Appendix A

Document Development and Response to Comments

Appendix A – Document Development and Responses to Comments

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Appendix A – Document Development and Responses to Comments

1.0 Introduction

This appendix outlines the regulatory history that led to the submission of a document combining the Feasibility Study (FS) and Source Control Evaluation (SCE) for the Willamette Cove Upland Facility (the Facility). Also included herein are Port of Portland (Port) responses to comments from the Oregon Department of Environmental Quality (DEQ); U.S. Environmental Protection Agency (EPA); Metro; and the Confederated Tribes of The Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians of Oregon, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon (the Tribes) on relevant source control and feasibility study documents.

2.0 Regulatory Background

In November 2000, the Port and Metro entered into a Voluntary Cleanup Program Agreement (Agreement No. EC-NWR-00-26) with the DEQ for remedial investigation and upland source control measures for the Facility.

To inform the remedial investigation activities, the Port conducted a detailed investigation of the site use and environmental investigation history at the Facility. That information is documented in the *Existing Data/Site History Report* (Hart Crowser, 2000).

In December 2000, a portion of the Willamette River within Portland was placed on the National Priorities List, officially creating the Portland Harbor Superfund Site (PHSS). Pursuant to the terms of a *Memorandum of Understanding* for the PHSS, the DEQ is the lead agency for assessment and cleanup of upland facilities that could pose a source of sediment contamination to the PHSS. The Facility was identified by the DEQ as an upland facility in which PHSS cleanup goals should be considered as part of the upland remedy.

Initial remedial investigation activities were conducted from April 2001 through September 2002. The results of that investigation were presented in the *Remedial Investigation* (Hart Crowser, 2003) and *Remedial Investigation Addendum* (Port, 2003). Additional sampling requested by DEQ was conducted in December 2005.

An analysis of the baseline risk for human health and ecological receptors at the Facility was submitted in draft form to DEQ in 2007 (NF/ACA, 2007). The baseline risk assessment was revised based on comments from DEQ and additional data collected during the revision process. The revisions were presented in the separate *Residual Risk Assessment* (RRA) documents for human health and ecological receptors respectively (Formation, 2013 and 2014a). The conclusions of the RRAs have been updated to include new information

as additional remedial investigation and actions have been completed. These updated evaluations have been documented in technical memorandums (Formation, 2014b; Port, 2018b).

Based on site characterization completed during remedial investigation activities, an SCE was completed, and the results submitted to DEQ in February 2013 (Apex, 2013). An evaluation of remedial options and recommendation of remedial alternatives to address unacceptable risk at the Facility was documented in the *Feasibility Study* submitted in October 2014 (Apex, 2014b).

Based on the comments provided by DEQ in response to the FS and SCE submittals, the amount of coordination required between source control and upland remedial actions, and the nexus of source control activities within the PHSS, the DEQ requested that the revised FS and SCE be combined, and these normally separate documents provided as one submittal. A *Combined Feasibility Study and Source Control Evaluation* (Combined FS/SCE) was submitted in September 2017 (Apex, 2017d).

Between February and September 2018, the Port, DEQ, and Metro conducted six meetings to discuss the comments and proposed revisions to the Combined FS/SCE. The *Revised FS/SCE* (this report) addresses comments received by the Port from DEQ, EPA, Metro, and incorporates the extensive discussion between DEQ and the Port in subsequent meetings.

3.0 Regulatory Comments and Responses

The comments provided by DEQ, EPA, Metro, and the Tribes, and the Port responses to these comments on documents related to the SCE and FS process are provided as attachments to this appendix. This section provides a short description of each document and the status of comments and/or responses provided by regulatory agencies and the Port.

3.1 Source Control Evaluation

The Port submitted the Source Control Evaluation on February 13, 2013 (Apex, 2013). DEQ provided comments on this document in a letter to the Port dated April 5, 2014 (DEQ, 2014a). Included in that letter were comments from EPA. The Port responded to both DEQ and EPA comments in a letter submitted June 13, 2014 (Port, 2014). The comment response letter is provided as Attachment A-1.

3.2 Feasibility Study

The Port first submitted a *Draft Feasibility Study* to DEQ on February 12, 2014 (Apex, 2014a). DEQ provided comments on that document in a letter dated August 7, 2014 (DEQ, 2014b). A series of meetings were conducted between August and October 2014 to resolve DEQ comments.

The Port submitted a revised *Feasibility Study* on October 3, 2014 (October 2014 FS; Apex, 2014b). DEQ provided comments on the October 2014 FS in a letter dated November 25, 2015 (DEQ, 2015). Additional comments were provided in a letter from the EPA dated December 3, 2014 (EPA, 2014), a memorandum from the EPA (EPA, circa 2015), and a technical memorandum from the Tribes dated November 26, 2014 (HydroAnalysis, 2014). For several reasons, including the decision to provide a revised FS and revised SCE in a combined document, and interim action performed at the Facility, it was agreed that a response to these comments would be deferred. Additionally, the scope of the Combined FS/SCE was significantly different than that of the October 2014 FS, so many of the comments provided by DEQ and others on the October 2014 FS were no longer relevant. A specific response to the October 2014 FS was not prepared, but to the extent that they were applicable, the comments were addressed in the Combined FS/SCE and this report. Comments on the October 2014 FS are provided as Attachments A-2, A-3, A-4, and A-5.

3.3 Removal Action

The Port submitted a *Removal Action Completion Report* on May 27, 2016 (Apex, 2016b) to document the 2015/2016 soil removal performed as an interim remedial action at the Facility. DEQ provided comments on this report in a letter dated July 28, 2016 (DEQ, 2016a). The Port provided a response to those comments in a letter dated September 16, 2016 (Port, 2016a). The comment response letter is provided as Attachment A-6.

3.4 Groundwater Monitoring

In 2016, the Port performed four rounds of groundwater monitoring to supplement the source control dataset. Each round of groundwater monitoring was documented in a data report submitted subsequent to the sampling event.

The results of the February 2016 sampling event were documented in the *Groundwater Data Report, February 2016* submitted on April 20, 2016 (Apex, 2016a). DEQ did not provide a letter documenting comments on that report. The results were discussed in the May 31, 2016 meeting which included representatives from DEQ, the Port, and Metro.

The results of the June 2016 sampling event were documented in the *Groundwater Data Report, June 2016* submitted on August 5, 2016 (Apex, 2016c). DEQ provided comments on that report in an email dated August 15, 2016 (DEQ, 2016b). The Port provided a response to those comments in a letter dated November 3, 2015 (Port, 2016b). The comment response letter is provided as Attachment A-7.

The results of the September 2016 sampling event were documented in the *Groundwater Data Report, September 2016* submitted on January 26, 2017 (Apex, 2017a). DEQ provided comments on that report in a letter dated March 17, 2017 (DEQ, 2017). Apex Companies, LLC provided a response to those comments on behalf of the Port in an email dated March 9, 2018 (Apex, 2017b) noting that the subsequent data report would be revised based on those comments. The DEQ letter and email are provided as Attachment A-8.

The results of the December 2016 sampling event were documented in the *Groundwater Data Report, December 2016* submitted on May 16, 2017 (Apex, 2017c). DEQ did not comment on that report.

3.5 Combined Feasibility Study and Source Control Evaluation

The Port submitted the *Combined Feasibility Study and Source Control Evaluation* on September 17, 2017 (Apex, 2017d). DEQ provided comments on that report in a letter dated January 24, 2018 (DEQ, 2018a). Additional comments were provided from the EPA in a letter dated November 14, 2017 (EPA, 2017) and Metro in a memorandum dated January 23, 2018 (Metro, 2018). A series of meetings were conducted between February and September 2018 to discuss DEQ comments. The response to those comments is provided as Attachment A-9.

The DEQ provided *Recommendations for Willamette Cove Upland FS/SCE – Screening and Illustration of Contaminated Data* as a document attached to an email dated January 22, 2018 (DEQ, 2018b). The document is provided in Attachment A-10.

During a meeting on March 22, 2018, DEQ requested additional documentation on the practicability evaluation conducted to develop the dioxin/furan TEQ removal action level. The Port provided additional documentation to DEQ in a series of emails from April to June 2018. The series of emails and associated attachments are provided as Attachment A-11.

The Port provided interim deliverables to DEQ during the meetings held to discuss comments on the Combined FS/SCE. DEQ provided comments on the deliverables provided in the August 16, 2018 meeting in a letter dated September 5, 2018 (DEQ, 2018c). The Port provide a response to those comments in a letter dated November 9, 2018 (Port, 2018a). The comment response letter is provided as Attachment A-12.

4.0 References

Apex (Apex Companies, LLC), 2013. *Source Control Evaluation, Willamette Cove Upland Facility, Portland, Oregon.* February 13, 2013.

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Apex (Apex Companies, LLC), 2014b. *Feasibility Study, Willamette Cove Upland Facility, Portland, Oregon.* October 3, 2014.

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DEQ (Oregon Department of Environmental Quality), 2014b. Letter: *DEQ Comments – Draft Feasibility Study, Willamette Cove Upland Area, ECSI #2066.* August 7, 2014.

DEQ (Oregon Department of Environmental Quality), 2015. Letter: *Additional Comments – October 2014 Feasibility Study, Willamette Cove Upland Facility, ECSI #2066.* November 25, 2015.

DEQ (Oregon Department of Environmental Quality), 2016a. Letter: *DEQ Comments – Removal Action Completion Report, Willamette Cove Upland Facility, ECSI #2066.* July 28, 2016.

DEQ (Oregon Department of Environmental Quality), 2016b. Email: *Willamette Cove Groundwater Monitoring Report.* August 15, 2016.

DEQ (Oregon Department of Environmental Quality), 2017. Letter: *September 2016 Groundwater Data Report, Willamette Cove Upland Facility, ECSI #2066.* March 7, 2017.

DEQ (Oregon Department of Environmental Quality), 2018a. Letter: *Combined Feasibility Study and Source Control Evaluation, Willamette Cove Upland Facility, ECSI #2066*. January 24, 2018

DEQ (Oregon Department of Environmental Quality), 2018b. Email Attachment: *Recommendations for Willamette Cove Upland FS/SCE – Screening and Illustration of Contaminated Data.* January 22, 2018.

DEQ (Oregon Department of Environmental Quality), 2018c. Letter: *Interim Deliverables for revised FS/SCE, Willamette Cove Upland Facility, ECSI #2066.* September 5, 2016.

EPA (United States Environmental Protection Agency), 2014. Letter: *Comments on Feasibility Study Report, Removal Action Engineering Design Report, and Removal Action Drawings and Specifications for the Willamette Cove Upland Facility.* December 3, 2014.

EPA (United States Environmental Protection Agency), ~2015. Memorandum: *Review of Oregon Department of Environmental Quality Additional Comments – October 2014 Feasibility Study, Willamette Cove Upland Facility, ECSI #2066, Dated November 25, 2015.* ~2015.

EPA (United States Environmental Protection Agency), 2017. Letter: *Combined Feasibility Study and Source Control Evaluation, Willamette Cove Upland Facility, Portland, Oregon, ECSI #2066*. November 14, 2017.

Formation (Formation Environmental), 2013. *Residual Human Health Risk Assessment, Willamette Cove Upland Facility.* December 2013.

Formation (Formation Environmental), 2014a. *Ecological Risk Assessment, Residual Risk Assessment, Willamette Cove Upland Facility.* January 2014.

Formation (Formation Environmental), 2014b. Technical Memorandum: *Evaluation of 2014 Soil Samples from the Willamette Cove Upland Site for Potential Impacts on Residual Risk Assessment Findings.* September 17, 2014.

Hart Crowser, 2000. *Existing Data/Site History Report, Willamette Cove, Portland, Oregon.* November 8, 2000.

Hart Crowser, 2003. *Remedial Investigation, Willamette Cove, Portland, Oregon, ECSI No. 2066.* March 11, 2003.

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NF/ACA (NewFields/Ash Creek Associates), 2007. *Draft Willamette Cove Baseline Risk Assessment, Willamette Cove Upland Facility.* August 23, 2007.

Metro, 2018. Memorandum: *Comments on the Combined Feasibility Study and Source Control Evaluatuion, Willamette Cove Upland Facility ECSI #2066.* January 23, 2018.

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Port (Port of Portland), 2016a. Letter: *Response to DEQ Comments, Removal Action Completion Report, Willamette Cove Upland Facility – ECSI #2066.* September 16, 2016.

Port (Port of Portland), 2016b. Letter: *Response to DEQ Comments, Groundwater Data Report, June 2016, Willamette Cove Upland Facility – ECSI #2066.* November 3, 2016.

Port (Port of Portland), 2018a. Letter: *FINAL Revised Response to Comments, Interim Deliverables for Revised FS/SCE, Willamette Cove Upland Facility, ECSI #2066.* November 9, 2018.

Attachment A-1

Response to DEQ Comments, Source Control Evaluation, Willamette Cove Upland Facility - June 2014

June 13, 2014

Mr. Ken Thiessen
Oregon Department of Environmental Quality
2020 SW Fourth Avenue, Suite 400
Portland, OR 97201-4987

Subject: Response to DEQ Comments
Source Control Evaluation
Willamette Cove Upland Facility

Dear Ken:

This letter provides the Oregon Department of Environmental Quality (DEQ) with a response to the comments received on the Willamette Cove Upland Facility *Source Control Evaluation* (dated February 13, 2013). The comments were provided to the Port of Portland (Port) in a letter from the DEQ dated April 15, 2014. The DEQ and EPA comments are repeated (in italics) followed by the Port response. Following the DEQ's response to this letter, the Port will prepare a revised Source Control Evaluation report.

DEQ Comments

General Comments

Adherence to JSCS. Source control evaluation should be completed following the framework outlined in the Portland Harbor Joint Source Control Strategy (DEQ/EPA, 2005) approved by EPA and DEQ, in particular Sections 4, 5 and 7 of the document. While the JSCS was developed to assist DEQ in source control decision-making, information in the document provides a framework for how source control evaluation should be completed for Portland Harbor sites.

Response: Fundamentally, the source control evaluation (SCE) was completed following the guidance in the JSCS. The data used in the SCE were collected over a 24-year period from 1988 to 2012. The RI was produced in 2003, two years before the JSCS guidance. The data were present in multiple tables from multiple documents. In an effort to streamline the data presentation for the reader, data tables from prior documents were placed in Appendix A as originally presented in the source documents. Those source documents included historical screening levels, some of which are no longer applicable. However, those screening levels were not used in the SCE. The data for the SCE have been compiled in a database that, while much more useful for the screening process, is not user-friendly for data presentation. A form of the database used in the SCE was presented in Appendix B on compact disk. That SCE database includes the JSCS screening levels that were used in the evaluation. We now realize that the SCE text did not clearly communicate the data presentations in Appendix A and

Appendix B. The text of the SCE will be updated to better describe the data format and screening process used.

<u>Scope of SCE Work.</u> The report should include a source control Conceptual Site Model (CSM) outlining all potential sources of contamination to the river present above Mean High Water (MHW), the most relevant being:

- *Groundwater-to-surface water migration by advective flow or preferential migration; and*
- *Soil migration via slope failure, stormwater erosion, human activity, or river-related processes including bed shear and wave action.*

Sampling results from below MHW, and below the upland site boundary, including those from adjacent site beaches and adjoining Willamette River sediments, should be presented and discussed as they relate to past, current, or potential future releases from upland sources. Site related impacts below MHW will be addressed by EPA as part of future Portland Harbor Superfund work. Additional DEQ comments presented below, and further in-person discussions will inform how this information can be related to the overall source control evaluation.

In presenting and discussing sampling results, a clear differentiation should be made between contamination above and below MHW (in figures, tables and text). For potentially erodible portions of the riverbank either above or bisected by the MHW line, DEQ's expectation is that the riverbank itself be evaluated in the SCE to determine if bank stabilization is needed to address potential upland contaminant migration to the river via shoreline erosion.

Response: Section 3 of the SCE is a descriptive CSM that addresses each pathway listed in Section 4.1 of the JSCS guidance (except air pollution because, as the guidance states, this is addressed under stormwater). As discussed in the model summary in Section 3.2 of the SCE, groundwater and riverbank erosion were carried forward (the two pathways identified in the comment above).

A section will be added to the SCE evaluating data from below MHW. Results from below MHW, including soil, beach, and sediment samples, will be presented and discussed within the context of potential for future releases to the river from soil above MHW.

The riverbank is evaluated in detail in Section 4.2 of the SCE.

<u>Area of Upland Soil Contamination Addressed Under the SCE.</u> Relating to the CSM comment above, the area of upland soil evaluated as a potential source to the river should include both river bank soil above MHW, and upland soil in proximity to the riverbank that could potential migrate to the river through processes including overland flow, riverbank erosion, trail erosion, aeolian deposition, etc. Please include figures and tables in the report illustrating the soil area considered potentially transportable to the river, and related sampling and risk screening results.

Response: Section 5.2 of the SCE states that soil samples collected from the riverbank and within approximately 20 feet of the top of bank were included in the soil screening evaluation. Figures 3 and 4 show the samples used in the analysis, including the upland samples above the top of bank. The tables in Appendix A list the data for the samples shown on Figures 3 and 4. Printed tables (1.1 through 5.1) list the results. Table A-1 is a database listing that was used to

screen against JSCS screening levels. The text in Section 5.2 summarizes the results of the screening. The text and tables will be revised to clarify the data used in the SCE.

Significance of Contamination Below MHW. Significant contamination has been detected below MHW which includes site beaches, in-water sediments and the Wharf Road area. A robust analysis needs to be presented in the report to support any conclusions that contamination at these areas are localized to over-water source areas and do not represent an ongoing upland source.

Response: A section will be added to the SCE evaluating data from below MHW.

Groundwater Contamination Addressed Under the SCE. All groundwater data from the upland portions of the site should be considered, however sampling results from borings or wells closest to the riverbank best represent potential risk to the river. As discussed in specific comments below, please discuss/illustrate both detections above relevant groundwater SLVs and evidence of free product.

Response: The groundwater section will be expanded to include screening of the grab groundwater samples and observations in test pits. There have been no observations of free product in the upland. Historical observations of free product on the beach will be summarized.

Extent of Riverbank Erosion and Prioritization. Three areas were identified in the report as being a medium source control concern, loosely illustrated in Figure 10. However, as noted in the figure and elsewhere in the SCE, contaminants are elevated above JSCS screening values at nearly all locations where bare soil is present in the riverbank area above MHW. Based on the prioritization criteria described in the JSCS (Section 4.4), all bare or otherwise erodible riverbank soil at the site with significant exceedances of screening values should be considered a medium priority pathway. Areas meeting JSCS "high priority" criteria (including a potentially complete transport pathway, and the presence of bioaccumulative compounds) should be identified. These JSCS "high priority" areas include riverbank soil in the Wharf Road area, riverbank soil adjacent to the former fuel dock railroad spur, and upland areas near the riverbank where high concentrations of dioxins/furans have been identified.

Source Control prioritization should be completed following the protocol outlined in Section 4.4 of the JSCS with particular attention paid to the prioritization "key factors" including the potential for a complete contaminant transport pathway, magnitude of SLV exceedances, presence of bioaccumulative chemicals, and propensity for contaminants to accumulate in sediments.

Response: Each of the applicable criteria in JSCS Section 4.4 are discussed in Section 6.1. The comment above implies that a potentially complete pathway and presence of bioaccumulative chemicals are sufficient to designate a site as high priority. However, Section 4.4.1 of the JSCS states:

> High priority source control sites are those facilities where DEQ and EPA determine that a complete contaminant migration pathway exists and the upland source is significantly impacting the river or poses a significant and

> imminent threat to the river based on an initial evaluation of the factors listed at the beginning of Section 4.4.

Key terms in that statement are "significantly impacting" and "poses a significant and imminent threat." To be high priority, there must be significant impact or a significant and imminent threat. With respect to Willamette Cove, the factor that speaks most directly to the significance of a potential impact is the "Estimated magnitude of potential contaminant mass loading to the river." The SCE did not include quantitative mass loading estimates, but areas where samples were collected from small soil patches between rip rap boulders were not considered to be significant. Additionally, there may be some confusion about whether erosion is occurring above or below the MHW mark. The SCE will be expanded to further discuss stability/erosion issues as these relate to the riverbank above the MHW mark and how that may factor into the prioritization of source control.

Screening. For source control screening, soil and groundwater sampling results should be compared to values presented in Table 3-1 of the JSCS, or values otherwise approved by DEQ.

The EPA provided updated Portland Harbor Preliminary Remediation Goals (PRGs) on April 14, 2014 which should also be considered. Exceedance ratios, to the extent that they are developed, should be derived accordingly. For bioaccumulative compounds that do not have screening level values presented in Table 3.1 or the EPA PRGs, DEQ's Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment (2007) should be considered. Other screening levels in the draft SCE report, such as occupational RBCs, should be removed.

Response: See the response to the first General Comment above. The SCE will be revised to clarify that the screening was conducted in accordance with the JSCS requirements. In addition, the other screening levels presented in the comment will be considered.

New Data. Please include the results and a discussion of recent (upland) dioxin/furan and other hot spot soil sampling in the revised SCE report. Central Parcel soil near the riverbank may be found to represent a high risk to river receptors.

Response: The SCE will be updated to include the results and a discussion of the new data.

Metal Debris. Slag, metal turnings, melted metal and other debris present at the site is not mentioned or delineated in this report. Site locations for these potential contaminant sources data were provided in the 2003 Remedial Investigation (RJ) report and should be carried forward into the SCE. In discussing, please identify the location of this material relative to MHW. To the extent that it is below MHW, it is potentially an in-water concern. If contamination extends into, or is sourced from the upland portion of the site, it is a potential source control concern.

Response: Discussion of debris was not included in the SCE as the RI clearly notes that the debris is present on the beach (i.e., below MHW). Discussion of the debris will be included in the discussion of data from below MHW.

Riverbank Erosion Potential. The draft SCE conclusions indicate that based on multiple lines of evidence, the short term potential for transport of riverbank soils from beach and shoreline areas to the river is low. Field observations of "human use erosion" from trails, encampments and metal recovery; erosional over-steepening of the river bank, and localized bank failures do not support these conclusions. Additional discussion on riverbank erosion is provided in the Specific Comments below. Site information indicates that the potential for riverbank erosion is high in a number of site areas. A discussion of riverbank slope stability consistent with the site Remedial Investigation findings and field observations above MHW is requested.

Response: This conclusion was presented only within the context of the proposed timing of bank source control actions. Essentially no maintenance has been conducted at the riverbank for a period of 30 to 40 years, yet the areas of visible erosion are mostly limited to approximately 15 percent of the riverbank, with the most severe erosion associated with a few undercut banks. See also response to the Specific Comment on Appendix B discussing erosion related to human use, encampments, and metal recovery. See also response to Specific Comment on Section 4.1 discussing slope stability.

Data Presentation. Site data are not presented in figures except exceedance ratios in Figure 10. Sampling results should be presented to support the source control CSM and source control prioritization as follows:

Soil. Sampling results for the Willamette Cove riverbank above MHW, and extending at least 100 feet inland from the top of riverbank. If there is a potential for upland soil greater than 100 feet from the top of riverbank to migrate to the riverbank slope or river, the 100 foot buffer should be extended as necessary.

Groundwater. Groundwater sampling results (well, boring, or push-probe) in proximity to the riverbank. To the extent that there is no "coverage" near the riverbank, analytical results from more distant (further upland) sampling locations should be included. All upland locations where free product, odor, sheen, were noted should be identified and discussed. Where upland groundwater plumes exceed SLVs but do not appear to be connected to the river, the SCE document must evaluate the stability of the plume and make the argument that the plume (exceeding SLVs) will not migrate to the river in the future.

Response: Using data within 100 feet of top of bank appears to be excessive. As DEQ states in their comment on Section 4.1, rain infiltrates rather than flows overland. Therefore, the potential for overland erosion is low. This is supported by observation of the upland area (i.e., landward of top of bank) where there is no visible erosion. Figures showing the results of soil data screening (using soil data from the riverbank and within 20 feet landward of the top of bank) will be presented on Figures.

The groundwater screening will be updated to include discussion of grab groundwater data, including visual/olfactory observations. There has been no observation of free product in the upland.

Upland Sources. Historical upland features of significance such as former manufacturing facilities, transformer locations, storage tanks, are identified in the RI (2003) and the Riverbank Soil Sampling Report (2006) but are not carried forward into the SCE document. Please present

and discuss these features as they have a bearing on SCE conclusions. Documentation of nearshore and over-water industrial operations, for example, would appear to support the conclusion that contamination detected below MHW at the Inner Cove, the Central Parcel Beach and Wharf Road came from over-water sources and has not migrated from the riverbank or upland areas.

Response: Site history information from prior documents will be summarized and evaluated in the SCE.

Specific Comments

Section 2.5. A summary of the nearshore sediment data (including Portland Harbor Area of Potential Concern/Sediment Management Area) should be presented here in order to:

- *document where high levels of in-river contamination are present adjacent to the uplands site that may be site-related;*
- *confirm the source control CSM and any related conclusions of the SCE; and*
- *support an evaluation of the extent to which upland sources may (or may not) be an ongoing source of contamination to the river.*

Response: The SCE will be revised to expand the discussion of sediment data.

Section 3.1. The stormwater-conveyance preferential pathway is indicated to be incomplete and is not analyzed further. The potential for Outfall Fall 49 to facilitate migration of groundwater contaminants to the river (from upland sources) is dismissed without support. Please illustrate OF 49 on a report Figure and provide further support for why this pipe is not a preferential pathway of upland groundwater contamination to the river.

The few inactive pipes present in the riverbank were investigated and found to be above the water table and do not appear to represent a preferential pathway risk. A field investigation determined that these pipes do not transmit water. Present a citation of this field findings report or append the document to the SCE.

Response: The SCE will be revised to further discuss OF 49 and the inactive pipes.

Section 4.1. A slope stability assessment by Richard Rinne, CEG was included in the Remedial Investigation (2003). Rinne reported that portions of the riverbank are unstable and have retreated over time. He indicated that riverbank retreat is attributable to high river stage events rather than upland runoff flowing off the site. DEQ agrees with Mr. Rinne's observations that rainwater on the site readily percolates into the sandy upland soils and that overland sheet flow to the river is unlikely to occur during even heavy rain events. Previous analysis of erodible soil from the RI found that the riverbanks is oversteepened and "erosion was indicated over the entire length of the riverbank as evidence by exposed tree roots, overhanging foundations, exposed support piles, and collapsed pavement." (RI, 2003). In addition, several sinkholes were observed in the central parcel which were apparently created when river water washed out soil from behind the riprap and concrete creating voids and erosional piping continued to the upland surface. Pertinent information from the 2003 RI should be included in the SCE report and discussed in relation to the potential for riverbank erosion.

This section also includes a statement that site development included riverbank slopes of IH:1V (45 0 or 100%) to 1.5H: 1 V (340 or 67%) supported at the base by a pile-supported retaining wall with the steep bank above protected by revetment materials. These steep banks have not been maintained for several decades and are locally susceptible to slope movement. The RI (2003) concludes that slopes become stable and less prone to slope movement at slopes less than 4H:IV (14° or 25%) such as beach areas. The conclusions in the SCE and RI reports appear to be inconsistent. Please explain this discrepancy about what slope angle is stable at this site.

Relevant to stability of the riverbank is the transient nature of the East and Central Parcel beach sand. Discuss this seasonal aggradation and erosion of unconsolidated beach materials at the site and the relationship of beach morphology change to stability of the adjacent riverbank soil present above MHW.

Response: The comment has misquoted the RI, resulting in a subtle but important distinction in the observations. The RI states that there are "indications of such erosion along the entire length" of the riverbank – meaning that indicators of erosion may be observed at any location, but the statement does not provide a description of the size of the erosion issue. As a direct result of the general observations discussed in the RI, in 2005 and again in 2009, the Port, DEQ, and Metro conducted site walks to identify areas of bare or potentially erodible soil to target for sampling (including reconnaissance from a boat in 2005). The identified areas from these site walks are where riverbank soil samples were collected. As noted in the sampling reports, in some cases, the areas of potentially erodible soil were so small that insufficient sample volume could be collected. In addition, detailed mapping of the riverbank was completed for the SCE (Section 4.2) that described and documented the extent of actual erosion on the riverbank. The SCE will be updated to clarify the discussions in the RI and SCE.

Regarding stable slopes, the comment misinterprets the conclusions of the RI. The RI states: "However, the sandy slopes subject to saturation and moving water tend to stabilize at about 4H:1V or flatter." That statement is specifically referring to the sandy beaches, and does not apply to the riverbank slopes. The RI discussion of the riverbank slopes is consistent with the observations made during the SCE reconnaissance. The SCE will be updated to clarify the discussions in the RI and SCE and to discuss beach morphology.

<u>Section 4.2.</u>

a) *With theexception of the Western Parcel, areas of the riverbank are subject to several factors that may result in exposure of site contaminants to human health and ecological receptors as well as sediment migration to the river. These include river processes in conjunction with human use of the riverbank. Trails to popular beach and fishing areas have resulted in riverbank gulleys which have eroded deeper during the span of DEQ's site observations. Cleared camping areas contribute to bare and unstable riverbank soils. These factors need to be considered in evaluating riverbank soil exposure and transport of soil to the river from above MHW. Heavy human use areas should be mapped to correlate contaminated soils with pathways of exposure to receptors.*
b) *Erodiblesoils were identified and sampled during the 2009 riverbank soil characterization work. If present above MHW, these areas should be mapped as erodible soil areas (e.g. Riverbank Sample Locations, SCE Figure 3).*

c) *Conditions at the OHWL are described in this Section.Conditions below OHWL are relevant to in-water work and should be included. Areas of fused metal turnings, slag, discolored sand, and sheen observations should be included in the riverbank reconnaissance description.*
d) *The location ofOF -49 and a general description and evaluation of other exposed riverbank pipes should be discussed.*
e) *Pleaseadd the Western Parcel to the figures showing the two bare or erodible shoreline soil areas identified by DEQ in 2010. These areas were identified as sampling locations WC-SSZ2 and WC-SSZI. These were both upstream of sampling location WC-SSA, a historical discrete riverbank sample collected in 2005 (Table 2.2) where Aroclor 1260 was detected at a concentration of 0.111 mg/kg. These data should be included in the evaluation of shoreline erosion.*

Response: Section 4.2 will be updated to include discussion of the above items or clarify existing discussions of these items.

Section 4.3. Erodible soil within revetted areas was sampled and analyzed in 2009. These data should be carried forward into the SCE.

Response: Erodible soil from the areas of rip rap was collected in 2010 (based on a site reconnaissance conducted in 2009). These soil data were included in the SCE. Soil data are discussed in Section 5.2.

Section 5.1.1. Dioxins and furans should be added to the list of nearshore sediment COI as detected concentrations exceed Portland Harbor Focused Preliminary Remediation Goals (PRGs).

Response: The SCE will be updated to include dioxins and furans as COIs.

Section 5.1.3. All groundwater sampling data that inform the evaluation of groundwater-to surface water migration pathway, including evidence of free product or sheen, should be presented and discussed in the SCE. This would include data not only from monitoring wells, but push-probes, borings and trenches.

Also, the text states that " ... 20 to 40 grab groundwater samples were collected from the site and analyzed for a suite of site COIs." These data are not carried forward in to the draft Source Control Evaluation and should be included in the final Source Control Evaluation.

Response: The SCE will be updated to include the discussions requested in the comment.

Section 5.2. In assessing the soil erosion pathway, soil data discussed in the SCE are defined as "soil samples collected from the riverbank and within approximately 20 feet of the top of bank". It is unclear whether soil below MHW is included. Separate discussions should be presented for: a) riverbank soil above MHW and upland soil within 100 feet of the top of riverbank (see General Comment regarding this issue above); and b) contamination present below MHW including lower riverbank, beach, and Willamette River sediment. The former are

the main focus of the SCE for soil, while the latter provide contextual information that will be passed on to EPA for future in-water work.

The text states that "Samples with copper, lead, and/or mercury above the SLV are from samples located throughout the Central and Eastern Parcels, and locations of higher relative concentrations of these metals do not correlate" Please discuss the correlation of elevated metals concentrations to elevated concentrations of other site Contaminants of Concern.

Response: As discussed in response to the General Comment, a distance of 20 feet was used because of the soil conditions (sandy soil allowing precipitation to infiltrate) and lack of upland erosion. Given these conditions, it is the Port and Metro's opinion that 20 feet is sufficient to evaluate the potential riverbank erosion pathway. Soil data from below MHW was not used in the soil screening. The SCE will be revised to include discussion of data from below MHW.

The discussion of the extent of contaminants of concern will be expanded.

Section 5.3.

a) *Total petroleum hydrocarbon (TPH) values, in addition to Polycyclic Aromatic Hydrocarbons (PAHs) should be screened against relevant SLVs.*
b) *Observations of oil sheen in wells should be noted.*
c) *Table A-2 referenced in the text is missing from Appendix A (on attached CD).*
d) *Data are not screened against JSCS SLVs but instead are presented as enrichment values making evaluation difficult. JSCS SLV screening for groundwater may be included in missing table A-2 (see note above).*
e) *The dissolved TPH concentration found in West Parcel Boring SE/E 19 of 297,000 ug/l should be included and added to the site evaluation.*
f) *In the West Parcel borings, only two samples were analyzed for TPH in groundwater. Please discuss how TPH in groundwater has been adequately characterized in this area, supporting the conclusion that the groundwater-to-surface water pathway for TPH is incomplete or not a consideration.*

Response: The SCE will be updated to include the discussions requested in the comment. Table A-2 is where screening against JSCS was presented.

Section 5.3. Appendix A. Table 7.6 shows that the most recent and highest concentration of chlorobenzene in monitoring well MW-2 is 86.6 ug/L. The SLV for chlorobenzene is 50 ug/L. Chlorobenzene was also detected in groundwater from B-6 and B-7 in the West Parcel. Given these results, chlorobenzene screens in as a potential chemical of concern for transport from groundwater to surface water. Chlorobenzene is not discussed in the screening of the groundwater pathway (Section 6.2). Please check to determine if other groundwater contaminants screen in when compared against SLVs.

Response: The screening will be updated and re-evaluated as needed and presented in the SCE.

Section 6.1.2, last bullet. Dioxins/furans from the bank may be the source of dioxins/furans detected in river sediment adjacent to this area. The SCE needs to address this potential upland source to the river, especially in erodible and unstable bank areas.

Response: The SCE will be updated with further discussion of sediment data and relationships to upland data.

Section 6.2. The statement that arsenic in upland soil is within the background range is not supported by site data and must be corrected. There are areas of the site with arsenic in soil is elevated above the expected background concentration of 8.8 mg/kg (DEQ. 2013, Table 4). The maximum arsenic concentration in SCE Appendix A, Table 1.5 for soil remaining at the site is 40.3 mg/kg at SS-19 in the Central Parcel.

Response: As described in the bullet, the statement is related to upland soil relevant to the monitoring wells of concern. Soil samples collected within 300 feet of monitoring wells with arsenic above SLVs were within the expected background concentration. The SCE will be revised to clarify this point.

Section 7. DEQ does not agree with draft SCE conclusions regarding the extent of source control concerns or their priority. Some riverbank areas above MHW are "high priority" based on ranking criteria outlined in the JSCS, and the area of medium priority is possibly larger than proposed. Delineation of source control areas of concern, and re-ranking of risk in these areas should be completed in a revised SCE that fully addresses DEQ comments.

Response: As discussed in the response to the General Comment on prioritization, the JSCS criteria were carefully considered in preparing the site rankings. The revised SCE will include a reassessment of the site rankings and additional detail supporting conclusions.

Figure 3. Based on information in this Figure, most of the composite sampling locations are above MHW and are may be a potential source of upland contamination to the river in erodible areas. Please confirm and discuss this correlation in the revised SCE report. As well, JSCS Section 4.4 "key factors" should be considered in assigning a priority to the soil represented by the sampling locations.

Response: Figure 3 only shows samples collected above MHW. The composite samples were collected at locations agreed to with DEQ. In many cases, however, the individual discrete samples used to create the composite were collected from small patches of soil between the rip rap boulders. This JSCS key factor (i.e., potential mass loading) was used to develop conclusions regarding site prioritization. The revised SCE will expand discussion of the conditions at each of the sampling locations and how those conditions contribute to the evaluation of key factors.

Figures 5 and 6. Riverbank features relevant to the SCE such as the location of Outfall 49, the locations of notable contamination areas (Inner Cove and Wharf Road sheen areas, slag, fused metal turnings, discolored sand), gullies or other erosion features (including manmade), and over-steepened slopes should be presented.

Response: These figures show the extent of bank erosion. The revised SCE will include a figure(s) showing the requested items.

Figure 10. Regarding the Exceedance Ratios presented in the figure, the following are unclear:

- *The source (data point or points) from which the ERs were derived;*
- *Whether the ERs represent all detections exceeding an ER of 1 for the data set comprising the various riverbank segments; and*
- *Whether ERs are based on samples collected above MHW, below MHW, or a mix of the two.*

Response: The revised SCE will clarify these issues.

Tables, general. Tabulated site data are screened against Ecological SLV s for ecological terrestrial receptors (DEQ 2001) and Industrial PRGs (EPA 2002). Please include appropriate Screening Level Values from the DEQ/EPA Joint Source Control Strategy, 2005, Table 3.1 for clarity.

Response: To clarify, the data for the SCE were screened against JSCS criteria – see the response to the first General Comment – the referenced tables are reproductions from the RI report that included historical screening that was not used for the SCE. Tables A-1 and A-2 in the SCE were used for screening. The revised SCE will clarify the screening process.

