JT	0.049 JT	0.032 JT	0.095 JT	0.040 JT	0.048 JT	0.031 UT	0.048 JT	0.12 JT	0.068 JT	0.54 JT
Total cPAH (BaPeq) (RI Calc)	ug/l	0.19 JT	0.032 UT	0.033 UT	0.031 UT	0.033 UT	0.033 UT	0.034 UT	0.031 UT	0.031 UT	0.031 UT	0.031 UT	0.032 UT	0.032 UT	0.031 UT
Pesticides															
2,4'-DDD	ng/l	0.11 U	0.11 U	0.11 U	0.12 U	0.13 U	0.11 U	0.12 U	0.12 U	0.12 U	0.11 UT	0.11 U	0.11 U	0.11 UT	0.14 U
2,4'-DDE	ng/l	0.11 U	0.11 U	0.11 U	0.12 U	0.13 U	0.11 U	0.12 U	0.12 U	0.12 U	0.11 UT	0.11 U	0.11 U	0.11 UT	0.14 U
2,4'-DDT	ng/l	0.087 U	0.087 U	0.087 U	0.089 U	0.099 U	0.087 U	0.093 U	0.091 U	0.088 U	0.087 UT	0.087 U	0.087 U	0.087 UT	0.11 U
Total 2,4-DDx (FS Calc)	ng/l	0.11 UT	0.11 UT	0.11 UT	0.12 UT	0.13 UT	0.11 UT	0.12 UT	0.12 UT	0.12 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.14 UT
Total 2,4-DDx (RI Calc)	ng/l	0.11 UT	0.11 UT	0.11 UT	0.12 UT	0.13 UT	0.11 UT	0.12 UT	0.12 UT	0.12 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.14 UT
4,4'-DDD	ng/l	0.10 U	0.10 U	0.10 U	0.11 U	0.12 U	0.10 U	0.11 U	0.11 U	0.11 U	0.1 UT	0.10 U	0.10 U	0.1 UT	0.12 U
4,4'-DDE	ng/l	0.075 U	0.075 U	0.075 U	0.077 U	0.086 U	0.075 U	0.080 U	0.079 U	0.076 U	0.075 UT	0.075 U	0.10 J	0.075 UT	0.090 U
4,4'-DDT	ng/l	0.088 U	0.088 U	0.088 U	0.090 U	0.11 U	0.14 J	0.094 U	0.092 U	0.089 U	0.088 UT	0.088 U	0.27 J	0.088 UT	0.11 U
Total 4,4-DDx (FS Calc)	ng/l	0.1 UT	0.1 UT	0.1 UT	0.11 UT	0.12 UT	0.23 JT	0.11 UT	0.11 UT	0.11 UT	0.1 UT	0.1 UT	0.42 JT	0.1 UT	0.12 UT
Total 4,4-DDx (RI Calc)	ng/l	0.1 UT	0.1 UT	0.1 UT	0.11 UT	0.12 UT	0.14 JT	0.11 UT	0.11 UT	0.11 UT	0.1 UT	0.1 UT	0.37 JT	0.1 UT	0.12 UT

Table 10-1
Analytical Results of Groundwater

Analyte	Sample ID	RM11E-MW001		RM11E-MW002s		RM11E-MW003d		RM11E-MW004		RM11E-MW005		RM11E-MULT1007		RM11E-MULT89881	
	Unit	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014
Total DDD (FS Calc)	ng/l	0.11 UT	0.11 UT	0.11 UT	0.12 UT	0.13 UT	0.11 UT	0.12 UT	0.12 UT	0.12 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.14 UT
Total DDD (RI Calc)	ng/l	0.11 UT	0.11 UT	0.11 UT	0.12 UT	0.13 UT	0.11 UT	0.12 UT	0.12 UT	0.12 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.14 UT
Total DDE (FS Calc)	ng/l	0.11 UT	0.11 UT	0.11 UT	0.12 UT	0.13 UT	0.11 UT	0.12 UT	0.12 UT	0.12 UT	0.11 UT	0.11 UT	0.16 JT	0.11 UT	0.14 UT
Total DDE (RI Calc)	ng/l	0.11 UT	0.11 UT	0.11 UT	0.12 UT	0.13 UT	0.11 UT	0.12 UT	0.12 UT	0.12 UT	0.11 UT	0.11 UT	0.10 JT	0.11 UT	0.14 UT
Total DDT (FS Calc)	ng/l	0.088 UT	0.088 UT	0.088 UT	0.09 UT	0.11 UT	0.18 JT	0.094 UT	0.092 UT	0.089 UT	0.088 UT	0.088 UT	0.31 JT	0.088 UT	0.11 UT
Total DDT (RI Calc)	ng/l	0.088 UT	0.088 UT	0.088 UT	0.09 UT	0.11 UT	.014 JT	0.094 UT	0.092 UT	0.089 UT	0.088 UT	0.088 UT	0.27 JT	0.088 UT	0.11 UT
Total DDx (FS Calc)	ng/l	0.11 UT	0.11 UT	0.11 UT	0.12 UT	0.13 UT	0.38 JT	0.12 UT	0.12 UT	0.12 UT	0.11 UT	0.11 UT	0.57 JT	0.11 UT	0.14 UT
Total DDx (RI Calc)	ng/l	0.11 UT	0.11 UT	0.11 UT	0.12 UT	0.13 UT	0.14 JT	0.12 UT	0.12 UT	0.12 UT	0.11 UT	0.11 UT	0.27 JT	0.11 UT	0.14 UT
cis-Chlordane	ng/l	0.13 U	0.13 U	0.13 U	0.14 U	0.15 U	0.13 U	0.14 U	0.18 J	0.14 U	0.13 UT	0.13 U	0.13 U	0.13 UT	0.16 U
cis-Nonachlor	ng/l	0.17 U	0.17 U	0.17 U	0.18 U	0.20 U	0.17 U	0.19 U	0.18 U	0.18 U	0.17 UT	0.17 U	0.17 U	0.17 UT	0.21 U
trans-Chlordane	ng/l	0.17 U	0.17 U	0.17 U	0.18 U	0.20 U	0.17 U	0.19 U	0.20 J	0.18 U	0.17 UT	0.17 U	0.17 U	0.17 UT	0.21 U
trans-Nonachlor	ng/l	0.12 U	0.12 U	0.12 U	0.13 U	0.14 U	0.12 U	0.13 U	0.13 U	0.13 U	0.12 UT	0.12 U	0.12 U	0.12 UT	0.15 U
Oxychlordane	ng/l	2.0 U	2.0 U	2.0 U	2.1 U	2.3 U	2.0 U	2.2 U	2.1 U	2.1 U	2 UT	2.0 U	2.0 U	2 U	2.4 U
Total Chlordane (FS Calc)	ng/l	2 UT	2 UT	2 UT	2.1 UT	2.3 UT	2 UT	2.2 UT	1.6 JT	2.1 UT	2 UT	2 UT	2 UT	2 UT	2.4 UT
Total Chlordane (RI Calc)	ng/l	2 UT	2 UT	2 UT	2.1 UT	2.3 UT	2 UT	2.2 UT	0.38 JT	2.1 UT	2 UT	2 UT	2 UT	2 UT	2.4 UT
Dieldrin	ng/l	0.74 U	0.74 U	0.74 U	0.76 U	0.85 U	0.74 U	0.79 U	0.90 J	0.75 U	0.74 UT	0.74 U	0.74 U	0.74 UT	0.89 U
gamma-Hexachlorocyclohexane	ng/l	0.30 U	0.30 U	0.30 U	0.31 U	0.35 U	0.30 U	0.32 U	0.32 U	0.31 U	0.3 UT	0.30 U	0.30 U	0.3 UT	0.36 U
Heptachlor epoxide	ng/l	0.16 U	0.16 U	0.16 U	0.17 U	0.19 U	0.16 U	0.18 U	0.17 U	0.17 U	0.16 UT	0.16 U	0.16 U	0.16 UT	0.20 U
Hexachlorobenzene	ng/l	0.27 U	0.27 U	0.27 U	0.28 U	0.31 U	0.27 U	0.29 U	0.29 U	0.28 U	0.27 UT	0.27 U	0.27 U	0.31 JT	0.36 J
Hydrocarbons															
Diesel Range Hydrocarbons	ug/l	49 U	12 U	11 U	12 U	12 U	40 J	12 U	12 U	12 U	11 UT	11 U	42 J	11 U	12 U
Gasoline Range Hydrocarbons	ug/l	13 U	13 U	56 J	13 U	13 U	13 U	13 U	13 U	13 U	13 UT	13 U	13 U	13 U	13 U
Residual Range Hydrocarbons	ug/l	130 U	20 U	27 U	21 U	31 U	57 J	26 U	20 U	25 U	19 UT	24 U	61 J	19 U	20 U
Phenols															
Pentachlorophenol	ug/l	0.36 U	0.35 U	0.36 U	0.34 U	0.36 U	0.36 U	0.37 U	0.34 U	0.34 U	0.34 UT	0.34 U	0.35 U	0.35 U	0.34 U
Phthalates															
Bis(2-ethylhexyl) phthalate	ug/l	0.68 J	0.14 U	0.14 U	0.13 U	0.14 U	0.28 J	0.15 U	0.16 J	0.13 U	0.13 UT	0.13 J	8.3	0.014 U	0.13 U
VOCs															
1,1-Dichloroethene	ug/l	0.080 U	0.080 U	0.080 U	0.080 U	0.10 J	0.080 U	0.080 U	0.080 U	0.32 J	0.28 JT	0.080 U	0.080 U	0.11 JT	0.080 U
1,2,4-Trimethylbenzene	ug/l	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 UT	0.069 U	0.069 U	0.069 UT	0.069 U
1,2-Dichlorobenzene	ug/l	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 UT	0.12 U	0.12 U	0.12 UT	0.12 U
1,3,5-Trimethylbenzene	ug/l	0.089 U	0.089 U	0.089 U	0.089 U	0.089 U	0.089 U	0.089 U	0.089 U	0.089 U	0.089 UT	0.089 U	0.089 U	0.089 UT	0.089 U
1,4-Dichlorobenzene	ug/l	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 UT	0.12 U	0.12 U	0.12 UT	0.12 U
Benzene	ug/l	0.062 U	0.062 U	0.062 U	0.062 U	0.062 U	0.062 U	0.062 U	0.062 U	0.062 U	0.062 UT	0.062 U	0.062 U	0.062 UT	0.062 U
Carbon disulfide	ug/l	0.13 J	0.069 U	0.080 J	0.16 J	0.069 U	0.069 U	0.069 U	0.069 U	0.069 U	0.069 UT	0.069 U	0.069 U	0.069 UT	0.069 U
Chlorobenzene	ug/l	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 UT	0.11 U	0.11 U	0.11 UT	0.11 U
Chloroethane	ug/l	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 UT	0.16 U	0.16 U	0.16 UT	0.16 U
Chloroform	ug/l	0.072 U	0.072 U	1.3	0.072 U	0.072 U	0.072 U	0.23 U	0.072 U	0.072 U	0.072 UT	0.30 U	0.17 J	0.36 UT	0.33 J
cis-1,2-Dichloroethene	ug/l	0.067 U	0.067 U	0.067 U	0.067 U	2.9	2.3	0.067 U	0.067 U	37	40 T	0.070 J	0.14 J	0.88 T	0.62
Ethylbenzene	ug/l	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.05 UT	0.050 U	0.050 U	0.05 UT	0.050 U
Isopropylbenzene	ug/l	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 UT	0.051 U	0.051 U	0.051 UT	0.051 U
m,p-Xylene	ug/l	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 UT	0.11 U	0.11 U	0.11 UT	0.11 U
o-Xylene	ug/l	0.074 U	0.074 U	0.074 U	0.074 U	0.074 U	0.074 U	0.074 U	0.074 U	0.074 U	0.074 UT	0.074 U	0.074 U	0.074 UT	0.074 U
Tetrachloroethene	ug/l	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.17 J	0.099 U	0.19 J	10	4.8 T	2.3	1.9	15 T	13
Toluene	ug/l	0.20 J	0.14 U	0.054 U	0.054 U	0.054 U	0.054 U	0.060 J	0.054 U	0.054 U	0.054 UT	0.054 U	0.054 U	0.054 UT	0.054 U
Trichloroethene	ug/l	0.20 J	0.10 U	0.10 U	0.10 U	5.7	4.5	0.10 U	0.10 U	4.1	4.7 T	1.4	1.3	3.8 T	3.2

Table 10-1
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	Unit	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014	-12-2013	-04-2014
Total BTEX (FS Calc)	ug/l	0.35 JT	0.14 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.21 JT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT
Total BTEX (RI Calc)	ug/l	0.20 JT	0.14 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.060 JT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT
Total Xylene (FS Calc)	ug/l	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT
Total Xylene (RI Calc)	ug/l	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT	0.11 UT
Major Cations/Anions and General Chemistry															
Bicarbonate	mg/l	264	275	558	536	108	109	234	273	151	156 T	132	173	120 T	111
Carbonate	mg/l	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 UT	3 U	3 U	3 UT	3 U
Chloride	mg/l	5.3	3.0	48.0	48	14.8	14.8	4.0	7.6	7.0	6.8 T	6.5	6.2	6.5 T	6.5
Conductivity	umhos/cm	515	473	1210	1280	312	251	505	486	352	330 T	343	347	325 T	306
Hardness as CaCO3	mg/l	220	282	550	684	118	112	238	247	144	146 T	149	174	142 T	136
Oxidation-Reduction Potential	mv	246 J	218	78.8 J	-116	71.4 J	-40	246 J	157	17 J	-28 T	263 J	126	281 JT	190
Iron, Divalent	mg/l	0.05 U	0.05 UJ	4.1	30.8 J	13.8	14.0	0.05 U	0.05 UJ	25.4	21.2 T	0.05 U	0.27	0.05 T	0.05 UJ
pH	ph units	7.05 J	7.39 J	6.91 J	6.84 J	6.95 J	6.91 J	6.95 J	7.10 J	6.84 J	7.02 JT	7.11 J	7.35 J	7.57 JT	7.21 J
Sulfate	mg/l	5.33	26.0	76.8 J	293	25.4 J	21.5	20.9 J	17.2	19.4 J	18.4 T	19.7 J	17.1	19.6 T	20.0
Turbidity	ntu	82.5	0.18 U	23.2	463	18.8	14.2	0.26 U	0.58	10.4	73.4 T	2.38	4.16	0.12 UT	0.15 U

Notes:
RI Calc = This result was calculated using the Remedial Investigation (RI) data rules for the Portland Harbor as described in Section 7.3 of the Final Supplemental Remedial Investigation/Feasibility Study (RI/FS) Work Plan (GSI and DOF, 2013).
FS Calc = This result was calculated using the Feasibility Study (FS) data rules for the Portland Harbor, which are consistent with the risk assessment and background data set data rules, as described in Section 7.3 of the Final Supplemental RI/FS Work Plan (GSI and DOF, 2013).