Table 2.2. It is not appropriate to use probable effect concentrations as the sole screening criteria for bioaccumulative contaminants of interest. Bioaccumulative contaminants should be screened against SL V s from JSCS Table 3.1 and EPA PRGs, or against the bioaccumulative SL V s using DEQ's 2007 Guidance/or Assessing Bioaccumulative Chemicals in Sediment (if Table 3.1 SL V s and EPA PRGs are not available for the contaminant of concern).

Response: See response to the Specific Comment on Tables, general. See also response to the first General Comment.

Tables 6.2-6.10. The water SLVs used to evaluate groundwater contaminant concentrations (DEQ 2001) should utilize appropriate values from Table 3.1 of the JSCS. However, due to the lack of updating of that table, in some instances there may be newer, updated individual SLVs that are more appropriate.

Response: See response to the Specific Comment on Tables, general. See also response to the first General Comment.

Table 7.4. The labels "East Parcel" and "West Parcel" are reversed.

Response: The SCE Table 7.4 will be corrected.

Table 7.7. TPH should be discussed in the main text.

Response: The SCE will be updated to include the discussion requested in the comment.

Appendix A, Data Tables. It is unclear why soil concentrations are screened against industrial PRGs and terrestrial ecological SLV s in these tables. If erosion of upland soil at the sample locations could make it to the river, these samples should be screened using in-water source control SLV s. In addition, the SLV s used are not consistent with those used in the upland ecological risk assessments which were updated to reflect EPA 2007 ecological SSLs and other sources. Pesticides, PCBs, dioxins furans and mercury should be evaluated considering bioaccumulation risk per JSCS Table 3.1. Please clarify.

Response: See response to the Specific Comment on Tables, general. See also response to the first General Comment.

Appendix B, Site Photographs. The series of shoreline photos is not representative of features relevant to a source control evaluation and features to be carried forward into in-water work. Please include site photographs to show such features as trail erosion, fused waste metal, slag, stained sand, debris remaining from site demolition, camping sites, fire rings, unused riverbank pipes, and OF-49.

Response: The photographs in Appendix B are in fact representative of what is most relevant to the SCE (riverbank erosion), as demonstrated by the following.

- The Willamette Cove riverbank is over 3,000 feet long. There are two trails to the river associated with visible erosion, each only a few feet wide. The first is located near the west end of the Central Parcel in a 300-foot-long portion of the bank identified as having significant erosion from river action. The erosion in this area is identified on Figure 5 (and carried through the SCE evaluation) and shown in Photographs 1 through 4 of Appendix B. The second is located in the cove on the East Parcel. The erosion associated with the trails is trivial compared to the general area around the trail.
- During the RI, scattered chunks of fused metal were observed on the sandy beach at the west end of the Central Parcel (the same location as discussed in the bullet above). The largest, up to 4 feet across, is shown in Photograph 12 of the RI report. The fused metal was located below the MHW line. The metal has no relevance to riverbank erosion and is likely insignificant with respect to source control. We understand that this may have relevance to future in-water work, and, as previously stated, features such as the fused metal will be summarized in the revised SCE.
- During the RI (2003), slag and metal and brick debris were identified on the beach at the south side of the cove (East Parcel). The impacted area is shown on Figure 6 of the RI report. The entire impacted area identified as containing slag or debris on that beach was capped as part of the McCormick & Baxter remediation project (Photographs 19 and 21 through 23).
- Historically, there have been three areas of petroleum seeps or sheen (with potential stained sand). One was located on the south side of the cove, associated with the McCormick & Baxter site and was capped during that remediation project. The other two (inner cove and Wharf Road area) were thoroughly investigated, and found to have not originated in the upland area (best evidence is that they originated from the river or historical overwater activities). Pictures were not provided because this was not relevant

to the bank erosion evaluation in the SCE. However, as previously stated, issues from below MHW will be summarized in the revised SCE.

- Site demolition debris relevant to riverbank erosion is shown in Photographs 10, 16, 18, and 20.
- Camping sites/fire rings, while indicative of trespassing and potential exposures, are not substantively relevant to the erosion evaluation in the SCE. It is understood that trespassing has/does occur at the site and that was factored into the risk assessment. However, trespassers are not significant with respect to erosion because trails do not add substantively to erosion (see first bullet above) and Metro actively patrols the site to prevent camping.
- As stated in the SCE (including references to relevant studies), the unused riverbank pipes are no longer active so are not potential sources. Therefore, no pictures were provided.
- OF-49 is a City-owned outfall that does not drain any of the upland facility, so it is not relevant to the SCE.
- The remainder of the pictures show erosion or potential erosion features (Photographs 5, 6, 8, 9, 11, 12, 14, 15, and 17) or large areas with no substantive erosion (Photographs 7 and 13). Photograph locations are shown on Figures 5, 6, and 7.

<u>Other Comments - Related to Site Contamination Below MHW</u>

a) *As has been previously noted, contamination at site beaches and other areas that are accessed by trespassers is not fully characterized in terms of nature and extent. While this portion of the site is below MHW (and under EPA jurisdiction), DEQ encourages the Port and Metro to consider additional measures to characterize and communicate potential risks in these areas. However, further characterization of contamination below MHW is not required as part of the upland SCE.*

b) *Sheen and petroleum product have been observed by DEQ at the river's edge at the Wharf Road and in the Inner Cove beach. Inner Cove beach excavations to the water table also exposed petroleum sheen on groundwater and associated soil. Locations where sheen and product are observed should be identified in the text and on figures and warrant further consideration at the time of future in-water work.*

c) *Page 6, Section 2.4.4, It is unclear how product at the Inner Cove beach was defined as mobile or immobile. DEQ observed petroleum sheen at the river's edge in September 2009. In September 2010, trenches excavated to the water table in the inner cove beach exposed petroleum sheen on groundwater and staining on soil. The source of this petroleum appears to result from previous over-water site activities. From the 2009 and 2010 site observations, it appears that the 2004 removal action was successful only locally in removing mobile product inland of the OL WL.*

d) *Page 7, Section 2.4.5, Surface Sediment Characterization: We disagree with the statement that " ... the chemical analysis and forensic evaluation concluded the hydrocarbon concentration in the samples is consistent with concentrations observed in urban waterways and that the varying degree of weathering and biomarker patterns suggest that the petroleum was deposited in small qualities over an extended period of time." The data collected from the site does not support this conclusion given that petroleum detections are co-located variably with significant detections of PCBs, dioxins and furans, diphenyl ethers, lead and mercury. As stated above, the petroleum source appears to be closely related to over-water activities.*

e) *The beach surface soil data collected at the Wharf Road by the Lower Willamette Group in 2008 provides valuable analytical results for this area. These data should be included the revised Source Control Evaluation.*

Response: These comments will be considered in preparing the summary discussion of the data collected below MHW.

EPA Comments

General Comments

1. Many different types of vertical datum are used in the report. The inconsistency in datum creates an uncertainty for evaluations that use elevations for pathways presented in the report. To reduce uncertainty and better support conclusions, it is recommended that elevations in the report be presented using the same datum and be consistent with other Upland Source documents. See Specific Comment #3 below.

Response: With the exception of Table 7.2 in Appendix A, NAVD88 is used throughout the report. Table 7.2 is a reproduction of a historical report.

2. The conclusions of the SCE need to be better supported by a clear presentation of historic and recent sampling conducted at the Willamette Cove Upland Facility. For example, the effectiveness of the removal action for petroleum product in the East Parcel is not supported by the results of confirmation samples. The use of data would be best documented with sample locations on figures with a legend that correlates samples/results to specific reporting/investigation events. Although sample types and dates are presented on figures, they cannot be correlated to descriptions of the specific investigation during which the sample was collected (e.g., Remedial Investigation [RI], etc.). It is recommended that investigations or report references be added to the sample descriptions on the figure legends to correlate the text and the figures.

Response: The SCE will be updated to include the discussions requested in the comment. The requested changes to figures will be considered.

3. The SCE should include a section evaluating overland transport and sheet flow pathways. The overland flow evaluation is needed to address the contamination present in surface soils and the unpaved areas of the Willamette Cove Upland Facility. It is recommended that this omission be addressed.

Response: The SCE stated that there is no substantive overland flow as demonstrated by soil type and the lack of observed flow-based erosion features. Overland flow on the bank was evaluated in the bank erosion discussion. The SCE will be expanded to better support the overland flow discussion.

4. To support the conclusion that no stormwater conveyances exist at the Willamette Cove Upland Facility and outfalls are no longer functional, the SCE should summarize the findings of

the documents referenced. In addition, if outfalls are no longer functional, a description of how stormwater leaves the Willamette Cove Upland Facility should be included. It is recommended that these issues be addressed in the final document.

Response: The SCE will be updated to include the discussions requested in the comment.

Specific Comments

1. Section 2.1, Page 2, Site Description-In the second paragraph, please provide a reference supporting the statement that the McCormick & Baxter Creosoting Company Superfund Site contaminant plume is affecting the Willamette Cove Upland Facility. A cross-section of the McCormick & Baxter Creosoting Company Superfund Site contaminant plume adjacent to and encroaching the Willamette Cove Upland Facility could also be included in the SCE to support the interpretations and clarify the source of COIs present in groundwater.

Response: The SCE will be expanded to clarify impacts from McCormick & Baxter.

2. Section 2.1, Page 2, Site Description-- The report states that riprap is present along most of the riverbank. It is recommended that the report also note that East Parcel of the Willamette Cove Upland Facility includes an extensive long-angled beach area.

Response: The SCE will be expanded to clarify the presence of beaches in some areas.

3. Section 2.1, Page 3, Groundwater Conditions --In this section, groundwater elevations are described as ranging from 7.2 to 21.5 feet (NA VD88). Table 7.2 in Appendix A lists groundwater elevations ranging from 5.04 to 19.37 feet and these elevations are relative to City of Portland Benchmark 2106 (elevation 68.94 feet, City of Portland datum). In keeping with common practice in environmental reporting, it is recommended that groundwater elevations be presented in the same datum consistently throughout the report.

Response: See response to EPA General Comment #1.

4. Section 2.2, Page 3, Historical Site Use-Please include the location and extent of the historical "former log pond" on Figure 2.

Response: The historical log pond will be added to appropriate figures.

5. Section 2.4, Upland Investigation-- Because the evaluation of PCB and metals in surface soil and riverbank soils is critical for meeting the study objectives, it is recommended that the SCE provide a more complete presentation and evaluation of these data.

Response: The SCE will be updated to include the discussion requested in the comment.

6. Section 2.4.1, Page 5, Remedial Investigation Soil Sampling-- The SCE states that 35 surface soil samples were collected; however, the details of the surface soil sampling are not

provided in the SCE. It is recommended that Section 2.4.1 be revised to include a description of surface soil sampling.

Response: The referenced reports documenting the sample collection and analyses provide these details. The revised SCE will summarize the sampling process.

7. Section 2.4.3, Page 6, Groundwater Sampling-- High concentrations of TPH (297,000 µg/L and 290,000 µ/L) were detected at SE/E-19, which is approximately 100 feet east of MW-I. Subsequent soil boring B-4 had detections of diesel and oil at 1,810 mg/kg and 1,920 mg/kg, respectively. The report does not include an evaluation of TPH migration through soil into groundwater and subsequent migration to the Willamette River. Based on the detections noted above, it is recommended that the SCE evaluate this pathway.

Response: The revised SCE will include evaluation of TPH in groundwater.

8. Section 2.4.3, Page 6, Groundwater Sampling-The SCE does not include a description of the water bearing unites) that were sampled during the groundwater investigation. Monitoring well screen intervals are not included in the report to help describe the water bearing units that were monitored. It is recommended that revisions be made to address these omissions.

Response: The referenced reports documenting the installation, sample collection, and analyses provide these details. The revised SCE will summarize well and aquifer information.

9. Section 2.4.3, Page 6, Groundwater Sampling-- The SCE does not describe the rationale for specific analytes in the groundwater analysis program to correlate analytical results of COIs that may have originated from past use of the Willamette Cove Upland Facility. The correlation of past site use and/or facility release history with COIs is critical to the study objective of determining if the site is a source of chemicals effecting the Willamette River. It is recommended that these issues be addressed in the final report.

Response: This information is in the referenced RI report. The revised SCE will summarize the rationale for the groundwater program.

10. Section 2.5, Page 7, Nearshore Sediment Data-- This section does not include a brief summary of the nearshore sediment data collected in the Portland Harbor RI report. The nearshore sediment data can be used in the pathway analysis to help assess whether the Willamette Cove Upland Facility is an ongoing source of contamination to the Willamette River at concentrations that represent a risk to human health and the environment and thus require control. It is recommended that this omission be addressed.

Response: The revised SCE will summarize sediment data.

11. Section 3.1, Page 7, Identification of Migration Pathways -- The report notes that stormwater conveyances are not present or are no longer active at the site. To support this conclusion, it is recommended that the report be revised to include a. summary of the data from the documents referenced, including the Riverbank Pipe Sampling from the Former Wharf Road Area.

Response: The revised SCE will summarize the stormwater evaluation.

12. Section 3.1 , Page 7, Identification of Migration Pathways -- With consideration of the surface soil data showing exceedances of SLVs and the extensive unpaved areas, the report does not include an evaluation of the overland transport migration pathway whereby contaminated soil present at the site may be entrained during precipitation events and transported to the river via overland flow. For example, soil data collected at the site suggests that the overland transport migration pathway could be significant. Chemical analysis of surface soil sample TP-22/S-1 collected on April 17, 2001 had detected concentrations of diesel at 2,390 ppm and oil at 5,960 ppm. In addition, these same samples had nickel and polycyclic aromatic hydrocarbons (PAHs) above the JSCS SLVs. Topographic contours presented on Figures 2 through Figure 6 indicate that surface water may be flowing into the Willamette River around the location Willamette River. This information suggests that surface water flowing across the Willamette Cove Upland Facility has the potential to transport contaminants to the Willamette River at concentrations above SLVs. Consequently, it is recommended that Section 4.2 be revised to describe where surface water discharges to the river in relation to COIs that have been detected in surface soils.

Response: See response to EPA General Comment #3.

13. Section 4.2, Page 9, Riverbank Reconnaissance, West Parcel-It is recommended that Section 4.2 of the SCE be revised to include additional information to support the conclusion in Section 4.4 that the West Parcel has low potential for erosion or bank movement even though it is subjected to relatively high bed shear during high-flow conditions.

Response: The revised SCE will be expanded to provide additional information.

14. Section 4.3 Page 11, Assessment of Potential for Erosion from River Action-- Although the SCE includes a description of bed shear during low-flow and high-flow river conditions, it is recommended that further details regarding the frequency of low-flow and high-flow conditions be included in this section to more clearly characterize the potential for riverbank erosion.

Response: The SCE will be updated to include the discussion requested in the comment.

15. Section 4.3, Page 11, Assessment of Potential for Erosion from River Action-- The evaluation of erosion due to waves did not include a range of river elevations. It should also be noted that wave action from boat wakes represents a significant erosion process. Due to changes in river stage, the bank elevation that may be subjected to bank erosion from boat wakes is considerable and it is recommended that this potential be described in the SCE. It is recommended that these issues be addressed in the final report.

Response: The revised SCE will be expanded to provide additional information.

16. Table 4.3, Railroad Embankment Soil Sample-Please add definitions for data qualifiers M6 and HI to the table notes.

Response: The SCE Table 4.4 will be updated to include definitions for all the data qualifiers.

17. Section 5.0, Page 12, Upland Data Screening-- Total Petroleum Hydrocarbon (TPH) results are presented in Appendix A but a qualitative evaluation of TPH (e.g., if mobile product is still present) has not been included to determine if they are a priority for source control. It is recommended that this omission be addressed.

Response: An evaluation of TPH will be added to the SCE.

18. Section 5.1.2, Page 13, Soil Data-- Because the soil data comprise samples collected by composite, incremental, and point soil sampling methods, a description of the methods is critical to support the interpretations and representativeness of soil sample data. It is recommended that the soils sampling methods be fully described or a reference to the sampling plan(s) be provided.

Response: The SCE will be updated to include the descriptions or references requested in the comment.

19. Section 5.2, Page 14, Riverbank Soil Data Screening Metals -- The first sentence of the third paragraph refers to "higher relative concentrations" of metals, but the second sentence of the third paragraph refers to the maximum enrichment ratios (ERs). Examples of the maximum ERs of composite subsamples should not be used to explain how copper, lead, and/or mercury concentrations do not correlate. Each of the composite samples at the locations described in this paragraph has at least two of the three metals above JSCS SLVs, which indicates that the metals concentrations do correlate. Additionally, historic uses of the site included industry along the entire waterfront; therefore, multiple sources of metals could be expected. It is recommended that this discussion be revised to reflect the concerns noted herein.

Response: The revised SCE will clarify the discussion of the extent of impacts.

20. Appendix A-It is recommended that JSCS SLVs be included on all result tables for simpler comparison of SLVs and analytical results.

Response: Because of the large amount of data, the screening was conducted in databases using JSCS SLVs. Historical tables were provided showing the originally collected data. The SCE will be revised to clarify the data screening.

21. Appendix A-It is recommended that result table names be consistently named and numbered in the appendix. Examples are Tables 4.2 and 2.2, where one set of tables are labeled "Riverbank Soil Samples" and one set of tables are labeled "Soil Chemistry Results: Polychlorinated Biphenyls" while both tables describe Riverbank soil sample results.

Response: See the response to the first DEQ General Comment. The SCE will be revised to clarify the data presentation.

22. Appendix A, Table 6.5, Groundwater Chemical Analyses Results: Metals (Borings and Probes) – The results for total and dissolved metals for boring B-6 look to be transposed. For all other sample results the total metals values when detected exceeded the dissolved metals values whether quantified or nondetect. For B-6 this trend is reversed for almost all of the metals. It is recommended that this data be further evaluated to determine whether these results are presented correctly in the final document.

Response: These data were provided as presented in the 2003 RI report, but the data will be reviewed for the final SCE.

Please call me at (503) 415-6325 if you have any questions.

Sincerely,

Dwight Leisle
Environmental Project Manager

c: Katy Weil, Metro
Kristine Koch, EPA
Rich Muza, EPA
Dwight Leisle, Port
Anzie Nelson, Port
Suzanne Barthelmess, Port
Michael Pickering, Apex Companies
Herb Clough, Apex Companies
Mark Lewis, Formation Environmental
LWP File

Attachment A-2

Additional Comments – October 2014 Feasibility Study, Willamette Cove Upland Facility – November 2015

Oregon
Kate Brown, Governor

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November 25, 2015 *via electronic delivery*

Dwight Leisle, PE
Port of Portland
7200 NE Airport Way
Portland, OR 97218

RE: Additional Comments - October 2014 Feasibility Study
Willamette Cove Upland Facility
ECSI# 2066

Dwight:

DEQ staff completed review of the ***Feasibility Study, Willamette Cove Upland Facility*** (FS) prepared by Apex on behalf of the Port of Portland (Port) and dated October 3, 2014. The FS outlines remedial options to address contaminants present in the upland portion of the Willamette Cove site, including portions of the riverbank above high water levels.

General and specific comments on the FS are presented below. Most of the general comments were presented to you during a November 24, 2014 site meeting. Please submit a revised FS document addressing our comments, and considering those of EPA and the Five Tribes included as attachments to this letter.

GENERAL COMMENTS

#1 a, Scope of Proposed Work. All of the "action" remedies show laying back of the riverbank to either a 3H:1V or 2H:1V slope, with work extending to ordinary high water (OHW). DEQ notes that the upland is defined in Section 2.1 as extending from the mean high water (MHW) line. MWH is approximately 7 feet lower (vertical elevation) than OHW. Please discuss/resolve this discrepancy. It is DEQ's expectation that the upland remedy will extend to MHW.

Additional discussion is needed between DEQ and the Port as to whether riverbank remedial measures will be completed as part of: 1) upland remedy implementation, 2) source control efforts, or 3) in conjunction with implementation of the in-water remedy. If considerable time is expected to elapse before the bankline remedy is implemented, interim stabilization efforts are expected to be necessary in high-risk portions of the bankline (above MHW) for source control purposes.

DEQ would prefer that removal actions focus on riverbank hot spots, considering both terrestrial and in-water exposure and the portion of the upland site closest to the river.

#1 b: Scope of Risk Evaluated in the Feasibility Study. The FS evaluates risk and presents hot spot summaries relative to upland exposure to human health and terrestrial receptors, but does not evaluate

areas of concern relative to riverbank and source control criteria. Areas of concern should be identified by comparing (in-water) EPA riverbank and DEQ source control criteria to riverbank soil in the area identified from top of bank to the mean high water line. Maps containing both EPA riverbank, DEQ in-water (SCE) and upland exceedances for ecological and human health risk should be included for applicable areas. The lower of DEQ source control and EPA riverbank PRGs contained within EPA's remedial action objective (RAO) 1 and RAO 9 should be applied from top of bank to mean high water. Areas containing sheen or product, or debris such as slag and metal turnings, should also be delineated. The upland remedy must fully address source control concerns. Please add a section to the FS documenting the results of the most recent source control evaluation work for the site, and how the proposed remedy will address source control concerns. The riverbank remedy will also need to address hot spots based on upland screening criteria and EPA PRGs based on RAOs 1 and 9.

As you know, the upland source control evaluation has not been finalized. A *Source Control Evaluation* (Apex, 2/13/13) was previously submitted to DEQ. DEQ comments on the SCE were provided in letter form on April 15, 2014. A response to DEQ's 2014 comments was presented in a Port letter dated June 13, 2014. Subsequent to this, missing data tables from the 2013 SCE were presented separately to DEQ by email. In lieu of additional revision of the 2013 SCE report, we recommend that a separate section be included in a revised FS that outlines all upland source control concerns, and confirms that the proposed upland site remedy fully addresses these concerns consistent with the *Portland Harbor Joint Source Control Strategy* and EPA RAO 1 and 9 PRGs.

<u>#2, Effectiveness of Proposed Remedy</u>. There is considerable uncertainty associated with the proposed remedial action: use of a thin cap (0.5-1') to encapsulate soil in the upland and riverbank. The FS acknowledges that some penetration of the cap will occur over time through bioturbation and other processes. However, ecological exposure to the biologically active soil communities and burrowing mammals occurs at deeper exposure depth (0-3ft), as was identified in the risk assessment. DEQ does not believe a thin cap is sufficiently protective of ecological exposure, particularly in hot spot areas. We also have concerns about the protectiveness for human health given the desirability of the area to Portland residents for recreation and ongoing concerns with transient occupancy. A standard (minimum 2-ft) cap should be proposed in these areas. However, DEQ is willing to consider a thin cap remedy in areas of moderate contamination. For non-hot spot areas, more discussion of likely disturbance/mixing needs to be presented, outlining disturbances from: 1) plants and animals; 2) human activity, and 3) meteorological factors including heavy rainfall, runoff and wind erosion. Also, effectiveness monitoring is a concern with a thin cap lacking a demarcation layer. Information should be provided regarding the use and effectiveness of "thin caps" at other remediation sites to support the argument that thin capping will provide long-term effectiveness. See following comment about thin cap use on the riverbank, which is of greater concern (comment #3 below).

DEQ would like revisions to reflect a standard (minimum 2-foot) cap at the site (including demarcation layer) for the site riverbank and areas with higher levels of contaminants. To reduce implementation risk and carbon emissions, we are in favor of leaving more hot spot material on-site in upland, non-riverbank / beach areas. A thinner cap (1') *may* be acceptable within the dripline of trees and certain portions of the upland (less contaminated areas) but would require more stringent monitoring. More discussion is needed on this issue.

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#3, Riverbank Slope and Cap Thickness. It is questionable whether a thin cap is going to be effective and stable on a sloping riverbank surface. Final riverbank slope is proposed to be either 2H:1V or 3H:1V as indicated in site figures. Higher-angle slopes are more likely to compromise capping through both human activity and physical processes. Please discuss. Note that DEQ typically requires a 2-3 foot cover for riverbank surfaces, with an underlying geotechnical fabric and anchoring cover (riprap or other) where inundation might occur. In Figures 17 and 18, a riverbank soil cap is shown extending to ordinary high water without any armoring.

#4, Implementation Risk. Under the proposed remedy (Alternative 7), an estimated 3,300 to 6,700 truck trips would be necessary through adjacent residential communities for implementation. For trips involving off-site transport of hot spot soil, significant implementation risk would be associated with this remedy. Carbon emissions are also a concern. For this reason, we believe that further discussion is necessary regarding alternative options for addressing site hot spots, including alternative transportation (potential use of rail cars or barges for soil transport), leaving more hot spot material on-site in upland areas not in contact with the river (with burial, if possible), etc.

#5, Vertical Extent of Contamination/Remedy Costs. A major source of uncertainty, with repercussions for cost and implementation, is the lack of subsurface soil data, most notably for dioxins. Depending on the depth of contaminants exceeding hot spot values, removal volumes vary *significantly,* with corresponding impacts on remedy costs. DEQ recommends that the Port complete subsurface sampling *prior* to final remedy selection so that the FS more accurately reflects likely removal actions, costs, implementation risks, etc.

#6, Likely Future Use of Site. More information is needed on the expected/likely human use of the site following remediation. Section 8.7 indicates that residual risk from the recommended removal and thin-cap remedy would be addressed through engineering and institutional controls, including information signs and a deed notice restricting site uses to "passive recreation" only. More *specific* information is needed on expected (human) site use to evaluate the effectiveness of the proposed remedy. For example, discuss whether human access is expected to be restricted to paved areas, whether access to the bankline will be restricted where human activity would be more likely to compromise the cap, etc. This has a bearing on whether portions of the site may be suitable for thinner capping.

#7, Sustainability of Proposed Remedy. There is some discussion of the carbon footprint of various remedial alternatives, which is informative. More is necessary, however, given the significant impact that remediation is likely to have on the neighboring community and environment in general (3,300 to 6,700 truck trips are estimated for remedy implementation). Please consider the following resources:

- DEQ's Green Remediation policy: http://www.deq.state.or.us/lq/pubs/docs/cu/GreenRemediationPolicy.pdf
- EPA Region 10's Clean and Green Remediation Policy: http://www.itrcweb.org/GuidanceDocuments/GSR-2.pdf
- Interstate Technology and Regulatory Council (ITRC) Green Remediation Guidance: http://www.itrcweb.org/GuidanceDocuments/GSR-2.pdf

Also, consideration should be given to alternative means for transporting contaminated soil from the site, and clean fill for the cap to the site, including rail and barge. At the nearby M&B site, barges were

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apparently used to transport soil onto the site for capping, significantly reducing both truck traffic through residential neighborhoods and carbon emissions.

#8, Groundwater. There is no discussion of groundwater risk or the basis for exclusion in the Summary of Baseline Risk (Section 3.0) or Site Model (Section 4.0). See general comment 1b above regarding the need for source control discussion in the FS.

#9, EPA and Tribes Comments. EPA and the Five Tribes have provided comments on the FS which were previously forwarded to you for consideration.

#10, Weighting of Site Risk Given Habitat/Receptors. DEQ recommends that the evaluation of remedial alternatives in the FS be modified to discriminate between portions of the site with upland-only versus upland- and in-water receptors. See specific comment below for Appendix D.

#11. Upland Versus In-Water Action. More discussion is needed regarding how the proposed remedy for the site upland would "fit" with an adjacent in-water remedy. Please discuss potential in-water remedial options outlined in the Portland Harbor draft *Feasibility Study* (LWG, 2012) for sediment contamination adjoining the site, whether proposed riverbank remedies might adversely impact or inhibit in-water work, etc.

#12, RCRA Waste. A more robust discussion of hazardous waste issues is requested, including the basis for determining that listed waste is not present (based on historical site use and associated waste streams), and the location and volume of potential characteristic hazardous waste.

#13, Post-Removal Residual Risk. Results from the 2015 upland removal event should be incorporated into a final FS document. Depending on the results of post-removal confirmatory sampling, little or no residual risk may be present in removal areas.

SPECIFIC COMMENTS

Section 2.7. Text indicates that there are no storm drains on the Facility. Our understanding is that at least one storm drain is present on-site but it is not active. The source control evaluation section of the FS should confirm that stormwater concerns are either not present or will be addressed by the upland remedy.

Section 2.8.2. Text should indicate the purpose of Wharf Road area sampling (evaluation of contaminants including dioxins).

Section 2.8.3: Post Residual RA Sampling: Text should indicate that the riverbank and beach areas were excluded in the ISM samples, which is not clear from the presentation. It would also be helpful to summarize the information on field sampling in the FS or other appropriate documents. Currently, it is spread out in multiple memos. It is difficult to understand the methods that were used for the incremental, composite and discrete samples taken post residual risk assessment, and the analyte lists associated with different sampling events. Maps showing the location of the subsamples that went into each incremental or composite sample should be provided.

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Section 3.0. Text should clarify that portions of the Central Beach and Inner Cove Beach units are not on the Upland Facility. Please reference or include a figure showing all of the six exposure units discussed. In this figure, show exposure units relative to MHW along the site bankline.

Section 3.2.2. Arsenic detections above the 8.8 mg/kg value, in particular up to 40 mg/kg as indicated, are not considered by DEQ to be "similar to" background.

Section 4.4. Under Source Control, the report notes that: "A source control remedy has not been identified but could include removal or bankline stabilization." DEQ expects that the upland remedy will be implemented to the commonly-accepted demarcation of MHW, and fully address/mitigate uncontrolled sources in the upland portion of the site. Please include a separate section to the FS identifying all source control concerns and how they will be addressed by the upland FS.

Section 5.1. The FS does not address source control to prevent movement of upland chemicals (primarily in the riverbank) to the river. The appropriate PRGs should be taken from both the Portland Harbor JSCS Table 3-1 and EPA PRGs for RAO 1 and 9. For dioxins/furans, there is a very low value of 0.0091 ng/kg for TEQ from the JSCS taken from DEQ's sediment bioaccumulation guidance. The JSCS criteria apply to soil above mean high water. However, application of DEQ JSC criteria above ordinary high water is determinate on the presence of erodible soil. EPA PRGs for RAO 1 and 9 apply from mean high water to top of bank. The lower of DEQ JSC criteria and EPA PRGs should be evaluated in the FS. These aquatic criteria are well below the upland hot spot level of 1,000 ng/kg, emphasizing the need for evaluation within the upland FS.

RAOs should be revised to incorporate the results of hot spot removal and confirmatory sampling in the upland. It needs to be acknowledged in the FS that bankline sampling for dioxin/furan contaminants is limited at the site. For portions of the bankline where sampling has not been completed, DEQ will assume that these contaminants may be present.

Section 5.1.2. The human health RAOs should be more descriptive, for example: "prevent recreational exposure to soil with concentrations exceeding acceptable risk levels" rather than "prevent exposure to soil."

Section 6.1. Upland terrestrial ecological hot spots should be based on total dioxin/furan TEQ, not individual congeners. Also, terrestrial hot spots should be identified at the Site for all soil down to mean high water.

Section 6.2.

- As noted in our general comments above, soil volumes vary widely and represent significant uncertainly for remedy selection. We recommend resolving this uncertainly through sampling prior to finalization of the site remedy.
- "Thickness" is indicated as 1 to 3 feet, which apparently corresponds to a minimum excavation of 0 to 1 foot below ground surface (bgs), and a maximum excavation from 0 to 3 feet bgs. Please clarify/confirm.

Section 7.2. The last bullet of section 7.2 states that a thin cap will enhance natural recovery. Calling this natural recovery is questionable, given that little or no contaminant degradation is expected and

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contaminant concentrations will only be reduced by capping and subsequent mixing. This is more aptly applied in an in-water setting where natural deposition of (clean or cleaner) material is expected in the contamination area to reduce contaminant exposure.

Section 8.

- As noted in DEQ's general comments above, more discussion is necessary regarding the role of remedial actions in addressing both upland exposure and source control , with source control being of equal if not greater importance in upland remedy selection. The limited discussion presented in Section 4.4 is not adequate.
- All alternatives include the following statement: "A minimum of five years of active inspection and maintenance is expected. Long-term annual inspection would be required thereafter." It is not completely clear what the active inspection and maintenance is but long-term monitoring will require more than annual inspection. It should include inspections after extreme events, and possibly every time a tree falls over, and the associated necessary repairs.
- One concern with a thin cap within tree driplines would be the potential for trees to fall and uproot contaminated soil. Please consider the long-term effectiveness of thin-capping from this standpoint and how the "risk" might be addressed.
- As noted in our general comments above, the "thin cap" suggested as a potential remedy for portions of the upland is non-standard with significant effectiveness and long-term reliability concerns on the part of DEQ. If the "soil mixing" paradigm is adopted as envisioned by thin-capping, a demarcation layer (preferred by DEQ) will not be feasible.

Section 8.3.1. Text states that confirmatory sampling might be required. In DEQ's opinion, sampling would be required.

Section 9.7 This section evaluates the practicability of hot spot removal based on cost alone. All the other balancing criteria should be considered in determining whether removal or treatment of hot spot material is warranted.

Section 10.3. The draft FS contains a residual risk assessment that attempts to quantify risk remaining at the site by eliminating sample locations that would be removed during remediation. The manner in which residual risk is addressed in the revised FS should be revisited with DEQ prior to submission

Willamette Cove FS Tables 1 and 2, PRGs for Ecological and Human Health. These tables should also include both DEQ's human health and ecological Source Control Criteria (Table 3.1 located at http://www.deq.state.or.us/lq/cu/nwr/PortlandHarbor/jointsource.htm), and EPA's PRGs for the riverbank identified as RAOs 1 and RAO 9 in the Portland Harbor FS. The objective of RAO 9 is to "Reduce migration of COCs in riverbanks and surface water such that levels are acceptable in sediment and surface water for human health and ecological receptors", while RAO 1 addresses direct contact to sediment and beaches. EPA's RAO 1 and 9 PGRs are included in Table 1 below.

DEQ Table 1, RAO 1 and 9 PRGs:

COC	Units	RAO 1 – Direct Contact, Beaches	RAO 9 PRG - Riverbank

Aldrin	ug/kg		2
Arsenic	mg/kg	3	3
BEHP	ug/kg		135
Cadmium	mg/kg		5
Chlordanes	ug/kg		1.5
Copper	mg/kg		149
DDx	ug/kg		6.1
Dieldrin	ug/kg		0.07
Hexachlorobenzene	ug/kg		0.3
Lindane	ug/kg		5
Lead	mg/kg		128
Mercury	mg/kg		1.1
PCBs	ug/kg		9
PAHs	ug/kg		23,000
cPAHs (BaP Eq)	ug/kg	12	12
1,2,3,4,7,8-HxCDF	ug/kg		0.000002
1,2,3,7,8-PeCDD	ug/kg		0.0001
2,3,7,8-PeCDF	ug/kg		0.0002
2,3,7,8-TCDD	ug/kg		0.0001
2,3,7,8-TCDF	ug/kg		0.0004
2,3,7,8-TCDD equivalent	ug/kg	0.01	
TBT	mg/kg		24
Zinc	mg/kg		459

- *Mercury*: More recent comprehensive sampling for mercury shows this is a COC for other receptors such as invertebrates, birds and mammals. The hot spot table should be updated to reflect these numbers. If some hot spot values are below background, background should also be listed. The COC designation should be changed for invertebrates, birds and mammals and the appropriate PRG should be included. Additionally, EPA's RAO 9 PRG for riverbank soil is 1.1 mg/kg, which applies from the top of bank to mean high water.
    - Invertebrates: 0.1 mg/kg (1 mg/kg hot spot)
    - Birds: 0.01 mg/kg (0.1 mg/kg hot spot)
    - Mammals: 5.1 mg/kg (51 mg/kg hot spot)
    - Riverbank: 1.1 mg/kg (see above)

Dioxin / Furan TEQ: For dioxins and furans, the updated risk results are presented in terms of exceedance ratios of congener specific and total TEQ risk based concentrations. Therefore, risk based concentrations were developed that equate acceptable LOAEL dose (or a lethal dose for comparison) to soil TEQ concentrations using regression relationships. This allows congener-specific modeling in the calculation of the wildlife dose, but also allows for a soil dioxin TEQ risk based concentration (RBC) to be calculated. Wildlife RBCs are presented in DEQ Table 2 (below). Additionally, since aquatic criteria (invertebrate and fish) are currently absent from the FS, they are presented in DEQ Table 2 below to be considered in the greenway for soil down to mean

high water. Soil above ordinary high water should also be evaluated using these criteria as a part of source control if erodible soil is present. Note that Appendix E selects a background range of 11-46 ng/kg mammalian TEQ based on Washington's report (cited in FS). EPA identifies background for the congener PRGs, ranging from 0.1 ng/kg to 0.2 ng/kg depending on the congener.

As an additional step to ease the interpretation of dioxin TEQ risk criteria using three different toxicity equivalency factors (TEFs) for mammals, birds and fish, regression equations were developed between bird and fish acceptable soil TEQ and mammalian dioxin soil TEQ concentrations. Mammalian TEQ RBCs protective of avian and aquatic receptors are presented in DEQ Table 4. Risks to aquatic life including invertebrates are primarily driven by the enrichment of 1,2,3,7,8-pentachlorodibenzo-p-dioxin at the Site. While this is not the only congener present, it consistently has the highest congener specific hazard quotient at the Site. EPA developed PRGs for riverbank soil for the 1,2,3,7,8- PCDD congener, and four others, which should also be considered in the FS. While there are also many contributions to avian and mammalian risk, the highest avian and mammalian hazard quotients are 1,2,3,6,7,8-hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-hexachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin and 1,2,3,7,8-pentachlorodibenzo-p-dioxin.