Definition of data qualifiers:
U = The material was analyzed for, but was not detected. The associated numerical value is the method detection limit (MDL).
J = The associated numerical value is an estimated quantity.
T = The associated numerical value was mathematically derived (e.g., from summing multiple analyte results such as Aroclors, or calculating the average of multiple results for a single analyte).
N = The analysis indicates the presence of a PCB Aroclor that has been identified as “presumptively present”. As per EPA guidelines, the data validator reviewed the associated chromatograms and determined that while the pattern-matching quality was marginal and the presence of many non-target compounds were apparent, the presence of an Aroclor was strongly suggested, and the results were thus qualified as presumptively present "N".

Table 10-2
Analytical Results of Subsurface Soil

Analyte	Sample ID	RM11E-MWS001		RM11E-MWS002s		RM11E-MWS004		RM11E-MWS005	
	Unit	-5_24' (Fill)	-24_29' (Native)	-5_20' (Fill)	-20_25' (Native)	-5_24' (Fill)	-24_29' (Native)	-5_21' (Fill)	-21_26' (Native)
Conventionals									
Total organic carbon	percent	0.760	0.531	0.879	0.692	0.468	0.1 T	1.23	1.85
Total solids	percent	83.0	72.4	78.8	69.0	80.2	70.8 T	80.5	72.3
Grain Size									
Clay	percent	9.31	8.70	1.54	11.13	22.04	--	15.03	10.33
Silt	percent	25.23	25.75	21.49	25.82	52.24	--	40.07	36.26
Total Fines	percent	34.5 T	34.5 T	23 T	36.95 T	74.28 T	--	55.1 T	46.59 T
Very fine sand	percent	3.48	7.55	2.05	4.20	5.45	--	4.69	9.95
Fine sand	percent	7.13	38.40	5.99	6.11	6.13	--	4.02	29.60
Medium sand	percent	4.48	15.69	4.73	1.92	2.50	--	1.51	5.50
Coarse sand	percent	3.24	3.01	6.53	2.80	1.93	--	2.19	1.40
Very coarse sand	percent	4.63	1.36	10.11	6.10	1.80	--	3.12	1.43
Fine gravel	percent	5.07	0.99	14.34	18.89	1.85	--	4.69	0.71
Medium gravel	percent	40.06	0.00	28.79	19.18	1.84	--	27.67	4.14
PCBs									
Aroclor 1016	ug/kg	11 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U
Aroclor 1221	ug/kg	11 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U
Aroclor 1232	ug/kg	11 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U
Aroclor 1242	ug/kg	26 U	2.1 U	4.4	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U
Aroclor 1248	ug/kg	11 U	2.1 U	2.1 U	2.1 U	8.2	2.1 UT	2.1 U	2.1 U
Aroclor 1254	ug/kg	360	7.0 U	8.2 J	2.1 U	2.1 U	2.1 UT	70	2.1 U
Aroclor 1260	ug/kg	190	21	34	2.1 U	2.1 U	2.1 UT	22 U	2.1 U
Aroclor 1262	ug/kg	11 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U
Aroclor 1268	ug/kg	11 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U
Total PCBs (FS Calc)	ug/kg	600 T	32 T	53 JT	2.1 UT	17 T	2.1 UT	88 T	2.1 UT
Total PCBs (RI Calc)	ug/kg	550 T	21 T	47 JT	2.1 UT	8.2 T	2.1 UT	70 T	2.1 UT
Metals									
Antimony	mg/kg	0.629 J	0.147 J	0.430 J	0.046 J	0.490 J	0.32 JT	0.451 J	0.288 J
Arsenic	mg/kg	6.54	2.17	5.46	3.61	8.52	5.03 T	7.07	3.30
Cadmium	mg/kg	0.535	0.099	0.398	0.082	0.301	0.18 T	0.251	0.116
Chromium	mg/kg	20.6 J	19.5 J	38.3 J	30.3 J	19.9 J	14 JT	23.5 J	20.9 J
Copper	mg/kg	146 J	22.8 J	89.0 J	27.2 J	35.7 J	22.5 JT	34.2 J	34.7 J
Lead	mg/kg	551 J	32.0 J	142 J	13.5 J	106 J	13.9 JT	54.5 J	38.6 J
Mercury	mg/kg	0.096	0.075	0.306	0.081	0.232	0.025 T	0.061	0.064
Nickel	mg/kg	18.1	20.7	35.6	25.0	17.9	17.9 T	18.4	23.9
Zinc	mg/kg	269 J	62.8 J	224 J	63.4 J	138 J	67.8 JT	121 J	73.7 J
PAHs									
2-Methylnaphthalene	ug/kg	28 U	2.8 U	14 U	2.8 U	8.9	2.8 UT	28 U	18 J
Acenaphthene	ug/kg	32 U	3.2 U	16 U	3.2 U	4.7 J	3.2 UT	32 U	20 J
Acenaphthylene	ug/kg	30 J	6.3 J	30 J	2.6 U	6.5	2.6 UT	26 U	20 J
Anthracene	ug/kg	53 J	4.8 J	23 J	3.2 U	11	3.2 UT	32 U	31 J
Benzo(a)anthracene	ug/kg	170	14	47	3.6 U	22	3.6 UT	54 J	67
Benzo(a)pyrene	ug/kg	160	14	110	3.6 U	28	3.6 UT	36 U	80
Benzo(b)fluoranthene	ug/kg	200	21	100	3.4 U	33	3.4 UT	34 U	78
Benzo(g,h,i)perylene	ug/kg	130	12	110	3.7 U	24	3.7 UT	37 U	60
Benzo(k)fluoranthene	ug/kg	66	6.2 J	40	4.0 U	10	4 UT	40 U	21 J
Chrysene	ug/kg	240	15	70	4.1 U	28	4.1 UT	120	70
Dibenzo(a,h)anthracene	ug/kg	30 U	3.0 U	20 J	3.0 U	3.0 U	3 UT	30 U	15 U

Table 10-2
Analytical Results of Subsurface Soil

Analyte	Sample ID	RM11E-MWS001		RM11E-MWS002s		RM11E-MWS004		RM11E-MWS005	
	Unit	-5_24' (Fill)	-24_29' (Native)	-5_20' (Fill)	-20_25' (Native)	-5_24' (Fill)	-24_29' (Native)	-5_21' (Fill)	-21_26' (Native)
Fluoranthene	ug/kg	250	29	81	3.7 U	51	3.7 UT	73	130
Fluorene	ug/kg	33 U	3.3 U	17 U	3.3 U	5.1 J	3.3 UT	63	17 U
Indeno(1,2,3-cd)pyrene	ug/kg	120	11	95	3.2 U	23	3.2 UT	32 U	49
Naphthalene	ug/kg	29 U	12	15 U	2.9 U	11	2.9 UT	29 U	45
Phenanthrene	ug/kg	210	18	44	3.6 U	27	3.6 UT	160	130
Pyrene	ug/kg	370	25	110	3.7 U	50	4.7 JT	110	160
Total LPAH (FS Calc)	ug/kg	350 JT	46 JT	130 JT	3.6 UT	74 JT	3.6 UT	300 T	270 JT
Total LPAH (RI Calc)	ug/kg	293 JT	41 JT	97 JT	3.6 UT	74 JT	3.6 UT	223 T	264 JT
Total HPAH (FS Calc)	ug/kg	1700 T	150 JT	780 JT	4.1 UT	270 T	21 JT	460 JT	720 JT
Total HPAH (RI Calc)	ug/kg	1700 T	150 JT	780 JT	4.1 UT	270 T	4.7 JT	357 JT	720 JT
Total PAH (FS Calc)	ug/kg	2100 JT	190 JT	910 JT	4.1 UT	340 JT	32 JT	760 JT	1000 JT
Total PAH (RI Calc)	ug/kg	2000 JT	190 JT	880 JT	4.1 UT	340 JT	4.7 JT	580 JT	980 JT
Total cPAH (BaPeq) (FS Calc)	ug/kg	220 T	20 JT	150 JT	3.6 UT	37 T	3.6 UT	42 JT	110 JT
Total cPAH (BaPeq) (RI Calc)	ug/kg	210 T	19 JT	150 JT	3.6 UT	36 T	3.6 UT	5.5 JT	100 JT
Pesticides									
2,4'-DDD	ug/kg	0.14	0.063 U	0.29	0.063 U	0.69	0.063 UT	0.63 U	0.063 U
2,4'-DDE	ug/kg	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.073 UT	0.79 U	0.079 U
2,4'-DDT	ug/kg	0.15 U	0.094 U	2.2	0.094 U	0.094 U	0.094 UT	0.94 U	0.094 U
Total 2,4-DDx (FS Calc)	ug/kg	0.25 T	0.094 UT	2.5 T	0.094 UT	0.78 T	0.094 UT	0.94 UT	0.094 UT
Total 2,4-DDx (RI Calc)	ug/kg	0.14 T	0.094 UT	2.5 T	0.094 UT	0.69 T	0.094 UT	0.94 UT	0.094 UT
4,4'-DDD	ug/kg	0.66	0.19	1.3	0.035 U	1.7	0.067 JT	1.2	0.041 J
4,4'-DDE	ug/kg	0.41	0.076	1.9	0.070 U	0.48	0.07 UT	0.70 U	0.070 U
4,4'-DDT	ug/kg	0.69	1.3	19	0.11	0.22	0.047 UT	0.47 U	0.047 U
Total 4,4-DDx (FS Calc)	ug/kg	1.8 T	1.6 T	22 T	0.16 T	2.4 T	0.13 JT	1.8 T	0.1 JT
Total 4,4-DDx (RI Calc)	ug/kg	1.8 T	1.6 T	22 T	0.11 T	2.4 T	0.067 JT	1.2 T	0.041 JT
Total DDD (FS Calc)	ug/kg	0.8 T	0.22 T	1.6 T	0.063 UT	2.4 T	0.099 JT	1.5 T	0.073 JT
Total DDD (RI Calc)	ug/kg	0.8 T	0.19 T	1.6 T	0.063 UT	2.4 T	0.067 JT	1.2 T	0.041 JT
Total DDE (FS Calc)	ug/kg	0.45 T	0.12 T	1.9 T	0.079 UT	0.52 T	0.073 UT	0.79 UT	0.079 UT
Total DDE (RI Calc)	ug/kg	0.41 T	0.076 T	1.9 T	0.079 UT	0.48 T	0.073 UT	0.79 UT	0.079 UT
Total DDT (FS Calc)	ug/kg	0.77 T	1.3 T	21 T	0.16 T	0.27 T	0.094 UT	0.94 UT	0.094 UT
Total DDT (RI Calc)	ug/kg	0.69 T	1.3 T	21 T	0.11 T	0.22 T	0.094 UT	0.94 UT	0.094 UT
Total DDx (FS Calc)	ug/kg	2 T	1.7 T	25 T	0.28 T	3.2 T	0.24 JT	3 T	0.22 JT
Total DDx (RI Calc)	ug/kg	1.9 T	1.6 T	25 T	0.11 T	3.1 T	0.067 JT	1.2 T	0.041 JT
cis-Chlordane	ug/kg	0.10	0.079	3.5	0.062 U	0.12	0.062 UT	0.62 U	0.062 U
cis-Nonachlor	ug/kg	0.097 U	0.097 U	0.55	0.097 U	0.097 U	0.097 UT	0.97 U	0.097 U
trans-Chlordane	ug/kg	0.15	0.12	5.6	0.064 U	0.14	0.064 UT	0.64 U	0.064 U
trans-Nonachlor	ug/kg	0.058 U	0.058 U	1.8	0.058 U	0.058 U	0.058 UT	0.58 U	0.058 U
Total Chlordane (FS Calc)	ug/kg	0.39 T	0.34 T	12 T	0.13 UT	0.4 T	0.13 UT	1.3 UT	0.13 UT
Total Chlordane (RI Calc)	ug/kg	0.25 T	0.2 T	11 T	0.13 UT	0.3 T	0.13 UT	1.3 UT	0.13 UT
Dieldrin	ug/kg	0.077 U	0.077 U	3.1	0.077 U	0.077 U	0.077 UT	0.77 U	0.077 U
gamma-Hexachlorocyclohexane	ug/kg	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 UT	0.31 U	0.031 U
Heptachlor epoxide	ug/kg	0.073 U	0.073 U	0.41	0.073 U	0.073 U	0.073 UT	0.73 U	0.073 U
Hexachlorobenzene	ug/kg	0.094	0.092 U	1.3	0.092 U	0.092 U	0.092 UT	0.43 U	0.092 U
Oxychlordane	ug/kg	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 UT	1.3 U	0.13 U
Hydrocarbons									
Diesel Range Hydrocarbons	mg/kg	140 J	24 J	33 J	2.6 U	20 J	3.25 JT	280 J	55
Residual Range Hydrocarbons	mg/kg	190 J	79 J	220 J	5.7 U	37 J	5.5 UT	1400 J	150

Table 10-2
Analytical Results of Subsurface Soil

Analyte	Sample ID	RM11E-MWS001		RM11E-MWS002s		RM11E-MWS004		RM11E-MWS005	
	Unit	-5_24' (Fill)	-24_29' (Native)	-5_20' (Fill)	-20_25' (Native)	-5_24' (Fill)	-24_29' (Native)	-5_21' (Fill)	-21_26' (Native)
Phenols									
Pentachlorophenol	ug/kg	53 U	5.3 U	27 U	5.3 U	5.3 U	5.3 UT	53 U	27 U
Phthalates									
Bis(2-ethylhexyl) phthalate	ug/kg	210 J	66 J	1100	8.9 U	8.9 U	8.9 UT	94 J	45 U

Notes:
All sample results are reported on a dry-weight basis.
-- = Not Analyzed. Refer to Table 3-1 of the Quality Assurance Plan Addendum (Appendix A of the Supplemental RI/FS Work Plan) for the project sampling and analytical approach.
RI Calc = This result was calculated using the Remedial Investigation (RI) data rules for the Portland Harbor as described in Section 7.3 of the Final Supplemental Remedial Investigation/Feasibility Study (RI/FS) Work Plan (GSI and DOF, 2013).
FS Calc = This result was calculated using the Feasibility Study (FS) data rules for the Portland Harbor, which are consistent with the risk assessment and background data set data rules, as described in Section 7.3 of the Final Supplemental RI/FS Work Plan (GSI and DOF, 2013).
Definition of data qualifiers:
U = The material was analyzed for, but was not detected. The associated numerical value is the method detection limit (MDL).
J = The associated numerical value is an estimated quantity.
T = The associated numerical value was mathematically derived (e.g., from summing multiple analyte results such as Aroclors, or calculating the average of multiple results for a single analyte).

Table 10-3
Analytical Results of Surface Soil

Analyte	Sample ID / Unit	RM11E-SL028	RM11E-SL029	RM11E-SL030	RM11E-SL031	RM11E-SL032	RM11E-SL033	RM11E-SL034	RM11E-SL035	RM11E-SL036
Conventionals										
Total organic carbon	percent	1.89	0.618	0.944	0.412	1.8 T	1.70	2.75	0.523	1.16
Total solids	percent	85.5	89.0	84.2	90.2	83.6 T	85.6	72.6	85.1	88.1
PCBs										
Aroclor 1016	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U	2.1 U	2.1 U
Aroclor 1221	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U	2.1 U	2.1 U
Aroclor 1232	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U	2.1 U	2.1 U
Aroclor 1242	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U	2.1 U	2.1 U
Aroclor 1248	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT	2.1 U	2.1 U	2.1 U	2.1 U
Aroclor 1254	ug/kg	6.8 J	2.1 U	2.1 U	2.4 J	8.9 T	94	2.1 U	17	40
Aroclor 1260	ug/kg	18	2.6 J	5.4	14	25 T	69	2.1 U	12	25
Aroclor 1262	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 T	2.1 U	2.1 U	2.1 U	2.1 U
Aroclor 1268	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	5 JT	2.1 U	2.1 U	2.1 U	2.1 U
Total PCBs (FS Calc)	ug/kg	32 JT	11 JT	14 T	24 JT	46 JT	170 T	2.1 UT	36 T	72 T
Total PCBs (RI Calc)	ug/kg	26 JT	2.6 JT	5.4 JT	16 JT	41 JT	163 T	2.1 UT	29 T	65 T
Metals										
Antimony	mg/kg	0.208 J	0.115 J	0.275 J	0.609 J	1.5 JT	0.342 J	0.176 J	1.200 J	6.300 J
Arsenic	mg/kg	6.37	4.38	3.36	3.14	5.58 T	6.99	3.33	4.50	12.0
Cadmium	mg/kg	0.231	0.397	0.197	0.262	0.66 T	0.477	0.241	0.067	0.128
Chromium	mg/kg	15.9 J	13.8 J	13.2 J	46.8 J	57.8 JT	16.4 J	17.4 J	154	186
Copper	mg/kg	28.6 J	34.0 J	25.5 J	33.7	104 JT	44.4 J	24.8 J	32.8	93.0
Lead	mg/kg	21.5 J	76.1 J	43.6 J	39.7 J	152 JT	86.1 J	14.5 J	218 J	178 J
Mercury	mg/kg	0.021	0.070	0.029	0.060	1.1 T	0.395	0.019	0.053	0.067
Nickel	mg/kg	26.7	14.0	14.7	54.0	60.7 T	18.2	25.5	759 J	691 J
Zinc	mg/kg	85.9 J	126 J	77.6 J	85.6 J	382 JT	282 J	129 J	136	254
PAHs										
2-Methylnaphthalene	ug/kg	28 U	28 U	14 U	14 U	14 UT	56 U	14 U	13	81
Acenaphthene	ug/kg	32 U	32 U	16 U	16 U	16 UT	64 U	16 U	4.2 J	21
Acenaphthylene	ug/kg	56 J	26 U	13 U	13 U	36 T	52 U	13 U	5.5 J	38
Anthracene	ug/kg	63	32 U	16 U	16 U	54 T	93 J	16 U	9.2 J	58
Benzo(a)anthracene	ug/kg	190	36 U	26 J	82	180 T	430	27 J	36	130
Benzo(a)pyrene	ug/kg	290	36 U	39	160	230 T	610	37	43	180
Benzo(b)fluoranthene	ug/kg	300	34 U	46	210	370 T	760	69	72	230
Benzo(g,h,i)perylene	ug/kg	360	37 U	46	150	190 T	400	36	34	120
Benzo(k)fluoranthene	ug/kg	84	40 U	20 U	64	110 T	220	20 U	24	87
Chrysene	ug/kg	240	41 U	35	110	270 T	530	52	65	230
Dibenzo(a,h)anthracene	ug/kg	30 U	30 U	15 U	35	38.5 T	99 J	15 U	9.2 J	24
Fluoranthene	ug/kg	430	37 U	47	65	385 T	1000	60	120	570
Fluorene	ug/kg	33 U	33 U	17 U	17 U	17 UT	66 U	17 U	4.0 J	31
Indeno(1,2,3-cd)pyrene	ug/kg	320	32 U	33	150	290 JT	810 J	65 J	37	130
Naphthalene	ug/kg	29 U	29 U	15 U	15 U	15 UT	58 U	15 U	16	130
Phenanthrene	ug/kg	260	36 U	35	20 J	155 T	500	28 J	61	690
Pyrene	ug/kg	580	37 U	51	86	410 T	1100	69	100	480
Total LPAH (FS Calc)	ug/kg	440 JT	36 UT	81 T	66 JT	280 T	740 JT	74 JT	110 JT	1000 T
Total LPAH (RI Calc)	ug/kg	380 JT	36 UT	35 T	20 JT	245 T	593 JT	28 JT	110 JT	1000 T
Total HPAH (FS Calc)	ug/kg	2800 T	41 UT	340 JT	1100 T	2500 JT	6000 JT	430 JT	540 JT	2200 T
Total HPAH (RI Calc)	ug/kg	2800 T	41 UT	320 JT	1100 T	2500 JT	6000 JT	420 JT	540 JT	2200 T
Total PAH (FS Calc)	ug/kg	3200 JT	41 UT	420 JT	1200 JT	2700 JT	6700 JT	510 JT	650 JT	3200 T

Table 10-3
Analytical Results of Surface Soil

Analyte	Sample ID / Unit	RM11E-SL028	RM11E-SL029	RM11E-SL030	RM11E-SL031	RM11E-SL032	RM11E-SL033	RM11E-SL034	RM11E-SL035	RM11E-SL036
Total PAH (RI Calc)	ug/kg	3200 JT	41 UT	360 JT	1100 JT	2700 JT	6500 JT	440 JT	650 JT	3200 T
Total cPAH (BaPeq) (FS Calc)	ug/kg	390 T	36 UT	57 JT	240 T	350 JT	910 JT	61 JT	67 JT	250 T
Total cPAH (BaPeq) (RI Calc)	ug/kg	370 T	36 UT	50 JT	240 T	350 JT	910 JT	53 JT	67 JT	250 T
Pesticides										
2,4'-DDD	ug/kg	0.077	0.063 U	0.34 U	0.063 U	0.09 T	0.073	0.093 U	0.066 U	0.064 U
2,4'-DDE	ug/kg	0.079 U	0.079 U	0.079 U	0.079 U	0.079 UT	0.079 U	0.079 U	0.083 U	0.080 U
2,4'-DDT	ug/kg	0.17 U	0.33	0.094 U	0.094 U	0.21 T	0.45	0.17	0.098 U	0.095 U
Total 2,4-DDx (FS Calc)	ug/kg	0.2 T	0.4 T	0.34 UT	0.094 UT	0.34 T	0.56 T	0.26 T	0.098 UT	0.095 UT
Total 2,4-DDx (RI Calc)	ug/kg	0.077 T	0.33 T	0.34 UT	0.094 UT	0.3 T	0.53 T	0.17 T	0.098 UT	0.095 UT
4,4'-DDD	ug/kg	0.20	0.15	0.59	0.072	0.25 T	0.31	0.13	0.037 U	0.070 J
4,4'-DDE	ug/kg	0.66	0.41	0.27	0.16	0.32 T	1.0	0.44	0.073 U	0.071 U
4,4'-DDT	ug/kg	0.75	2.2	0.37	0.47	1.8 T	3.9	0.87	0.049 U	0.063 J
Total 4,4-DDx (FS Calc)	ug/kg	1.6 T	2.8 T	1.2 T	0.7 T	2.4 T	5.2 T	1.4 T	0.073 UT	0.17 JT
Total 4,4-DDx (RI Calc)	ug/kg	1.6 T	2.8 T	1.2 T	0.7 T	2.4 T	5.2 T	1.4 T	0.073 UT	0.13 JT
Total DDD (FS Calc)	ug/kg	0.28 T	0.18 T	0.76 T	0.1 T	0.34 T	0.38 T	0.18 T	0.066 UT	0.1 JT
Total DDD (RI Calc)	ug/kg	0.28 T	0.15 T	0.59 T	0.072 T	0.34 T	0.38 T	0.13 T	0.066 UT	0.070 JT
Total DDE (FS Calc)	ug/kg	0.7 T	0.45 T	0.31 T	0.2 T	0.36 T	1 T	0.48 T	0.083 UT	0.08 UT
Total DDE (RI Calc)	ug/kg	0.7 T	0.41 T	0.27 T	0.16 T	0.32 T	1 T	0.44 T	0.083 UT	0.08 UT
Total DDT (FS Calc)	ug/kg	0.84 T	2.5 T	0.42 T	0.52 T	2 T	4.4 T	1 T	0.098 UT	0.11 JT
Total DDT (RI Calc)	ug/kg	0.75 T	2.5 T	0.37 T	0.47 T	2 T	4.4 T	1 T	0.098 UT	0.063 JT
Total DDx (FS Calc)	ug/kg	1.8 T	3.2 T	1.5 T	0.82 T	2.7 T	5.8 T	1.7 T	0.098 UT	0.29 JT
Total DDx (RI Calc)	ug/kg	1.6 T	3.1 T	1.2 T	0.70 T	2.7 T	5.7 T	1.6 T	0.098 UT	0.13 JT
cis-Chlordane	ug/kg	0.83	0.12	0.11	0.29	0.57 T	1.2	0.29	0.065 U	0.063 U
cis-Nonachlor	ug/kg	0.30	0.097 U	0.097 U	0.12	0.32 T	0.21	0.11	0.11 U	0.098 U
trans-Chlordane	ug/kg	1.0	0.16	0.15	0.37	0.68 T	1.6	0.26	0.067 U	0.065 U
trans-Nonachlor	ug/kg	0.87	0.079	0.092	0.36	0.85 T	0.71	0.37	0.061 U	0.059 U
Total Chlordane (FS Calc)	ug/kg	3.1 T	0.47 T	0.47 T	1.2 T	2.5 T	3.8 T	1.1 T	0.14 UT	0.14 UT
Total Chlordane (RI Calc)	ug/kg	3 T	0.36 T	0.35 T	1.1 T	2.4 T	3.7 T	1 T	0.14 UT	0.14 UT
Dieldrin	ug/kg	0.43	0.077 U	0.077 U	0.077 U	2 JT	0.26 U	0.13 J	0.081 U	0.078 U
gamma-Hexachlorocyclohexane	ug/kg	0.031 U	0.031 U	0.031 U	0.031 U	0.062 T	0.042 J	0.031 U	0.033 U	0.032 U
Heptachlor epoxide	ug/kg	0.087	0.093	0.073 U	0.073 U	0.073 UT	0.094	0.073 U	0.077 U	0.074 U
Hexachlorobenzene	ug/kg	0.095	0.092 U	0.092 U	0.092 U	0.16 T	0.28	0.23	0.096 U	0.16
Oxychlordane	ug/kg	0.13 U	0.13 U	0.13 U	0.13 U	0.13 UT	0.13 U	0.13 U	0.14 U	0.14 U
Hydrocarbons										
Diesel Range Hydrocarbons	mg/kg	17 J	17 J	11 J	19 J	23 JT	30 J	61 J	--	--
Residual Range Hydrocarbons	mg/kg	300 J	260 J	110 J	160 J	140 JT	160 J	310 J	--	--
Phenols										
Pentachlorophenol	ug/kg	53 U	53 U	27 U	27 U	94 JT	110 U	99 J	5.6 U	5.4 U
Phthalates										
Bis(2-ethylhexyl) phthalate	ug/kg	89 U	89 U	45 U	45 U	262 JT	180 U	240 J	20 J	31 J

Table 10-3
Analytical Results of Surface Soil

Notes:
All sample results are reported on a dry-weight basis.
-- = Not Analyzed. Refer to Table 3-1 of the Quality Assurance Plan Addendum (Appendix A of the Supplemental RI/FS Work Plan) for the project sampling and analytical approach.
RI Calc = This result was calculated using the Remedial Investigation (RI) data rules for the Portland Harbor as described in Section 7.3 of the Final Supplemental Remedial Investigation/Feasibility Study (RI/FS) Work Plan (GSI and DOF, 2013).
FS Calc = This result was calculated using the Feasibility Study (FS) data rules for the Portland Harbor, which are consistent with the risk assessment and background data set data rules, as described in Section 7.3 of the Final Supplemental RI/FS Work Plan (GSI and DOF, 2013).
Definition of data qualifiers:
U = The material was analyzed for, but was not detected. The associated numerical value is the method detection limit (MDL).
J = The associated numerical value is an estimated quantity.
T = The associated numerical value was mathematically derived (e.g., from summing multiple analyte results such as Aroclors, or calculating the average of multiple results for a single analyte).