DEQ Table 2: Applicable upland terrestrial bird, mammal, and aquatic source control criteria applicable down to mean high water. Mammalian and avian criteria are applicable down to mean high water. 10x the acceptable risk levels are considered hot spot values for terrestrial receptors. Aquatic fish and invertebrate criteria are also applicable down to mean high water, but only apply above ordinary high water if erodible soil is present. Above ordinary high water, 10 x the aquatic acceptable risk levels are used as source control criteria.

Hot spots should be evaluated for mammalian and avian receptors as 10X the LOAEL RBCs shown below.

	Aquatic Invertebrate SLV (Fish TEQ)	DEQ Sediment SLVs for Fish	Mammalian Dioxin TEQ LOAEL RBC (ng/kg)	Avian Dioxin TEQ LOAEL RBC (ng/kg)	Mammalian Dioxin TEQ LD50 RBC (ng/kg)	Avian Dioxin TEQ LD50 RBC (ng/kg)
Dioxin TEQ SLV (ng/kg)	21.5 [a]	0.56	3	64	30	641
2,3,7,8-TCDD	9 [b]					

a NOAA Squirt Freshwater Sediment Probable Effects Level (PEL)

[b] DEQ Guidance for Ecological Risk Assessment, 2001, Table 2

DEQ Table 3, Portland Harbor dioxin / furan PRGs Applicable to top of bank. RAO 9 PRGs represent the lowest of human health fish consumption cancer and non cancer PRGs (RAO 2) and ecological wildlife fish consumption PRGs (RAO 6). Note that RAO 1 addresses direct contact to sediments and beaches.

Dioxin / Furan Congener	Fish Consumption PRG (ng/kg)	Beach / Sediment Direct Contact PRG (ng/kg)

1,2,3,4,7,8-HxCDF	0.002	
1,2,3,7,8-PeCDD	0.1	
2,3,4,7,8-PeCDF	0.2	
2,3,7,8-TCDD	0.1	
2,3,7,8-TCDF	0.4	
2,3,7,8-TCDD TEQ	-	10

DEQ Table 4, DEQ Dioxin TEQ Applicable SLVs Converted to Mammalian TEQ Units: In order to depict the range of PRGs in one unit, fish and bird PRGs were converted to mammalian TEQ using regression equations. Table 4 presented soil mammalian TEQ values calculated using regression equations that represent acceptable risk for invertebrates, fish and avian dioxin TEQ.

	Invertebrate SLV (Uses Fish TEQ)	**Fish SLV (from Table 1)**	**Mammalian Dioxin TEQ LOAEL RBC (ng/kg)**	**Avian Dioxin TEQ LOAEL RBC (ng/kg)**	**Mammalian Dioxin TEQ LD50 RBC (ng/kg)**	**Avian Dioxin TEQ LD50 RBC (ng/kg)**
Representative Mammalian Dioxin TEQ (ng/kg)	25	0.7	3	95	30	955
Regression Equation	*Mammal TEQ =1.17 x (Fish TEQ)*	*Mammal TEQ =1.17 x (Fish TEQ)*	-	*Mammalian TEQ = 1.49 x (Avian TEQ)*	-	*Mammalian TEQ = 1.49 x (Avian TEQ)*

Appendix C

- The memo describes only the relative differences in concentration in a Site wide summary and not the implications for exposure and risk by COC or exposure area. Ideally, given the results that show an increase in spatial scale or magnitude for different COCs, this would be described in an updated risk summary. Updated screening table should be provided for the new data by receptor and exposure area. Exceedances of the PRGs in the 2014 samples should be identified, especially where there are changes to the results of the risk assessment. For example, the West Parcel ISM sample for this area exceeded PRGs for copper and dioxin / furan TEQ, risk that was not identified in the residual risk assessment.
- For dioxins and furans, the ecological ratio tables included in this appendix attempt to relate updated risk information, but no discussion on the tables is provided to discuss the methodology used and the risk presentation as TEQ exceedance ratios.
- Page 4, top paragraph. The arsenic background level of 8.8 mg/kg is an upper predictive level. The ISM sample represents a mean. It is not appropriate to compare a mean (ISM) sample with a UPL.
- Page 4, fifth paragraph, and page 5, Conclusions. From Table 2, the 2014 maximum discrete sample concentration is almost 100 times the prior maximum discrete concentration. The 2014 maximum composite concentration is about 600 times the prior maximum composite concentration. These substantially higher concentrations should be reflected in a change to the conclusion about environmental risk.

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- Page 5, fourth paragraph. The RRA identified PCBs as potential COCs, but PCBs were not analyzed in the 2014 ISM samples. Because of the lack of additional PCB data, we do not have the information to draw additional conclusions regarding PCB risks. Also, we do not know if PCB materials were the source of high dioxin/furan concentrations.
- Tables 2 and 3 should indicate concentration units.
- Table 2. Higher concentrations measured in the additional sampling used in the residual risk assessment were not re-screened. For example, in the Central Parcel the previous maximum mercury concentration was 20.2 mg/kg. The maximum value in 2014 was 74.2 mg/kg. The screening value for mercury in the HHRA is 4.7 mg/kg (based on one tenth of the non-cancer urban residential RBC of 47 mg/kg). Mercury was not screened in on the basis of comparing the UCL with the screening level. It appears that even with the new data, human exposure to mercury may still be acceptable. However, this should be confirmed by comparing the new mercury UCL with the screening value. Naphthalene is another chemical showing a large increase in 2014 concentrations (maximum 11 mg/kg in Central Parcel) compared with prior results (maximum 1.07 mg/kg). Because the new higher maximum value is below the HHRA screening value of 25 mg/kg (based on cancer RBC for urban resident), it is not necessary to include naphthalene in a revised risk analysis.
- Arsenic Figure**.** There may be an error in the sample location layers for this figure. The samples for transient exposure are limited relative to the larger set of data for recreational exposure. The different receptors should likely be evaluated using the same sample locations. For other chemicals such as dioxins/furans, all the data appear to be used for both receptors.

<u>Appendix D.</u>

DEQ requests that the dioxin/furan removal practicability evaluation be modified to acknowledge receptor-dependent risk varies in the Willamette Cove, with lower RBCs (and attendant hot spot values) between aquatic and terrestrial exposure areas.

1. *Upland Site, Terrestrial Risk:* This area is defined as landward to the riverbank mean high water. Applicable (ecological) preliminary remediation goals are the lowest of the PRGs identified in Table 1 of the FS for terrestrial receptors. Dioxin <u>TEQ presented as mammalian RBCs fr</u>om Table 2 are 3 ng/kg and 95 ng/kg, and hot spot levels are 30 ng/kg and 955 ng/kg for mammals and birds respectively.

2. *Riverbank and Erodible Soil, Terrestrial and Aquatic Risk*: Defined as the area from top of bank down to mean high water. In addition to terrestrial risk, this area will be compared against DEQ source control criteria and EPA riverbank PRGs that evaluate the potential for riverbank and erodible riparian soils (greenway) to pose a risk to aquatic habitats and receptors through inundation or erodible soils. Source control criteria and EPA RAO 1 and 9 PRGs should be used to complete this evaluation, and added to the FS.

In accordance with this approach, DEQ recommends that the removal practicability analysis consider removal based on:

1. Proximity to sensitive environments such as the Willamette River and associated riparian areas.
2. The range of receptors benefiting from the remedy, including terrestrial and aquatic species.

3. Confidence in the long term effectiveness of the remedy.
4. Magnitude of the exceedance(s).

DEQ would welcome an opportunity to discuss our comments following review, and outline a process for completing the upland FS after upland removal has been completed and all confirmatory sampling is in hand. Please call me at (503) 229-5417 if you have questions or comments.

Sincerely,

Daniel Hafley, Project Manager/Hydrogeologist
NWR Cleanup Section

Ec: Keith Johnson, DEQ
Matt McClincy, DEQ
Jennifer Peterson, DEQ
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Katy Weil, Metro
Eva DeMaria, EPA
Sean Sheldrake, EPA
Rita Cabral, Industrial Economics
Rose Longoria, Yakima Nation

Cc: ECSI# 2066

DEQ-DC1

Attachment A-3

EPA Comments, October 2014 Feasibility Study, Willamette Cove Upland Facility – December 2014

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
OREGON OPERATIONS OFFICE
805 SW Broadway, Suite 500
Portland, Oregon 97205

December 3, 2014

Mr. Dan Hafley
Oregon Department of Environmental Quality
2020 SW 4th Avenue, Suite 400
Portland, Oregon 97201

Dear Mr. Hafley:

The Environmental Protection Agency has completed its review of the Feasibility Study Report, Removal Action Engineering Design Report, and Removal Action Drawings and Specifications for the Willamette Cove Upland Facility. For your consideration and use, we have enclosed the technical review comments prepared by the EPA and its contractor, CDM Smith. The Willamette Cove area has been identified as a key area for the EPA's in-water efforts at the Portland Harbor Superfund Site.

The following are the significant concerns found during review of the documents:

- Preconceived constraints on how specific alternatives could address property reuse within upland areas to achieve protectiveness seem to exist. For instance, excavation of large areas of soil contamination with onsite disposal could result in greater overall protectiveness by decreasing hot spot contamination residuals left throughout the Facility, resulting in less reliance on institutional controls and greater redevelopment potential for recreational use.

- The residual risk assessment conducted for the recommended alternative indicates that the preferred remedy does not seem to entirely meet the protectiveness standards for cancer risk established in OAR 340-122 as a lifetime excess cancer risk of $1x10^{-6}$ for individual carcinogens or $1x10^{-5}$ for multiple carcinogens.

- Deferral of robust cleanup of hot spot soil contamination within the riverbank area and Greenway setback to later source control measures, in-water cleanup, or habitat restoration seems too heavily relied on. Since the scope and timing of these future measures are uncertain and achieving protectiveness promptly is important, cleanup within the riverbank area and Greenway setback should be evaluated and conducted as part of the remedial action at the Facility to the degree that work could be conducted without direct adverse impacts to the Willamette River.

- Inconsistency between assumptions for the preferred alternative in the FS and the removal action design approach seems to exist. The removal action design excludes the capping and access controls that are specified in the preferred alternative of the FS. Exclusion of these parts lowers the protectiveness of this remedial action to the Willamette River. Exclusion of capping and access controls from the initial excavation and disposal work also encourages use of the site for recreational purposes for an interim period of time when protectiveness may not be ensured.

- It seems that the Greenway setback established under local ordinance is perceived to prevent robust cleanup of hot spot soil contamination within upland areas. While the Greenway setback ordinances do result in additional coordination and review on cleanup approaches, it does not appear to be a prohibition on cleanup work. The removal action design also includes activities such as access road building that encroach within the setback zone so it is not clear why direct cleanup activities are decreased within the setback area.

- Requirements for erosion control and sedimentation protection for the removal action design are very limited. For example, the only physical best management practices shown on drawings is silt fencing, which is relatively ineffective for small drainages as shown on the removal action design drawings. Because of the Facility's proximity to the Willamette River, a more robust approach of best management practices should be carried out to meet the substantive requirements of the Clean Water Act.

The following are the recommendations identified during review of the documents:

- The FS and the removal action design should be revised to show more robust cleanup of hot spot contamination within the Greenway setback and adjacent riverbank, to the degree that the riverbank is not harmed or destabilized. Hot spot excavations should be extended into the Greenway setback and riverbank to as close to the mean high water level as is practical.

- The potential long-term impact of leaving openly excavated areas should be considered in the design. It is recommended that concurrent with the removal action, the excavations be backfilled to pre-existing grade.

- The removal action design should be revised to include more robust erosion and sedimentation control best management practices to protect the Willamette River.

EPA and CDM Smith are available to meet with you at your convenience to discuss these review comments. Please feel free to contact me at (503) 326-6554 or muza.richard@epa.gov with any questions that you might have on the EPA's review of these draft documents for Willamette Cove Upland Facility.

Sincerely,

Rich Muza

Rich Muza
Remedial Project Manager

Enclosures

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Review Comments on Feasibility Study
Willamette Cove Upland Facility
Portland, Oregon
Dated October 3, 2014

General Comments

1. The timing of riverbank SCM and in-water remedy relative to the upland area remedial action is uncertain and remediation of hot spot contamination within the riverbank and 50-foot setback inland (i.e., Greenway setback) should not be deferred to occur during the riverbank SCM or in-water remedy. The FS evaluations should be revised to include remediation of contamination in these areas.

2. The preliminary remediation goals (PRGs), remediation levels, and remedial action objectives (RAOs) used to develop remedial alternatives in this FS do not consider protection of the Willamette River, aquatic receptors, or groundwater. For example, the dioxin/furan hot spot remediation level of 1,000 nanogram/kilogram (ng/kg) TEQ was determined by a cost versus dioxin/furan mass removal evaluation and has no consideration of whether this remedial level is protective of the Willamette River. The results of the ongoing source control evaluations for the riverbank erosion and groundwater pathways should be considered in determining remediation levels for constituents of concern (COCs) at the Facility.

3. EPA notes that based on the data presented in Appendix B, the vertical extent of contamination has not been delineated and the actual excavation depths required to meet the RAOs may be greater than 3 feet in some of the remedial action areas, increasing remediation costs for the alternatives involving excavation.

4. To provide and evaluate a range of alternatives that will allow ODEQ to select a remedial action, the FS should include another alternative that will remove dioxin/furan congener hot spots for protection of ecological receptors in the Central and West Parcel. Based on Figure 15, in the Central Parcel, the areas where dioxin/furan congeners exceed the hot spot level are generally collocated with the areas of non-dioxin/furan hotspots, indicating a contiguous area of contamination. In addition, another alternative that removes hot spots based on the dioxin/furan TEQ should be included.

5. The comparative evaluation of remedial action alternatives scores Alternative 4 (Excavation and On-Site Disposal) low relative to the other alternatives based on a low ranking for implementability and implementation risk. Alternatives 4 and 5, both including an on-site landfill, are ranked lowest for implementability and it is stated that "construction of an on-site landfill is not expected to be acceptable to the community or planning agencies." As discussed in Specific Comment #16, it is not appropriate to use expected community and public agency acceptance to evaluate implementability and the ranking of the alternatives should be adjusted accordingly in the FS.

   The effectiveness ranking for Alternative 4 should also be considered higher for Alternative 6 (Focused Excavation with Off-Site Disposal and Cap) because under Alternative 4, all of the soil exceeding remediation levels would be removed and consolidated into an on-site landfill, allowing for greater redevelopment potential for recreation use than Alternative 6. Alternative 6 relies on a cap over much of the site and restricted recreational use for protectiveness. Alternative 4 should also be considered to have higher long-term reliability than Alternatives 6 and 7 because of the greater control of maintaining a cap of a landfill of limited areal extent, relative to maintaining a cap over much of the site under Alternative 6. The effectiveness and long-term reliability ranking of these alternatives should be adjusted accordingly.

6. With the exception of Alternative 3 (Excavation and Off-Site Disposal) none of the remedial alternatives will prevent precipitation from infiltrating through contaminated soil and potentially leaching contaminants into groundwater. For alternatives involving excavation or grading of soil, there is potential to increase infiltration rates and mobilize contaminants to groundwater. Each alternative description should include a discussion of potential impacts to groundwater and post-remediation groundwater monitoring should be considered as a component of the remedy, if deemed necessary through the recommended evaluations.

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7. Post-remediation drainage of the cap or excavation areas is critical to prevent erosion of the cap, ponding, or storm water discharges to the Willamette River; however, none of the remedial alternative descriptions discuss grading to promote post-remediation drainage of the site. Some of the alternatives propose excavation to depths of up to 3 feet and backfill with only 1-foot of soil. A description should be provided in the FS of how drainage will be handled for each alternative.
8. For any of the alternatives leaving contaminated soil in place (all alternatives except Alternative 3), placement of geotextile demarcation fabric between the cap and residual contaminated soil should be included in the remedy. The demarcation fabric will help, in the future, to determine if the overlying cap has been eroded to expose the underlying soil. The demarcation fabric will also be critical for integrating future riverbank erosion source control measure with the upland cap.

Specific Comments

1. Section 2, Page 2 – It is recommended that a section be added to the FS that identifies potential sources of contamination and contaminants based on historical site activities.

2. Section 2.1, Page 3, fifth paragraph – Figures showing the lateral and vertical extent of the contaminant plume emanating from the McCormick & Baxter site could be presented in the FS and discussed within Section 4.

3. Section 2.6, Page 6 – It is recommended that groundwater monitoring well locations be shown on Figures 3 through 7 and the range of groundwater levels be referenced to the well locations. The date of the groundwater level observations should also be provided.

4. Section 2.8, Page 7 – From the database export in Appendix B, it is difficult to identify depths, analytes, and detections for each of the sample locations shown in Figures 3 through 7. It is recommended that data tables showing each analyte group, what samples were analyzed, and the results be provided in the FS so it is clear what data are available at each sample location. Typically, summary tables from the previous remedial investigation report are used for this purpose.

5. Section 2.8.4, Page 8, first paragraph – There is no discussion of how constituents of interest (COIs) were included in the screening to identify the list of COCs presented in this section. The FS should provide a summary of discussion of how COIs were selected. From the site description and historical site use it is not clear what the source contamination is and how the list of COCs were selected. Rational for not including volatile organic compounds and pesticides in the list of COCs should be presented in this section. It is recommended that these omissions be added to the document.

6. Section 3.1.1, Page 9 – The PRG exceedence values are not clearly stated in this section. For example, under one bullet it is stated that "mercury exceeded the PRG by 25 percent" and in another bullet it is stated that "copper exceeded the PRG by a factor of 50 percent". It is recommended that the discussion of PRG exceedances be made clear and consistent and supplemented by a table comparing the values.

7. Section 4.0, Page 14 – As stated in Specific Comment #1, it is recommended that a section be added to FS that identifies potential sources of contamination based on historical site activities.

8. Section 4.1, Page 14 – It is recommended that a discussion of the vertical extent of contamination exceeding PRGs and hot spot levels be included in this section.

9. Section 5.1, Page 17 –EPA assumes that the groundwater pathway is being addressed in the groundwater source control evaluation; however, the remedial alternatives in this FS need to consider potential impacts to groundwater from implementation of the remedy.

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10. Section 5.1.1, Page 17 – The RAOs should include preventing exposure of ecological receptors to surface and subsurface soil containing COCs above cleanup levels. This is particularly relevant in consideration of cap design. It is recommended that this issue be addressed in the document.

11. Section 6.1, Page 19, first paragraph – The extent of the 1,000 nanogram per kilogram dioxin/furan remediation area does not generally correspond to the extent of ecological hot spots identified based on individual congeners. The area planned for remediation is a much smaller area. Therefore, significant uncertainty exists for achieving protection of ecological receptors. It is recommended that this issue be addressed in the document.

12. Section 8.2, Page 26, Effectiveness – The statement that "COCs have relatively low solubility so are immobile" should be supported by a presentation of site data, such as COC concentrations in shallow groundwater monitoring wells. It is recommended that this omission be added to the document.

13. Section 8.6, Page 38, first paragraph – The Alternative 6 description states that site soil will be used to backfill the hot spot excavations. EPA notes that any on-site soil that is to be used to backfill the excavations for this alternative will require testing to ensure that the soil does not contain COCs at concentrations exceeding the PRGs for ecological and human health exposure. The same comment applies to Alternative 7. It is recommended that these omissions be addressed in the document.

14. Section 8.7, Page 41, second paragraph – In the other capping alternatives, measures were described to minimize the impacts of burrowing animals; however, in Alternatives 7 and 8 the impact of burrowing animals is described as enhancement to the capping measure. If mixing of clean capping soil, amendment, and underlying contaminated soil is part of the remedial measure, then the FS should include an evaluation of mechanized soil mixing and describe the means for evaluating the effectiveness of the mixing for reducing bioavailability and COC concentrations in soil. It is recommended that this omission be addressed in the document.

15. Section 8.7 and 8.8 – The effectiveness of an amended cap and mixing of cap soil with contaminated soil to reduce bioavailability of COCs and reduce COCs concentrations in soil has not been evaluated. Pilot testing of this technology at the facility could be conducted and the results should be incorporated into the FS. One of the RAOs is to "prevent exposure of ecological receptors to surface soil containing COCs above the levels in Table 1." Given the minimal thickness of the cap and the expected soil exposure from burrowing animals achieving this RAO has great uncertainty; therefore, the protectiveness of Alternatives 7 and 8 is questionable. It is recommended that these issues be addressed in the document.

16. Section 9.4, Page 48 – The statement that "the ability to implement these alternatives is assumed to be directly related to acceptance by the local community and local planning agencies…" is not consistent with the OAR 340-122-0090(3)(c), which states that the following factors should be considered when evaluating the implementability of an alternative:
    A. *Practical, technical, and legal difficulties and unknowns associated with the construction and implementation of a technology, engineering control, or institutional control, including potential scheduling delays;*
    B. *The ability to monitor the effectiveness of the remedy;*
    C. *Consistency with federal, state and local requirements; activities needed to coordinate with other agencies; and the ability and time required to obtain any necessary authorization from other governmental bodies;*
    D. *Availability of necessary services, materials, equipment, and specialists, including the availability of adequate offsite treatment, storage, and disposal capacity and services, and availability of prospective technologies; and*
    E. *Any other information relevant to implementability.*

    Public and community concerns of the remedial action are considered by DEQ during their selection of the remedy and during the public comment period. Until the community and public agencies have

provided input on the remedial alternatives, this should not be used as a factor in evaluating the implementability of the alternatives. It is recommended that the scoring for implementability in Table 12 be adjusted accordingly.

17. Section 9.6, Page 49 – The 15 percent discount in the remediation cost estimates should be applied before calculating net present-worth. It is recommended that this issue be corrected.

18. Section 10.3.4, Page 55, last paragraph – The FS should expand the details and provide the basis for the statement that "reduction in exposure from the cap, the reduction in bioavailability of organic COCs, and the conservatism built into the exposure estimates result in qualitative risk estimates that are equivalent to acceptable risk levels for non-threatened/endangered species…" It is recommended that the qualitative risk estimates be presented in this section.

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Review Comments on Removal Action Engineering Design
Willamette Cove Upland Facility
Portland, Oregon
Dated October 21, 2014

General Comments

1. The preferred alternative presented in the FS was Alternative 7 (Focused Excavation and Off-Site Disposal with Alternate Cap and Access Restriction). The RA Design Report presents the hot spot removal action portion of the preferred alternative to accelerate the cleanup schedule before the ROD. However, Section 2.2 does not adequately describe why portions of the preferred alternative, including cap construction and access restrictions, are not being implemented following hot spot removal. The report should present a preliminary schedule with a timeframe for future source control actions and other pertinent milestones.

2. **Proposed Hot Spot Excavation Areas:** The Greenway setback reduces or eliminates a significant portion of the identified hot spot excavation areas presented in the FS. As stated in Section 2.2 of the RA Engineering Design Report, the risk assessment concluded that baseline risks exceed acceptable levels for both ecological and human receptors. The RA Design Report does not state why hot spot excavations could not occur within the Greenway setback. The report should provide the basis for the design excluding work within the Greenway setback, including a discussion of the effect of deferring that portion of the remedy to be conducted with future source control actions.

   The design includes construction of erosion control and potential for haul road improvements within the Greenway setback. In addition, the design establishes methods to limit impact of excavation on existing Big Leaf Maple, Madrone, and Oregon White Oak trees outside of the Greenway setback.

   Chapter 33.440 (Greenway Overlay Zones) of the Portland Zoning Code does not specifically prohibit remediation work within the Greenway setback. The proposed methods for remediation around trees could be applied to hot spots within the Greenway setback to protect existing vegetation. Excavation of hot spot contamination, backfill to existing grade with clean soil, and removal of invasive vegetation would achieve the intent of the remedy that was recommended in the FS. EPA recommends that the design consider hot spot excavation within the Greenway setback as part of this work to remove contaminated soil in the upland area. The design of the remedy should be coordinated with the City of Portland to meet the necessary requirements for working within the Greenway setback.

3. **Erosion Control Measures:** The hot spot excavations are located adjacent to the Willamette River. As noted in the specific comments below, there are two small drainage areas that connect the removal area with the edge of the Willamette River. The design Drawing Set shows a single line of silt fence between the removal area and the river. EPA recommends that APEX include multiple erosion control measures, particularly in the small drainage areas where surface runoff could result in a release of contaminated materials to the river should the erosion control measure be overtopped. The additional erosion control measures should be shown on the Drawing Set.

4. **Confirmation Sampling:** The confirmation sampling approach for all COCs should be clarified in the RA Design Report. Section 3.8 of the RA Design Report states that sample results from prior sampling will be used as confirmation that removal goals have been achieved; however, the Drawing Set states that the final extent and depth of excavation will be based on confirmation sampling. Sheets C-3 through C-6 of the Drawing Set also indicates that sample locations shown are considered confirmation samples for analytes shown. Previous investigation sample results should not be used for confirmation of the final excavation extent. Please revise the RA Design Report and Sheets C-3 through C-6 of the Drawing Set to be consistent with the intended confirmation sampling methodology. In addition, excavation wall confirmation samples should be collected at the property boundary and final riverward excavation wall to

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note if contamination extends beyond these excavation limits. The RA Design Report does not discuss the step out depth or distance for additional excavation, should a confirmation sample exceed the hot spot removal levels. The additional excavation extent for failed confirmation samples should be described in the report.

The RA Design Report generally states how confirmation samples will be collected following excavation; however, the confirmation sampling procedure presented in the report is not clear. Under the Sample Locations bullets, confirmation sampling would be conducted at a spacing of 100 linear feet of the excavation perimeter and a minimum of one sample per 5,000 square feet of excavation area. However, under the Sampling Procedure section, it is stated that samples would consist of 4-point composites collected at the corners of a nominal 5-foot square.

5. **Disposal of Excavated Material:** The RA Design Report states that samples have been collected and analyzed for metals using toxicity characteristic leaching procedure (TCLP). The report should also state whether dioxins and the other COCs were analyzed using TCLP. The report should include a waste management and disposal plan to state how the excavated soil stockpile will be sampled and analyzed to verify that the soil meets the disposal requirements of the receiving landfill.

6. **Excavation Areas:**
   a. The design Drawing Set presents plans for Excavation Areas 1, 2, 3, 5, and 6. The excavation areas are either incorrectly labeled or Excavation Area 4 was not included in the draft design. Please clarify.
   b. The design indicates that excavation would cease adjacent to property boundaries and Greenway setback. Hotspot contamination could remain adjacent to excavated areas. Run off from storm events contacting this soil may cause recontamination of remediated areas. The design should address potential recontamination of remediated areas.

7. **Backfill of Excavated Areas:**
   a. The design does not require backfill of excavated areas with the exception of clean backfill around existing trees. Excavated areas would presumably create poorly drained areas. Post-remediation drainage of the excavation areas is critical to prevent erosion, ponding, excess infiltration to groundwater, or storm water discharges to the Willamette River.
   b. The design intends to make use of existing material within the excavation to back slope excavation walls. The design does not specify a maximum back slope grade. EPA recommends that a maximum allowable back slope grade be specified in the design. In addition, the design should describe how soil to be reused will be tested to confirm that COCs concentrations do not exceed remediation levels.
   c. The design does not indicate that the excavation areas will be backfilled with clean fill to the pre-excavation grades. Ponding of water in these areas may result and have adverse effects to remaining trees. An arborist should be consulted on drainage requirements of the remaining trees.

8. **Work adjacent to Railroad**: Railroad safety rules will require flaggers and railroad safety training if work is within a specific distance from the nearest rail.

Specific Comments

Removal Action Engineering Design Report

1. **Section 2.2 – Prior Investigations and Studies:** It is recommended that a summary table of results driving the hot spot excavation be provided.

2. **Section 3.3.3 – Soil Excavation:** This section does not discuss storm water management. Storm water management will be important with regard to mobilization of contaminated soil particles, recontamination of remediated areas, excess infiltration to groundwater, and the potential for release of contaminated

material to the Willamette River. It is recommended that storm water management be addressed in the RA Design Report.

3. **Section 3.3.4 – Soil Disposal:** It is recommended that the Port verify with local landfills that waste with dioxins and PCBs will be accepted by local landfills.

4. **Section 3.6.1 – Waste Streams:** It is not clear why decontamination water would be added to soil being disposed of in an off-site landfill. It was previously stated that water would be collected and sampled for waste designation. EPA recommends collection and containerization of all decontamination fluids.

5. **Section 3.6.2 – Emissions, Dust, and Spills:** Dust control should also be conducted during excavation activities; however, the report states that dust control would only be conducted as needed. It is recommended that trigger levels for implementing dust control be described in the RA Design Report.

6. **Figures 2, 3, and 4:** Please add "Mean High Water" to legend.

Drawing Set

1. **Cover – Drawing Set and Legend:**
   a. Please review the legend and add missing line types and symbols. Missing line types include the 100-year flood plain and the Greenway setback. Missing symbols include monitoring well, tree type, excavation stations, and areas for haul road improvement.

2. **Sheet G-1 – Site Plan:**
   a. The sheet calls out 100-year floodplain, although the line type is not shown. The Greenway setback is not shown on this sheet. Please correct these concerns.
   b. The RA Design Report states that monitoring wells were used to determine groundwater levels at the site; however, the monitoring wells are not shown on the sheet. EPA recommends showing monitoring wells to avoid damage to them during construction. Note: Monitoring well MW-4 is shown on Sheet C-3, Detail B – Area 2 Excavation. Monitoring wells MW-5 and MW-6 are shown on Sheet C-4, Detail A – Area 3 Excavation. It is recommended that all monitoring wells at the Facility be shown so that the contractor can properly protect them during construction.
   c. EPA recommends showing existing concrete barriers on the Site Plan.
   d. A fiber optic line may run along the north south side of the property boundary. Please confirm.

3. **Sheet C-1 – Erosion Control, Site Preparation, and Construction Management Plan:**
   a. Please show the Greenway setback on Sheet C-1.
   b. The proposed silt fence and haul roads would be placed within the 50-foot Greenway setback. Please confirm that this is acceptable with respect to the City of Portland's Greenway setback development requirements.
   c. A drainage area leading to the Willamette River appears to the southeast of Excavation Area 2. According to the elevation contour intervals presented in the plan there is a 10-foot elevation change in this area. It is recommended that additional erosion control measures be included in this area to prevent potential uncontrolled discharges to the Willamette River.
   d. A drainage area appears in the south central portion of Excavation Area 3. According to the elevation intervals presented in the detail, there is a 5-foot elevation change in this area. It is recommended that additional erosion control measures be included in this area to prevent potential uncontrolled discharges to the Willamette River.

4. **Sheet C-3 – Excavation, Grading and Erosion Control Plan – Area 1 and Area 2:**
   a. Detail A - Area 1 Excavation.
      i. Please show the UPRR railroad line.
   b. Detail B - Area 2 Excavation.
      i. See previous comments regarding erosion and sediment control in this area.

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ii. Please show the UPRR railroad line.

5. **Sheet C-4 – Excavation, Grading and Erosion Control Plan – Area 3:**
   a. Please show the silt fence on Sheet C-4.
   b. See previous comments regarding erosion and sediment control in this area.
   c. Please show the railroad line location.
   d. Please scale the line types.

6. **Sheet C-6 – Excavation, Grading and Erosion Control Plan – Area 6:**
   a. Please show the railroad line location.

7. **Sheet C-7 – Details:**
   a. Detail B -- EPA recommends the use of wire backed silt fence at a minimum. The wire backing will provide additional strength in a critical area such as along the river. Please provide additional erosion control measures in accordance with the City of Portland Erosion and Sediment Control Manual.
   b. Detail C – Please indicate the additional length of lateral excavation required should confirmation sampling be required.
   c. Detail D – Please specify the maximum allowable back slope grade.

8. **Sheet C-8 – Details:**
   a. Detail E – Please specify the maximum allowable back slope grade.
   b. Detail G -- It is not clear from the detail if backfilled soil will be sloped into the excavation. EPA recommends providing clean fill from the drip line to the excavation floor. Specification Section 015639, Paragraph 1.1.A requires the subcontractor to provide temporary fencing, barricades, and guards to protect trees. EPA recommends providing this level of detail for Detail D. Common method for protection of trees in excavation areas is orange safety fence.

Construction Specifications

1. Section 011100:
   a. Paragraph 1.1.A – Estimated quantities presented in the RA Design Report differ slightly from those presented in the specification. Please correct.

2. Section 015639 – Tree and Plant Protection:
   a. Paragraph 3.6.A.1 – Please provide a minimum maintenance time for replacement trees.

3. Section 015713 – Temporary Erosion, Sediment, and Pollution Control:
   a. Paragraph 1.3.A – Please add "Erosion and Sediment Control Regulations" to the reference.
   b. It is recommended that a Sediment and Erosion Control Plan meeting the requirements of City of Portland Title 10 – Erosion and Sediment Control Regulations be included in the design.

4. Section 312000, Paragraph 3.4.C. – It is stipulated that excavated surfaces should be graded to drain; however, this is counter to the Drawing Set requirement for back sloping the final excavation walls into the excavation area creating the potential for standing of pools of water and not a surface that will drain. Please correct this issue.

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Attachment A-4

***EPA Memorandum: Review Comments on Feasibility Study, Willamette Cove Upland Facility* – November 2015**

Review of
Oregon Department of Environmental Quality
Additional Comments - October 2014 Feasibility Study
Willamette Cove Upland Facility
ECSI# 2066
Dated November 25, 2015

Following are the United States Environmental Protection Agency's (EPA) comments on Oregon Department of Environmental Quality's (DEQ) November 25, 2015 comment letter – Additional Comments – October 2014 Feasibility Study, Willamette Cove Upland Facility ECSI #2066. DEQ prepared and submitted the letter to the Port of Portland (Port) after review of the Port's October 2014 Feasibility Study (FS). EPA reviewed and commented on the October 2014 FS in a memorandum dated December 2014. In general, EPA agrees with DEQ's comments and are providing the following follow up comments/clarification. Numbering used below follows DEQ comments.

1a. <u>EPA requests the Scope of Proposed Work</u> – EPA agrees that the riverbank source control measures should extend to the mean high water (MHW) level and should be compatible with the in-water remedy selected for Sediment Decision Unit (SDU) 6.5E. The Portland Harbor FS assumes that riverbank source control measures adjacent to areas within the river requiring active remediation will be conducted in conjunction with in-water cleanup actions. The technology assignment rules developed in the Portland Harbor FS (July 2015) assign excavation and capping to contaminated riverbanks. EPA agrees that further discussion is required to coordinate riverbank source control measures with upland and in-water remedy identification, selection, and implementation.

1b. <u>Scope of Risk Evaluated in the Feasibility Study</u> - EPA agrees that the Portland Harbor Preliminary Remediation Goals (PRGs) for remedial action objectives (RAO) 1 and 9 should be applied from the top of the bank to MHW. These PRGs should also be applied to any soil with potential for erosion to the Willamette River, such as the two small drainage-like features in the Central Parcel that connect the remedial action area to the Willamette River. Any imported or onsite soil used to cap areas with potential for erosion to the river should be tested to verify that concentrations do not exceed the PRGs for RAO1 and RAO9.

4. <u>Implementation Risk</u> – EPA shares DEQ's concern regarding an estimated 3,300 to 6,700 truck trips through adjacent residential areas and the associated carbon emissions. One goal of EPA Region 10's 2009 Clean and Green Policy is to reduce air toxics emissions and greenhouse gas production and conserve natural resources and energy and to support sustainable human and ecological use and reuse of remediated land. However, leaving hot spot material in place as way to minimize greenhouse gas emissions is inconsistent with EPA's 2010 Superfund Green Remediation Strategy; the goal of EPA's policy is to ensure that the selected remedy minimizes greenhouse gas and air toxics emissions rather than be an evaluation criterion. Evaluation of hot spots should be subject to a higher cost threshold for removal and treatment or off-site disposal consistent with ODEQ requirements. Any hot spot material left in place should be managed in a manner that maximizes the

post-remediation use and reuse of the property. For example, excavating contaminated soil and containing it in a properly constructed onsite landfill (Alternative 4 of the FS). An onsite landfill will occupy minimal space on the Willamette Cove property, provide the greatest protection from recontamination of river sediment, terrestrial and aquatic receptors, and allow for unrestricted land use in the future.

8. Groundwater – EPA agrees with DEQ's comment that evaluation of groundwater is needed in the FS. The FS should evaluate whether source control measures are necessary to prevent contaminants in groundwater from contaminating sediment and the river under existing conditions. In addition, the FS should consider how remedial alternatives addressing soil contamination might affect contaminant transport to the river via the groundwater pathway. EPA's review of the 13 February 2013 Source Control Evaluation (SCE) found the SCE for the groundwater pathway to be deficient and unable to support the groundwater pathway designation of Low Priority. The groundwater pathway evaluation in the 2013 SCE did not contain many of the elements included in Joint Source Control Strategy (JSCS) guidance for a weight-of-evidence evaluation of the groundwater pathway and many of the groundwater analytical results had laboratory detection limits far exceeding the groundwater screening levels. With the exception of Alternative 3 - Excavation and Off-site disposal, none of the remedial alternatives will prevent precipitation from infiltrating through contaminated soil and potentially leaching contaminants into groundwater. For alternatives involving excavation or grading of soil, there is potential to increase infiltration rates and mobilize contaminants to groundwater. Each alternative description should include a discussion of potential impacts to groundwater and post remediation groundwater monitoring should be included as a component of the remedy.

11. Upland Versus In-Water Action - EPA notes that the draft Portland Harbor FS developed by the LWG has been superseded by the revised Portland Harbor FS (July-August 2015) being developed by EPA. Specifically, the revised Portland Harbor FS describes the relationship between in-water cleanup actions and riverbank source control measures.