Table 10-4
Analytical Results of Surface Sediment

Analyte	Sample ID / Unit	RM11E-G068	RM11E-G069	RM11E-G070	RM11E-G071	RM11E-G072	RM11E-G073	RM11E-G074	RM11E-G075	RM11E-G076[1]	RM11E-G077	RM11E-G078
Conventionals												
Total organic carbon	percent	0.865	1.40	1.99	1.38	1.64	1.03	1.16	0.685	0.974	0.280	1 T
Total solids	percent	63.3 J	56.4	39.1	66.0	56.3	75.1	63.5	67.7	69.7	79.1	63.4 T
PCBs												
Aroclor 1016	ug/kg	2.1 U	2.6 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.6 U	2.1 U	2.1 UT
Aroclor 1221	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT
Aroclor 1232	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	3.7 U	2.1 U	2.1 UT
Aroclor 1242	ug/kg	7.7 J	2.1 U	2.1 U	17	2.1 U	2.1 U	5.2	2.1 U	2.1 U	2.1 U	2.1 UT
Aroclor 1248	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	5.8 U	2.1 U	2.1 UT
Aroclor 1254	ug/kg	28 J	3.9 U	2.1 U	51 J	16	2.7 J	29	5.3 U	16 J	2.1 U	2.1 UT
Aroclor 1260	ug/kg	55	54	420	110	15	13	39	39	87	280	330 JT
Aroclor 1262	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT
Aroclor 1268	ug/kg	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 UT
Total PCBs (FS Calc)	ug/kg	97 JT	64 T	430 T	180 JT	38 T	23 JT	80 T	49 T	110 JT	290 T	340 JT
Total PCBs (RI Calc)	ug/kg	90 JT	54 T	420 T	178 JT	31 T	15.7 JT	73.2 T	39 T	103 JT	280 T	330 JT
Grain Size												
Clay	percent	5.30	4.62	4.70	3.89	6.96	1.36	5.61	1.74	1.94	1.06	5.9 T
Silt	percent	26.74	25.64	51.95	23.85	32.62	5.74	30.92	5.31	7.05	4.00	18.7 T
Total Fines	percent	32 T	30.3 T	56.7 T	27.7 T	39.6 T	7.1 T	36.5 T	7.05 T	8.99 T	5.06 T	25 T
Very fine sand	percent	7.66	18.33	5.51	6.29	13.25	6.08	11.04	4.49	2.16	1.06	10.91 T
Fine sand	percent	26.15	39.48	13.96	24.33	34.36	23.58	27.69	28.21	28.66	9.24	50.4 T
Medium sand	percent	13.53	4.09	7.58	15.72	2.23	4.90	9.40	21.89	22.94	14.09	4.6 T
Coarse sand	percent	13.49	0.72	8.69	6.66	1.37	2.27	3.58	5.07	21.45	17.67	1.12 T
Very coarse sand	percent	6.39	0.64	7.56	4.65	1.64	2.52	1.89	3.01	8.23	8.39	1.55 T
Fine gravel	percent	2.08	0.80	4.78	6.14	1.70	9.04	2.32	7.46	6.44	8.20	1.53 T
Medium gravel	percent	0.00	0.10	1.94	0.63	2.61	45.53	0.00	30.34	0.63	41.24	1.11 JT
Pesticides												
2,4'-DDD	ug/kg	0.21 J	--	--	--	--	--	--	--	0.38	0.063 U	--
2,4'-DDE	ug/kg	0.18 U	--	--	--	--	--	--	--	0.18 U	0.079 U	--
2,4'-DDT	ug/kg	0.16 U	--	--	--	--	--	--	--	0.16 U	0.094 U	--
GSI Total 2,4-DDx (FS Calc)	ug/kg	0.38 JT	--	--	--	--	--	--	--	0.55 T	0.094 UT	--
GSI Total 2,4-DDx (RI Calc)	ug/kg	0.21 JT	--	--	--	--	--	--	--	0.38 T	0.094 UT	--
4,4'-DDD	ug/kg	0.74	--	--	--	--	--	--	--	0.98	0.074	--
4,4'-DDE	ug/kg	1.5	--	--	--	--	--	--	--	0.81	0.17	--
4,4'-DDT	ug/kg	0.23 U	--	--	--	--	--	--	--	0.25 J	0.047 U	--
GSI Total 4,4-DDx (FS Calc)	ug/kg	2.4 T	--	--	--	--	--	--	--	2 JT	0.27 T	--
GSI Total 4,4-DDx (RI Calc)	ug/kg	2.24 T	--	--	--	--	--	--	--	2 JT	0.244 T	--
GSI Total DDD (FS Calc)	ug/kg	0.95 JT	--	--	--	--	--	--	--	1.4 T	0.11 T	--
GSI Total DDD (RI Calc)	ug/kg	0.95 JT	--	--	--	--	--	--	--	1.36 T	0.074 JT	--
GSI Total DDE (FS Calc)	ug/kg	1.6 T	--	--	--	--	--	--	--	0.9 T	0.21 T	--
GSI Total DDE (RI Calc)	ug/kg	1.5 T	--	--	--	--	--	--	--	0.81 T	0.17 T	--
GSI Total DDT (FS Calc)	ug/kg	0.23 UT	--	--	--	--	--	--	--	0.33 JT	0.094 UT	--
GSI Total DDT (RI Calc)	ug/kg	0.23 UT	--	--	--	--	--	--	--	0.25 JT	0.094 UT	--
GSI Total DDx (FS Calc)	ug/kg	2.7 JT	--	--	--	--	--	--	--	2.6 JT	0.39 T	--
GSI Total DDx (RI Calc)	ug/kg	2.5 JT	--	--	--	--	--	--	--	2.2 JT	0.24 T	--
cis-Chlordane	ug/kg	0.28 J	--	--	--	--	--	--	--	0.36	0.062 U	--
cis-Nonachlor	ug/kg	0.15 U	--	--	--	--	--	--	--	0.15 U	0.097 U	--
trans-Chlordane	ug/kg	0.47	--	--	--	--	--	--	--	0.51	0.064 U	--

Table 10-4
Analytical Results of Surface Sediment

Analyte	Sample ID / Unit	RM11E-G068	RM11E-G069	RM11E-G070	RM11E-G071	RM11E-G072	RM11E-G073	RM11E-G074	RM11E-G075	RM11E-G076[1]	RM11E-G077	RM11E-G078
trans-Nonachlor	ug/kg	0.15 J	--	--	--	--	--	--	--	0.28 J	0.058 U	--
Oxychlordane	ug/kg	0.52 U	--	--	--	--	--	--	--	0.52 U	0.13 U	--
GSI Total Chlordane (FS Calc)	ug/kg	1.2 JT	--	--	--	--	--	--	--	1.5 JT	0.13 UT	--
GSI Total Chlordane (RI Calc)	ug/kg	0.9 JT	--	--	--	--	--	--	--	1.2 JT	0.13 UT	--
Dieldrin	ug/kg	0.19 U	--	--	--	--	--	--	--	0.19 U	0.077 U	--
gamma-Hexachlorocyclohexane	ug/kg	0.12 U	--	--	--	--	--	--	--	0.12 U	0.031 U	--
Heptachlor epoxide	ug/kg	0.20 U	--	--	--	--	--	--	--	0.20 U	0.073 U	--
Hexachlorobenzene	ug/kg	0.47	--	--	--	--	--	--	--	0.36	0.10	--
Dioxins/Furans												
1,2,3,4,6,7,8-Heptachlorodibenzofuran	pg/g	--	--	--	--	19.8	--	--	25.1	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	pg/g	--	--	--	--	98.2	--	--	162	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran	pg/g	--	--	--	--	1.72 J	--	--	1.89 J	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran	pg/g	--	--	--	--	1.77 J	--	--	2.20 J	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	pg/g	--	--	--	--	0.722 J	--	--	0.904 J	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran	pg/g	--	--	--	--	0.663 J	--	--	0.695 J	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	pg/g	--	--	--	--	4.72	--	--	6.29	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran	pg/g	--	--	--	--	0.304 U	--	--	0.562 J	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	pg/g	--	--	--	--	1.54 J	--	--	1.77 J	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran	pg/g	--	--	--	--	0.226 U	--	--	0.315 J	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	pg/g	--	--	--	--	0.401 J	--	--	0.325 J	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran	pg/g	--	--	--	--	0.940 J	--	--	1.23 J	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran	pg/g	--	--	--	--	0.663 J	--	--	0.972 J	--	--	--
2,3,7,8-Tetrachlorodibenzofuran	pg/g	--	--	--	--	0.187 U	--	--	0.146 U	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/g	--	--	--	--	0.316 U	--	--	0.264 U	--	--	--
Total Dioxin/Furan TEQ (FS Calc)	pg/g	--	--	--	--	3.1 JT	--	--	4.4 JT	--	--	--
Total PCDD/F (FS Calc)	pg/g	--	--	--	--	860 JT	--	--	1860 JT	--	--	--
Total Dioxin/Furan TEQ (RI Calc)	pg/g	--	--	--	--	3.1 JT	--	--	4.4 JT	--	--	--
Total PCDD/F (RI Calc)	pg/g	--	--	--	--	855 JT	--	--	1860 JT	--	--	--
Dioxins/Furan Homologs												
Hexachlorodibenzofuran homologs	pg/g	--	--	--	--	24.5	--	--	39.9	--	--	--
Hexachlorodibenzo-p-dioxin homologs	pg/g	--	--	--	--	20.2	--	--	42.0	--	--	--
Heptachlorodibenzofuran homologs	pg/g	--	--	--	--	95.5	--	--	137	--	--	--
Heptachlorodibenzo-p-dioxin homologs	pg/g	--	--	--	--	192	--	--	441	--	--	--
Pentachlorodibenzofuran homologs	pg/g	--	--	--	--	1.49 J	--	--	3.71	--	--	--
Pentachlorodibenzo-p-dioxin homologs	pg/g	--	--	--	--	2.10 J	--	--	1.26 J	--	--	--
Tetrachlorodibenzofuran homologs	pg/g	--	--	--	--	0.187 U	--	--	0.146 U	--	--	--
Tetrachlorodibenzo-p-dioxin homologs	pg/g	--	--	--	--	2.25	--	--	1.25	--	--	--
Octachlorodibenzofuran	pg/g	--	--	--	--	73.4	--	--	114	--	--	--
Octachlorodibenzo-p-dioxin	pg/g	--	--	--	--	650	--	--	1540	--	--	--

Table 10-4
Analytical Results of Surface Sediment

Analyte	Sample ID / Unit	RM11E-G079	RM11E-G080	RM11E-G081	RM11E-G082[1]	RM11E-G083[2]	RM11E-G084	RM11E-G085	RM11E-G086[2]	RM11E-G087	RM11E-G088	RM11E-G089[2]
Conventionals												
Total organic carbon	percent	0.484 T	2.22	2.09	0.626	2.30	2.50	1.35	0.487	2.87	1.27	0.771
Total solids	percent	73.4 T	66.5	52.0	69.3	42.8	60.2	78.7	79.1	73.2	66.1	72.1
PCBs												
Aroclor 1016	ug/kg	2.1 UT	2.1 U	16 U	69 U	3.3 U	31 U	2.1 U	2.1 U	26 U	2.1 U	2.1 U
Aroclor 1221	ug/kg	2.1 UT	2.1 U	2.1 U	8.4 U	3.3 U	7.0 U	2.1 U	2.1 U	3.6 U	2.1 U	2.1 U
Aroclor 1232	ug/kg	2.1 UT	2.1 U	15 U	190 U	3.3 U	45 U	2.1 U	2.1 U	30 U	2.1 U	3.1 U
Aroclor 1242	ug/kg	2.1 UT	2.1 U	9.8 U	99 U	3.3 U	22 U	2.1 U	2.1 U	24 U	2.1 U	2.3 J
Aroclor 1248	ug/kg	2.1 UT	2.1 U	28 U	190 U	3.3 U	19 U	25	19	31 U	2.1 U	2.1 U
Aroclor 1254	ug/kg	2.1 UT	2.1 U	58 J	130 U	3.6 J	63	23 J	13 J	3.6 U	2.1 U	2.1 U
Aroclor 1260	ug/kg	1405 JT	130	68	560	11	34	15	8.9	250	2.5 J	13
Aroclor 1262	ug/kg	2.1 UT	2.1 U	2.1 U	2.1 U	3.3 U	2.1 U	2.1 U	2.1 U	3.6 U	2.1 U	2.1 U
Aroclor 1268	ug/kg	2.1 UT	2.1 U	2.1 U	2.1 U	3.3 U	2.1 U	2.1 U	2.1 U	3.6 U	2.1 U	2.1 U
Total PCBs (FS Calc)	ug/kg	1400 JT	140 T	160 JT	910 T	26 JT	160 T	69 JT	47 JT	310 T	11 JT	23 JT
Total PCBs (RI Calc)	ug/kg	1405 JT	130 T	126 JT	560 T	15 JT	97 T	63 JT	41 JT	250 T	2.5 JT	15.3 JT
Grain Size												
Clay	percent	1.8 T	4.3	12.8	0.99	1.9	3.6	0.1	0.6	1.2	9.2	5.7
Silt	percent	5.16 T	17.2	45.5	3.82	41.6	16.0	2.5	2.6	5.7	42.1	6.7
Total Fines	percent	7 T	22 T	58.3 T	4.8 T	44 T	20 T	2.6 T	3.2 T	6.9 T	51 T	12 T
Very fine sand	percent	1.32 T	6.93	10.39	4.15	13.24	3.70	0.50	2.36	3.06	9.57	10.96
Fine sand	percent	9.63 T	25.38	28.88	31.47	32.57	5.01	3.03	17.69	14.41	17.91	30.75
Medium sand	percent	15.03 T	7.77	1.84	22.57	2.67	1.77	3.51	15.86	9.70	1.44	9.08
Coarse sand	percent	13.65 T	5.46	0.52	11.78	1.03	1.99	4.00	9.20	13.07	1.16	3.60
Very coarse sand	percent	5.1 T	10.10	0.47	3.81	1.47	3.09	6.71	6.81	13.24	1.37	3.17
Fine gravel	percent	5.72 T	14.81	0.63	4.73	2.31	4.25	13.16	8.42	16.46	3.83	4.44
Medium gravel	percent	49.58 T	8.07	1.32	24.12	0.40	69.13	71.56	36.58	22.00	4.29	23.49
Pesticides												
2,4'-DDD	ug/kg	0.063 U	--	--	0.26 J	--	1.6 J	--	--	--	--	--
2,4'-DDE	ug/kg	0.079 U	--	--	0.18 U	--	0.18 U	--	--	--	--	--
2,4'-DDT	ug/kg	0.094 U	--	--	0.16 U	--	0.16 U	--	--	--	--	--
GSI Total 2,4-DDx (FS Calc)	ug/kg	0.094 UT	--	--	0.43 JT	--	1.8 JT	--	--	--	--	--
GSI Total 2,4-DDx (RI Calc)	ug/kg	0.094 UT	--	--	0.26 JT	--	1.6 JT	--	--	--	--	--
4,4'-DDD	ug/kg	0.30	--	--	0.95	--	4.8 J	--	--	--	--	--
4,4'-DDE	ug/kg	0.23	--	--	0.67	--	3.1 J	--	--	--	--	--
4,4'-DDT	ug/kg	0.11 U	--	--	0.23 U	--	0.23 U	--	--	--	--	--
GSI Total 4,4-DDx (FS Calc)	ug/kg	0.59 T	--	--	1.7 T	--	8 JT	--	--	--	--	--
GSI Total 4,4-DDx (RI Calc)	ug/kg	0.53 T	--	--	1.62 T	--	7.9 JT	--	--	--	--	--
GSI Total DDD (FS Calc)	ug/kg	0.33 T	--	--	1.2 JT	--	6.4 JT	--	--	--	--	--
GSI Total DDD (RI Calc)	ug/kg	0.30 T	--	--	1.21 JT	--	6.4 JT	--	--	--	--	--
GSI Total DDE (FS Calc)	ug/kg	0.27 T	--	--	0.76 T	--	3.2 JT	--	--	--	--	--
GSI Total DDE (RI Calc)	ug/kg	0.23 T	--	--	0.67 T	--	3.1 JT	--	--	--	--	--
GSI Total DDT (FS Calc)	ug/kg	0.11 UT	--	--	0.23 UT	--	0.23 UT	--	--	--	--	--
GSI Total DDT (RI Calc)	ug/kg	0.11 UT	--	--	0.23 UT	--	0.23 UT	--	--	--	--	--
GSI Total DDx (FS Calc)	ug/kg	0.7 T	--	--	2.2 JT	--	9.8 JT	--	--	--	--	--
GSI Total DDx (RI Calc)	ug/kg	0.53 T	--	--	1.9 JT	--	9.5 JT	--	--	--	--	--
cis-Chlordane	ug/kg	0.062 U	--	--	0.19 J	--	0.88 J	--	--	--	--	--
cis-Nonachlor	ug/kg	0.097 U	--	--	0.15 U	--	0.21 J	--	--	--	--	--
trans-Chlordane	ug/kg	0.064 U	--	--	0.28 J	--	1.5 J	--	--	--	--	--

Table 10-4
Analytical Results of Surface Sediment

Analyte	Sample ID / Unit	RM11E-G079	RM11E-G080	RM11E-G081	RM11E-G082[1]	RM11E-G083[2]	RM11E-G084	RM11E-G085	RM11E-G086[2]	RM11E-G087	RM11E-G088	RM11E-G089[2]
trans-Nonachlor	ug/kg	0.058 U	--	--	0.13 J	--	0.60 U	--	--	--	--	--
Oxychlordane	ug/kg	0.13 U	--	--	0.52 U	--	0.52 U	--	--	--	--	--
GSI Total Chlordane (FS Calc)	ug/kg	0.13 UT	--	--	0.94 JT	--	3.2 JT	--	--	--	--	--
GSI Total Chlordane (RI Calc)	ug/kg	0.13 UT	--	--	0.6 JT	--	2.6 JT	--	--	--	--	--
Dieldrin	ug/kg	0.077 U	--	--	0.19 U	--	0.19 U	--	--	--	--	--
gamma-Hexachlorocyclohexane	ug/kg	0.031 U	--	--	0.12 U	--	0.12 U	--	--	--	--	--
Heptachlor epoxide	ug/kg	0.073 U	--	--	0.20 U	--	0.20 U	--	--	--	--	--
Hexachlorobenzene	ug/kg	1.1 U	--	--	0.18	--	0.16 J	--	--	--	--	--
Dioxins/Furans												
1,2,3,4,6,7,8-Heptachlorodibenzofuran	pg/g	--	--	--	--	--	--	--	--	33.8	9.05	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	pg/g	--	--	--	--	--	--	--	--	183	56.3	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran	pg/g	--	--	--	--	--	--	--	--	2.57 J	0.691 J	--
1,2,3,4,7,8-Hexachlorodibenzofuran	pg/g	--	--	--	--	--	--	--	--	3.47	0.965 J	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	pg/g	--	--	--	--	--	--	--	--	1.46 J	0.519 J	--
1,2,3,6,7,8-Hexachlorodibenzofuran	pg/g	--	--	--	--	--	--	--	--	1.36 J	0.349 J	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	pg/g	--	--	--	--	--	--	--	--	8.31	2.66 J	--
1,2,3,7,8,9-Hexachlorodibenzofuran	pg/g	--	--	--	--	--	--	--	--	0.807 J	0.283 U	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	pg/g	--	--	--	--	--	--	--	--	3.14 J	0.854 J	--
1,2,3,7,8-Pentachlorodibenzofuran	pg/g	--	--	--	--	--	--	--	--	0.564 J	0.106 U	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	pg/g	--	--	--	--	--	--	--	--	1.13 J	0.0899 U	--
2,3,4,6,7,8-Hexachlorodibenzofuran	pg/g	--	--	--	--	--	--	--	--	2.53 J	0.541 J	--
2,3,4,7,8-Pentachlorodibenzofuran	pg/g	--	--	--	--	--	--	--	--	0.634 J	0.109 U	--
2,3,7,8-Tetrachlorodibenzofuran	pg/g	--	--	--	--	--	--	--	--	0.839	0.151 U	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/g	--	--	--	--	--	--	--	--	0.225 U	0.274 U	--
Total Dioxin/Furan TEQ (FS Calc)	pg/g	--	--	--	--	--	--	--	--	6.31 JT	1.49 JT	--
Total PCDD/F (FS Calc)	pg/g	--	--	--	--	--	--	--	--	2160 JT	556 JT	--
Total Dioxin/Furan TEQ (RI Calc)	pg/g	--	--	--	--	--	--	--	--	6.31 JT	1.48 JT	--
Total PCDD/F (RI Calc)	pg/g	--	--	--	--	--	--	--	--	2160 JT	556 JT	--
Dioxins/Furan Homologs												
Hexachlorodibenzofuran homologs	pg/g	--	--	--	--	--	--	--	--	67.7	13.2	--
Hexachlorodibenzo-p-dioxin homologs	pg/g	--	--	--	--	--	--	--	--	43.4	9.02	--
Heptachlorodibenzofuran homologs	pg/g	--	--	--	--	--	--	--	--	163	45.8	--
Heptachlorodibenzo-p-dioxin homologs	pg/g	--	--	--	--	--	--	--	--	329	101	--
Pentachlorodibenzofuran homologs	pg/g	--	--	--	--	--	--	--	--	27.8	0.0960 U	--
Pentachlorodibenzo-p-dioxin homologs	pg/g	--	--	--	--	--	--	--	--	4.62	0.475 J	--
Tetrachlorodibenzofuran homologs	pg/g	--	--	--	--	--	--	--	--	8.48	0.151 U	--
Tetrachlorodibenzo-p-dioxin homologs	pg/g	--	--	--	--	--	--	--	--	0.486 J	0.274 U	--
Octachlorodibenzofuran	pg/g	--	--	--	--	--	--	--	--	134	29.5	--
Octachlorodibenzo-p-dioxin	pg/g	--	--	--	--	--	--	--	--	1780	454	--

Table 10-4
Analytical Results of Surface Sediment

Notes:

All sample results are reported on a dry-weight basis.

-- = Not Analyzed. Refer to Table 3-1 of the Quality Assurance Plan Addendum (Appendix A of the Supplemental RI/FS Work Plan) for the project sampling and analytical approach.

RI Calc = This result was calculated using the Remedial Investigation (RI) data rules for the Portland Harbor as described in Section 7.3 of the Final Supplemental Remedial Investigation/Feasibility Study (RI/FS) Work Plan (GSI and DOF, 2013).

FS Calc = This result was calculated using the Feasibility Study (FS) data rules for the Portland Harbor, which are consistent with the risk assessment and background data set data rules, as described in Section 7.3 of the Final Supplemental RI/FS Work Plan (GSI and DOF, 2013).

[1] The detection limit was elevated for select PCB Aroclors in samples RM11E-G076 and RM11E-G082. The chromatogram indicated the presence of non-target background components that prevented adequate resolution of the target compounds at the normal limit. The results were flagged as estimated (J) to indicate matrix interference.

[2] Per agreement with EPA, sample was held for potential dioxin/furan analysis pending the results at RM11E-G088. Dioxin/furan analysis were not conducted at this location based on RM11E-G088 concentrations being below EPA's proposed RALs.

Definition of data qualifiers:

U = The material was analyzed for, but was not detected. The associated numerical value is the method detection limit (MDL).

J = The associated numerical value is an estimated quantity.

T = The associated numerical value was mathematically derived (e.g., from summing multiple analyte results such as Aroclors, or calculating the average of multiple results for a single analyte).

Table 10-5
Grouping of Remedial Action Levels for SMA Determination by FS Alternative

Table 10-5a: Remedial Action Levels from the Draft FS for the Portland Harbor (March 2012)

FS Alternative	Benthic Toxicity	Total PCBs	BaPEq	2,3,4,7,8 PCDF	Total DDE	Total DDD	Total DDT
	Year	ug/kg	ug/kg	pg/g	ug/kg	ug/kg	ug/kg
Alternative B	Comp. Benthic Risk Areas achieved at Year 10 (estimated) MQ > 0.7	1,000	20,000	NA	1000	NA	NA
Alternative C	Comp. Benthic Risk Areas achieved at Year 0 MQ > 0.7	750	15,000	NA	1000	NA	NA
Alternative D	Comp. Benthic Risk Areas achieved at Year 0 MQ > 0.7	500	8000	NA	200	NA	NA
Alternative E	Comp. Benthic Risk Areas achieved at Year 0 MQ > 0.7	200	4000	20	50	100	150
Alternative F	Comp. Benthic Risk Areas achieved at Year 0 MQ > 0.7	75	1500	10	20	50	60

Table 10-5b: EPA's Updated Remedial Action Levels (February 2014)

FS Alternative	Benthic Toxicity	Total PCBs	BaPEq	Dioxin/ Furan TEQ	Total DDx
	Year	ug/kg	ug/kg	pg/g	ug/kg
Alternative B	Comp. Benthic Risk Areas achieved at Year 0 MQ > 0.7	1,000	20,000	120	650
Alternative C	Comp. Benthic Risk Areas achieved at Year 0 MQ > 0.7	750	15,000	81	550
Alternative D	Comp. Benthic Risk Areas achieved at Year 0 MQ > 0.7	500	8000	53	450
Alternative E	Comp. Benthic Risk Areas achieved at Year 0 MQ > 0.7	200	4000	38	300
Alternative F	Comp. Benthic Risk Areas achieved at Year 0 MQ > 0.7	75	1500	22	160

Notes:

The purple highlighted cells indicate areas where the values presented in the Draft FS differ from those currently proposed.