Attachment A-5

***Technical Memorandum: Tribes Comments on Willamette Cove Feasibility Study* – November 2014**

HydroAnalysis

TECHNICAL MEMORANDUM

To: Ken Thiessen and Matt McClincy, Oregon Department of Environmental Quality

From: Ken Hickey and Bruce Jacobs, HydroAnalysis, Inc.

Subject: **Comments on the Willamette Cove Feasibility Study**

Date: November 26, 2014

This memorandum provides comments on behalf of the Five Tribes[1] on the *Feasibility Study, Willamette Cove Upland Facility, Portland, Oregon*, prepared for Port of Portland by APEX, October 3, 2014.

In brief, the Willamette Cove upland area covers 24 acres bounded on the river side by the mean high water line and on the upland side by the Union Pacific Railroad tracks. The upland area was historically used for a variety of activities including wood products operations, marine salvage, and ship building. A variety of contaminants have been detected in near-shore area soils including metals, PCBs, dioxins/furans, and PAHs.

The purpose of the Willamette Cove Feasibility Study was to evaluate remedial options and to recommend a preferred alternative. The study's primary components were; (1) an evaluation of soil contamination data and identification of remedial action thresholds and (2) remedial options evaluation and recommendations.

We have conducted an expedited review based solely upon the draft feasibility study referenced above. We have not read the other supporting documents. Substantive and editorial comments are provided below.

Substantive comments

(1) Section 2.8: the document describes soil-based contaminants of concern and should include a statement that other media, such as groundwater, have been screened-out. This statement appears in the first paragraph of Section 7, but should be moved up to Section 2.

(2) Section 6.1, 1st paragraph: the stated goal of identifying "an appropriate mid-range hot-spot removal alternative" indicates a bias on the alternatives evaluation. The most appropriate alternative should be selected based on its protectiveness, balancing factors, and other

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[1] The Five Tribes comprises the Confederated Tribes of The Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians of Oregon, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

technical considerations. The goal should not be to bias the process towards a "mid-range" alternative.

(3) Section 6.1: the practicability evaluation is central to the feasibility study and should be included in the body of the report. Further, Appendix D features an evaluation of the cost of remediating dioxins/furans at concentration thresholds that vary by several orders of magnitude. The practicability evaluation selects 1,000 ng/kg as a preferred remedial action goal, but does not provide a rationale for why this remedial action level is protective (only why it is cost-effective). Please provide an explanation for this selection from an environmental protection perspective. For example, this may include some discussion of the toxicity of dioxins/furans and established regulatory standards that are based on concentrations found to be protective of human health.

(4) Section 9, Table 12: it would be more effective to provide a table that summarizes the key characteristics of each alternative, e.g., area and volume of soil treated, cost, and so on. There was a great deal of detailed information provided in Section 8 and that information should be summarized in a user-friendly matrix table. The +/- system shown in Table 12 is cryptic and not a compelling presentation of information.

Editorial comments

(1) We suggest adding Incremental Sampling Methodology (ISM) to the "Abbreviations/Acronyms" section (p. v).

(2) Section 2.1, Figure 1: it would be worthwhile to add an inset showing the Willamette Cove site within the Portland Harbor Superfund site area.

(3) Section 3.1.1, Figure 8: please clarify the legends. The diagonal lines indicate two different things ("Surface Soil Exceeds Background…" and "Exceeds Mammal RPG"). It is not clear to which of the four figures these legend labels apply.

Attachment A-6

***Response to DEQ Comments, Removal action Completion Report, Willamette Cove Upland Facility* – September 2016**

September 16, 2016

Mr. Dan Hafley
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100

Subject: Response to DEQ Comments
Removal Action Completion Report
Willamette Cove Upland Facility – ECSI #2066

Dear Dan:

This letter provides the Oregon Department of Environmental Quality (DEQ) with a response to the comments received on the Removal Action Completion Report for the Willamette Cove Upland Facility. The comments were provided to the Port of Portland (Port) in a letter from the DEQ dated July 28, 2016. The comments are repeated (in italics) followed by the Port response. In the comment letter, DEQ requested submittal of a revised report. As requested in the DEQ comment letter, there will be a thorough summary of the removal action and an analysis of the post-removal data in the residual risk analysis in the forthcoming feasibility study (FS). The Port respectfully submits that the responses to comments below together with the further analysis in the FS adequately address DEQ's comments and that submittal of a revised report is not necessary.

DEQ Comments and Port Responses

Section 2.2. In the last paragraph of the section, please clarify that the 1,000 ng/kg TEQ is based on a 2,3,7,8-TCDD equivalent.

Response: As defined in the laboratory analytical reports, the toxic equivalent is the 2,3,7,8-TCDD equivalent using the World Health Organization 2005 toxic equivalency factors. This will be clarified in future documents.

Section 3.0. Relevant contaminants for each of the five remediation areas should be identified at the beginning of the document (as is done in Section 4.4). A stand-alone table is recommended for the report identifying relevant hot spot or remediation (dioxin/furan) levels that were applied.

Response: A stand-alone table (Table 1 attached) was created that summarizes the contaminants of concern for each area and the hot spot or remediation levels that were applied during confirmation sampling.

<u>Section 4.1.1.</u> Please clarify that the construction stormwater permit was a 1200-C permit based on the excavation area exceeding one-acre in size.

Response: The construction stormwater permit was a 1200-C permit. An administrative waiver was requested and approved for the public notice requirements for projects involving 5 acres or more. The actual excavation area was 2.5 acres.

<u>Section 4.1.5.</u> Here or elsewhere, please discuss the effectiveness of silt fencing and other measures to reduce or eliminate potential runoff associated with soil removal work. Discuss the current status of the 1200-C permit that governed this issue, and the state of silt fencing at the site.

Response: Stormwater control measures were effective and there was no discharge of sediment from the project site. The silt fence was installed prior to site work. During construction, the fence was inspected in the vicinity of site work on a daily basis and repairs made as needed. In accordance with the permit, the silt fence was inspected in its entirety on a weekly basis, or in the event of a rain event of 0.25 inches or greater. There were no rain events triggering a required inspection. The weekly inspections were documented and included in the report (Appendix D). Except for damage caused by trespassers (repaired as observed), there were no issues identified with the silt fence. The site consists of relatively sandy soil so stormwater readily penetrates. As such, there was no observed runoff and no accumulation of silt at the silt fence throughout the duration of the project. The silt fence is still in place and maintained by Metro.

The 1200-C permit is still open for the site. The removal action subcontractor (AEC) will schedule a site inspection with the City of Portland to verify that the excavation areas have sufficient vegetation to warrant removal of the erosion and sedimentation controls. The permit will be closed; however, the silt fence will remain in place at the request of Metro.

<u>Section 4.2.2.</u> Please identify the location of the "soil processing area" (Excavation Area 6) and identify on a figure or figures.

Response: There was no processing of soil. Soil was staged for loading within the northeast corner of Area 6. Figure 2 from the report was updated with the staging area and is attached to this letter.

<u>Section 4.2.3.</u> Text indicates that special tree excavation areas are shown in Figures 3 through 7, but are only identified as such in Figures 3 and 6 (corresponding to Areas 3 and 6. In the figures referenced in this section (Figures 3 through 7), special tree excavation is shown only for Areas 3 and 6, corresponding to Figures 5 and 7. The discrepancy is confusing; please clarify.

Response: The intent of the text is to indicate that anywhere that special excavation was used is shown on the site plan figures (Figures 3 through 7). Because no special tree excavation was conducted in Areas 1, 2, or 5, there is no special excavation shown on those figures. We do note that the primary purpose of Figures 3 through 7 is to show the confirmation sample locations. Consequently, the special excavation areas are easier to see in the as-constructed drawings in Appendix C (drawings C-4 and C-6).

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Section 4.2.4. *Please discuss the fact that larger non-protected species of trees cataloged by the City of Portland and presented in Appendix F were primarily "snags."*

Response: A total of 37 trees ranging in size from 8 inches (diameter at breast height; DBH) to 24 inches DBH were removed (35 of the 37 trees ranged from 8 to 12 inches DBH). The following summarizes the number and type of species removed:

Willow – 1
Black Cottonwood – 10
Norway Maple – 1
Lombardy Poplar – 8
Snag – 17

Section 4.2.5.

- *The discussion of top soil indicates that sample results were compared to DEQ Clean Fill Requirements. Data should also be compared to levels protective of surface water exposures if there is a potential for erosion to the river. Also, please include the referenced letter (with sampling results) in an appendix to the report.*
- *The haul road section indicates that the layout of the road is shown on Figure 2, which does not appear to be correct.*
- *Please include a figure that shows the PAH hot spot portion of Area 2 that could not be excavated, and reference the figure in the section on temporary fencing.*

Response:

- Topsoil was used to backfill the areas of special tree excavation. Most of these areas were located away from the riverbank. Small areas were filled with topsoil near the riverbank in Area 3. Any areas where topsoil was used were seeded with native grasses and these grasses are becoming well-established. Therefore, there is little potential for erosion of these soils to the river. For completeness, Table 2, attached, lists the topsoil sample results together with the Portland Harbor Remediation Goals (PRGs) for Remedial Action Objective 9 and the DEQ Clean Fill levels. Concentrations of arsenic, chlordanes, and dioxins/furans exceeded the PRGs. The exceedances for arsenic and dioxins/furans are less than three times the screening level and likely represent natural or anthropogenic background levels. Chlordanes exceeded the PRG by a factor of up to 760. However, as discussed above, there is little potential for erosion of the topsoil to the river.
- A revised Figure 2 showing the haul road is attached to this letter.
- A revised Figure 4 showing the hot spot and fencing area is attached to this letter.

Section 4.3.

- *The area of where concrete was found (Area 6), and proposed excavation did not occur, should be shown (presumably on Figure 7).*
- *Please clarify that the Truck Wash was in fact a wheel wash. Decontamination of trucks and tires was performed on the concrete-paved area east of Area 6 following failure of the in-ground wheel wash. Please discuss how decontamination soil and water (cleanup-derived waste) from the over-slab cleanup work were managed during and following truck removal work.*

Response:

- A revised Figure 7 showing the area that was not excavated due to asphalt concrete is attached to this letter.
- The truck wash was a wheel wash station. Drawing C-1 in the as-constructed drawings (Appendix C of the report) shows the location of the wash station on the concrete paved area. Water from the decontamination of trucks and tires flowed over the concrete pavement and was contained in the northeast corner of the paved area by a concrete wall and sandbags. The water was pumped from the collection area to the soil loading area daily and was applied to soil leaving the site. At project completion, the concrete in the water collection area was scraped clean with a small loader, and the sediment was added to the soil removal pile.

Section 4.4.

- *We believe it would be helpful to illustrate the confirmatory sampling results associated with the removal. DEQ notes that this will be necessary for the upcoming FS, and believes inclusion of figures is a useful supplement to tables presented in this section. At the very least, a figure or figures should be included in the report highlighting the area side walls where hot spots were not fully removed (our understanding the excavation area "floors" were all below either hot spot concentrations or the 1,000 ng/kg value for dioxins).*
- *Under "Area 1 and Area 5", please identify the contaminant(s) that were successfully removed to below hot spot values.*

Response:

- Figures illustrating confirmation sample results will be included in the FS. All final base samples were below hot spot and remediation levels. Soil was removed to below hot spot levels in sidewalls in Areas 1, 2, and 5. Figures 5 and 7 were revised to show the location of sidewall samples above hot spot and/or remediation levels. A few samples in Areas 3 and 6 exceeded hot spot levels, summarized as follows.
    - In Area 3 (Figure 5), five sidewall samples exceeded hot spot and/or remediation levels. Three of these samples were along the property boundary with the railroad (RA3-S9, RA3-S10, RA3-S11) where further excavation was not allowed. Sample RA3-D-S1, a sidewall sample from the debris excavation at a depth of approximately 2.5 feet exceeded hot spot levels for several metals. No additional debris was visible in that sidewall so no further excavation was conducted in that location. Sample RA3-S29 slightly exceeded the hot spot level for mercury. The team decided to defer additional action at that location to the final remedy.
    - In Area 6 (Figure 7), one sidewall sample (RA6-S5) exceeded hot spot levels; that sample was located at the Greenway setback near the top of bank. One other sidewall sample in Area 6 (RA6-S17) was above the hot spot level. However, when additional soil was removed from that area, the edge of a concrete slab was revealed. The concrete slab is greater than 6 inches thick so there is no sidewall soil at that location.
- Mercury was the contaminant that historically was detected above hot spot levels in Areas 1 and 5.

<u>Section 5.0.</u> The summary should include discussion of (perimeter) areas where removal objectives were not achieved, either because contamination extended off-site (adjacent to the UPRR rail line) or into the Greenway. Illustration would be helpful. The last paragraph should clarify that dioxin concentrations exceeding "hot spot remediation levels" for dioxins/furans. Also, chlorophenols were not identified as hot spots; sampling for this class of analytes was performed to potentially identify the source of the extremely high concentrations of dioxins found in Area 3.

Response: To clarify, it was never the objective to remove materials off-site or from within the Greenway (for some areas), so it is not correct to state that objectives were not achieved in these areas. The attached Figures 5 and 7 show the locations where hot spot and/or remediation levels were not achieved. Comments on the dioxins/furans and chlorophenols are acknowledged.

<u>Other.</u> Please discuss any issues that came up with off-site trucking of contaminated soil, including the change to the truck route through the St. Johns neighborhood, and the spill that occurred in Wasco County.

Response: The route from the site to the landfill for off-site soil disposal was changed during the first week. The route was changed to align with designated trucking routes through the St. Johns neighborhood. On November 2, 2015, a fully loaded dump truck and trailer tipped over on Oregon State Highway 197 near the landfill. The spill was cleaned up by removing the soil and overexcavating the area by six inches. Confirmation soil samples were taken in the spill excavation and farther down the road. The samples from the spill area were compared to samples from farther down the road to confirm that the spilled soil had been removed. Confirmation samples showed the cleanup was successful. A comprehensive discussion of the spill and cleanup is presented in the Subcontractor Truck Accident Letter dated December 22, 2015.

<u>Other.</u> Please discuss the purpose of chlorophenol sampling, and an explanation of the results.

Response: Chorophenol sampling was conducted to assess if the source of dioxins/furans may be related to wood treatment chemicals such as pentachlorophenol. Chlorophenols were not detected, even in the sample with the highest relative concentrations of dioxins/furans (Matrix Comp).

<u>Tables.</u> Soil depths should be added to the tables for each lateral (sidewall) and base (vertical) sample location.

Response: Future data presentation will include soil sample depths.

<u>Figures.</u>

- *We recommend that the final depth of excavation (prior to any backfilling) be presented on Figures 3 through 7, or in separate figures. One way to illustrate (varying) depth would be with color-coding of excavation areas.*
- *Where sidewall composite samples are evenly spaced along excavation area*

perimeters, DEQ presumes that the 5 subsamples comprising the composite were likewise evenly spaced. Where not evenly spaced (for example in a number of excavation areas shown in Figure 5 for Area 3, the "configuration" of sidewall sub-sampling is unclear. Please clarify. Where subsurface samples were not collected along the perimeter, for example in Area 6 (where paving was encountered), it would be helpful to provide explanatory text in figures.

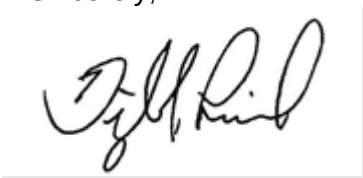
- *Special tree excavation areas, where soil was removed to only 0.5 feet bgs and the area backfilled with clean soil, are not well illustrated in the figures. If the final configuration of these areas is different from that presented in the (pre-removal) base maps, please illustrate. We recommend color-coding or other to make the special tree excavation areas more distinct on report figures.*

Response:

- Notes on the figures identified the depths of excavations. We will evaluate the use of visual depth representation on future figures.
- Sampling was conducted in accordance with the design (see Figure 5 of the Removal Action Engineering Design Report) that used generally even spacing of the sub-samples. The sidewall samples are shown on the figures in the center of the sampling interval. Attached Figure 7 shows the location of pavement and concrete adjacent to the Area 6 excavation.
- Special tree excavation areas are shown on the as-constructed drawings in Appendix C of the report.

Please call me at (503) 415-6325 if you have any questions.

Sincerely,



Dwight Leisle
Environmental Project Manager

Attachments: Table 1
Table 2
Figure 2 (Revised)
Figure 4 (Revised)
Figure 5 (Revised)
Figure 7 (Revised)

c: Eva DeMaria, EPA
Sean Sheldrake, EPA
Katy Weil, Metro
Dwight Leisle, Port
Anzie St. Clair, Port
Suzanne Barthelmess, Port
Herb Clough, Apex Companies
Mark Lewis, Formation Environmental
LWP File

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Table 1
Remediation Levels
Willamette Cove Removal Action
Portland, Oregon

	Hot Spot Contaminant of Concern					Screening Level Applied	Screening Level Source[3]				Remediation Level
							Hot Spot Concentration				
	Area 1	Area 2	Area 3	Area 5	Area 6		Ecological	Transient Trespasser	Construction Worker	Recreational Trespasser	
Metals (mg/kg)											
Antimony						27	27	--	310	243	--
Arsenic						131	--	--	--	131	--
Beryllium						--	--	--	--	--	--
Cadmium						51	51	--	--	--	--
Chromium						--	--	--	--	--	--
Copper					X	700	700	--	--	--	--
Lead			X		X	430	430	11,695	6,140	9,040	--
Mercury	X	X	X	X	X	3	3	--	--	--	--
Nickel						380	380	--	--	--	--
Selenium						--	--	--	--	--	--
Silver						--	--	--	--	--	--
Thallium						--	--	--	--	--	--
Zinc			X			1,200	1,200	--	--	--	--
Chlorophenols (µg/kg) [5]											
4-Chloro-3-methylphenol						--	--	--	--	--	--
2-Chlorophenol						--	--	--	--	--	--
2,4-Dichlorophenol						--	--	--	--	--	--
Pentachlorophenol (PCP)						--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol						--	--	--	--	--	--
2,3,5,6-Tetrachlorophenol						--	--	--	--	--	--
2,4,5-Trichlorophenol						--	--	--	--	--	--
2,4,6-Trichlorophenol						--	--	--	--	--	--
Dioxins (ng/kg)											
2,3,7,8-TCDD						--	195	20,800	11,500	1,130	--
1,2,3,7,8-PeCDD						--	567	20,800	11,500	1,130	--
1,2,3,4,7,8-HxCDD						--	530	208,000	115,000	11,300	--
1,2,3,6,7,8-HxCDD						--	230	208,000	115,000	11,300	--
1,2,3,7,8,9-HxCDD						--	230	208,000	115,000	11,300	--
1,2,3,4,6,7,8-HpCDD						--	3,910	2,080,000	1,150,000	113,000	--
OCDD						--	217,000	69,300,000	38,500,000	3,750,000	--
2,3,7,8-TCDF						--	1,300	208,000	115,000	11,300	--
1,2,3,7,8-PeCDF						--	4,310	693,000	385,000	37,500	--
2,3,4,7,8-PeCDF						--	335	69,300	38,500	3,750	--
1,2,3,4,7,8-HxCDF						--	229	208,000	115,000	11,300	--
1,2,3,6,7,8-HxCDF						--	229	208,000	115,000	11,300	--
2,3,4,6,7,8-HxCDF						--	229	208,000	115,000	11,300	--
1,2,3,7,8,9-HxCDF						--	452	208,000	115,000	11,300	--
1,2,3,4,6,7,8-HpCDF						--	3,830	2,080,000	1,150,000	113,000	--
1,2,3,4,7,8,9-HpCDF						--	3,830	2,080,000	1,150,000	113,000	--
OCDF						--	54,900	69,300,000	38,500,000	3,750,000	--
2,3,7,8-TCDD Eq			X			1,000	195	20,000	11,500	1,120	1,000
Total TCDD						--	--	--	--	--	--
Total PeCDD						--	--	--	--	--	--
Total HxCDD						--	--	--	--	--	--
Total HpCDD						--	--	--	--	--	--
Total TCDF						--	--	--	--	--	--
Total PeCDF						--	--	--	--	--	--
Total HxCDF						--	--	--	--	--	--
Total HpCDF						--	--	--	--	--	--
PAHs (µg/kg)											
Acenaphthene						--	--	--	--	--	--
Acenaphthylene		X				--	--	--	--	--	--
Anthracene		X				--	--	--	--	--	--
Benz(a)anthracene		X				49,700	--	--	--	49,700	--
Benzo(a)pyrene		X				4,970	--	388,000	214,000	4,970	--
Benzo(b)fluoranthene						49,700	--	--	--	49,700	--
Benzo(k)fluoranthene						49,700	--	--	--	49,700	--
Benzo(g,h,i)perylene		X				--	--	--	--	--	--
Chrysene		X				--	--	--	--	--	--
Dibenz(a,h)anthracene						4,970	--	--	--	4,970	--

Please see notes at end of table.

Table 1
Remediation Levels
Willamette Cove Removal Action
Portland, Oregon

	Hot Spot Contaminant of Concern					Screening Level Applied	Screening Level Source[3]				
							Hot Spot Concentration				Remediation Level
	Area 1	Area 2	Area 3	Area 5	Area 6		Ecological	Transient Trespasser	Construction Worker	Recreational Trespasser	
PAHs continued (µg/kg)											
Dibenzofuran						100	100	--	--	--	--
Fluoranthene		X				--	--	--	--	--	--
Fluorene						--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene						--	--	--	--	--	--
1-Methylnaphthalene						--	--	--	--	--	--
2-Methylnaphthalene						--	--	--	--	--	--
Naphthalene						--	--	--	--	--	--
Phenanthrene		X				--	--	--	--	--	--
Pyrene		X				--	--	--	--	--	--
cPAHs (BaP Eq)		X				4,970	--	388,000	214,000	4,970	--
Total HPAHs						56,000	56,000	--	--	--	--

Notes:
1. mg/kg = milligrams per kilogram
2. µg/kg = micrograms per kilogram
3. Screening levels from draft feasibility study Tables 1 and 2 (hot spots) and Appendix G (remediation level).
4. Remediation level based on remedy selected in 2014 Feasbility Study.
5. Phenols were included in analyte list to assess potential source of dioxins/furans. Phenols were not identified as contaminants of concern.

Table 2
Willamette Cove Import Topsoil
Willamette Cove Removal Action
Portland, Oregon

	East County Materials Import Soil	PRG RAO 9	DEQ Clean Fill Screening Values
Sample Date:	9/8/2015		
Metals (mg/kg)			
Aluminum	19,500	--	103,000
Antimony	<0.624	--	0.56
Arsenic	3.57	3	8.8
Barium	184	--	790
Beryllium	0.737	--	21
Cadmium	0.287	0.5	0.63
Calcium	3,400	--	--
Chromium	18.9	--	76
Cobalt	14.6	--	43
Copper	25.2	359	34
Iron	31,800	--	86,000
Lead	15.8	196	28
Magnesium	3,390	--	--
Manganese	806	--	1,800
Mercury	0.0526	0.09	0.23
Nickel	13.5	--	47
Potassium	783	--	--
Selenium	<1.25	--	0.71
Silver	<0.125	--	4.2
Sodium	130	--	--
Thallium	0.15	--	5.2
Vanadium	95.6	--	180
Zinc	74.3	459	180
PCBs (µg/kg)			
Aroclor 1016	<5.36	--	--
Aroclor 1221	<5.36	--	--
Aroclor 1232	<11.8	--	--
Aroclor 1242	<5.36	--	--
Aroclor 1248	<5.36	--	--
Aroclor 1254	<5.36	--	--
Aroclor 1260	<5.36	--	--
Total PCBs	nd	9	200
SVOCs (µg/kg)			
Acenaphthene	<585	--	29,000
Acenaphthylene	<585	--	--
Aniline	<585	--	304
Anthracene	<585	--	29,000
Azobenzene (1,2-DPH)	<585	--	113
Benzo(a)anthracene	<585	--	150
Benzo(b)fluoranthene	<585	--	150
Benzo(k)fluoranthene	<585	--	1,100
Benzo(g,h,i)perylene	<585	--	--
Benzoic acid	<5850	--	--
Benzyl alcohol	<585	--	16,020
Bis(2-Chloroethoxy) methane	<585	--	402
Bis(2-Chloroethyl) ether	<585	--	0.1
Bis(2-Chloroisopropyl) ether	<585	--	9
Bis(2-Ethylhexyl) adipate	<585	--	410,000
Bis(2-ethylhexyl)phthalate	<585	135	4,500
4-Bromophenyl phenyl ether	<585	--	--
Butyl benzyl phthalate	<585	--	260,000
Carbazole	<585	--	--

Please see notes at end of table.

Table 2
Willamette Cove Import Topsoil
Willamette Cove Removal Action
Portland, Oregon

	East County Materials Import Soil	PRG RAO 9	DEQ Clean Fill Screening Values
Sample Date:	9/8/2015		
SVOCs continued (µg/kg)			
4-Chloroaniline	<585	--	12
4-Chloro-3-methylphenol	<585	--	--
2-Chloronaphthalene	<585	--	--
2-Chlorophenol	<585	--	60,000
4-Chlorophenyl phenyl ether	<585	--	--
Chrysene	<585	--	14,000
Dibenz(a,h)anthracene	<585	--	15
Dibenzofuran	<585	--	2
1,2-Dichlorobenzene	<585	--	70,000
1,3-Dichlorobenzene	<585	--	--
1,4-Dichlorobenzene	<585	--	81
Di-n-butylphthalate	<585	--	--
Diethylphthalate	<585	--	100,000
Dimethylphthalate	<585	--	200,000
2,4-Dimethylphenol	<585	--	20,000
1,2-Dinitrobenzene	<585	--	168
1,3-Dinitrobenzene	<585	--	164
1,4-Dinitrobenzene	<585	--	164
4,6-Dinitro-2-methylphenol	<1400	--	277
2,4-Dinitrophenol	<585	--	20,000
2,4-Dinitrotoluene	<585	--	35.4
Di-n-octyl phthalate	<585	--	--
Fluoranthene	<585	--	29,000
Fluorene	<585	--	29,000
Hexachlorobenzene	<585	0.3	260
Hexachlorobutadiene	<585	--	67.8
Hexachlorocyclopentadiene	<585	--	10,000
Hexachloroethane	<585	--	510
Indeno(1,2,3-cd)pyrene	<585	--	150
Isophorone	<585	--	1,596
1-Methylnaphthalene	<585	--	738
2-Methylnaphthalene	<585	--	310,000
2-Methylphenol	<585	--	--
3+4-Methylphenol(s)	<585	--	--
Naphthalene	<585	--	87
2-Nitroaniline	<585	--	5,646
3-Nitroaniline	<585	--	70,000
4-Nitroaniline	<585	--	122
Nitrobenzene	<585	--	8.4
2-Nitrophenol	<585	--	--
4-Nitrophenol	<585	--	--
N-Nitrosodimethylamine	<585	--	2.3
N-Nitroso-di-n-propylamine	<585	--	1.2
N-Nitrosodiphenylamine	<585	--	4,500
Pentachlorophenol (PCP)	<585	--	140
Phenanthrene	<585	--	--
Phenol	<585	--	30,000
Pyrene	<585	--	1,700,000

Please see notes at end of table.

Table 2
Willamette Cove Import Topsoil
Willamette Cove Removal Action
Portland, Oregon

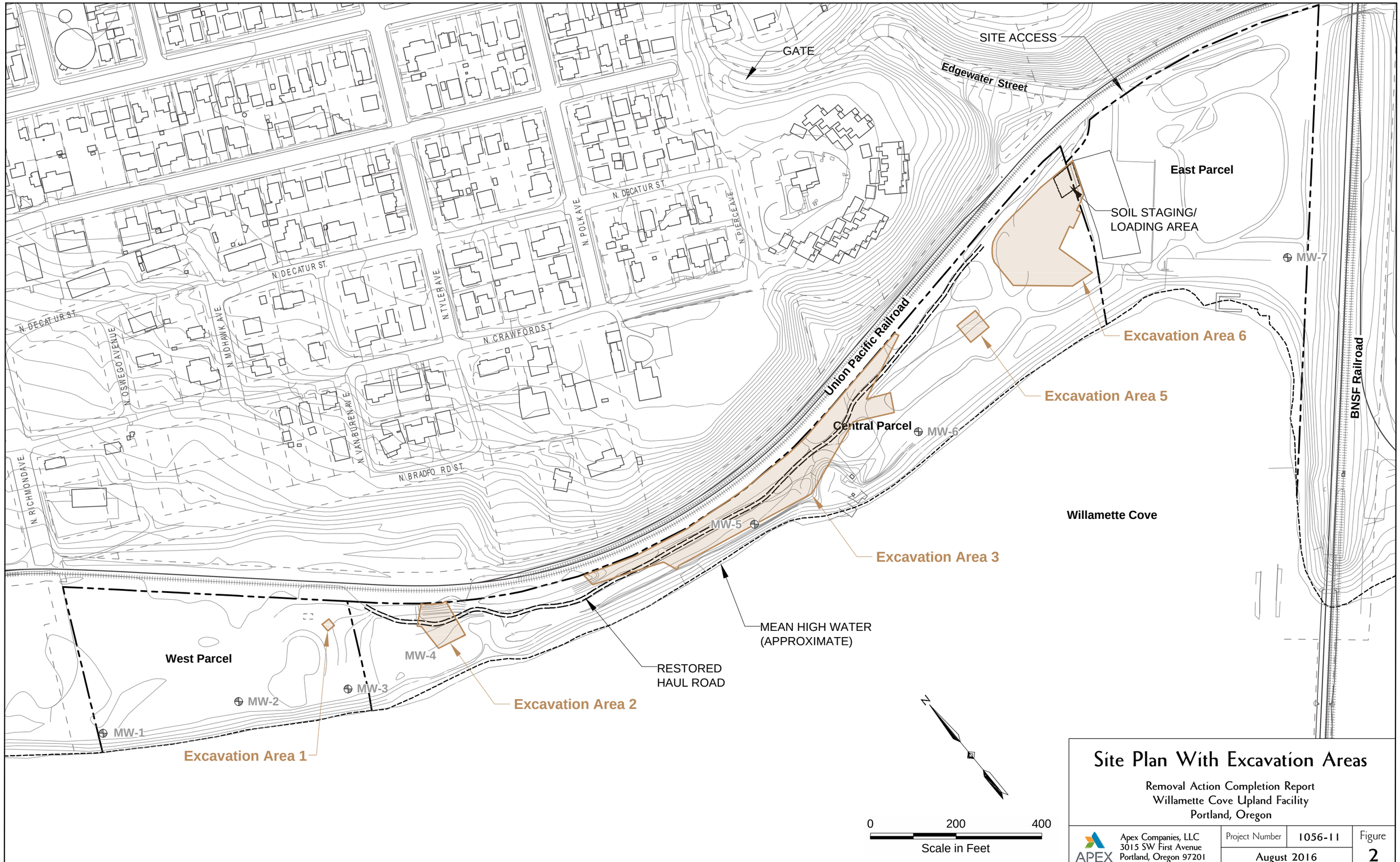
	East County Materials Import Soil	PRG RAO 9	DEQ Clean Fill Screening Values
Sample Date:	9/8/2015		
SVOCs continued (µg/kg)			
Pyridine	<1170	--	386
2,3,4,6-Tetrachlorophenol	<585	--	20,000
2,3,5,6-Tetrachlorophenol	<585	--	--
1,2,4-Trichlorobenzene	<585	--	407
2,4,5-Trichlorophenol	<585	--	4,000
2,4,6-Trichlorophenol	<585	--	1,900
Total PAHs	nd	23,000	--
cPAHs	nd	12	--
Pesticides (µg/kg)			
Aldrin	<2.07	2	11
alpha-BHC	<2.07	--	70
beta-BHC	<2.07	--	270
delta-BHC	<2.07	--	--
gamma-BHC (Lindane)	<2.07	5	380
cis-Chlordane	136	1.4	--
trans-Chlordane	150	1.4	--
4,4'-DDD	<9.31	114	21
4,4'-DDE	<16.6	226	21
4,4'-DDT	<12.8	246	21
DDx	nd	6.1	--
Dieldrin	<4.97	0.07	4.9
Endosulfan I	<4.14	--	20,000 [4]
Endosulfan II	<7.87	--	20,000 [4]
Endosulfan sulfate	<4.14	--	--
Endrin	<11.6	--	40
Endrin Aldehyde	<4.14	--	--
Endrin ketone	<2.07	--	--
Heptachlor	13.3	--	100
Heptachlor epoxide	11.1	--	53
Methoxychlor	<12.4	--	310,000
Toxaphene (Total)	<62.1	--	440
Chlordane (Technical)	1060	1.4	1,300
Dioxins (pg/g)			
2,3,7,8-TCDD	<0.0913	0.2	4.4
1,2,3,7,8-PeCDD	0.459	0.2	--
1,2,3,4,7,8-HxCDD	0.712	--	--
1,2,3,6,7,8-HxCDD	2.53	--	--
1,2,3,7,8,9-HxCDD	1.74	--	--
1,2,3,4,6,7,8-HpCDD	60.7	--	--
OCDD	514	--	--
2,3,7,8-TCDF	0.340	0.4	--
1,2,3,7,8-PeCDF	0.305	--	--
2,3,4,7,8-PeCDF	0.594	0.3	--
1,2,3,4,7,8-HxCDF	1.19	0.4	--
1,2,3,6,7,8-HxCDF	0.765	--	--
2,3,4,6,7,8-HxCDF	1.05	--	--
1,2,3,7,8,9-HxCDF	0.373	--	--
1,2,3,4,6,7,8-HpCDF	12.4	--	--
1,2,3,4,7,8,9-HpCDF	1.00	--	--
OCDF	39.2	--	--

Please see notes at end of table.

Table 2
Willamette Cove Import Topsoil
Willamette Cove Removal Action
Portland, Oregon

	East County Materials Import Soil	PRG RAO 9	DEQ Clean Fill Screening Values
Sample Date:	9/8/2015		
Total TCDD	1.66	--	--
Total PeCDD	1.22	--	--
Total HxCDD	17.6	--	--
Total HpCDD	108	--	--
Total TCDF	6.00	--	--
Total PeCDF	5.65	--	--
Total HxCDF	20.7	--	--
Total HpCDF	40.1	--	--

Notes:
1. < = Analyte note detected above the method detection limit
2. **Bold** = analyte detected above method detection limit
3. -- = Not available
4. The value is a total screening level for Endosulfan I and II combined.
5. Shaded value exceeds PRG.

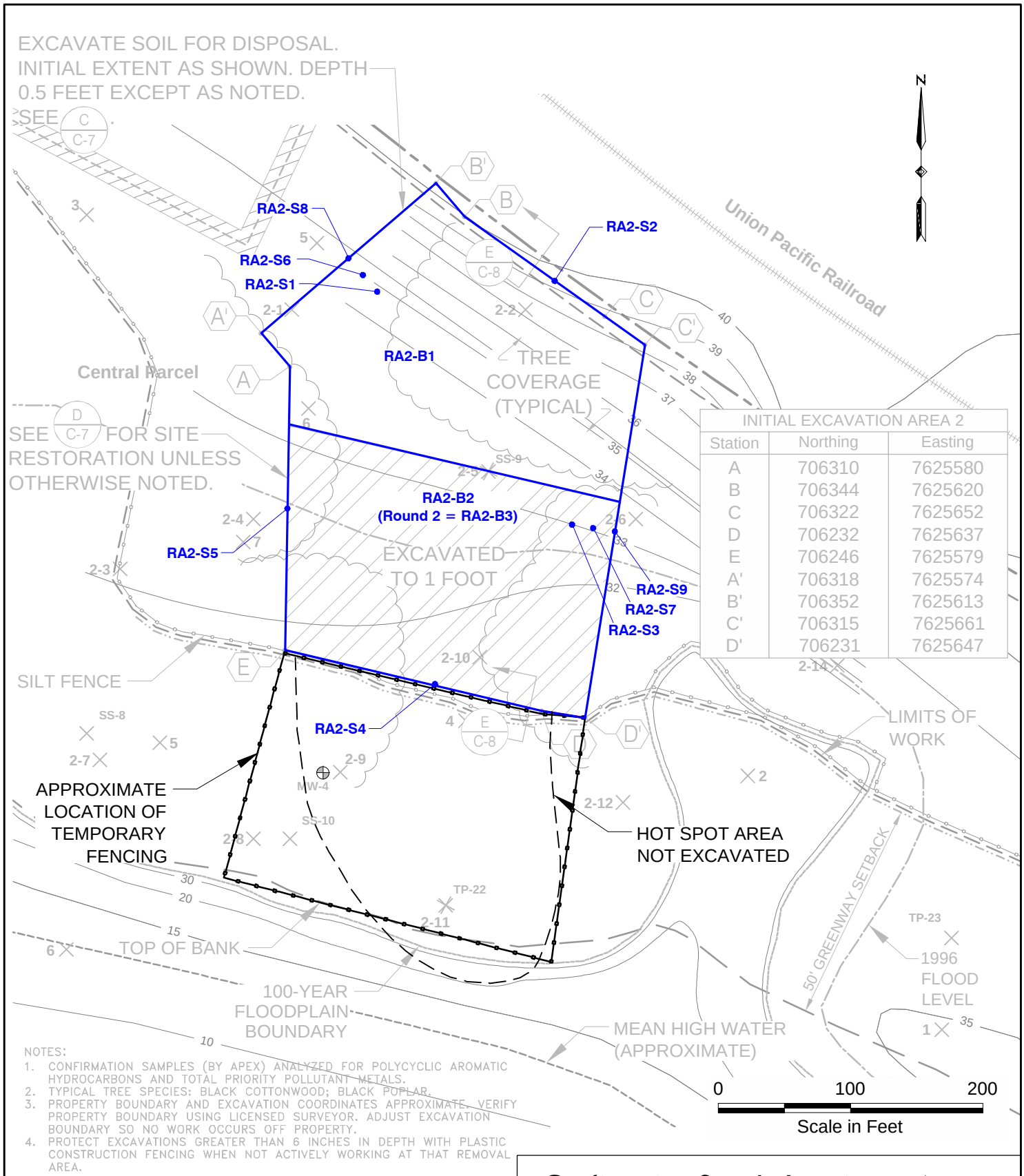


Site Plan With Excavation Areas

Removal Action Completion Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-11	Figure
August 2016		2



INITIAL EXCAVATION AREA 2		
Station	Northing	Easting
A	706310	7625580
B	706344	7625620
C	706322	7625652
D	706232	7625637
E	706246	7625579
A'	706318	7625574
B'	706352	7625613
C'	706315	7625661
D'	706231	7625647

NOTES:
1. CONFIRMATION SAMPLES (BY APEX) ANALYZED FOR POLYCYCLIC AROMATIC HYDROCARBONS AND TOTAL PRIORITY POLLUTANT METALS.
2. TYPICAL TREE SPECIES: BLACK COTTONWOOD; BLACK POPLAR.
3. PROPERTY BOUNDARY AND EXCAVATION COORDINATES APPROXIMATE. VERIFY PROPERTY BOUNDARY USING LICENSED SURVEYOR. ADJUST EXCAVATION BOUNDARY SO NO WORK OCCURS OFF PROPERTY.
4. PROTECT EXCAVATIONS GREATER THAN 6 INCHES IN DEPTH WITH PLASTIC CONSTRUCTION FENCING WHEN NOT ACTIVELY WORKING AT THAT REMOVAL AREA.