BaPEq = benzo(a)pyrene equivalent
DDD = dichloro-diphenyl-dichloroethane
DDE = dichloro-diphenyl-dichloroethene
DDT = dichloro-diphenyl-trichloroethane
FS = Feasibility Study (for the Portland Harbor)
MQ = Mean Quotient
PCDF = polychlorinated dibenzofuran
RAL = remedial action level
SMA = Sediment Management Area
TEQ = toxicity equivalent

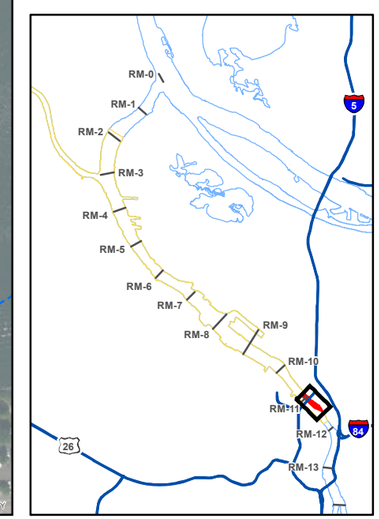
FIGURE 1-1
Project Area

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon

LEGEND

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- Shoreline Properties
- U.S. Army Corps of Engineers Navigation Channel
- Active Outfall
- Inactive Outfall
- River Mile (RM) Tenths



MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
RM = River Mile
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).

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Feet

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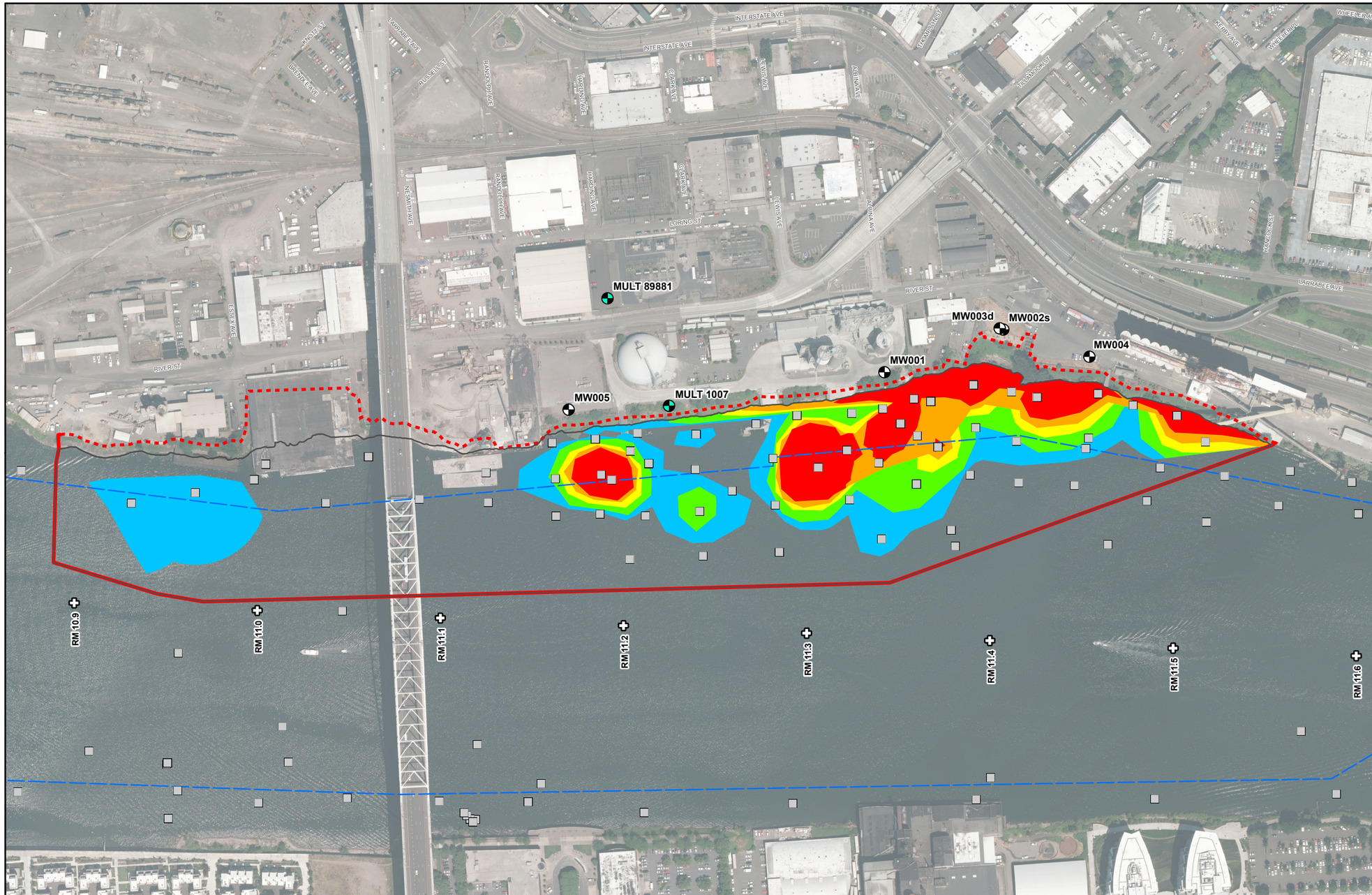

FIGURE 1-2
Potential Sediment Management Areas from the Portland Harbor Draft Feasibility Study and RM11E Monitoring Well Locations

Field Sampling and Data Report River Mile 11 East

Willamette River
Portland, Oregon

LEGEND

Potential Sediment Management Areas from Portland Harbor Draft FS[8]

- FS Alternative B
- FS Alternative C
- FS Alternative D
- FS Alternative E
- FS Alternative F

Supplemental RI/FS Monitoring Well

- New Well (October, 2013)
- Existing Well[7]

All Other Features

- Existing Surface Sediment Sample Locations
- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
SMA = Sediment Management Area
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
6. Source of the existing sediment sample locations is the Draft FS Sediment Database dated March 29, 2011 (Anchor QEA et al., 2012).
7. Only existing monitoring wells that were included in the Supplemental RI/FS groundwater monitoring efforts are included in this figure.
8. The SMAs in the Draft FS report prepared by the LWG were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations of bounding chemicals of concern (PCBs, BaPEq, DDD, DDE, DDT, and 2,3,4,7,8-PCDF).
9. The source of the existing data that was used to generate the SMA footprints is the LWG's FS Sediment Database (Integral et al., 2011). Analyte group totals (e.g., total PCBs) in this database were calculated using the Portland Harbor FS (RA/background) data rules.

N

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Feet

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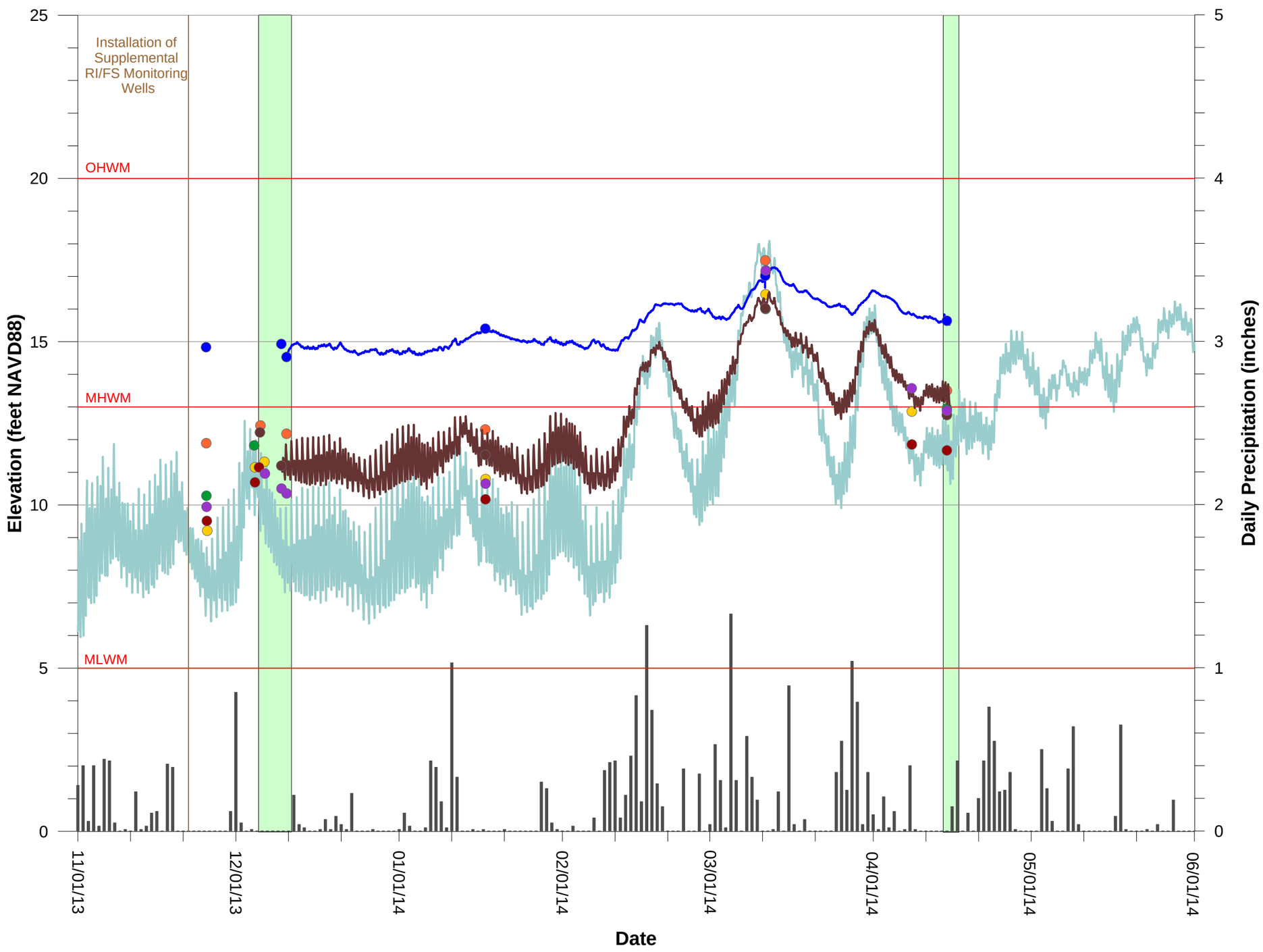

FIGURE 4-1
Willamette River Stage and Groundwater Elevations 2013-2014

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland Oregon

Legend

- MW001 Manual Measurements
- MW002s Manual Measurements
- MW002s Transducer Measurements
- MW003d Manual Measurements
- MW003d Transducer Measurements
- MW004 Manual Measurements
- MW005 Manual Measurements
- MULT 89881
- MULT 1007
- River Elevation
- Precipitation Data
- Portland Harbor Water Level Datums
- Supplemental RI/FS Groundwater Sampling Events

Notes:

Supplemental RI/FS groundwater sampling events occurred from December 6-10, 2013 and April 14-15, 2014.

OHWM = Ordinary High Water Mark, refers to upper edge of the riverbank and defines the elevation beyond which inundation by the river is limited to extreme flow events, which occur approximately every 5 years.

MHWM = Mean High Water Mark, refers to the elevation defining the shoreline boundary of the Portland Harbor Superfund Site and is based on DEQ memorandum dated July 9, 2003 to EPA regarding the upland/in-water boundary for the Superfund Site (DEQ 2003b).

MLWM = Mean Low Water Mark, refers to the average approximate average low water height.

River stage data were recorded on a 30-minute basis from USGS station number 14211720. Station is located on the upstream side of the Morrison Bridge (RM 12.8). River stage elevation data reported by the USGS are corrected to NAVD88 at the Site by adding 5.05 feet to the USGS reading.

Precipitation data were obtained from the Astor Elementary School rain gage located approximately 4 miles from the Site. Daily totals were obtained from the City of Portland Hydra Network available on the USGS Web site.

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Prepared on July 3, 2014

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FIGURE 5-1
Surface Soil
Sample Locations

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon

LEGEND

Supplemental RI/FS Sample

- Surface Soil (October, 2013)

All Other Features

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).