Legend:

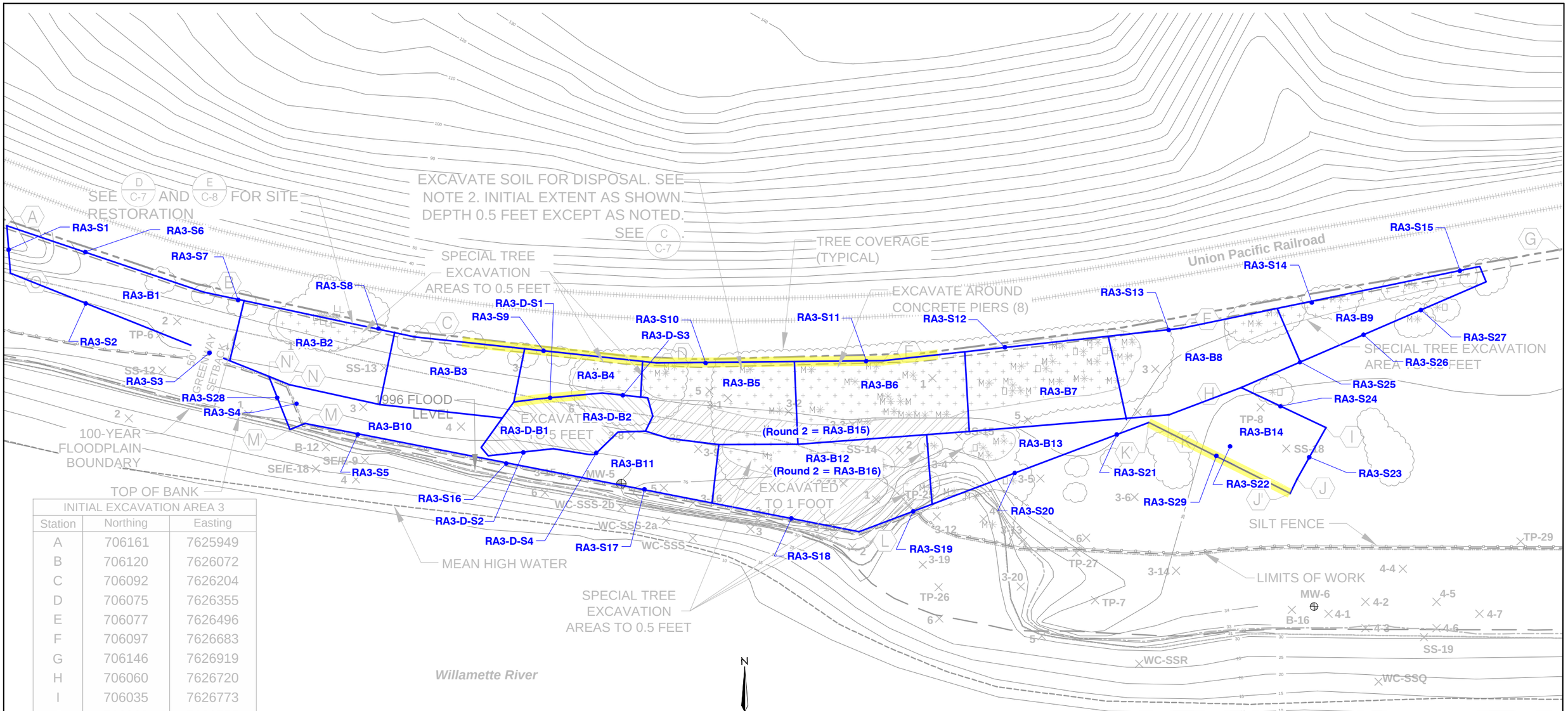
RA2-B1 — Excavation Area - Confirmation Sample Consists of 5 Composited Points

RA2-S1 — Sidewall - Confirmation Sample Consists of 5 Composited Points

Confirmation Sample Locations - Area 2

Removal Action Completion Report
Willamette Cove Upland Facility
Portland, Oregon

APEX — Apex Companies, LLC, 3015 SW First Avenue, Portland, Oregon 97201	Project Number	1056-11	Figure
	August 2016		4



INITIAL EXCAVATION AREA 3		
Station	Northing	Easting
A	706161	7625949
B	706120	7626072
C	706092	7626204
D	706075	7626355
E	706077	7626496
F	706097	7626683
G	706146	7626919
H	706060	7626720
I	706035	7626773
J	706003	7626755
K	706043	7626675
L	705970	7626481
M	706038	7626135
N	706062	7626125
O	706131	7625951
J'	705994	7626755
K'	706038	7626662
M'	706034	7626126
N'	706067	7626113

NOTES:
1. CONFIRMATION SAMPLES (BY APEX) ANALYZED FOR CHLOROPHENOLS, DIOXINS/FURANS, AND TOTAL PRIORITY POLLUTANT METALS.
2. SAVE DESIGNATED TREES SHOWN, SEE G C-8
   - ✳ L BIG LEAF MAPLE
   - ✳ M MADRONE
   - ✳ O OREGON WHITE OAK
3. OTHER TREE SPECIES PRESENT: BLACK COTTONWOOD; BLACK POPLAR.
4. PROPERTY BOUNDARY AND EXCAVATION COORDINATES APPROXIMATE. VERIFY PROPERTY BOUNDARY USING LICENSED SURVEYOR. ADJUST EXCAVATION BOUNDARY SO NO WORK OCCURS OFF PROPERTY.
5. PROTECT EXCAVATIONS GREATER THAN 6 INCHES IN DEPTH WITH PLASTIC CONSTRUCTION FENCING WHEN NOT ACTIVELY WORKING AT THAT REMOVAL AREA.

Legend:

RA3-B1 — Excavation Area - Confirmation Sample Consists of 5 Composited Points

RA3-S1 — Sidewall - Confirmation Sample Consists of 5 Composited Points

Sidewall Sample Concentration Exceeded Hot Spot Level

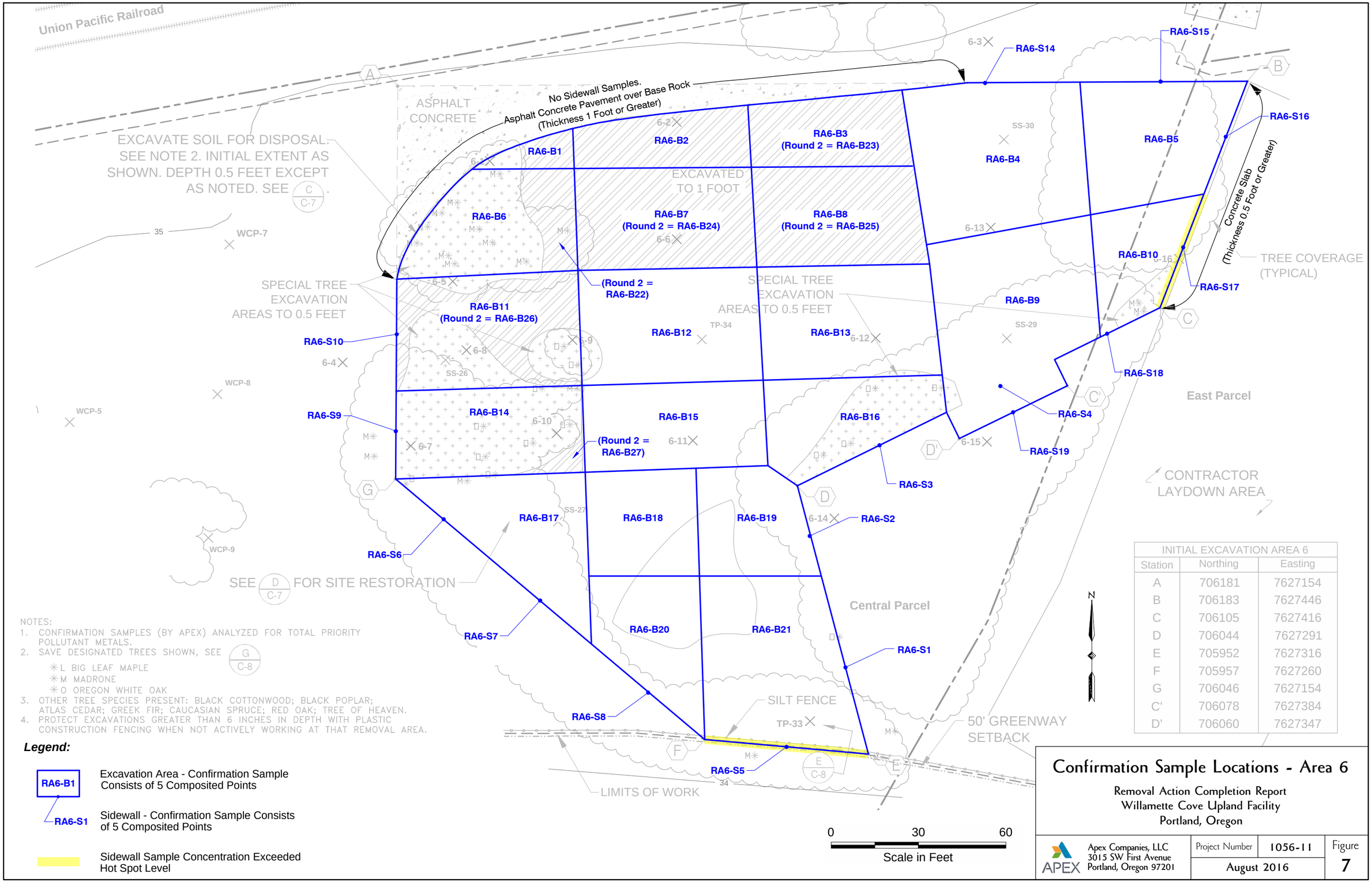
0 60 120
Scale in Feet

Confirmation Sample Locations - Area 3

Removal Action Completion Report
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-03	Figure
August 2016		5



INITIAL EXCAVATION AREA 6		
Station	Northing	Easting
A	706181	7627154
B	706183	7627446
C	706105	7627416
D	706044	7627291
E	705952	7627316
F	705957	7627260
G	706046	7627154
C'	706078	7627384
D'	706060	7627347

NOTES:
1. CONFIRMATION SAMPLES (BY APEX) ANALYZED FOR TOTAL PRIORITY POLLUTANT METALS.
2. SAVE DESIGNATED TREES SHOWN, SEE G/C-8
   - L BIG LEAF MAPLE
   - M MADRONE
   - O OREGON WHITE OAK
3. OTHER TREE SPECIES PRESENT: BLACK COTTONWOOD; BLACK POPLAR; ATLAS CEDAR; GREEK FIR; CAUCASIAN SPRUCE; RED OAK; TREE OF HEAVEN.
4. PROTECT EXCAVATIONS GREATER THAN 6 INCHES IN DEPTH WITH PLASTIC CONSTRUCTION FENCING WHEN NOT ACTIVELY WORKING AT THAT REMOVAL AREA.

Legend:

RA6-B1 — Excavation Area - Confirmation Sample Consists of 5 Composited Points

RA6-S1 — Sidewall - Confirmation Sample Consists of 5 Composited Points

Sidewall Sample Concentration Exceeded Hot Spot Level

Confirmation Sample Locations - Area 6

Removal Action Completion Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-11	Figure
August 2016		7

Attachment A-7

***Response to DEQ Comments, Groundwater Data Report, June 2016, Willamette Cove Upland Facility* – November 2016**

November 3, 2016

Mr. Dan Hafley
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100

Subject: Response to DEQ Comments
Groundwater Data Report, June 2016
Willamette Cove Upland Facility – ECSI #2066

Dear Dan:

This letter provides the Oregon Department of Environmental Quality (DEQ) with a response to the comments received on the Groundwater Data Report – June 2016 for the Willamette Cove Upland Facility. The comments were provided to the Port of Portland (Port) in an email from the DEQ dated August 15, 2016. The comments are repeated (in italics) followed by the Port response. In the comments, DEQ requested submittal of a revised report. As requested in the DEQ email, there will be a thorough discussion including multiple lines of evidence and risk screening in the forthcoming combined feasibility study and source control document (FS/SCE). The Port respectfully submits that the responses to comments below together with the further analysis in the FS/SCE adequately address DEQ's comments and that submittal of a revised report is not necessary.

DEQ Comments and Port Responses

Groundwater flow direction can only be inferred from the elevation data set presented (wells are largely in a straight line, making determination of gradient using the standard "three point method" impractical). The report should include a more substantive discussion of groundwater elevation data and gradient, including the (ongoing, anomalous) elevation readings at MW-2. Please discuss water elevations in the Willamette River at the time of sampling, and use the data to support the conclusion that groundwater flow direction is towards the river. If local river elevation data are not available (say, from USGS), you should consider installation of staff gauges adjacent to the site for collection of elevation data.

Response: Water level data from the USGS Willamette River gauging station (located at the Morrison Bridge in downtown Portland approximately 6 miles upriver from Willamette Cove) were compared to the well elevation data collected during the monitoring events. The minimum, maximum, and average river levels for the day of the gaging event, the week prior to the gaging event, and the month prior to the gaging event were calculated (see Table 1). The averages for the week and month prior to the gaging event were calculated to account for the slower movement of groundwater compared to surface water and the effect of the tidal variation in the river levels. Except for the short term averages in two wells in February, groundwater

elevations measured in the wells are higher than the average river levels, indicating that the overall groundwater gradient is toward the river. Short-term, local reversals in gradient may occur near the riverbank, but these reversals would occur only during maximum water level events that are of short duration. Groundwater levels were higher than even the maximum river level for both events at MW-2 and MW-7.

The groundwater elevation at monitoring well MW-2 has been consistently higher than in the surrounding wells. It is possible this is due to differing hydrologic properties of the fill used in the former log pond. The type and quality of the fill in this area compared to the surrounding area will be assessed in the West Parcel investigation that is scheduled to be conducted concurrent with the December 2016 groundwater monitoring event.

We recommend that the groundwater report include some presentation (illustration) of analytical results to help with data interpretation, notably for contaminants exceeding relevant screening values (EPA PRGs). Trend analysis is also recommended, including older (pre-2016) data where relevant. Note that Illustration of groundwater sampling results, trend analysis, development of exceedance ratios, etc. will be needed to support risk screening and weight-of-evidence decision-making in the forthcoming revised source control evaluation.

Response: Figures were prepared presenting analytical results for parameters detected in multiple rounds above EPA PRGs. These include arsenic, lead, zinc, PAHs, and PCBs. Trend charts were created for analytes with multiple data points in individual wells above the applicable PRG. Trend charts were created for total and dissolved arsenic, total lead, total zinc, and carcinogenic PAHs (cPAHs). Trend analysis for other relevant site analytes will be created as appropriate when additional data are collected. The figures and trend charts are attached to this letter.

"Natural attenuation parameters" data are presented in Table 7 but not discussed. DEQ notes that TOC is elevated in MW-1, -2, and -3, presumably associated with the detection of TPH. Groundwater conditions, in general, appeared to be more "reducing" at the MW-1, -2, and -3 locations.

Response: Table 7 was expanded to include field parameter data. The revised Table 7 is attached to this letter and will be included in future groundwater reports. In general, the data from Table 7 suggest that groundwater in the West Parcel (MW-1 through MW-3) is more reducing than elsewhere at Willamette Cove. This is supported by an average negative oxidatiion-reduction potential (ORP) in the West Parcel wells, a detectable concentration of sulfide in MW-2, and consistently higher concentrations of arsenic III compared to other areas of the Site.

Field parameter data including turbidity, pH, etc. are not compiled in tables or discussed in the report. Please do so in this and future groundwater reports. DEQ notes that (sampling) turbidity values were very low during June 2016 sampling, including at location MW-3 where PCBs were most elevated.

Response: Please see response to above comment.

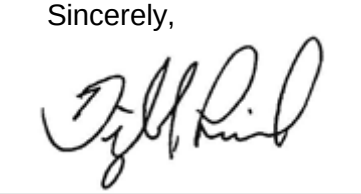
In Appendix A, turbidity data are not presented for MW-7 sampling. Also, pH data are highly variable, ranging from 5.24 (MW-6 to) to 10.23 (MW-2). Please discuss.

Response: Turbidity data was inadvertently not collected for MW-7 during the June 2016 monitoring event.

Table 7 shows the pH data including historical data from 2002 and 2005. The long-term data are relatively consistent with MW-2 typically higher than other wells. The higher relative pH readings in MW-2 may be a results of differing soil type due to the fill placed in the former log pond. As noted above, this will be assessed during the West Parcel investigation that is scheduled to be conducted concurrent with the December 2016 groundwater monitoring event.

Please call me at (503) 415-6325 if you have any questions.

Sincerely,



Dwight Leisle
Environmental Project Manager

Attachments: Table 1 – Groundwater Elevations
Table 7 – Groundwater Analytical Results – Natural Attenuation Parameters

Figure 3 – Arsenic Results – June 2016
Figure 4 – Lead Results – June 2016
Figure 5 – Zinc Results – June 2016
Figure 6 – cPAH Results – June 2016
Figure 7 – Total PCBs About EPA PRGs

Chart 1 – Total Arsenic in West Parcel Monitoring Wells
Chart 2 – Total Arsenic in Central and East Parcel Monitoring Wells
Chart 3 – Total Lead in West Parcel Monitoring Wells
Chart 4 – Total Lead in Central and East Parcel Monitoring Wells
Chart 5 – Total Zinc in West Parcel Monitoring Wells
Chart 6 – Total Zinc in Central and East Parcel Monitoring Wells
Chart 7 – Dissolved Arsenic in West Parcel Monitoring Wells
Chart 8 – cPAHs in Monitoring Wells MW-1 Through MW-4

7200 NE Airport Way Portland OR 97218
Box 3529 Portland OR 97208
503 415 6000

c: Eva DeMaria, EPA
Sean Sheldrake, EPA
Katy Weil, Metro
Dwight Leisle, Port
Anzie St. Clair, Port
Suzanne Barthelmess, Port
Herb Clough, Apex Companies
Mark Lewis, Formation Environmental
LWP File

7200 NE Airport Way Portland OR 97218
Box 3529 Portland OR 97208
503 415 6000

Table 1
Groundwater Elevations
Willamette Cove Upland Facility
Portland, Oregon

Well ID	Date	Top of Casing Elevation (feet)	Depth to Water (feet bgs)	Groundwater Elevation (feet)
MW-1	2/7/2002	35.74	26.83	8.91
	5/28/2002		26.25	9.49
	8/29/2005		28.43	7.31
	12/16/2005		28.04	7.70
	2/23/2016		24.60	11.14
	6/3/2016		25.40	10.34
MW-2	2/7/2002	44.04	29.25	14.79
	5/28/2002		24.67	19.37
	8/29/2005		27.81	16.23
	12/16/2005		28.91	15.13
	2/23/2016		26.38	17.66
	6/3/2016	44.05	25.93	18.12
MW-3	2/7/2002	41.97	30.02	11.95
	5/28/2002		30.97	11.00
	8/29/2005		36.93	5.04
	12/16/2005		34.80	7.17
	2/23/2016		30.99	10.98
	6/3/2016		32.7	9.27
MW-4	2/7/2002	35.20	26.1	9.10
	5/28/2002		24.92	10.28
	8/29/2005		27.97	7.23
	12/16/2005		27.68	7.52
	2/23/2016		24.23	10.97
	6/3/2016		24.96	10.24
MW-5	2/7/2002	36.03	27.12	8.91
	5/28/2002		26.53	9.50
	8/29/2005		29.95	6.08
	12/16/2005		29.21	6.82
	2/23/2016		25.01	11.02
	6/3/2016		26.15	9.88
MW-6	2/7/2002	35.95	27.08	8.87
	5/28/2002		25.15	10.80
	8/29/2005		29.98	5.97
	12/16/2005		29.29	6.66
	2/23/2016		25.01	10.94
	6/3/2016		26.14	9.81
MW-7	2/7/2002	34.57	23.12	11.45
	5/28/2002		23.49	11.08
	8/29/2005		26.45	8.12
	12/16/2005		26.49	8.08
	2/23/2015		21.62	12.95
	6/3/2016		22.35	12.22
MW-8	2/23/2016	35.69	24.68	11.01
	6/3/2016		25.51	10.18
MW-9	2/23/2016	33.31	20.93	12.38
	6/3/2016		22.01	11.30

Please see notes at end of table.

Table 1
Groundwater Elevations
Willamette Cove Upland Facility
Portland, Oregon

Event	Date[4]	Measurement	River Stage[5] (feet)	River Gauge Reference Elevation (feet)	River Elevation (feet)
February 2016	Day 2/23/16	Minimum	7.03	2.92	9.95
		Maximum	8.14		11.06
		Average	7.55		10.47
	Week 2/17/16-2/23/16	Minimum	6.88		9.80
		Maximum	9.11		12.03
		Average	8.04		10.96
	Month 1/24/16-2/23/16	Minimum	3.84		6.76
		Maximum	9.11		12.03
		Average	6.83		9.75
June 2016	Day 6/3/16	Minimum	4.14		7.06
		Maximum	7.40		10.32
		Average	5.57		8.49
	Week 5/28/16-6/3/16	Minimum	3.17		6.09
		Maximum	7.40		10.32
		Average	4.84		7.76
	Month 5/4/16-6/3/16	Minimum	3.17		6.09
		Maximum	9.11		12.03
		Average	6.30		9.22

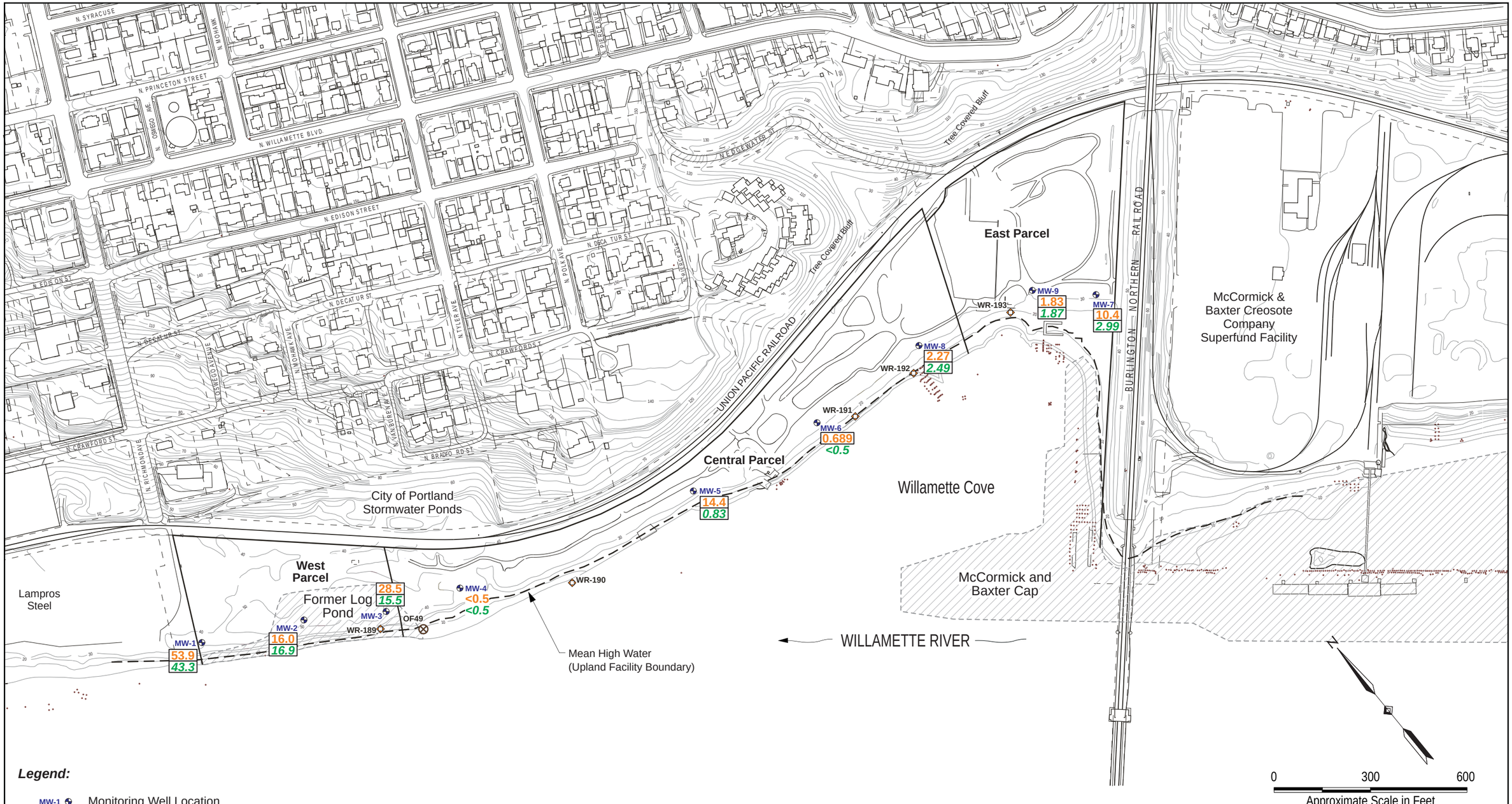
Notes:

1. Elevations relative to City of Portland datum.
2. bgs = below ground surface.
3. Elevation for wells MW-2, MW-8, and MW-9 are from survey on June 16, 2016. All other well elevations from survey conducted in 2002.
4. The minimum, maximum, and average river stage shown for the day of the gaging event, and the week and month prior.
5. United States Geologic Survey (USGS) Sta. 14211720.

Table 7
Groundwater Analytical Results – Natural Attenuation Parameters
Willamette Cove
Portland, Oregon

Sample ID	Sample Date	SM 5310B	EPA 300.0	SM 4500-S	EPA 353.2	Arsenic by EPA 1632		Field Parameters					
		Total Organic Carbon	Sulfate	Sulfide	Nitrate + Nitrite Nitrogen	Arsenic III	Arsenic V	pH	Temperature	Conductivity	Dissolved Oxygen	Oxidative-Reductive Potential	Turbidity
		Concentration in mg/L (ppm)				Concentration in ug/L (ppb)		pH units	°C	µS/cm	ppm	mV	NTUs
RAO 4 (Human Health Groundwater)		--	--	--	--	--	--	--	--	--	--	--	--
RAO 8 (Ecological Toxicity, Groundwater)		--	--	--	--	--	--	--	--	--	--	--	--
MW-1	2/7/2002	--	--	--	--	--	--	7.7	5.7	1,210	--	--	--
	5/23/2002	--	--	--	--	--	--	7.8	14.9	1,301	3.74	--	109
	8/30/2005	--	--	--	--	--	--	6.60	15.77	1,489	0.27	--	--
	12/16/2005	--	--	--	--	--	--	6.77	15.62	1,345	0.43	-118.7	98.7
	2/23/2016	15.7	1.00 U	0.05 U	0.02 U	21.9	0.32 U	6.28	12.6	828	2.23	0.2	1.55
	6/3/2016	10.6	1.18	0.03 U	0.025 U	40.6	5.01 B	6.17	13.8	853	3.81	21.2	1.99
MW-2	2/7/2002	--	--	--	--	--	--	10.9	5.8	390	--	--	31.6
	5/23/2002	--	--	--	--	--	--	7.7	13.9	11	4.67	--	39.1
	8/30/2005	--	--	--	--	--	--	10.36	16.53	447	0.29	--	6.9
	12/16/2005	--	--	--	--	--	--	10.77	14.06	384	0.38	-227.3	13.7
	2/23/2016	26.8	31.3	2.4	0.04	2.15	0.032 U	10.15	13.4	296.5	2.4	-22.9	2.09
	6/3/2016	24.2	30.4	3.3	0.214	2.6	1.06 B	10.23	13.6	261	3.86	-16.2	1.73
MW-3	2/7/2002	--	--	--	--	--	--	8.8	5.8	1,270	--	--	136
	5/23/2002	--	--	--	--	--	--	7.2	13.6	1,208	3.69	--	148
	8/30/2005	--	--	--	--	--	--	5.82	17.06	2,575	1.05	--	--
	12/16/2005	--	--	--	--	--	--	6.35	15.28	2,129	0.35	-146.6	>1,000
	2/23/2016	23.1	1.00 U	0.05 U	0.02 U	9.47	0.16 U	6.03	13.8	1000	1.99	8.5	2.09
	6/3/2016	21.5	24.2	0.03 U	0.025 U	10.2	7.75	6.06	14.2	979	1.29	16.5	5.15
MW-4	2/7/2002	--	--	--	--	--	--	8.1	5.7	330	--	--	878
	5/23/2002	--	--	--	--	--	--	7.9	11.9	410	2.01	--	569
	8/30/2005	--	--	--	--	--	--	5.37	15.63	354	0.29	--	--
	12/16/2005	--	--	--	--	--	--	6.00	15.03	303	0.85	-4.1	>1,000
	2/23/2016	8.54	10.3	0.05 U	0.02 U	1.16	0.08 U	6.09	14.0	408.2	1.96	11.3	11.9
	6/3/2016	1.58	17.5	0.03 U	1.34	0.008 U	0.261	8.68	14.4	359	1.77	39.4	9.9
MW-5	2/7/2002	--	--	--	--	--	--	8.2	5.7	341	--	--	600
	5/23/2002	--	--	--	--	--	--	8.1	13.5	315	3.31	--	466
	8/30/2005	--	--	--	--	--	--	5.98	15.37	383	5.40	--	40
	12/16/2005	--	--	--	--	--	--	6.30	14.60	336	6.54	43.4	49.6
	2/24/2016	6.92	16.4	0.05 U	2.6	0.009 J	0.008 U	5.85	12.6	232.8	4.82	36.7	2.21
	6/3/2016	3.19	28.6	0.03 U	6.11	0.169	1.29	5.90	12.7	260	4.62	33.4	1.79
MW-6	2/7/2002	--	--	--	--	--	--	7.9	5.7	691	--	--	294
	5/23/2002	--	--	--	--	--	--	8.4	14.4	252	4.20	--	511
	8/30/2005	--	--	--	--	--	--	5.90	16.04	341	0.25	--	21
	12/16/2005	--	--	--	--	--	--	5.99	16.99	289	0.07	-30.3	19.1
	2/23/2016	6.94	10.7	0.05 U	0.13	0.018 J	0.008 U	5.57	13.2	156.8	5.9	24.2	1.20
	6/6/2016	2.15	14.9	0.03 U	0.025 U	0.015 B	0.673	5.24	14.4	426	1.53	27.6	6.61
MW-7	2/7/2002	--	--	--	--	--	--	7.3	5.7	1,591	--	--	--
	5/23/2002	--	--	--	--	--	--	8.5	14.8	1,222	3.87	--	491
	8/30/2005	--	--	--	--	--	--	6.39	14.15	833	0.75	--	983
	12/16/2005	--	--	--	--	--	--	6.84	14.37	838	--	-155.0	219
	2/24/2016	8.53	1.00 U	0.05 U	0.02 U	8.89	0.32 U	6.58	13.8	664	2.03	27.1	6.42
	6/6/2016	3.66	1.00 U	0.03 U	0.025 U	9.82	2.82	6.14	15.7	1402	0.98	-123.8	--
MW-8	2/24/2016	6.9	11.4	0.05 U	0.14	0.48	0.08 U	5.93	13.3	238.4	7.31	41.4	3.36
	6/6/2016	1.55	10.1	0.03 U	0.025 U	1.72	0.732	5.91	14.4	673	0.94	-78.4	1.75
MW-9	2/24/2016	6.33	1.00 U	0.05 U	0.17	0.75	0.08 U	6.36	12.6	238.1	3.49	31.7	1.83
	2/24/2016 DUP	5.86	1.00 U	0.05 U	0.18	0.78	0.08 U	--	--	--	--	--	--
	6/6/2016	3.11	1.27	0.03 U	3.04 M	1.07	0.934	6.15	15.3	655	2.2	-16.4	1.3
	6/6/2016 DUP	1.44	1.98	0.03 U	4.44 M	1.1	1	--	--	--	--	--	--

Notes:
1. U = Non-detected value.
2. J = Estimated value after QA review.
3. M = Due to matrix interference, the reported result may contain a high bias.
3. mg/L = milligrams per liter (parts per million).
4. ug/L = micrograms per liter (parts per billion).
5. °C = degrees celcius.
6. µS/cm = microsiemens per centimeter.
7. ppm = parts per million.
8. mV= millivolts.
9. NTUs = Nephelometric turbidity units.



Legend:

MW-1	Monitoring Well Location
53.9	Total Arsenic Concentration in micrograms per liter (µg/L)
43.3	Dissolved Arsenic Concentration in micrograms per liter (µg/L)
▭	Exceeds Preliminary Remediation Goal (PRG)
OF49	City of Portland Outfall
WR-189	Potential Historical Outfall (Inactive)

Environmental Protection Agency (EPA) Preliminary Remediation Goals - Remedial Action Objectives (RAOs)		
RAO4	Human Health Groundwater	0.02 µg/L
RAO8	Ecological Toxicity Groundwater	150 µg/L

Note: Base map prepared from an electronic file provided by Hart Crowser.

Arsenic Results - June 2106

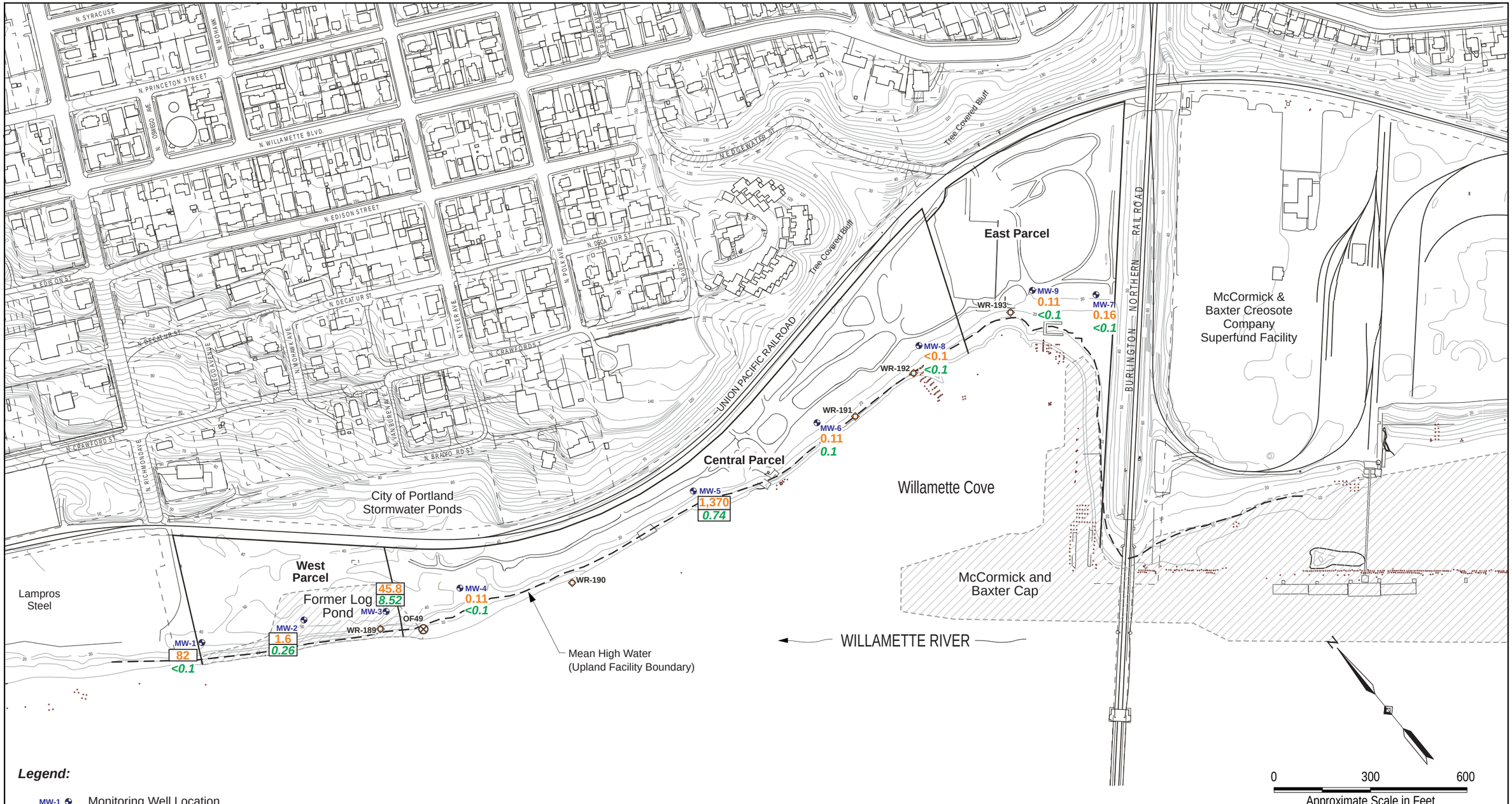
Groundwater Data Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number 1056-12

October 2016

Figure 3



Legend:

MW-1	Monitoring Well Location
82	Total Lead Concentration in micrograms per liter (µg/L)
<0.1	Dissolved Lead Concentration in micrograms per liter (µg/L)
▭	Exceeds Preliminary Remediation Goal (PRG)
OF49	City of Portland Outfall
WR-189	Potential Historical Outfall (Inactive)

Note: Base map prepared from an electronic file provided by Hart Crowser.