N

0 100 200
Feet

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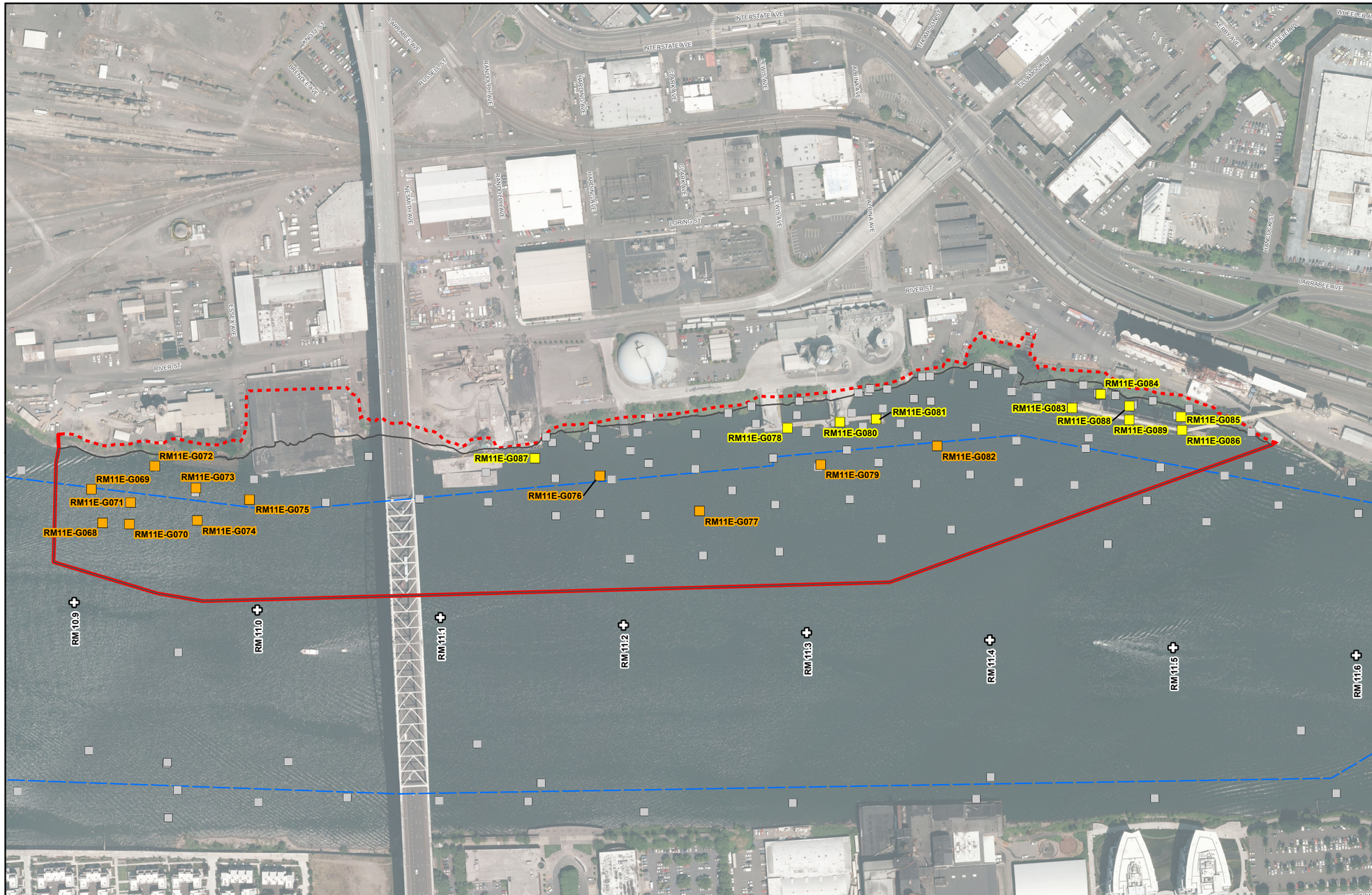
FIGURE 6-1
Surface Sediment Sample Locations

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon



LEGEND

Supplemental RI/FS Surface Sediment Sample

- Power Grab (October, 2013)
- Manual Grab (May, 2014)

All Other Features

- Existing Surface Sediment Sample Locations
- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
6. Source of the existing sediment sample locations is the updated RM11E dataset described in Section 10.2 of this report.

N

0 150 300
Feet

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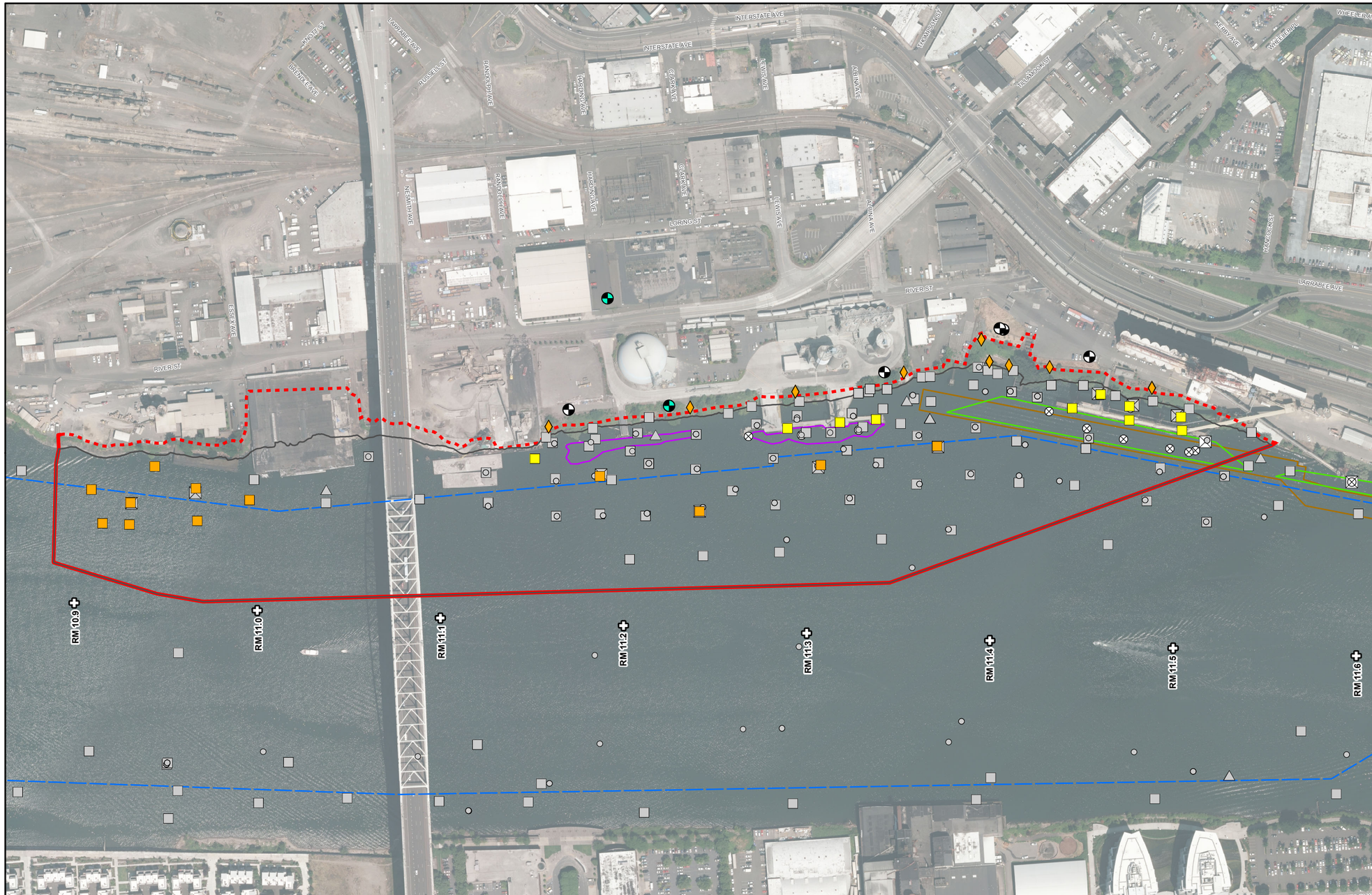
FIGURE 10-1a
Existing Sediment and Supplemental RI/FS Sample Locations

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon



LEGEND

Supplemental RI/FS Samples

- Surface Sediment Power Grab (October, 2013)
- Surface Sediment Manual Grab (May, 2014)
- Surface Soil (October, 2013)
- New Well (October, 2013)
- Existing Well[7]

Existing Sediment Sample Locations

- Subsurface Sediment
- Surface Sediment
- Sediment Trap

Excluded Sediment Samples

- Subsurface Sediment (dredged/capped)
- Surface Sediment (dredged)

Replaced Sediment Samples

- Surface Sediment

Dredged and/or Capped Areas

- Cargill Dredged Area (2002)
- Cargill Dredged/Capped Area (2009)
- Glacier NW Dredged Area (2004)

All Other Features

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
6. Source of the existing sediment sample locations is the updated RM11E dataset described in Section 10.2 of this report.
7. Only existing monitoring wells that were included in the Supplemental RI/FS groundwater monitoring efforts are included in this figure.

N

0 150 300
Feet

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FIGURE 10-1b
Existing Sediment and Supplemental RI/FS Sample Locations

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon

LEGEND

Supplemental RI/FS Samples

- Surface Sediment Power Grab (October, 2013)

Existing Sediment Sample Locations

- Subsurface Sediment
- Surface Sediment
- Sediment Trap

Replaced Sediment Samples

- Surface Sediment

All Other Features

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
6. Source of the existing sediment sample locations is the updated RM11E dataset described in Section 10.2 of this report.
7. Sample labels reflect the "sample_ID" (as noted in Appendix J data file) for surface sediment and soil samples. For subsurface sediment, sediment traps, and groundwater samples, the "LocationID" is shown for clarity since multiple sampling intervals and/or events may have been conducted at this location.

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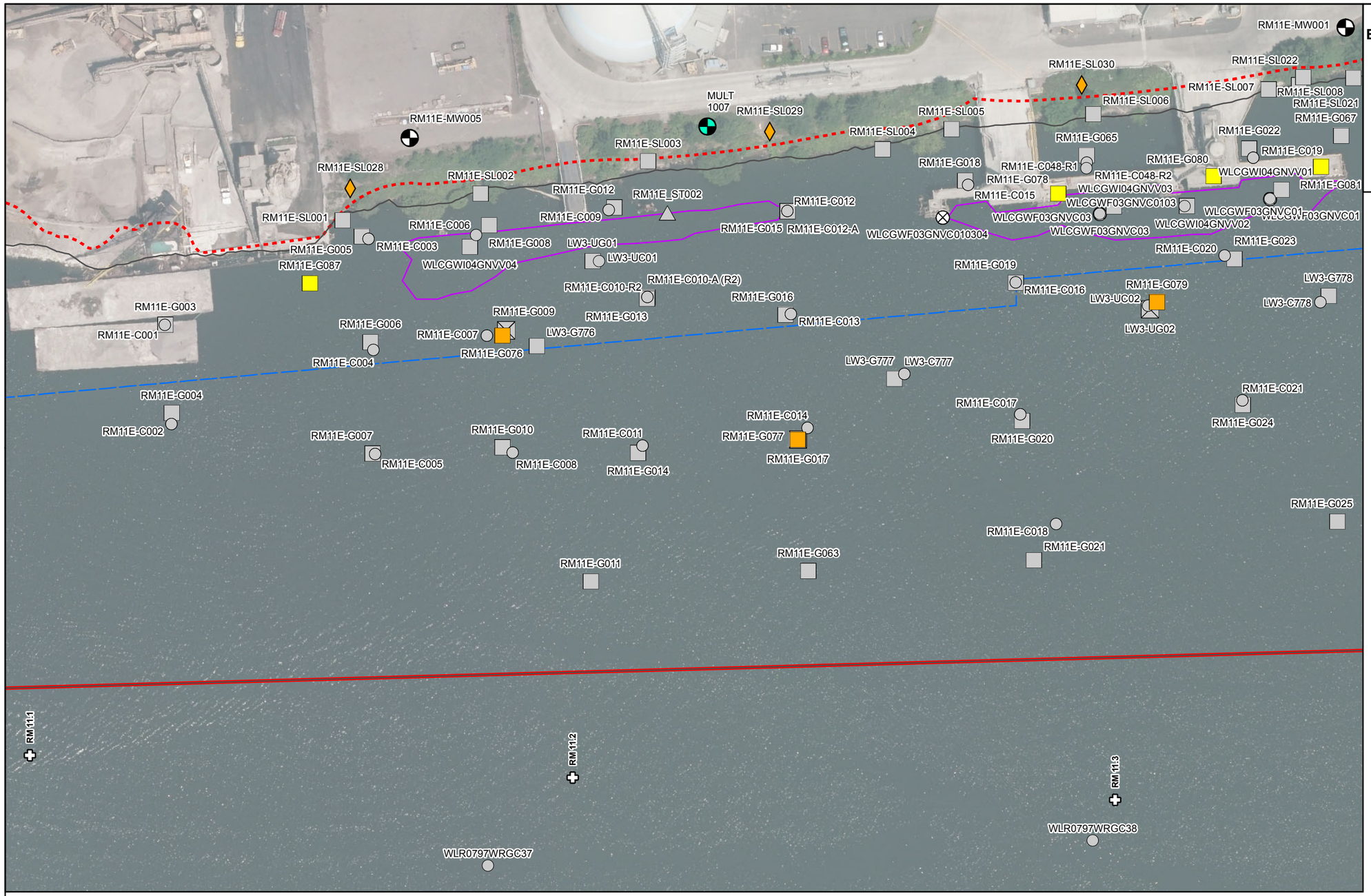

FIGURE 10-1c
Existing Sediment and Supplemental RI/FS Sample Locations

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon

LEGEND

Supplemental RI/FS Samples

- Surface Sediment Power Grab (October, 2013)
- Surface Sediment Manual Grab (May, 2014)
- Surface Soil (October, 2013)
- New Well (October, 2013)
- Existing Well[8]

Existing Sediment Sample Locations

- Subsurface Sediment
- Surface Sediment
- Sediment Trap

Excluded Sediment Samples

- Subsurface Sediment (dredged/capped)

Replaced Sediment Samples

- Surface Sediment

Dredged and/or Capped Areas

- Glacier NW Dredged Area (2004)

All Other Features

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
6. Source of the existing sediment sample locations is the updated RM11E dataset described in Section 10.2 of this report.
7. Sample labels reflect the "sample_ID" (as noted in Appendix J data file) for surface sediment and soil samples. For subsurface sediment, sediment traps, and groundwater samples, the "LocationID" is shown for clarity since multiple sampling intervals and/or events may have been conducted at this location.
8. Only existing monitoring wells that were included in the Supplemental RI/FS groundwater monitoring efforts are included in this figure.