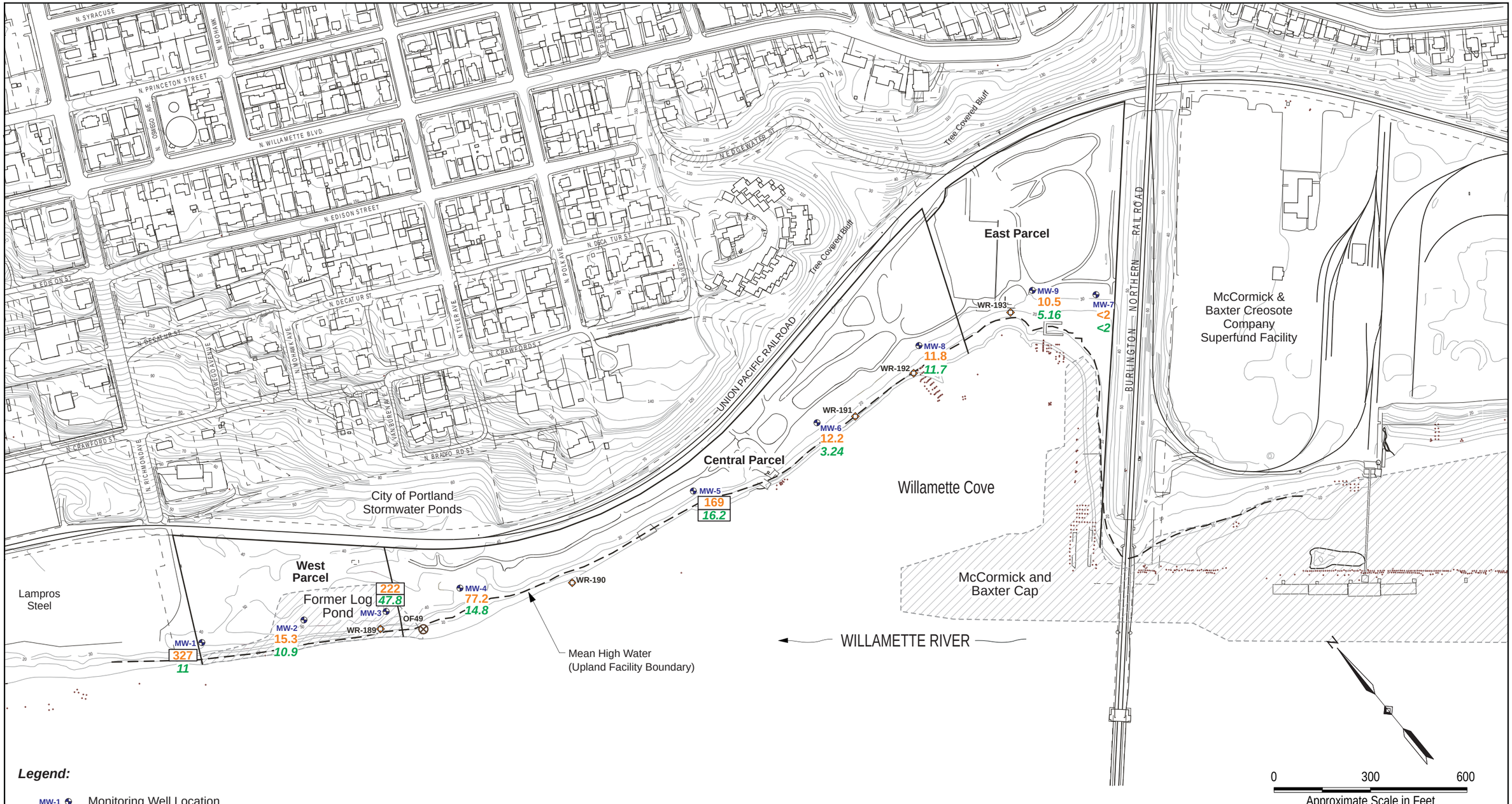
Environmental Protection Agency (EPA) Preliminary Remediation Goals - Remedial Action Objectives (RAOs)		
RAO4	Human Health Groundwater	--
RAO8	Ecological Toxicity Groundwater	0.5 µg/L

Lead Results - June 2016

Groundwater Data Report
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-12	Figure
October 2016		4



Legend:

MW-1	Monitoring Well Location
327	Total Zinc Concentration in micrograms per liter (µg/L)
11	Dissolved Zinc Concentration in micrograms per liter (µg/L)
▭	Exceeds Preliminary Remediation Goal (PRG)
OF49	City of Portland Outfall
WR-189	Potential Historical Outfall (Inactive)

Note: Base map prepared from an electronic file provided by Hart Crowser.

Environmental Protection Agency (EPA) Primary Remediation Goals - Remedial Action Objectives (RAOs)		
RAO4	Human Health Groundwater	--
RAO8	Ecological Toxicity Groundwater	36.5 µg/L

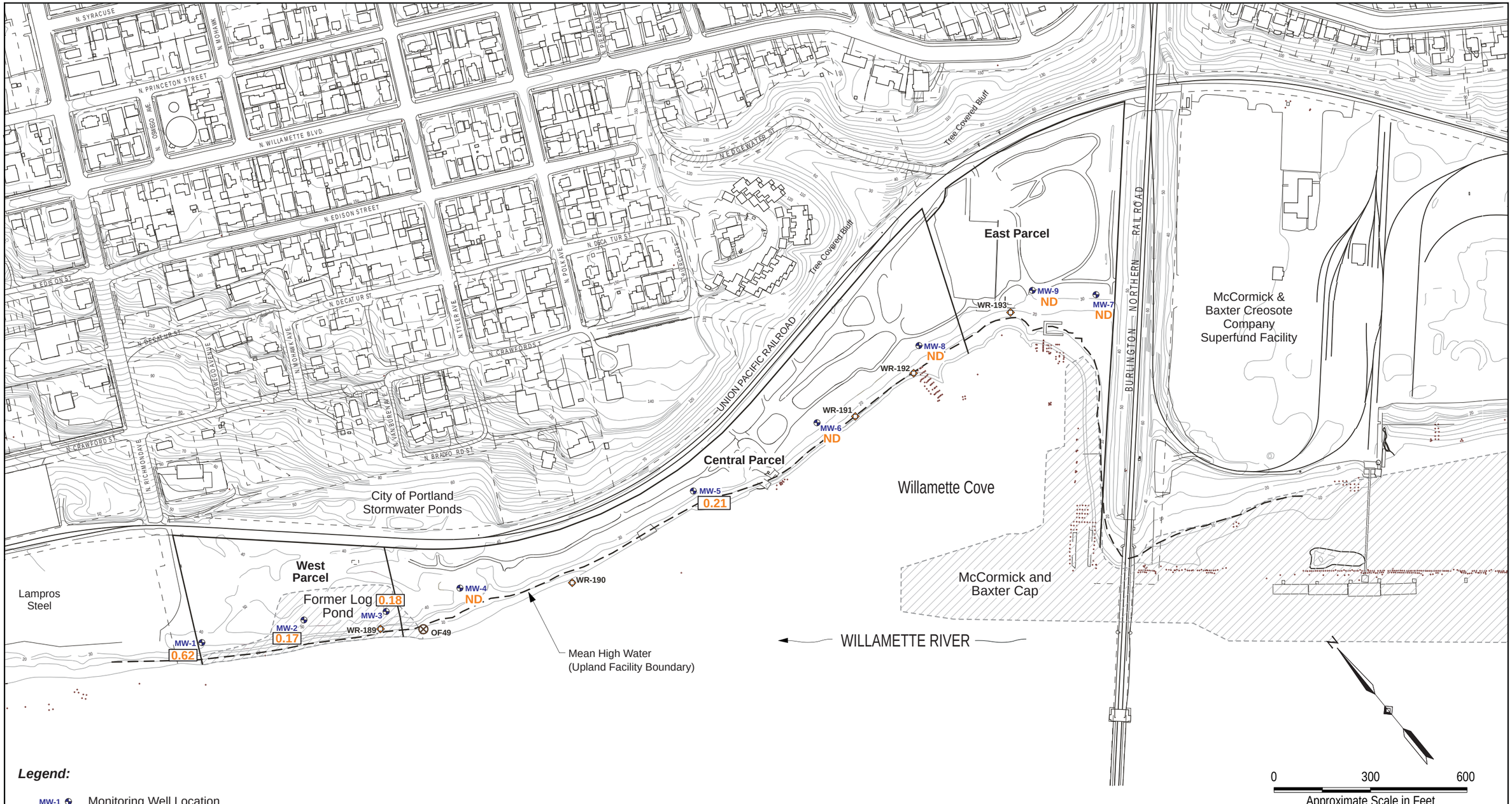
Zinc Results - June 2016

Groundwater Data Report
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-12	Figure
October 2016		5



Legend:

MW-1 0.463	Monitoring Well Location Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAH) in micrograms per liter (µg/L)
ND	Not Detected
▭	Exceeds Preliminary Remediation Goal (PRG)
OF49 ⊗	City of Portland Outfall
WR-189 ◇	Potential Historical Outfall (Inactive)

Note: Base map prepared from an electronic file provided by Hart Crowser.

Environmental Protection Agency (EPA) Preliminary Remediation Goals - Remedial Action Objectives (RAOs)		cPAH
RAO4	Human Health Groundwater	0.001 µg/L
RAO8	Ecological Toxicity Groundwater	--

cPAH Results - June 2016

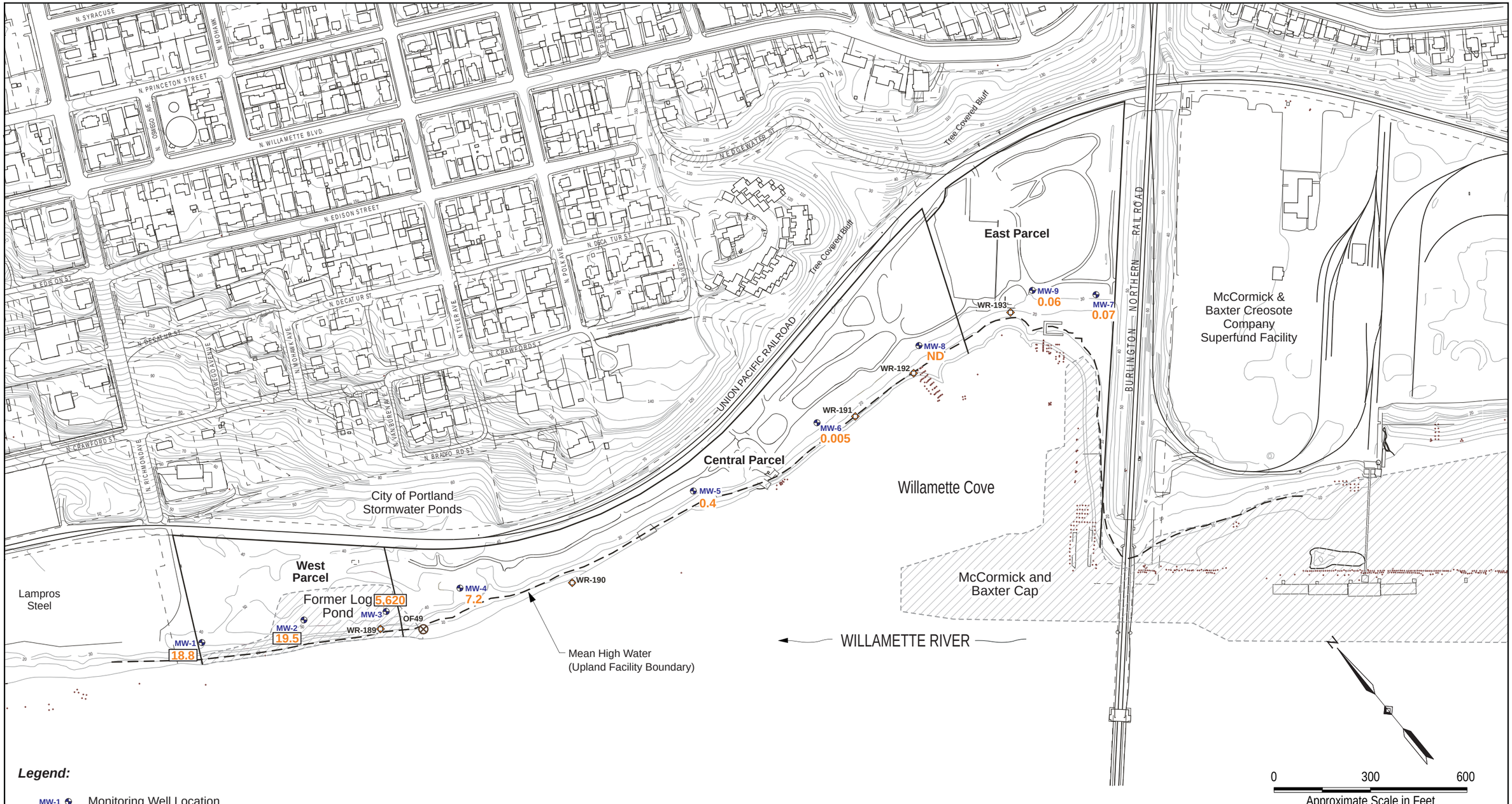
Groundwater Data Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number 1056-12

October 2016

Figure 6



Legend:

MW-1 / 18.8	Monitoring Well Location Total Polychlorinated Biphenyls (PCBs) Concentration in nanograms per liter (ng/L)
ND	Not Detected
▭	Exceeds Preliminary Remediation Goal (PRG)
OF49 ⊗	City of Portland Outfall
WR-189 ◇	Potential Historical Outfall (Inactive)

Note: Base map prepared from an electronic file provided by Hart Crowser.

Environmental Protection Agency (EPA) Preliminary Remediation Goals - Remedial Action Objectives (RAOs)		
RAO4	Human Health Groundwater	--
RAO8	Ecological Toxicity Groundwater	10 ng/L

Total PCBs Above EPA PRGs

Groundwater Data Report
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-12	Figure
October 2016		7

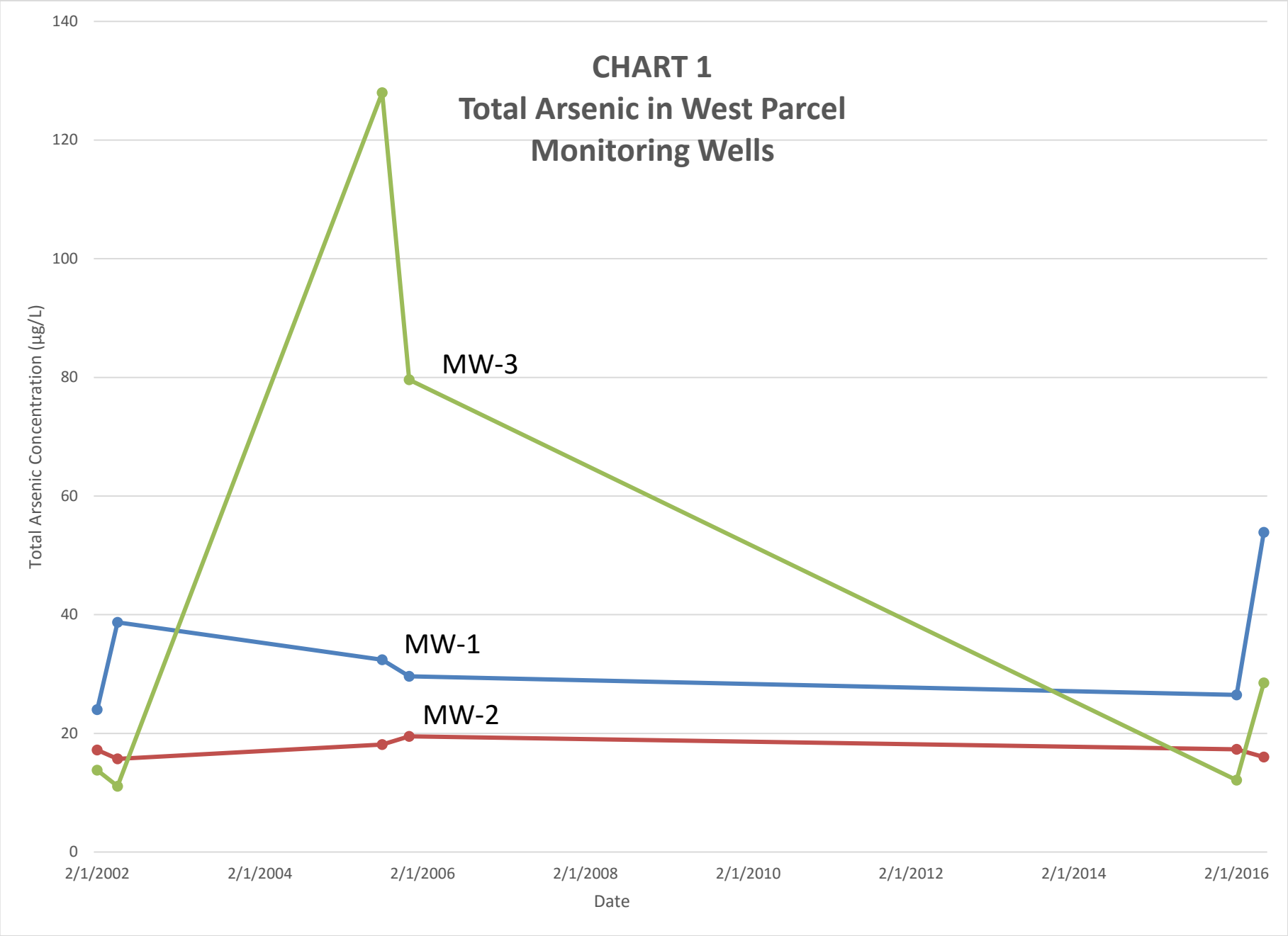


CHART 1
Total Arsenic in West Parcel
Monitoring Wells
Total Arsenic Concentration (µg/L)
140
120
100
80
60
40
20
0
MW-3
MW-1
MW-2
2/1/2002
2/1/2004
2/1/2006
2/1/2008
2/1/2010
2/1/2012
2/1/2014
2/1/2016
Date

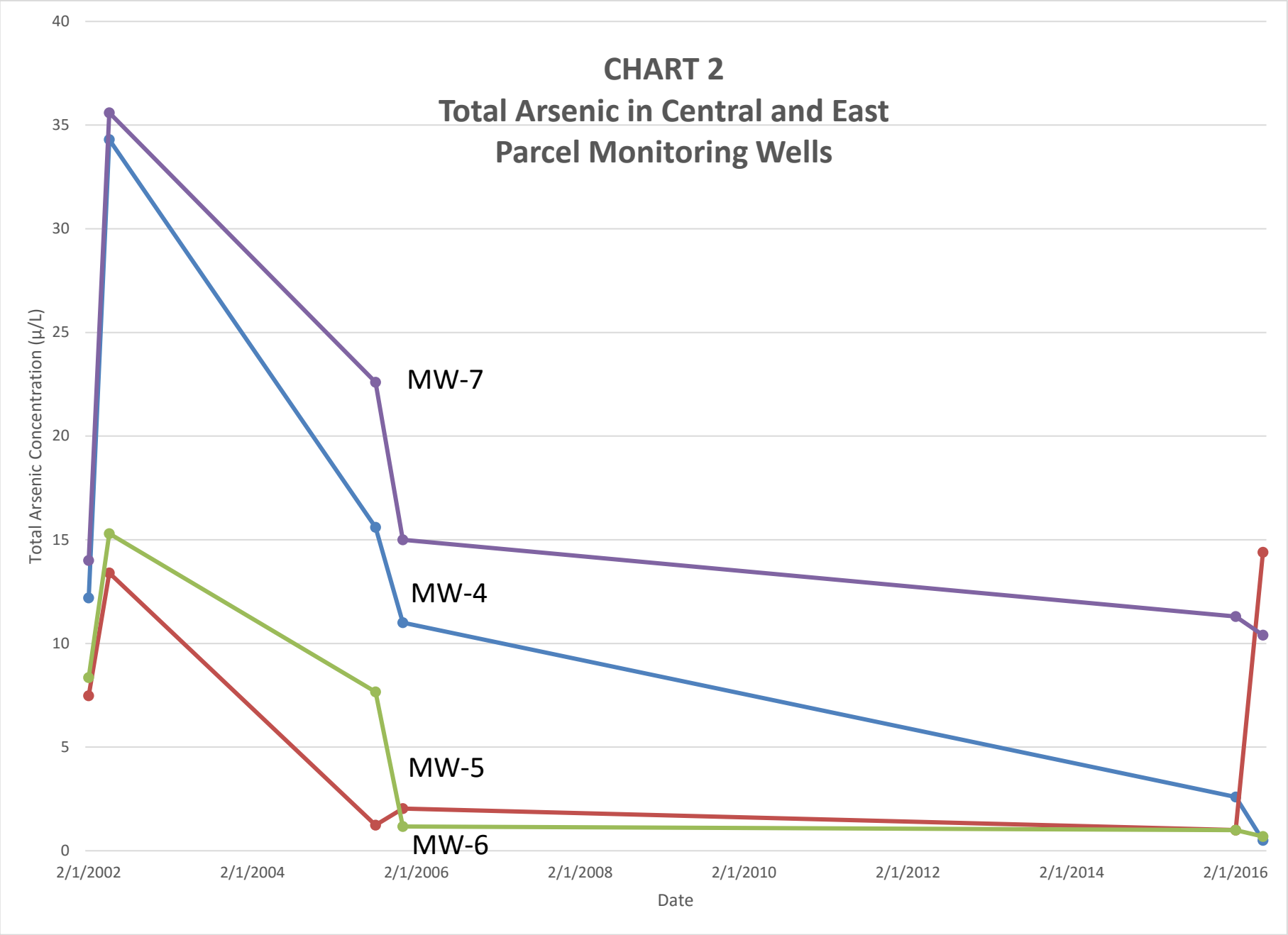


CHART 2
Total Arsenic in Central and East
Parcel Monitoring Wells
Total Arsenic Concentration (µ/L)
40
35
30
25
20
15
10
5
0
2/1/2002
2/1/2004
2/1/2006
2/1/2008
2/1/2010
2/1/2012
2/1/2014
2/1/2016
Date
MW-7
MW-4
MW-5
MW-6

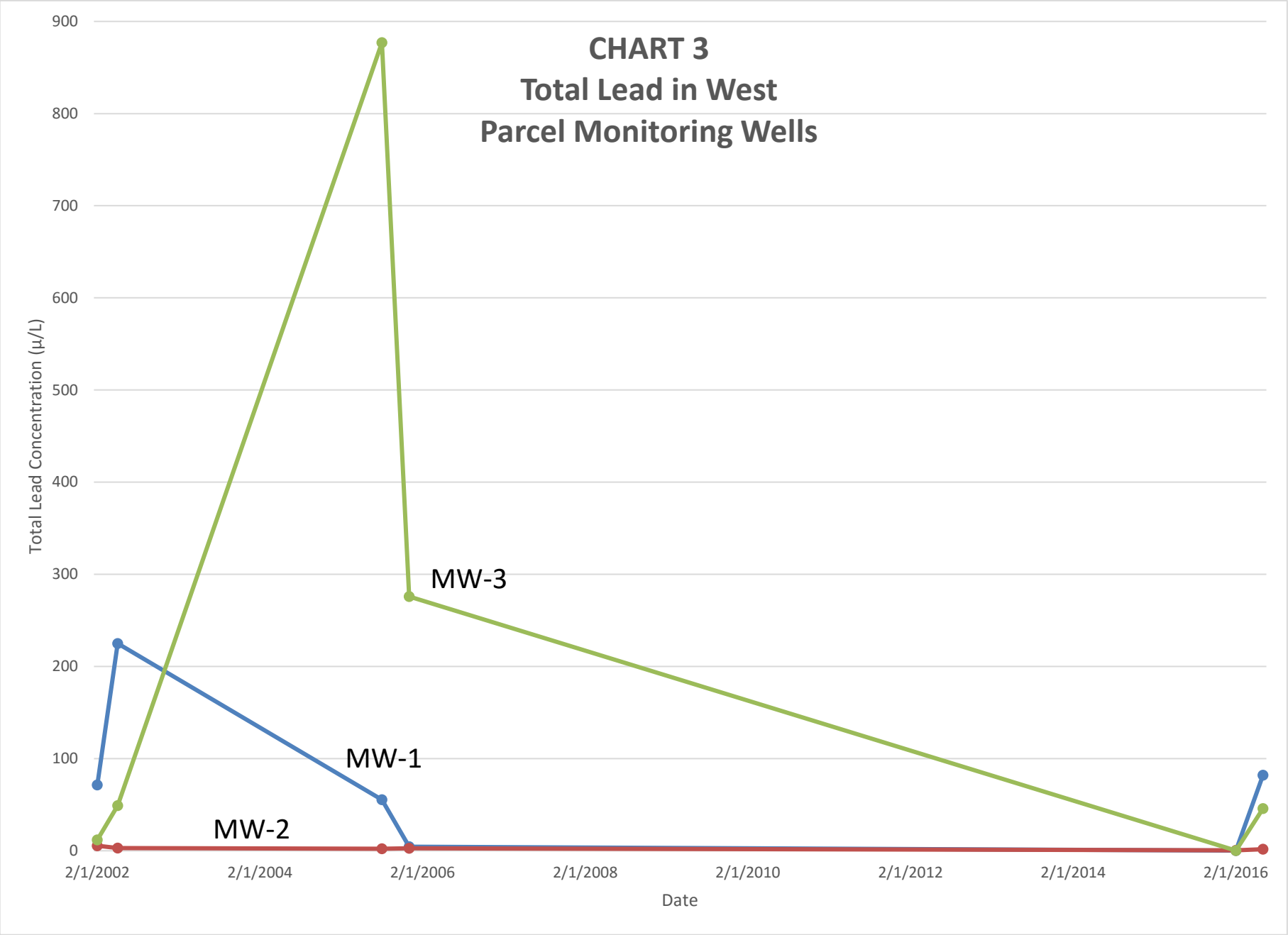


CHART 3
Total Lead in West
Parcel Monitoring Wells
Total Lead Concentration (µ/L)
900
800
700
600
500
400
300
200
100
0
2/1/2002
2/1/2004
2/1/2006
2/1/2008
2/1/2010
2/1/2012
2/1/2014
2/1/2016
Date
MW-3
MW-1
MW-2

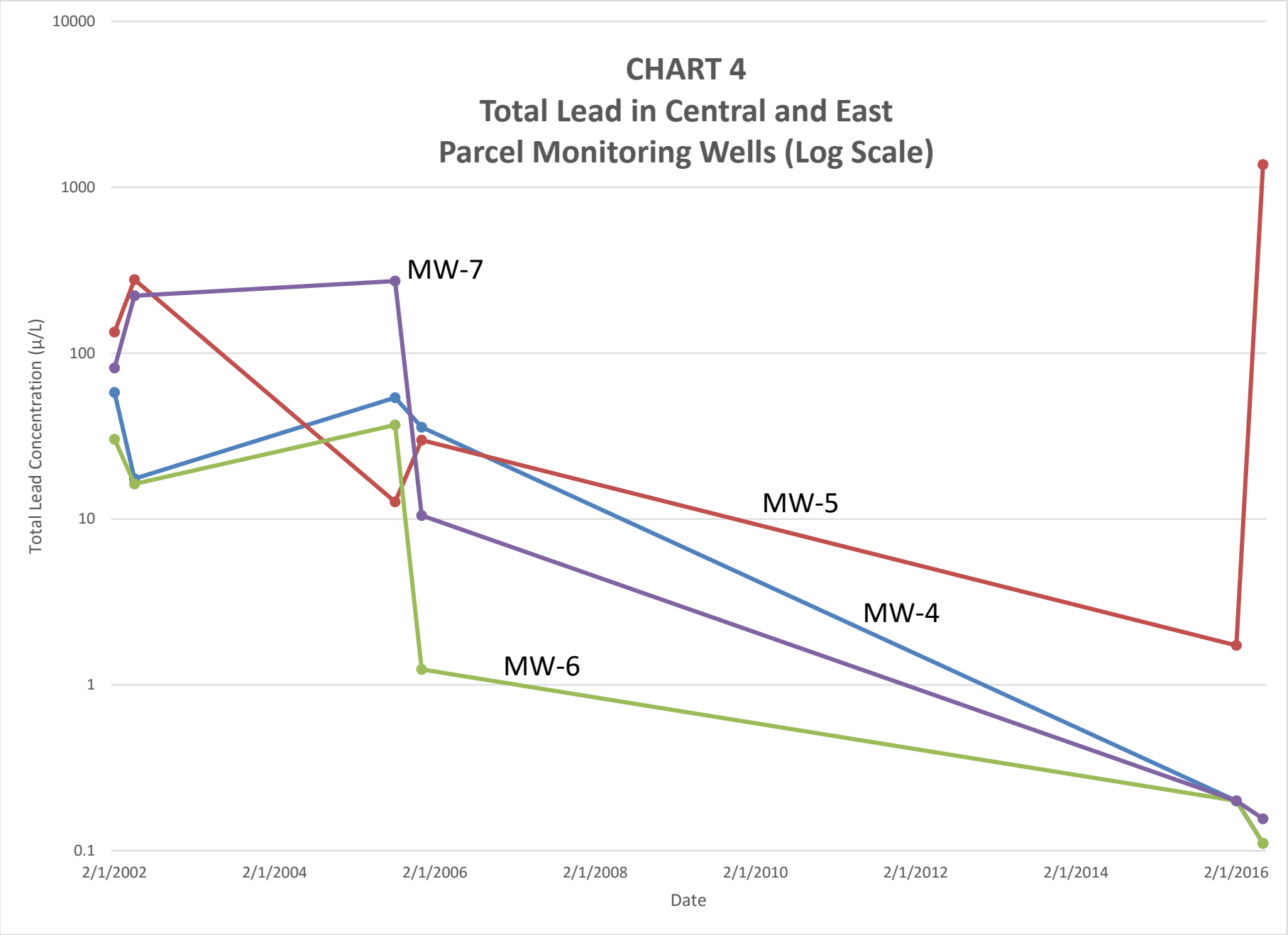


CHART 4
Total Lead in Central and East
Parcel Monitoring Wells (Log Scale)
10000
1000
100
10
1
0.1
Total Lead Concentration (µ/L)
MW-7
MW-5
MW-4
MW-6
2/1/2002
2/1/2004
2/1/2006
2/1/2008
2/1/2010
2/1/2012
2/1/2014
2/1/2016
Date

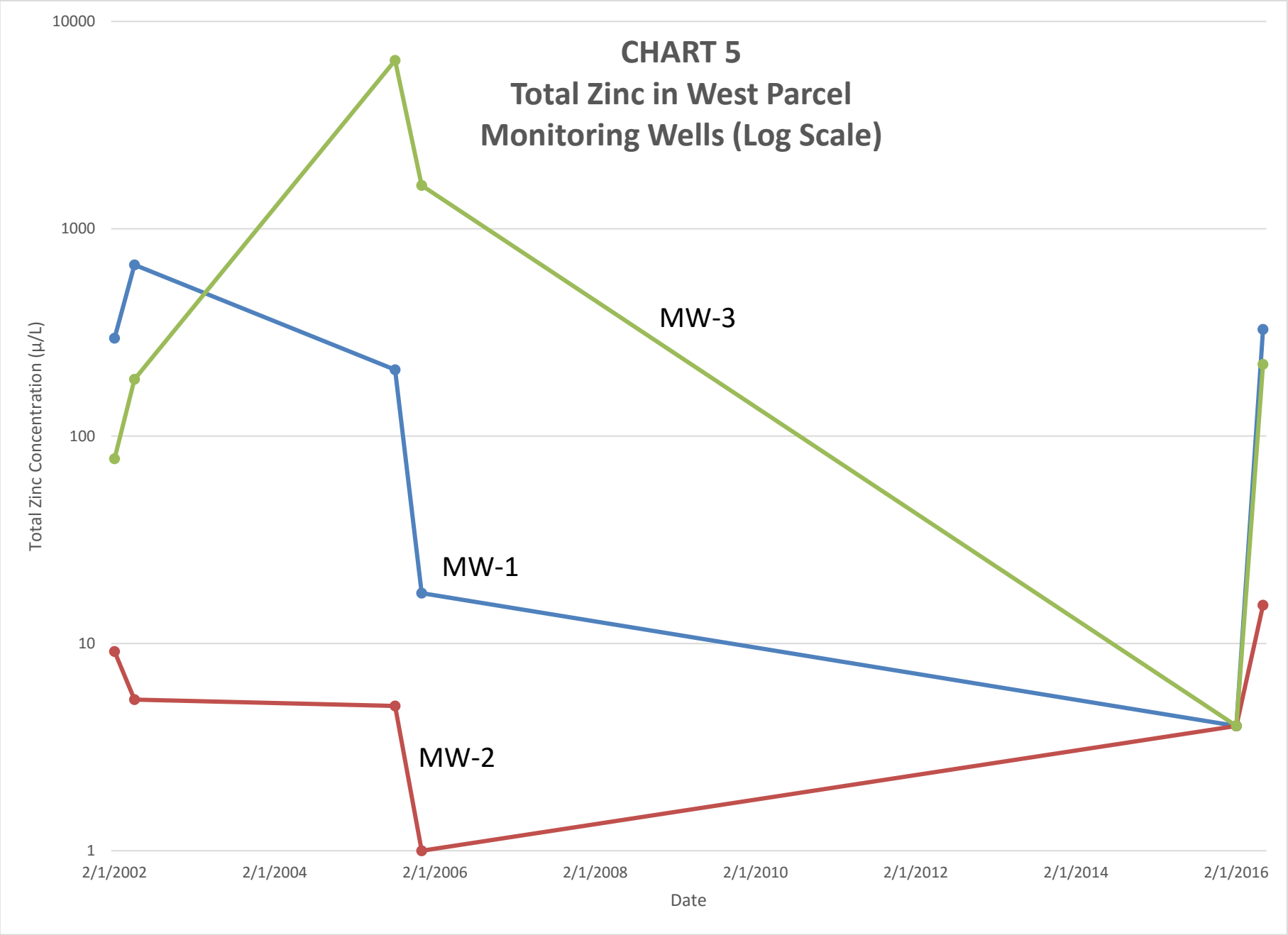


CHART 5
Total Zinc in West Parcel
Monitoring Wells (Log Scale)
10000
1000
100
10
1
Total Zinc Concentration (µ/L)
MW-3
MW-1
MW-2
2/1/2002
2/1/2004
2/1/2006
2/1/2008
2/1/2010
2/1/2012
2/1/2014
2/1/2016
Date

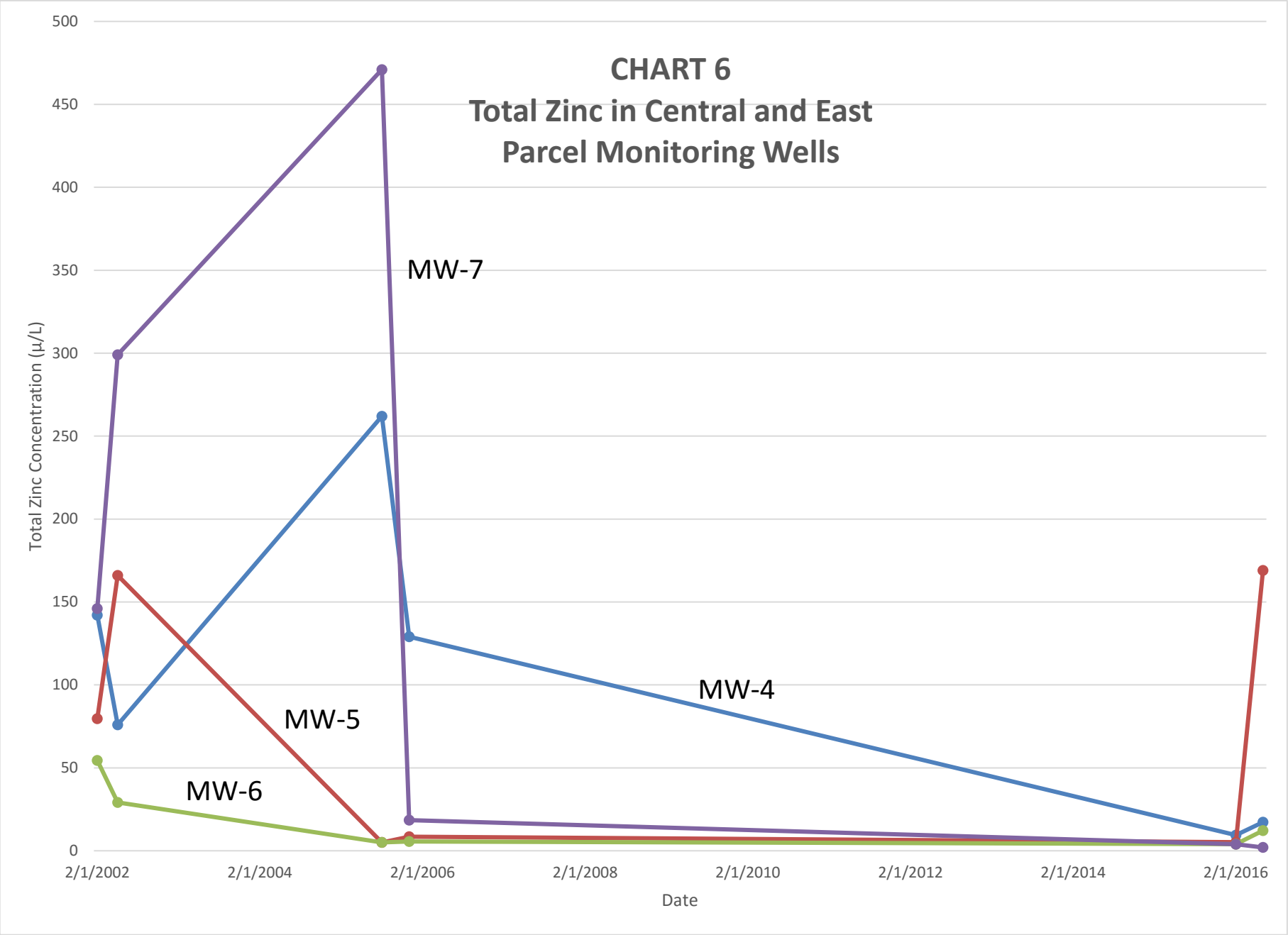


CHART 6
Total Zinc in Central and East
Parcel Monitoring Wells
Total Zinc Concentration (µ/L)
500
450
400
350
300
250
200
150
100
50
0
2/1/2002
2/1/2004
2/1/2006
2/1/2008
2/1/2010
2/1/2012
2/1/2014
2/1/2016
Date
MW-7
MW-4
MW-5
MW-6

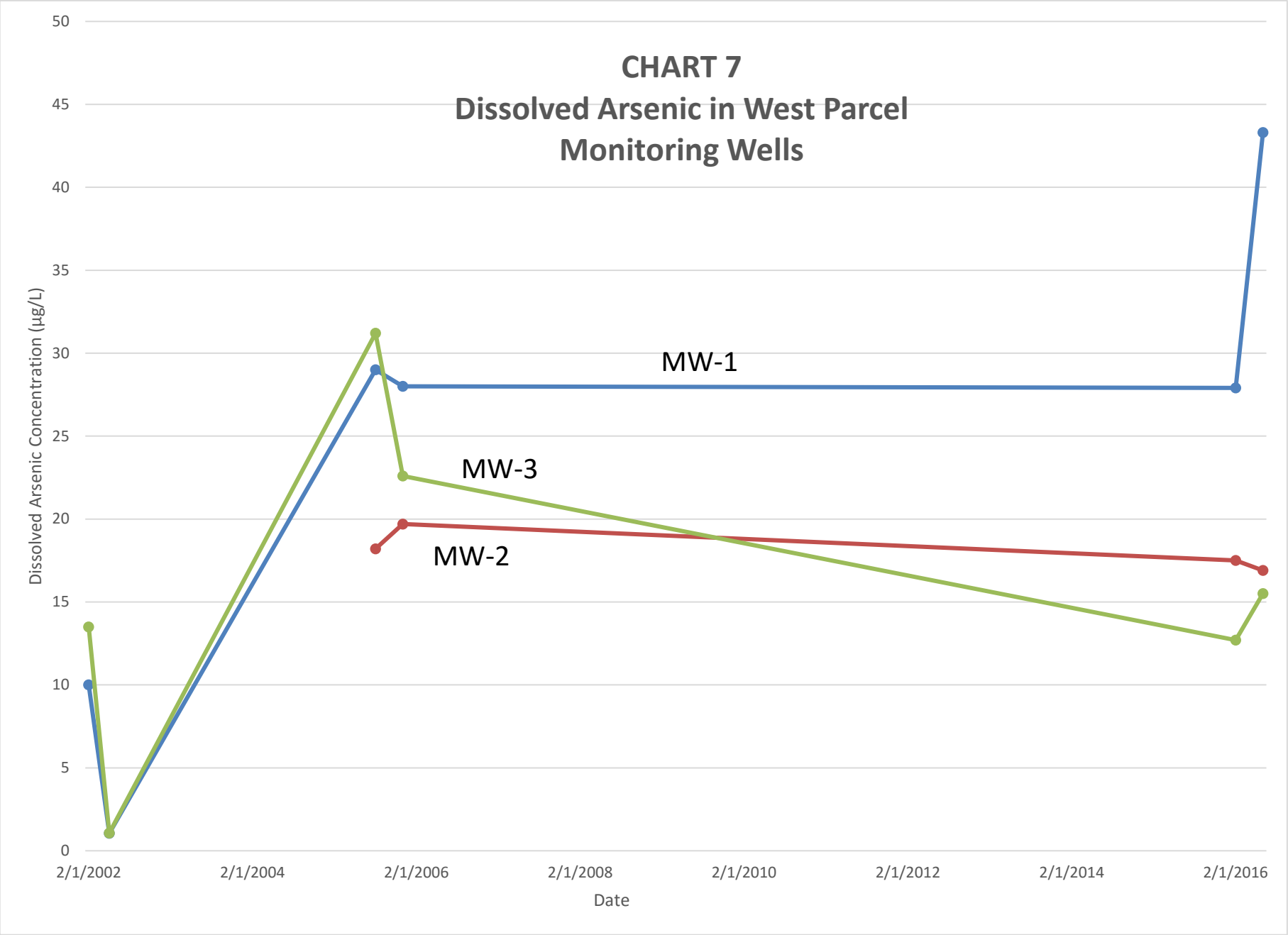


CHART 7
Dissolved Arsenic in West Parcel
Monitoring Wells
Dissolved Arsenic Concentration (µg/L)
50
45
40
35
30
25
20
15
10
5
0
MW-1
MW-3
MW-2
2/1/2002
2/1/2004
2/1/2006
2/1/2008
2/1/2010
2/1/2012
2/1/2014
2/1/2016
Date

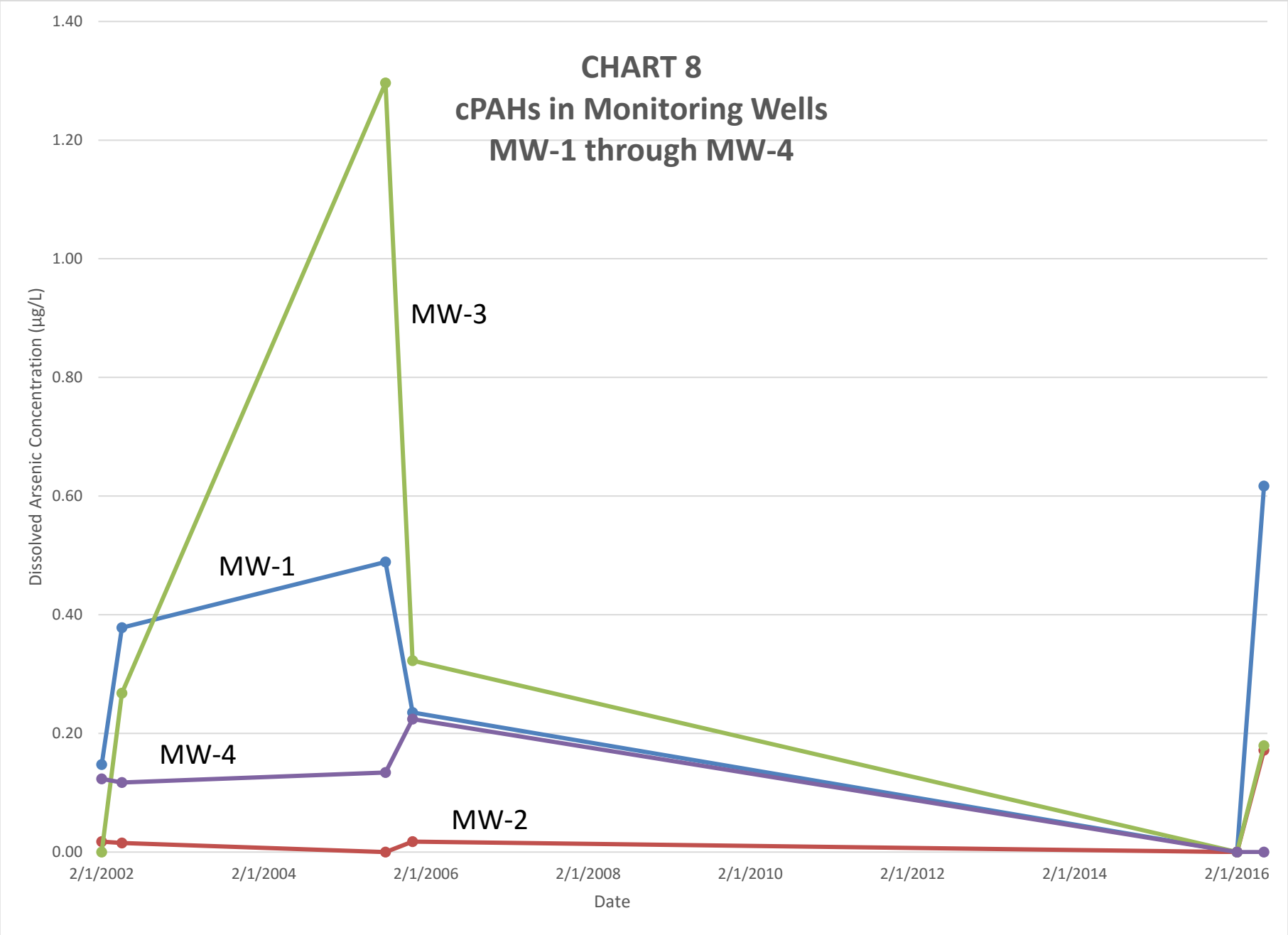


CHART 8
cPAHs in Monitoring Wells
MW-1 through MW-4
Dissolved Arsenic Concentration (µg/L)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
MW-3
MW-1
MW-4
MW-2
2/1/2002
2/1/2004
2/1/2006
2/1/2008
2/1/2010
2/1/2012
2/1/2014
2/1/2016
Date

Attachment A-8

DEQ Comments, September 2016 Groundwater Data Report, Willamette Cove Upland Facility and Email Response – March 2017

Oregon
Kate Brown, Governor

Department of Environmental Quality
Northwest Region
700 NE Multnomah Street, Suite 600
Portland, OR 97232
(503) 229-5263
FAX (503) 229-6945
TTY 711

March 7, 2017 *via electronic delivery*

Dwight Leisle, PE
Port of Portland
7200 NE Airport Way
Portland, OR 97218

RE: September 2016 Groundwater Data Report
Willamette Cove Upland Facility
ECSI# 2066

Dwight:

DEQ staff completed review of the ***September 2016 Groundwater Data Report, Willamette Cove Upland Facility*** (Report) prepared by Apex on behalf of the Port of Portland (Port) and dated January 26, 2017. The Report documents the results of monitoring conducted in accordance with the Revised Groundwater Monitoring Work Plan (Apex 2016) approved by DEQ. A few comments are presented below for your consideration in preparation of the revised Upland FS and SCE scheduled for submission to the agency in June.

Future Screening. With issuance of the Portland Harbor ROD, source control screening should be based on Cleanup Levels/Targets presented in Table 17 of the ROD. If not available, SLVs from Table 3-1 of the JSCS should be used. To the extent that upland releases might impact Willamette River sediment, sediment RALs and PTW thresholds presented in Table 21 of the ROD (notably for PCBs and dibenzo-dioxins and -furans) should also be considered.

Small Typo. Text in Section 4.1 of the Report references 5.10 to 15.50 bgs (second paragraph). It appears that the appropriate "datum" should be City of Portland Datum.

Data Observations. DEQ presents a few observations from review of the Report data tables, all of which will warrant evaluation in the upcoming revised Upland FS.

- Arsenic. This contaminant is notably elevated in *dissolved* groundwater samples at the MW-1, -2, and -3 locations within the West Parcel. While detections of arsenic in groundwater can often be attributed to natural (background) conditions, this does not appear to be the case here. The cleanup level in the Portland Harbor ROD (0.018 ug/L for groundwater) is exceeded by orders of magnitude. The presumed source of the arsenic is extensive West Parcel fill, although the MW-1 location, with the highest concentrations of dissolved arsenic (to 56.9 ug/L) is shown as being outside of the fill "footprint".
- PAHs. As with arsenic, PAHs are elevated at the MW-1, -2, and -3 locations, and presumably associated with West Parcel fill (excepting MW-1?). The *variability* of sampling results at all three locations is curious, with a pronounced increase in detections during the June and

September 2016 sampling events (as compared to February). It would be helpful to evaluate the extent to which turbidity or water level elevations might be impacting sampling results. Detections significantly exceed groundwater Cleanup Levels presented in the Portland Harbor ROD.

- PCBs. All West Parcel well locations show evidence of PCB impacts, although as with PAHs, there is quite a bit of variability in sampling results, most notably at the MW-3 location. As with PAHs, discussion of sample turbidity, etc. may provide some be illustrative in that there is quite a bit of variability in results.
- NA Parameters. Arsenic "speciation" is presented from the EPA 1632 analytical methodology; results are not discussed in the report. DEQ notes that Arsenic III is predominant in most samples including at the MW-1 location where the element is most elevated. Turbidity data are not presented for MW-3 through MW-9 relating to the December 2016 sampling event, and for previous events in selected wells. These data have value in assessing the representativeness of detected contaminants. Finally, explanation is not provided in Table 7A Notes for some data qualifiers (H, M, and B).
- Dioxin and Pesticides. The isolated detections of dioxin and 4,4-DDD represent significant exceedance ratios as indicated in the report.
- TPH. Under the Portland Harbor ROD, a cleanup level for TPH-diesel is not presented, excepting the 2.6 ug/L value for C10-C12 range aliphatic compounds.

I can be reached at (503) 229-5417 if you have questions or comments.

Respectfully,

Daniel Hafley, Project Manager/Hydrogeologist
NWR Cleanup Section

Ec: Jennifer Sutter, DEQ
Carmen Owens, Apex
Herb Clough, Apex
Katy Weil, Metro

Cc: ECSI# 2066

From: Carmen Owens
To: HAFLEY Dan
Cc: Herb Clough; "katy.weil@oregonmetro.gov"; "Leisle, Dwight"; SUTTER Jennifer
Subject: RE: Willamette Cove Data Report Schedule
Date: Thursday, March 9, 2017 11:03:00 AM

Hi Dan

Thank you for the comments, we will incorporate these comments and suggested changes into the fourth quarter groundwater data report.

Carmen

Carmen Owens, E.I.T.
Project Manager,

Apex Companies, LLC
3015 SW First Avenue
Portland, OR 97201

O) 503-924-4704 x1904 M) 503-974-6056

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From: HAFLEY Dan [mailto:dan.hafley@state.or.us]
Sent: Tuesday, March 7, 2017 9:16 AM
To: 'Leisle, Dwight' <Dwight.Leisle@portofportland.com>; Carmen Owens <COwens@apexcos.com>; SUTTER Jennifer <jennifer.sutter@state.or.us>
Cc: Herb Clough <HClough@apexcos.com>; 'katy.weil@oregonmetro.gov' <katy.weil@oregonmetro.gov>
Subject: RE: Willamette Cove Data Report Schedule

Dwight –

You are of course right. My apologies. DEQ comments on the September 2016 report are attached for your consideration.

DH

From: Leisle, Dwight [mailto:Dwight.Leisle@portofportland.com]
Sent: Tuesday, March 07, 2017 9:00 AM
To: 'HAFLEY Dan'; 'Carmen Owens'; SUTTER Jennifer
Cc: Herb Clough
Subject: RE: Willamette Cove Data Report Schedule

Dan,

Do you mean you are working on a comment letter for the September 2016 groundwater report? We have not sent you the December 2016 report (although we sent you the preliminary Dec 2016 groundwater tables in an email on 02/13/2017).

Dwight

From: HAFLEY Dan [mailto:dan.hafley@state.or.us]
Sent: Tuesday, March 07, 2017 8:32 AM
To: 'Carmen Owens'; SUTTER Jennifer
Cc: Herb Clough; Leisle, Dwight
Subject: RE: Willamette Cove Data Report Schedule

Carmen –

Thank you. I am working on a comment letter for the December 2016 groundwater report, which I hope to have to you shortly.

From: Carmen Owens [mailto:COwens@apexcos.com]
Sent: Monday, March 06, 2017 1:44 PM
To: HAFLEY Dan
Cc: Herb Clough; Leisle, Dwight
Subject: Willamette Cove Data Report Schedule

Dan

The follow up soil samples for Willamette Cove West Parcel Groundwater Investigation have been sent to the lab. We expect complete results in 3-4 weeks (due to the long analysis time for dioxins). Once we have the complete data set from the soil samples, we will incorporate the soil results into the December 2016 Groundwater Data Report and provide that to you as one report. Detailed analysis of the data from this report will be incorporated in the upcoming Feasibility Study/Source Control Evaluation for the site.

Thanks
Carmen

Carmen Owens, E.I.T.
Project Manager,

Apex Companies, LLC
3015 SW First Avenue
Portland, OR 97201

O) 503-924-4704 x1904 M) 503-974-6056

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Attachment A-9

Response to DEQ Comments, Combined Feasibility Study and Source Control Evaluation, Willamette Cove Upland Facility – March 2019

March 7, 2019

Dan Hafley
Oregon Department of Environmental Quality
700 NE Multnomah Street, Suite 600
Portland, OR 97232

Subject: **Response to Comments**
Combined Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
ECSI No. 2066

Dear Dan:

This letter provides the Oregon Department of Environmental Quality (DEQ) with a response to comments received on the *Combined Feasibility Study and Source Control Evaluation – Willamette Cove Upland Facility* (FS/SCE; Apex, 2017). The comments were provided to the Port of Portland (Port) in a letter from the DEQ dated January 24, 2018. Comments on the FS/SCE from the U.S. Environmental Protection Agency (EPA) and Metro were provided concurrently in letters dated November 14, 2017 and January 23, 2018 respectively. DEQ, EPA and Metro comments are repeated (in italics) followed by the Port response.

DEQ Comments

GENERAL COMMENTS

General Content. The document largely relies on discursive text when development of summary tables and figures would be more useful for illustrating risk information that supports remedial decision-making.

Response: Use of language will be carefully considered in the Revised FS/SCE with a specific focus on being more specific and concise and will refer to summary tables and figures when appropriate.

Basis for Revised FS/SCE Submission. There are a number of FS- and SCE-related documents that preceded submission of the September 2017 document. These include a February 2013 Source Control Evaluation and 2014 Feasibility Study for the site uplands, regulatory comments on the documents, and, in some cases, responses by the Port. The FS should present an overview of these submissions and confirm that past comments by DEQ and EPA are addressed in the current FS/SCE. An appendix should be included that documents previous comments and indicates for each comment where in the document the comment is addressed.

Response: A new Appendix A has been added to the Revised FS/SCE document. This Appendix includes a narrative describing the legal, regulatory, and document submittal history leading to the current Combined FS/SCE. Revisions have also been made to Section 1 (Introduction) referring to Appendix A and summarizing the history. In addition, regulatory comments and responses are documented for the *Source Control Evaluation* (February 2013), *Feasibility Study* (2014), *Removal Action Completion Report* (May 2016), *Groundwater Data Report* (May 2017), and *Recommendations for Willamette Cove Upland FS/SCE – Screening and Illustration of Contaminant Data* (January 2018).

<u>Contaminants of Concern.</u> The conceptual site model, and associated discussion in the FS/SCE, need to be updated to reflect the exceptionally high concentrations of dioxins that have been detected at the site, the source(s) of which are unclear. Mercury is also notably elevated at the site, including at selected bankline locations. Discussion of these two COCs, in particular, is inadequate. DEQ is not expecting the site risk assessment to be redone. We are expecting the residual site risk in the upland site (including bankline) be conveyed in a sufficiently comprehensive and clear manner to support remedy selection.

Response: Historical operations at the Facility include a range of industrial uses that have the potential to be sources for dioxin/furans, mercury, and other COCs for the Facility. A specific source of high concentrations of dioxin/furans and mercury beyond the Facility history is unknown.

Revisions have been made to Sections 2, 3, and 5 to more clearly present the residual, or current, risk at the site. Section 5 includes a discussion of the nature and extent of contamination, and how this relates to the conceptual site model.

An updated COC evaluation was conducted to incorporate data collected since completion of the Residual Risk Assessments for the Facility. The evaluation was presented in memo dated December 28, 2018. The updated evaluation has been discussed and incorporated throughout the FS/SCE as appropriate to present the current risk to ecological and human receptors at the Facility more clearly.

<u>Data Presentation, General.</u> It is DEQ's expectation, as has been articulated both verbally and in written communication, that the results of recent site investigation and the 2015/2016 uplands hot spot removal action are to be incorporated in the final upland FS. For soil, what has been presented is a "data dump" that largely does not discriminate between pre- and post-removal sampling results, or outline the current risk profile for the site as necessary for remedial decision-making. Figures in the document illustrating excess risk and hot spots in the upland have likewise not been updated. Updated risk screening is performed for source control only (see additional discussion below). DEQ has provided specific recommendations on data presentation and screening, both for the upland and riverbank portions of the site, that are present as an attachment to this letter.

Response: Revised data presentation and screening have been included in the Revised FS/SCE that reflect recent site investigations and the 2015/2016 removal action. Additional description is included in the response to specific comments below. The attachment to this letter referred to in the last sentence of the comment is missing. We confirmed this attachment was provided in the 01/22/18 DEQ email.

<u>Risk Screening for Remedy Development and Selection.</u> Data screening and presentation are confusing. In general, analysis of "upland" soil data for exceedance quotient and hot spot development, including human and ecological receptors, should encompass data from the eastern site perimeter to the MHW line of the riverbank. Source control screening for soil should encompass the top of bank area (we

recommend within 50 feet of top-of-bank) to the waterline. Consistent with the Portland Harbor ROD, screening of erodible soil should include Table 17 Cleanup Levels, and Table 21 Remedial Action Levels and Principal Threat Waste thresholds. As with DEQ hotspots, there is an expectation by EPA that PTW will undergo active remedial measures to the extent feasible. Exceedances of CULs or RALs in potentially erodible soil are expected to require remedial measures that may include removal, capping, or other. Please consider. Independent of this letter, DEQ will provide recommendations on data presentation for the Revised FS/SCE document.

Response: New data presentation and screening for both the Facility upland and source control have been included in the Revised FS/SCE consistent with this comment; the subsequent clarifying meetings between DEQ, the Port, and Metro; and the April 18, 2018 email from DEQ.

As defined during technical meetings conducted between DEQ, the Port, and Metro, upland soil at the Facility is defined as any soil landward of mean high water (MHW) within the Facility boundaries. The current upland soil dataset will include all samples collected at the Facility that have not been removed during either the 2008 or 2015 soil removal actions.

EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. Based on this determination, source control information that was included in the SCE section and additional requested materials are now presented in Appendix D.

<u>Nature of Riverbanks.</u> Most of the Willamette Cove riverbank is considered "EPA riverbank", being listed in Section 6.6.6 and shown on Figure 9 of the ROD, and adjoining in-water Sediment Management Areas. Please discuss and consider in data screening, presentation, and remedial alternative development.

Response: Additional description of how this site fits within the Portland Harbor Superfund Cleanup, and the effects this has on the decisions for an upland remedy are included in Section 4 (former Section 3) and throughout the rest of the document as appropriate.

<u>Viability of Soil Removal/Consolidation Alternatives.</u> For alternatives that involve contaminant consolidation or full removal, including recommended Alternative 5, there is an assumption that removal of soil across the site in the range of 2 to 3 feet below ground surface (bgs) will result in residual contaminant concentrations meeting cleanup standards for both human and ecological receptors. It is unclear that this is a safe assumption given that contaminants have been detected at significant depth in selected site areas, including the Central Parcel (dump area) and West Parcel (former log pond area). More data analysis/presentation is necessary to support this assumption.

Response: The removal depths of 2 to 3 feet used for the alternatives analysis was developed in Section 5.1.1 by summarizing the likely depths of contamination based on site data. These depths were used to compare alternatives and were not meant to be definitive removal depths or volumes. The basis for these removal depths is expanded in Section 5.1.1 of the Revised FS/SCE. Confirmation sampling will need to be performed, and removal will continue until confirmation samples achieve acceptable concentrations. This was specified in the alternative descriptions, but the importance of this factor has been clarified.

<u>Viability of Recommended Alternative 7.</u> This alternative, one of two recommended remedies in the FS/SCE, relies on: a) a thin (1 foot) amended cap for protection of ecological receptors (including riverbank areas); and b) signage, engineering controls during construction work, and deed restrictions to protect human health. This remedy is unlikely to be protective on a long-term basis. Alternatives 3a, 4, and 7 rely on thin capping, but their long-term effectiveness/reliability is questioned in the FS. Inclusion of a demarcation layer would seem to be helpful for monitoring cap competency, but is not discussed.

Response: As part of the subsequent discussion on this comment during technical meetings, it was agreed that the Revised FS/SCE would include evaluation of confirmation sampling, as part of the long-term O&M. Confirmation sampling to assess cap performance and a demarcation layer will also be evaluated.

<u>Impediments to remedy implementation.</u> There is no significant discussion of relict structures on the property, in the form of structural debris and foundations, dock remnants, etc. These would appear to be a major challenge, in some site areas, to both soil removal and capping (including the riverbank). A similar consideration would be variations in upland topography, in particular for a thin cap remedy.

Response: Removal of relict structures has been taken into consideration for cost estimates.

<u>Future Site Use/Access Restrictions.</u> Proposed remedies assume that human access to the upland site will be limited (trails, benches, viewing sites, etc.) and that access to site riverbanks and beaches will not be limited. Restrictions to access will be implemented with "…a combination of signs, paved trails, and physical barriers such as railings and fencing."

To date, limiting access to the site has proven challenging at best, and trespass commonly occurs. Given the size and location of the site, it is unclear whether access can be restricted as suggested. The FS should discuss how these restrictions might be maintained, and whether they would be the responsibility of current site owner Metro. Costs associated with long-term site management, in particular for recommended Alternatives 5 and 7, need to be included in the cost estimates and the balancing factor discussion.

As a corollary to this first point, further discussion should be presented as to whether access restrictions are necessary under the recommended remedy, notably Alternative 7. Assuming that removal of contamination above the designated human health cleanup levels is successfully completed, restrictions on access may not be necessary. More discussion/analysis is warranted.

More information should be provided on likely future site use as envisioned by site owner Metro. A figure should be included in the document showing the location of the proposed bike path through the site, and any other development features.

Response: Site restrictions are discussed in Sections 2.4, 5.3, and within each remedial alternative evaluated in Section 9 as appropriate. The proposed bike path was added to Figure 2.

<u>Riverbank Remediation.</u> In the FS, the site riverbank has been included in the recommended upland remedy, with the upland delineated by MHW. The site riverbank is contaminated in many areas, with ongoing erosion to the river a known or potential concern. In other words, source control has not been achieved. EPA acknowledged the presence of riverbank contamination in their 2017 Portland Harbor

Record of Decision (ROD). Remediation of riverbank contamination, notably in the East and Central Parcel, will need to be completed in such a manner as to support adjacent in-water work. The FS needs to discuss how remediation of bankline soil, and associated layback and capping, might impact the proposed upland remedy. Laying back the riverbank slope to 3H:1V as proposed, particularly in areas where the bankline is steep, will have an impact on the final configuration of both the upland and the Greenway, and potentially the area proposed for soil consolidation and capping under Alternative 5. Also, thin capping (1 foot) of the riverbank is unlikely to be considered sufficiently projective on a long-term basis and approved by DEQ.

Response: EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. As such, the Revised FS/SCE addresses the remedy for upland soil, and does not include assessment of the riverbank. Coordination between the upland remedy and the in-water remedy (beginning at the top of bank) are discussed in the Revised FS/SCE.

Alternative 7 Details. More detailed information is necessary on the recommended remedy. The following items as well as any other factors that will impact remedy design should be discussed: a) estimated volume of soil to be consolidated; b) area and thickness of the consolidation area (including cap) with appropriate sloping; c) buffer between the consolidation area and bankline; and d) Greenway considerations.

Response: It is assumed this comment refers to Alternative 5, not 7. As part of the subsequent discussion on this comment, considerations for location of the soil consolidation area within the Facility were considered. It is likely that work on the riverbank as part of the in-water remedy will affect the possible size and location of the soil consolidation area. As such, a final decision on size, shape, and location of the soil consolidation area and other factors affecting the bankline will be finalized during remedial design.

Sustainability. Recommended Alternatives 5 and 7, as outlined in the (Table 25) Soil Alternative Evaluation Summary, would require 6,600 and 5,100 truck trips, respectively, along with tens-of-thousands of truck miles. Given the scope/scale of recommended remedial work, and the proximity of residential and commercial communities that would be impacted, a more formal analysis of the sustainability of the remedial alternatives is necessary. Sections 10 and 11 of the document should include a formal analysis of the sustainability of remedial action alternatives, including recommended alternatives. Elements to be considered in the remedy sustainability analysis include: energy and water requirements, air emissions, land and ecosystem impacts, material consumption and waste generation, and long-term stewardship actions. Please see EPA's Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites as a starting point.

Consideration must be given in the FS to alternative means of transport, including rail and barge, for removal of contaminated and clean media to and from the site.

Response: Consideration of rail and barge transport will be an important part of the implementation of this remedy. However, as a reasonable estimation of these costs is not possible without more information on the in-water remedy, trucks are used for comparison of alternatives. Language has been added throughout the document noting that from an implementation risk perspective both barge and rail are preferred transportation options, and these options will be evaluated during final design.

<u>Bankline Stabilization.</u>

- *DEQ (and EPA) recommend that the Bank Assessment for Non-Point Source Consequences of Sediment (BANCS) model, developed by Dave Rosgen, be used to assess the potential for erosion of the WC bankline. The BANCS model includes estimation of a Bank Erosion Hazard Index (BEHI) and the Near Bank Stress (NBS). The BEHI considers factors including the amount of surface protection, bank angle, bank height, and root depth and density in identifying erosion risk. We recommend that index "ratings" be applied at a maximum resolution of 100 feet. The NBS can be estimated using several different methods. We recommend using available site information to select and evaluate the most applicable method(s).*
- *Given the manner in which information is presented in Figures 29-32, it is difficult to envision what bankline remedy will be applied to what portions of the bankline. Please include detailed figures showing the expected bankline remedy for Alternatives 5 and 7.*
- *DEQ is concerned that laying back and remediating the upper bankline (above MHW) alone could present logistical problems for in-water remediation. On a steep riverbank slope, laying back only the riverbank above MHW could result in an unnatural grade-break at the MHW line that could be logistically difficult and technically impractical to address as part of the in-water remediation.*
- *The Port previously discussed laying back the site riverbank, perhaps to a slope of up to 5H:1V for the purpose of gaining restoration credits. To the extent that this is being considered for any portion of the bankline it should be discussed in the FS.*
- *The riverbank FS should include a baseline Habitat Equivalency Analysis and evaluate the remedial alternatives on habitat quality. The purpose of this is to determine if mitigation will be required, as if so, identify the costs. This will also help to ensure that the selected remedial alternative can be permitted.*

Response: See response to General Comment on Risk Screening for Remedy Development and Selection. An April 18, 2018 email from DEQ confirmed that EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. Riverbank and shallow in-water data from the Willamette Cove site, erosion analysis, etc. are presented in new Appendix F of the FS/SCE for EPA consideration.

<u>Data Uncertainty, Riverbank.</u> There is considerable uncertainty as to contaminant conditions in subsurface riverbank soil given a general absence of data. Recommended remedies include soil removal and layback of the upper riverbank to achieve a grade of 3H:1V in the Central and East Parcel areas. Depending on the results of post-layback sampling, additional soil removal or more robust capping may be necessary.

Response: An April 18, 2018 email from DEQ confirmed that EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. Forthcoming pre-design work is expected to include additional riverbank and beach contaminant characterization work.

<u>Consistency of Upland and Riverbank Remedies with Portland Harbor.</u> DEQ recommends that a section be added to the report discusses the consistency of both risk screening remedial decision-making with the 2017 Portland Harbor Superfund Site Record of Decision. This would include both the relevance of CL, RALs, and PTW thresholds presented in Tables 17 and 21 of the ROD, and remedial requirements outlined in Section 14 of the EPA document.

Response: The Portland Harbor Cleanup Levels, Remedial Action Levels, and Principal Waste Thresholds have been added to Section 3.2.2.1 which discusses screening levels and their relevance.

Coordination of Remedy Implementation with In-Water Work. DEQ, Metro, and the Port all acknowledge that upland and in-water remediation work needs to be coordinated in such a way as to: a) efficiently export contaminated materials and import clean fill for both in-water and upland remediation; and b) allow for a "seamless" construction of upland and in-water remedial elements. This would include, ideally, layback and remediation of the entire bankline in one construction event.

Response: Noted. See also response to General Comment on Risk Screening for Remedy Development and Selection and response to General Comment on Riverbank Remediation.

SPECIFIC COMMENTS

Section 2.1. Related to the topographic information presented here: it would be helpful to include a few (generalized) bankline cross-sectional figures illustrating the elevations and relative position of: top of bank, MHW, MLW, OHW, OLW, and toe of bank. Consider preparing figures for at least two representative bankline sections with differing character where remedial action is contemplated, for example the East Parcel inner cove and Central Parcel. This will be helpful in showing what portion of the bankline will be "addressed" (or not addressed) by recommended remediation measures. OHW is an important datum as it triggers the need for USCOE 404 permitting and consultation.

Under "Topography" on Page 3, text indicates that the upland elevation is typically 30-45' (NAVD88), but as high as 55' in the West Parcel. The river elevation is indicated as "typically less than 10 feet," and the riverbank a generally steep "20- to 3-foot slope down to the river." It is unclear if the math adds up; the cross-sectional figures will be helpful.

Response: Figure 3 was added to the Revised FS/SCE showing a cross section of the Inner Cove and Central Parcel respectively.

Section 2.2. Please update this section to include discussion of potential/known sources of dioxins at the site, which have been detected at exceptionally high concentrations in the Central Parcel and represent the most significant site-wide risk. Include discussion of the "dump area" that was discovered during the 2015/2016 removal action, the surmised source of this material (an on- or off-site foundry?), and other information pertinent to sources in this area. The surmised source of mercury, which is notably elevated at the site, should be discussed.

Response: Section 2.2 was expanded to include discussion of the Central Parcel debris area and potential sources of the high dioxin concentrations. The source of the elevated mercury concentration is unknown.

Section 2.8.4. It does not appear that identified COPCs include consideration of source control criteria and the results of recent upland investigation and confirmation sampling. Please discuss/confirm. For source control, any contaminant exceeding EPA ROD Table 17 cleanup levels would be considered a COPC, as would any residual contamination in the uplands or riverbank exceeding human or ecological PRGs (presented in Tables 1 and 2 of the report) for "terrestrial" receptors. It is unclear how a number of compounds, including mercury, are not considered COPCs for human health. At the least, riverbank

detections exceeding 0.085 mg/kg mercury would exceed EPA's Table 17 cleanup level and warrant discussion.

Response: Residual risk at the site has been updated considering additional recent site investigations and the 2015/2016 removal action. An updated list of COCs is shown on Tables 1 and 3 (formerly Tables 1 and 2) of the Revised FS/SCE.

Section 2.8.6. It is DEQ's expectation that the FS/SCE include a robust discussion of "new" sampling results. For groundwater, this would include both re-development and sampling of existing wells MW-1 to -7, and additional groundwater characterization in the West Parcel. Both are described only briefly in this section. For West Parcel work, please include discussion of the basis for DEQ's request for additional characterization, which includes the detection of contaminants, including PCBs, in existing wells and information presented to DEQ on the source of fill material in the former log pond area.

Response: The description of recent groundwater sampling and results has been expanded in current Section 2.8.5 (formerly Section 2.8.6), along with a brief discussion of the basis for additional characterization. A more detailed description of the basis for DEQ's request for additional groundwater characterization is included in the narrative at the beginning of new Appendix A.

Section 2.9. We understand the use of MHW as a historical point of "delineation" for the upland portion of the site, but question its use for risk screening (see Tables 3 through 8). It is unclear, for example, how distinguishing soil data as either "within 100 feet of Mean High Water" or "Greater than 100 feet from Mean High Water" is useful in comparing data to Portland Harbor riverbank/sediment screening values, nor why soil data from the site interior are screened against these values.