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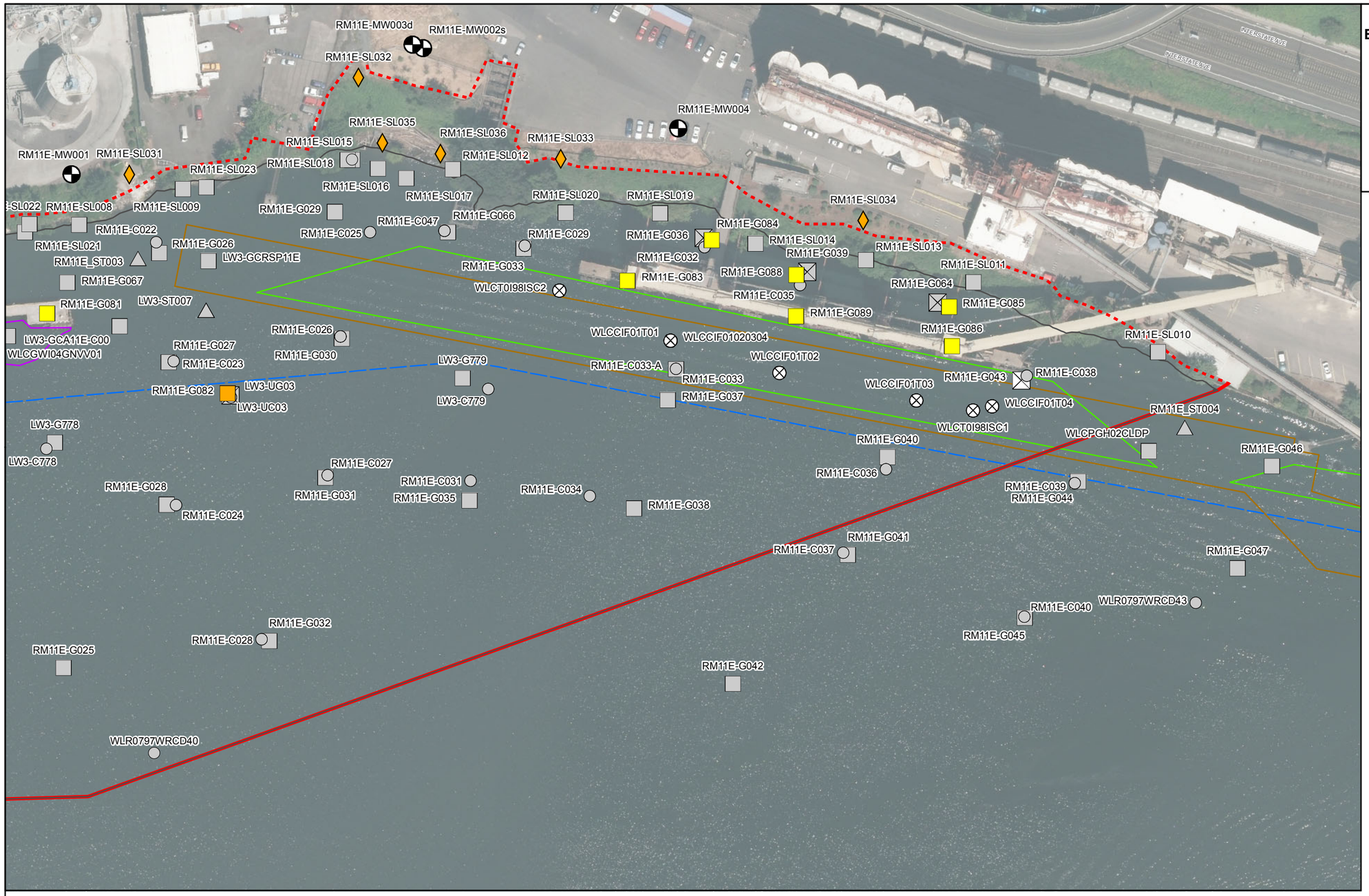

FIGURE 10-1d
Existing Sediment and Supplemental RI/FS Sample Locations

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon

LEGEND

Supplemental RI/FS Samples

- Surface Sediment Power Grab (October, 2013)
- Surface Sediment Manual Grab (May, 2014)
- Surface Soil (October, 2013)
- New Well (October, 2013)
- Existing Well[8]

Existing Sediment Sample Locations

- Subsurface Sediment
- Surface Sediment
- Sediment Trap

Excluded Sediment Samples

- Subsurface Sediment (dredged/capped)
- Surface Sediment (dredged)

Replaced Sediment Samples

- Surface Sediment

Dredged and/or Capped Areas

- Cargill Dredged Area (2002)
- Cargill Dredged/Capped Area (2009)
- Glacier NW Dredged Area (2004)

All Other Features

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
6. Source of the existing sediment sample locations is the updated RM11E dataset described in Section 10.2 of this report.
7. Sample labels reflect the "sample_ID" (as noted in Appendix J data file) for surface sediment and soil samples. For subsurface sediment, sediment traps, and groundwater samples, the "LocationID" is shown for clarity since multiple sampling intervals and/or events may have been conducted at this location.
8. Only existing monitoring wells that were included in the Supplemental RI/FS groundwater monitoring efforts are included in this figure.

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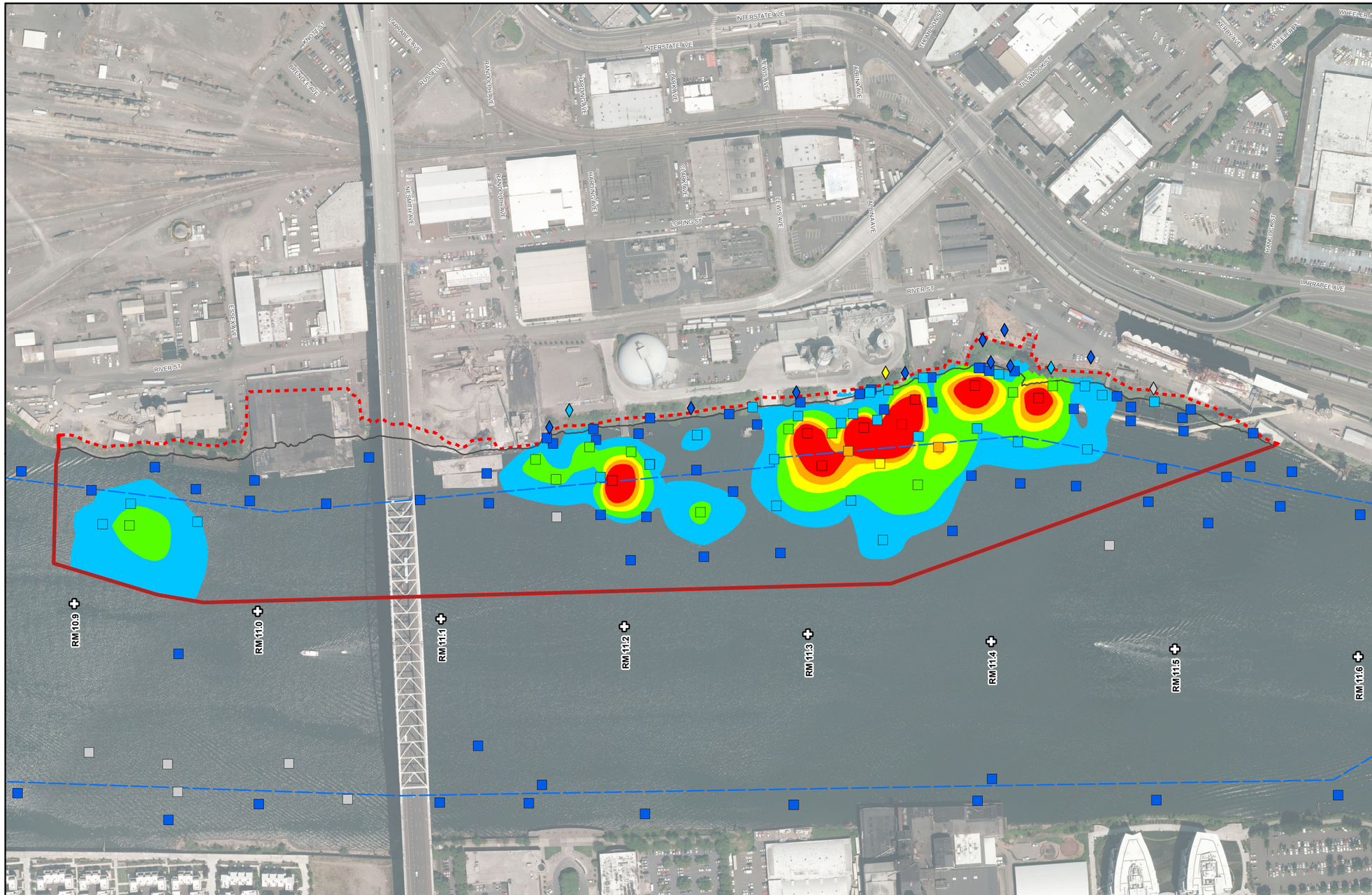
FIGURE 10-2
Total PCBs in Surface Sediment and Soil

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon



LEGEND

- Surface Sediment Sample
- Soil Sample

Total PCBs in Surface Sediment (EPA RAL Footprints)

- Alt B: >1,000 ug/kg
- Alt C: >750 - 1,000 ug/kg
- Alt D: >500 - 750 ug/kg
- Alt E: >200 - 500 ug/kg
- Alt F: >75 - 200 ug/kg
- Below RALs: 0 - 75 ug/kg
- Non-Detect

All Other Features

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
RAL = Remedial Action Level
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
6. The Total PCB RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment (including bank soil samples collected below an elevation of 13 ft NAVD88) concentrations in a manner consistent with that used by the LWG in the Draft FS for the Portland Harbor (and shown in Figure 1-2.)
7. The source of the sediment and soil data is the updated RM11E dataset described in Section 10.2 of this report. As noted in Section 9.3.1 of this report, the Total PCB concentrations were calculated using the Portland Harbor FS (RA/background) data rules.

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FIGURE 10-3
Total Dioxin/Furan TEQ in Surface Sediment and Soil

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon

LEGEND

- Surface Sediment Sample
- Soil Sample

Total Dioxin/Furan TEQ in Surface Sediment (EPA RAL Footprints)

- Alt B: >120 pg/g
- Alt C: >81 - 120 pg/g
- Alt D: >53 - 81 pg/g
- Alt E: >38 - 53 pg/g
- Alt F: >22 - 38 pg/g
- Below RALs: 0 - 22 pg/g
- Non-Detect

All Other Features

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
RAL = Remedial Action Level
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
6. The Total Dioxin/Furan TEQ RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment (including bank soil samples collected below an elevation of 13 ft NAVD88) concentrations in a manner consistent with that used by the LWG in the Draft FS for the Portland Harbor (and shown in Figure 1-2.)
7. The source of the sediment and soil data is the updated RM11E dataset described in Section 10.2 of this report. As noted in Section 9.3.1 of this report, the Total Dioxin/Furan TEQ concentrations were calculated using the Portland Harbor FS (RA/background) data rules.

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FIGURE 10-4
Total DDx in Surface Sediment and Soil

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon

LEGEND

- Surface Sediment Sample
- Soil Sample

Total DDx in Surface Sediment (EPA RAL Footprints)

- Alt B: >650 ug/kg
- Alt C: >550 - 650 ug/kg
- Alt D: >450 - 550 ug/kg
- Alt E: >300 - 450 ug/kg
- Alt F: >160 - 300 ug/kg
- Below RALs: 0 - 160 ug/kg
- Non-Detect

All Other Features

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
RAL = Remedial Action Level
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
6. The Total DDx RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment (including bank soil samples collected below an elevation of 13 ft NAVD88) concentrations in a manner consistent with that used by the LWG in the Draft FS for the Portland Harbor (and shown in Figure 1-2.)
7. The source of the sediment and soil data is the updated RM11E dataset described in Section 10.2 of this report. As noted in Section 9.3.1 of this report, the Total DDx concentrations were calculated using the Portland Harbor FS (RA/background) data rules.

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FIGURE 10-5
Total Benzo(a)pyrene Equivalent (cPAHs) in Surface Sediment and Soil

Field Sampling and Data Report
River Mile 11 East

Willamette River
Portland, Oregon

LEGEND

- Surface Sediment Sample
- Soil Sample

Total Benzo(a)pyrene Equivalent (cPAHs) in Surface Sediment (EPA RAL Footprints)

- Alt B: >20,000 ug/kg
- Alt C: >15,000 - 20,000 ug/kg
- Alt D: >8,000 - 15,000 ug/kg
- Alt E: >4,000 - 8,000 ug/kg
- Alt F: >1,500 - 4,000 ug/kg
- Below RALs: 0 - 1,500 ug/kg
- Non-Detect

All Other Features

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

MAP NOTES:

Date: July 3, 2014
AOPC = Area of Potential Concern
FS = Feasibility Study
RAL = Remedial Action Level
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
6. The Total Benzo(a)pyrene Equivalent (cPAHs) RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment (including bank soil samples collected below an elevation of 13 ft NAVD88) concentrations in a manner consistent with that used by the LWG in the Draft FS for the Portland Harbor (and shown in Figure 1-2.)
7. The source of the sediment and soil data is the updated RM11E dataset described in Section 10.2 of this report. As noted in Section 9.3.1 of this report, the Total Benzo(a)pyrene Equivalent (cPAHs) concentrations were calculated using the Portland Harbor FS (RA/background) data rules.

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GSI Water Solutions, Inc.

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