Response: See response to General Comment on Risk Screening for Remedy Development and Selection.

Section 3.0 – Summary of baseline risk. See DEQ General Comments above related to presentation of residual risk data. Please consider focusing report revisions on illustration of residual risk data, representing both hot spots and exceedance quotients (EQs) for relevant exposure pathways. Please be sure that all relevant COCs and exposure pathways are included in presentation of residual risk analysis. To the extent that "indicator compounds" are used, please justify. DEQ is willing to consider the use of maximum EQs for the purpose of data illustration.

Please also identify any COCs, identified in recent incremental sampling and removal action confirmatory sampling, not presented in Tables 1 or 2, and include as appropriate. Conclusions of acceptable risk to populations using COC detection frequencies as the primary line of evidence should be balanced with characterization data. COC such as antimony and PCBs were analyzed infrequently and thus detected infrequently. The distinction between the two is important.

Response: Figures illustrating the current site risk are included in the Revised FS/SCE. These figures show summed exceedance ratios as described in the Recommendations document provided by DEQ. Use of the term "infrequently" was intended to describe the percentage of samples with detections above the relevant screening levels, and not to represent actual numbers. This terminology is removed, and the sections of text are clarified.

Section 3.2, third bullet. The statement that recreational use is assumed to occur over a lifetime is incorrect. The exposure time frame is assumed to be the same as residential exposure (now 26 years).

Response: The text has been corrected.

Section 4.2.

- *Discussion here primarily relies on older bankline assessments, including an assessment completed by Hart Crowser in 2003. There is limited discussion of the observations from a 2017 assessment completed at the request of DEQ, which was initiated following significant bankline erosion during the winter of 2016/2017. Observations in Section 4.2.1.2 that bankline conditions were "unchanged" are presumably in reference to the 2012 inspection event. This characterization appears qualitative at best as it is not grounded empirically.*
- *A more formal assessment of bankline conditions and the potential for erosion should be completed using the BANCS model (see general comment above).*
- *Riverbank in the vicinity of Station 5+00 to 7+00 in the East Parcel is of particular concern to DEQ based on the presence of elevated metals, steepness of slope, and the position of this area below the BNRR rail line. Soil in this area is only partially covered, and options appear to be limited regarding bank stabilization.*
- *Please see DEQ general comments above regarding data screening, COCs, etc.*

Response: See response to General Comment on Risk Screening for Remedy Development and Selection. An April 18, 2018 email from DEQ confirmed that EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity.

Section 4.2.2.4.1. In this and other sections of the report, there are numerous references to "concentrations that only slightly exceed screening levels," "relatively high ER," "highest relative ER", "relatively frequent detection," etc. which do not convey site information in a meaningful way. A more quantitative discussion is requested; DEQ prefers that risk screening results be presented in (easy-to-read) tables and figures, and summarized in text.

One line of evidence used in the riverbank source control evaluation is descriptions of sediment COIs. The starting point for COIs in sediment adjacent to the facility is the upland COI list, but additional COIs may be identified based on sediment and surface water characterization. Please consider.

Response: The text of the Revised FS/SCE emphasizes the use of quantitative language and refers to tables and figures for reference as necessary. Additional screening for source control accounted for sediment COIs by screening against RALs and PTWs.

Section 4.2.2.4.3.1. It should be noted that riverbank soil samples are not available in the West Parcel.

Response: Text has been added to note there are no riverbank soil samples in the West Parcel.

<u>Section 4.2.2.4.3.3.</u> The first paragraph concludes that the sheen and NAPL addressed in the removal action originated from an over water activity. The basis for this conclusion is not clear, either here or in the referenced section 2.9.2.

Response: The basis for this conclusion is documented in the 2005 Memorandum: Removal Action Activities by Ash Creek Associates, which summarizes actions taken to address the observed sheen and LNAPL. The conclusions that the sheen and NAPL originate with overwater activity is based on the complete delineation and removal of the NAPL (inland OLW) and the colocation of the NAPL with the location of historic overwater activities associated with former cooperage operations. This is clarified in the text.

<u>4.2.2.4.3.</u> As is noted elsewhere, DEQ is having trouble understanding the manner in which screening was completed to assess potential adverse impacts on sediments. Tables 3 through 8 present screening of soil data against EPA riverbank/sediment criteria (Table 17 and JSCS), including data that are not anywhere in the riverbank vicinity. These tables are presumably the basis of discussion presented in this and following sections. The report should clearly identify soils/sampling locations that have the potential for erosion to the river, identify EQs, and summarize and present this information in a concise, readable fashion. For riverbank soil, one option would be to present a figure identifying the maximum EQ at each location, along with some representation of the number of exceedances for individual COCs (see attached recommendations). To the extent that upland hot spots are present, these should also be identified.

Also, there is varying language in this and ensuing sections of the report regarding COPCs, COIs, and COCs. It is perhaps worth a reminder that chemicals detected at the site which have not been screened should be designated as "Chemicals of Interest" (COIs), while those that have been screened-in should be designated as "Chemicals of Potential Concern" (COPCs). Chemicals that do not meet acceptable risk levels should be designated as "Chemicals of Concern" (COCs).

Response: Sample locations included in the source control data set are illustrated on sample location figures in Appendix C. Appendix D and E figures include ecological PRG exceedances, human health PRG exceedances, and CL, RAL, and PTW exceedances, as recommended by DEQ. The use of the terms COI, COPC, and COC has been clarified in the Revised FS/SCE.

<u>Section 4.3.</u> With exception of a single (simple) figure, groundwater data are not illustrated, nor does there appear to be any data analysis beyond the baseline screening presented in Tables 9 through 15 of the report. Exceedance quotients (referred to as ERs in the report) and frequencies are liberally cited in text, but do not appear to have be included. Tables and figures should be included in the report summarizing sampling results and identifying where exceedances occur (to complement/clarify text). DEQ is inclined to agree that upland groundwater is not a significant concern outside of the West Parcel area, but clear and focused presentation is necessary to support this conclusion.

Response: A new Appendix D figure showing summed exceedance ratios for groundwater as described in the Recommendations document provided by DEQ has been added. A new Appendix D table summarizing the groundwater screening and identifying COCs has been added.

<u>Section 4.3.1.</u> NAPL and sheen observations are included here, but there are also sample results that go along with these observations, including: a) Inner Cove test pits and samples; and b) Wharf Road sediment sampling results completed by the Lower Willamette Group. It would be useful if these results were also described, as they are included in the baseline risk assessment.

Response: A description of non-aqueous phase liquids (NAPL) and sheen observations and associated sample results is included in the text portion of Appendix D. The sample results are included in Appendix D tables and NAPL and sheen observations are shown on Appendix D figures.

<u>Section 4.3.4.1.</u> See comment above for Section 4.2.2.4.1 in reference to nomenclature, including use of "infrequent".

Response: Noted.

<u>Section 4.3.4.2.</u> DEQ is not comfortable that a suspended solids concentration of 1,590 mg/L is consistent with what could be expected for unfiltered groundwater as derived based on arsenic concentration distribution. Further information would be necessary to support this conclusion on a site-specific basis. We agree, in general, that dissolved-phase concentrations of contaminants are likely more representative of the "transportable" contaminant fraction. This is particularly true for contaminants such as PCBs, high molecular weight PAHs, metals, and dioxins given their affinity for organic carbon.

Response: The reference to the suspended solids concentration for arsenic has been removed.

<u>Section 5.1.1, Vertical Extent.</u> The supposition that soil contamination is generally shallow would be better supported by figures presenting subsurface sampling results. For example, as a supplement to figures showing maximum EQs in surface soil in the upland (non-riverbank area) site, a complementary figure could be presented for subsurface soil, including the results of post-removal confirmatory sampling. As has been noted elsewhere, we believe that illustration of data is ultimately more useful that long narrative discussion. There are significant contaminant detections in the subsurface, notably in the Central Parcel (TPH) and the West Parcel fill area. As soil consolidation and capping (Alternative 5) is one of two recommended cleanup alternatives, presentation of subsurface data must necessarily be robust to judge its suitability as a final upland remedy.

Response: Figures showing the summed ERs for surface and subsurface soil separately are included in the new Appendix E.

<u>Section 5.1.2.2.</u> The lateral extent of dioxin/furan TEQ at the west and eastern ends of the Central Parcel have not been delineated.

Response: The distinction between ISM sample results and lateral delineation has been clarified in this section, specifically as it refers to the west and east ends of the Central Parcel.

<u>Section 5.2.</u> Portions of the site have large relic foundation structures or debris, which might be a significant impediment to either upland or riverbank remedy implementation. DEQ recommends a more comprehensive discussion of relic structures/debris, and suggests that a survey of this material be included with the FS and considered in remedy evaluation. Also, consideration should be given to

whether State Historic Preservation Office (SHPO) consultation is necessary, to the extent that Native American relics may be present.

Response: Consultation with the State Historic Preservation Office will be conducted.

Section 5.3. Restrictions on site use are typically considered as part of remedial action alternatives, not as a basis for developing them. Based on information provided by Metro (site owner) and assuming that site ownership does not change, DEQ agrees with evaluating recreational and transient use scenarios for the site upland. We are less comfortable with the supposition that restrictions on human use of the site could be implemented with a combination of "signs, paved trails, and physical barriers such as railings and fencing." Provided that residual contamination in the upland is below recreational/trespasser risk-based values, however, access restrictions would not be necessary.

Response: Site restrictions are discussed in Sections 2.4, 5.3, and within each remedial alternative evaluated in Section 9 as appropriate.

Section 6.1.2 bullets and Figure 25.

- *It is not clear that the RAOs for human health match all the receptors shown in Figure 25. In particular, the RAO should include transient trespasser (TT on the figure). Perhaps it is assumed that this exposure scenario is covered by recreational exposure; if so, that should be stated. The site residual risk assessment shows acceptable transient trespasser risk in all three parcels. However, after recalculation (see comment on Table 27), the residual risk (without cap or other controls) to trespassers in DU-6 is unacceptable. Also, please discuss why construction workers are considered for the Central and East Parcels only. Excavation worker is not discussed; please explain.*
- *As noted in our general comments, analysis is necessary to confirm that all relevant site COCs are included in Tables 1 and 2 for residual contaminants that remain present at the site. DEQ is willing to consider the use of "indicator compounds" for the purposes of data illustration provided that their use has been shown to fully capture contaminant risk.*

Response: Language in the RAOs has been updated to correspond with the receptors considered for this site. A revised residual risk assessment is presented in Section 11 and associated tables and includes revision to the presentation of residual risk from DU-6.

Section 6.2. Text (and tables) should be updated to discuss the 2017 Portland Harbor ROD, Table 17 cleanup levels, and Table 21 RALs and PTW values with respect to source control.

Response: EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. As such, the Revised FS/SCE addresses the remedy for upland soil, and does not include assessment of the riverbank.

Section 6.2.3. Two types of "hot spots" are potentially in play at the site: a) those outlined in Oregon Administrative Rule, and b) PTW values presented in the Portland Harbor ROD. DEQ hot spot rules apply to any contamination in the site upland (including riverbank) as it relates to "terrestrial" human or ecological exposure scenarios. To the extent that contamination is present in the riverbank and adjoining upland that has the potential to migrate to the Willamette River, PTW thresholds presented in Table 21

of the Portland Harbor ROD are applicable (from a source control standpoint). With respect to residual contamination present at the site, both hot spots and PTW need to be identified.

Response: Data are screened against Principal Waste Thresholds as part of the source control evaluation and the results presented in tables and figures included in Appendix D.

Section 7.0.

- *See DEQ's general and specific comments regarding presentation of residual site data. Impacted area/volume estimates should be updated accordingly, along with those for hot spots and PTW.*
- *It is unclear to what extent contaminant "estimates" take into account the results of 2015/2016 soil removal activities. Please clarify update as necessary.*
- *As noted elsewhere, the "practical remediation level" of 1,000 ng/kg for dioxins was prepared for removal work that has been completed; its value in remedy selection for residual contamination is questionable. We recommend removal of the "practicability evaluation" except as it relates to documenting the 2015/2016 removal action. It is unclear if a focus on dioxins and furans will cover other COCs such as metals, as dioxin and furan analysis is limited to large ISM samples and the Central Parcel removal action area.*
- *The remedial action area and extent should be focused on relevant upland source control PRGs. Removal of Appendix F is recommended unless its context is better clarified.*

Response: Residual site data presentation has been prepared and is included in the Revised FS/SCE. These figures consider additional recent site investigations and the 2015/2016 removal action. The text was expanded to clarify the basis for area and volume calculations.

The context for the development and application of the 1,000 nanogram/kilogram (ng/kg) removal action level was presented to DEQ in an email dated April 18, 2018. The application of dioxin/furan screening levels was clarified in subsequent meetings and DEQ email dated May 17, 2018. These emails and attachments are provided as Attachment A-11 in Appendix A.

Section 7.2. The Central parcel is divided into West End and East End soil; DEQ could not find a figure illustrating the dividing line. The text references the areas corresponding to DU-6 and DU-5, which aren't clearly shown in any of the figures (e.g., Figure 26).

Response: The division of the Central Parcel into west end, east end, and center is delineated in the text and on figures. Additional sample location figures are included in the Appendix C of the Revised FS/SCE. The sample locations figures are separated by sample type (discrete, composite, and ISM) to allow for better visualization of the locations.

Section 8.1.

- *A more in-depth and nuanced evaluation of remedial technologies is necessary for both soil and groundwater. See the following comments.*
- *Discussion of technology screening, a very important element of the development of remedial action alternatives, is very short (one paragraph). The results of screening presented in Tables 16a and 16b of the report should be summarized, including the basis for excluding technologies. It is typical for a range of (potentially applicable) remedial technologies to be carried forward for*

detailed screening and analysis prior to assembly of remedial action alternatives. This is generally absent.

- *Most technologies are screened out in what appears to be a "primary screening" presented in Tables 16a and 16b. In the case of groundwater, only "monitoring" has been retained. Treatment walls/caps are indicated as being retained by shading, however accompanying Screening Comments indicate that these are not applicable. Please clarify.*

Response: The evaluation of remedial technologies has been expanded and includes a more detailed screening of applicable technologies. The incorrect screening in current Table 10 (former Table 16a) has been corrected.

Section 9.0. *Please update discussion as necessary based on comments presented elsewhere in this letter.*

Response: This section has been updated to reflect prior changes in the Revised FS/SCE.

Section 9.2.

- *Text indicates that trees would be removed under this alternative, presumably to allow for a continuous 2-foot clean capping layer over the site upland and riverbank above MHW. Please discuss why tree removal is necessary.*
- *Please indicate whether a demarcation layer will be placed below clean fill.*
- *Please discuss the extent to which relic structures at the site would be an impediment to effective capping.*
- *DEQ infers that layback to 3H:1V and capping is planned for the Central and East Parcels only. Please clarify.*
- *Text indicates that capping would "extend down the slope" and "would be conducted as part of the in-water remediation and/or habitat restoration." Referenced Figure 29 shows the riverbank cap extending to MHW only. Please discuss whether capping of the full riverbank is contemplated.*
- *In addition to not addressing hot spots, this remedy does not appear to address PTW that may be present within riverbank soil. Note that Figure 28 of the Harbor ROD requires removal/capping of riverbank PTW within an SMA regardless of the erosion potential.*

Response: Tree removal is required in this alternative as most trees cannot survive the addition of one to two feet of fill, particularly some of the sensitive species present at the site such as madrones. A demarcation layer will be included.

Section 9.3.1.

- *Please clarify that this alternative involves the excavation and off-site disposal of all near-surface soil exceeding relevant human health or ecological PRGs. As noted elsewhere, DEQ is not confident that removal of surface soil to a maximum depth of 3 feet will result in an "acceptable" leave surface.*
- *See comments for Section 9.2.*

Response: The text has been updated to clarify that this alternative will remove and dispose of all surface soil exceeding relevant PRGs off-site. The removal depth of two to three feet was used to

compare alternatives and was not meant to be a definitive removal depth. Confirmation sampling will need to be performed, and removal will continue until confirmation samples achieve acceptable concentrations. See response to comment on Section 9.2.

Section 9.3.2. As noted in Page 79 text, it seems unlikely that thin capping would prove an effective long-term remedy. See also comments for Section 9.2.

Response: The description on Page 79 in the text notes "there is significant uncertainty if the 1-foot-thick cap in the tree drip line areas would be effective." The discussion of the long-term effectiveness/reliability of the cap was intended to inform the weighting of this options as compared to removal, and not to question its ability to be an effective remedy. In addition, this qualification only refers to the cap within the drip line of trees, and not the entire site. See response to comment on Section 9.2.

Section 9.4.

- *Alternative 4 and 5 contemplate excavation and on-site consolidation of soil from the West and Central Parcels, as illustrated in Figure 30. Text indicates that a 2-foot cap will cover this material, which is also illustrated in Figure 29. What is not clear for either alternative is the thickness of consolidated soil that is contemplated (post-compaction), and whether based on 3H:1V side-sloping there is adequate "room" for the constructed containment cell. An added consideration is the extent to which layback of riverbank might reduce the upland area available for containment.*
- *See comments for Section 9.2.*

Response: As part of the subsequent discussion on this comment, considerations for location of the soil consolidation area within the Facility were considered. It is likely that work on the riverbank as part of the in-water remedy will affect the possible size and location of the soil consolidation area. As such, a final decision on size, shape, and location of the soil consolidation area and other factors affecting bankline will be finalized during remedial design.

Sections 9.5 through 9.8. See previous comments for Alternatives 2 through 5.

Response: The revisions described in the comments above will be carried through as relevant.

Section 9.7. The third paragraph states that over time burrowing animals would reduce overall concentrations of the existing surface soil. Over time, we expect burrowing to increase concentrations in the existing surface soil (the cap) and reduce concentrations in the previous surface soil on which the cap was placed.

Response: The intention of this statement was to explain that burrowing animals would mix the activated carbon throughout the surface soil, increasing the contaminant mass in contact with the activated carbon. As the cap will consist of clean fill mixed with activated carbon, mixing by burrowing animals would indeed slightly increase the surface concentration in isolated areas. This misrepresentation is clarified.

Sections 10.2 to 10.6.

- *It would help to include a brief description of each alternative so that the reader does not have to refer back to previous sections for alternative descriptions.*
- *The number of truck trips and associated impacts on neighborhood and greenhouse gas generation is a significant weighting factor for implementability and implementation risk. The movement of thousands of truckloads of soil through local neighborhood is considered untenable by DEQ. More evaluation of alternative methods (rail, barge) is necessary. Individual alternatives should be modified, or separate alternatives presented that incorporate these transport methods.*

Response: Table 20 was added to the Revised FS/SCE which summarizes the main components to each alternative. Consideration of rail and barge transport will be an important part of the implementation of this remedy. However, as a reasonable estimation of these costs is not possible without more information on the in-water remedy, trucks are used for comparison of alternatives. Language has been added throughout the document noting that both barge and rail are preferred transportation options.

Section 10.7. A revised hot spot discussion should be presented: a) focused on residual contaminants; and b) considering the full range of site COCs in soil and groundwater. A separate section should be added discussing PTW, to the extent present, in riverbank soil and/or West Parcel groundwater.

Response: Section 10.7 has been expanded to clarify the residual contaminants not treated or removed in the presented alternatives. All site COCs were considered in this evaluation, and the expanded text details this consideration.

Section 11.0.

- ***Alternative 7** is presented as one of two recommended upland remedies, but the effectiveness and long-term reliability of a thin (1-foot) cap is acknowledged here. It is suggested in report text that its suitability might be demonstrated through "extensive literature reviews and/or bench studies." If this alternative remains in the "recommended" category, additional information should be presented in the FS to show that it is likely to be an effective remedy with acceptable long-term reliability. It is more likely that a standard (minimum 2 feet thick) will be required. A few comments to consider:*
    - *Use of a thin cap in the upland would necessitate incorporation of a visual barrier between contaminated soil and clean cover to provide for effective, reliable inspection. Typically this would consist of a water-permeable demarcation layer with good visual warning properties.*
    - *Thin capping is unlikely to be allowed on sloped surfaces where erosion is more likely to occur, including riverbank areas.*
    - *In the event that thin capping was approved for some site areas, contingency measures would be necessary and effectiveness monitoring more robust than for a standard upland cap. This may significantly impact the cost-effectiveness of this alternative.*

- ***Alternative 5** is, at present, the remedial action that is viewed most favorably by DEQ. However, we have a number of concerns about this remedy (as articulated elsewhere in this letter) including the following:*
    - *It is unclear whether the underlying premise of this remedy, namely that soil below 2-3 bgs at this site meets relevant PRGs, is well founded. While some capping of excavated*

areas is contemplated in the FS, DEQ is concerned that this could be necessary over a larger area, undermining the "consolidate and cap" concept. Subsurface data should be presented to support this alternative, and deficiencies in the data set noted.

- *It remains unclear whether there is adequate space in the upland for contaminated soil consolidation when riverbank layback, consolidation cell sloping, etc. are considered.*
- *It is unclear to what extent restrictions on (human) site access will be necessary, and can be effectively maintained.*

- ***Groundwater.*** *As noted in our comments for Section 7 of the report, technologies other than "monitoring" have been eliminated prematurely. Greater consideration needs to be given to upland alternatives before "deferral" to the in-water remedy can be supported. We agree that additional data are needed to better determine whether upland groundwater contaminants are discharging to the river, and recommend that the Port develop a work plan to address this.*

Response: Considerations for location of the soil consolidation area within the Facility were considered. It is likely that work on the riverbank as part of the in-water remedy will affect the possible size and location of the soil consolidation area. As such, a final decision on size, shape, and location of the soil consolidation area will be finalized during remedial design.

Assessment of groundwater technologies was not included in the Revised FS/SCE because the only exposure pathway for groundwater is transport to the river (i.e., source control). Because source control is being addressed with the in-water remedy, the feasibility study included upland soil only.

Section 11.2. A residual risk assessment consists of two elements: 1) a quantitative assessment of the risk resulting from concentrations of chemicals remaining on the site at the conclusion of any treatment or removal; and 2) a qualitative or quantitative assessment of the adequacy and reliability of any institutional or engineering controls to be used to control chemicals remaining on the site. OAR 340-122-0084(4).

Residual ecological risk to bird and mammalian receptors using exposure unit sized ISM results would require a revision of Table 1 PRGs to represent baseline conditions in order to ensure appropriate scale consideration of all relevant PRGs. For example, mercury concentrations detected in ISM and removal action samples are above bird and mammal PRGs and necessitates inclusion in the table presented on Page 103. Surrogate concentrations should not be limited to the removal action goal. See also comment on Section 3.0, Summary of Baseline Risk.

For ecological residual risk to plants and invertebrates point-by-point, residual risk maximum risk ratios should be presented for all COCs prior to capping, including antimony, chromium, nickel, and PCBs. For some COCs, such as antimony and PCBs, data availability limits this evaluation, and this uncertainty should be described.

Response: A revised residual risk assessment is presented in Section 11.2 and associated tables. This risk assessment was updated using the COCs identified in the Updated COC Evaluation Memo. This risk assessment includes consideration of additional site contaminants, residual risk maximum ratios, and a thorough description of uncertainty.

FIGURES

Figures, general. It is unclear to what extent data presented in Figures 12 through 16 include riverbank data. Please clarify and identify the datum represented by the dashed line in figures.

Response: The distinction between upland and riverbank data is clarified in these figures, and throughout the Revised FS/SCE with a combination of additional figures requested in the Recommendations document and description in the text. A figure showing a cross-section of the riverbank has been added that shows and defines all relevant site datum, including the distinction between upland and riverbank. These distinctions and labels are carried through on all site figures.

Figures 3 through 7. These figures are difficult to read/interpret, in part due to the inclusion of the DU-series sample locations, and dotted lines which represent the boundaries of ISM decision units. Also, it is unclear why incremental sampling locations are illustrated in some (large) figures, and not in others (e.g., Figure 5). The FS should illustrate current contaminant conditions to support remedy selection.

Response: The presentation of sample locations has been separated by sample type (discrete, composite, and ISM) to better facilitate identification of samples. These figures are presented in a new Appendix C.

Figure 8. The figure appears to represent debris, sheen, or NAPL observations in the riverbank portion of the site only. For example, sheen has been observed in both upland wells and borings. All observations should be presented.

Response: Observations of sheen in upland wells and borings has been added to Figure 4 (former Figure 8)

Figures 9 and 10. Only nearshore sediment data are shown. It is unclear whether data presentation is confined, for example, to within 200 feet of the bankline. The dashed line demarking riverbank from river should be identified – ordinary low water? Also, figures are labeled as identifying the extent of COIs exceeding EPA CLs (PH ROD Table 17 values for sediment, presumably), but are expressed in concentration ranges. It might be better to illustrate data in the form of EQs.

Response: As investigations of the sediment adjacent to Willamette Cove are ongoing, sediment data within 100 feet of the riverbank bank are presented in tables accompanied by a sample location figure in Appendix F (former Appendix D).

Figures 13 through 16. It is unclear whether presented figures represent pre- or post-2016 removal conditions. Please clarify. As noted in General Comment #1 above, it is DEQ's expectation that the results of the large hot spot removal action be fully incorporated into this FS/SCE.

Response: The presentation of pre- and post- removal action data is clarified in both figures and tables throughout the Revised FS/SCE.

Figures 17 through 19. DEQ is appreciative of the reconnaissance observations, but feel that the presentation does not fully capture the extent to which bankline erosion is occurring. During site visits in 2017, DEQ personnel observed sections of bankline (notably in the Central Parcel) where mass wasting

was evident in the form of large down-dropped slump blocks. Elsewhere, exposed debris, tree roots, etc. are indicative of ongoing erosion of portions of the site bankline. Figures should clarify whether inspection of the West Parcel bankline was completed, and present results if they are available. See comments above on BANCS model.

Response: See response to General Comment on Risk Screening for Remedy Development and Selection. April 18, 2018 email from DEQ confirmed that EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity.

Figure 21. The illustration of bankline areas with a slope of 1H:1V or steeper, denoted by a circled "A," is incomplete. DEQ notes, for example, that there is a prominent over steepened bankline at the downstream end of the inner cove, and beneath the elevated BNRR rail line facing the cove. Again, it is unclear whether the West Parcel bankline was included.

Response: See response to General Comment on Risk Screening for Remedy Development and Selection. An April 18, 2018 email from DEQ confirmed that EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity.

Figure 22. DEQ would identify portions of the bankline below the BNRR line as "showing clear signs of erosion".

Response: As this figure proposed source control actions on the bankline, it has been removed from the Revised FS/SCE. Work on the bankline will be part of remedial design in coordination with in-water work.

Figure 23. The presented figure is over-simplified, and termination of the exceedance area at shoreline speculative. It would be better to include a more detailed figure showing well and boring locations.

Response: Groundwater sample locations are presented in new Appendix C. Revised figures summarizing ROD CLs in groundwater are included in new Appendix D.

Figures 24 and 25. What is the distinction between ecological risk areas and subareas? DEQ assumes that oval-shaped subareas represent additional risk (e.g., for PCBs) beyond that identified in blue for the larger areas.

Response: Subarea was intended to represent a risk area that is contained within a larger risk area. The nomenclature has been changed to make the distinctions on Figures 6 and 7 (former Figures 24 and 25) clear.

Figure 26. As noted in our General Comments above, the final FS/SCE document should represent current site conditions. Hot spot areas that were removed during recent upland work should not be included, for the most part, in data discussion and presentation. Please clarify if presented hot spots are confined to the upland (non-riverbank) site. If so, consider presentation of a separate figure illustrating riverbank hot spots.

Response: Pre- and post-removal action site conditions are clarified throughout this report in text, tables, and figures. A datum was added to this and other relevant figures for reference of the upland site boundary.

Figure 28. Typical section G is shown in Figure 30 as being in the upland interior site, but appears to include a bankline component. Please clarify.

Response: Typical section E (former typical section G) represents a cross-section of the soil consolidation area. The bankline is not represented in the section.

Figure 29.

- *Riverbank sections show "typical" bankline configuration as being 2H:1V. In fact, portions of the riverbank area are significantly steeper (some near-vertical), including in areas where hot spot-level contamination is present. Cross section figures should illustrate the range of riverbank conditions at the site, and illustrate how a partial layback of the riverbank (above MHW) might work. In the East Parcel below the BNRR tracks, excavation of hot spot soil, along with layback and capping as necessary, would appear to be impractical. Please discuss.*
- *For typical section H, remediation is indicated to OHW rather than MHW as in other sections. Please resolve.*
- *Based on the existing site data set, DEQ expects capping to be necessary in most bankline areas where soil is exposed, either currently or through layback. Cap thickness is not presented in Figure 29, but is shown as 2 feet in typical section G in Figure 28 in the site interior. Note that a minimum of 2 feet of clean material will be necessary for capping, following layback, in residual contamination areas, with armoring as necessary.*

Response: Cross-sections have been added to represent a range of riverbank conditions on Figure 3. Cross sections showing how the remedy will coordinate with the in-water have been removed. An April 18, 2018 email from DEQ confirmed that EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity.

Figure 30. Use of "typical section" signifiers appears to indicate that the West Parcel bankline would be repaired and/or augmented with up to 6 inches of 2-inch minus rock in the West Parcel, and the remaining site bankline would be managed per typical section E. Typical section E, however, shows excavation of 1 to 3 feet but no capping. To the extent that residual contamination is present in the bankline, either removal or capping will be necessary. Please clarify/resolve.

Response: Figure 30 was replaced with Figures 8 and 9 that show typical riverbank cross sections illustrating the coordination of the in-water remedy with potential upland remedies.

Figures 30 and 31. These figures illustrate actions for more than one alternative, which is confusing. Separate figures are recommended for each remedial alternative.

Response: A separate figure has been included illustrating each alternative.

Figures 31 and 32. Presented information is unnecessarily convoluted, referring to notes which in turn refer to cross-sectional diagrams. Also, nearly all riverbank remedial actions outside of the West Parcel

are couched as "repairs, " but can vary from modest addition of 2-inch minus rock to full layback and capping. Clarity is necessary, in particular for recommended remedial Alternatives 5 and 7.

Response: An April 18, 2018 email from DEQ confirmed that EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity.

TABLES

Tables, General. Data tables 3 through 15 of the document are focused on source control screening only (riverbank and groundwater), yet they seem to include data from throughout the upland site. The data set also seems to include confirmatory soil sampling results from the 2016 removal action, although these are not "called out. The inclusion of upland soil data that do not present a source control concern is not appropriate/necessary, unless one is considering the potential for leaching-to-groundwater. On the other hand, DEQ expects tables and figures in the report to "illustrate" residual risk for upland receptors. Also, please label table inserted in text (e.g., Section 11).

Response: Data screening tables have been revised for clarity. Data tables in Appendix D and Appendix E include both upland risk and source control data screening. Data that was removed during removal actions at the Facility are not included. The source control data set has been modified as described above.

Tables 1 and 2. Tables 1 and 2. This appears to present an incomplete set of COCs and receptor pathways considering an updated baseline risk analysis. DEQ notes, for example, that cleanup values are not presented for mercury, which is significantly elevated at the site. All COCs with exceedances of either human health or eco risk criteria should be presented in the tables, and hot spots identified as appropriate. Exceedance areas and hot spots should be presented on updated figures.

Response: Residual risk at the site has been updated considering additional recent site investigations and the 2015/2016 removal action. An updated list of COCs is shown in Tables 1 and 3 (former Tables 1 and 2) of the Revised FS/SCE.

Tables 3 through 8. These tables present contaminant data for "riverbank soil", grouped by their location relative to mean high water (MHW). Results are screened against riverbank soil/sediment cleanup values presented in Table 17 of the PHSS ROD (of JSCS SLVs, as needed) with exceedances highlighted. It is appropriate to compare bankline data, particularly for soil/sediment that is potentially mobile or exposed, to EPA's cleanup levels for the PHSS. It is unclear whether this is necessary for detections "greater than 100 feet from mean high water", nor is it clear how far the presented data set extends into the site upland. Are all updated data included in these tables? Please clarify.

Response: See response to General Comment Risk Screening for Remedy Development and Selection.

Tables 9 through 15. The tables present contaminant data for upland groundwater and, as with soil/sediment, are grouped by their location relative to MHW. Results are screened against groundwater cleanup values presented in Table 17 of the PHSS ROD (or JSCS SLVs, as needed) with exceedances highlighted. As with soil/sediment, data are grouped based on their proximity to/distance from MHW. Two comments: a) "Breaking up" the data based on distance from MHW is of questionable utility for

groundwater. The concern with groundwater contamination in the upland, from a source control concern, is the potential for contaminants to migrate to and impact Willamette River receptors; and b) from a source control standpoint, the focus of screening should be on groundwater data in closest proximity to the river.

Response: The use of distance from mean high water to distinguish proximity to the river has been removed from the data screening.

Table 16a and relevant text. Initial screening of remedial options for soil should include a discussion of the potential for contaminants to be leachable, and represent an ongoing source to groundwater.

Response: Discussion of the chemical characteristics of each contaminant group was added to the table and text.

Table 16b. Initial screening for groundwater eliminates all technologies other than monitoring and MNA. The "Passive/Reactive Treatment Walls/Reactive Caps" technology is not highlighted and presumably retained, but screening comments indicate that it is neither applicable nor cost-effective. We presume it was meant to be highlighted as "eliminated. DEQ is not comfortable with the manner in which the groundwater screening and upland alternatives were eliminated; potential treatment options should have been retained for more detailed analysis.

Response: Assessment of groundwater technologies was not included in the Revised FS/SCE as the feasibility study included upland soil only.

Table 17 through 24. See General Comments above concerning the likely reliability of cost estimates. For capping remedies, cap inspection and maintenance costs are presented for 5 years, and inspections for 25 years. Two comments as they pertain to the recommended alternatives (5 and 7): 1) long-term monitoring and maintenance associated with Alternative 7 (site-wide thin capping) are likely to be significantly higher than for Alternative 5, as inspection, maintenance, and analytical testing will be required by DEQ to confirm that the (thin) cap is not compromised over time, and 2) the cap footprint for Alternative 7 is much larger, encompassing the entire site. Also, inspection and maintenance costs should be calculated for at least 25 years (and will in reality, be required in perpetuity) for any long-term capping remedy.

Cost estimates should account for measures that will be necessary to restrict access to the site envisioned in the remedial alternatives. For Alternative 7, it appears to be assumed that human access will be restricted for most of the site, while for Alternative 5 measures will be necessary to limit access to, at a minimum, the East Parcel capped area.

Response: Costs associated with periodic monitoring of the cap are included in Alternative costs, and maintenance costs are extended to 25 years.

Table 25. An important element of this table is transport of contaminated material off of the site for disposal, relocation of soil within the site for capping, and import of clean material onto the site for capping. These are important from the standpoint of cost, carbon-footprint, and the potential for impacting nearby residents and businesses. More detailed information is necessary on the "truck miles" and "truck trips" presented in this table, in particular for recommended Alternatives 5 and 7. For

example, the 5,100 truck trips in the alternative are presumably associated with both off-site disposal of higher-concentration soil, and the import of clean material for on-site capping. Clarification is needed. For Alternative 5, a large part of the 6,600 truck trips is presumably associated with consolidation of soil on the East Parcel for capping.

As noted in our General Comments above, much more serious consideration needs to be given to alternative methods for (contaminated and clean) soil movement, including rail and barge transport. In the same vein, more discussion is necessary in the FS regarding the sustainability of remedial alternatives, including recommended Alternatives 5 and 7.

Response: Consideration of rail and barge transport will be an important part of the implementation of this remedy. However, as a reasonable estimation of these costs is not possible without more information on the in-water remedy, trucks are used for comparison of alternatives. Language has been added throughout the document noting that from an implementation risk perspective both barge and rail are preferred transportation options, and these options will be evaluated during final design.
Table 26. The scoring presented here is very simplistic and not particularly useful.

Response: Table 21 (former Table 26) summarizes how the alternatives compare, and is intended to provide a broad overview. More detailed information regarding scoring is provided in Section 10.

Table 27. From Table 2, the dioxin TEQ PRG for transient trespasser is 208 ng/kg, not 2080 ng/kg. This changes the DU-7 transient trespasser residual risk from below 1E-6 to 5E-6.

Response: A revised residual risk assessment is presented in Section 11, and this error has been corrected.

APPENDICES

Appendix B. Tables B-1 to B-10 appear to be similar to Tables 3 through 8 of the "Tables" but encompassing a broader set of analytes. Similarly, Tables B-11 through B-23 present groundwater data similar to that in the "Tables" portion of the report. As with the Tables, data sets are divided in reference to MHW, and screened against PHSS Table 17 cleanup levels and JSCS values. Nowhere in the report is there a (separate) presentation of the most recent upland sampling results, including confirmatory data from the large 2016 upland removal action, compared to relevant upland PRGs for human health and terrestrial ecological receptors.

Response: Revised data screening has been conducted and the presentation clarified.

Appendix D. Data here are identified as "adjacent to Willamette Cove", the meaning of which is unclear. It appears the summary includes a mixture of beach and riverbank sample composites previously evaluated in the Willamette Cove HERA (e.g. BT and 6R series), in addition to surface and subsurface in water sediment samples (e.g. G and C series). Please clarify the definition of sediment and soil datasets, as DEQ notes many of the LWG beach samples were collected at the same elevation (greater than MHW) as the erodible soil samples presented in Appendix B. The data presentation also appears to be limited in COI presentation. Please identify the scope of the presented data (within 100 feet of bankline, for example?) and include a figure identifying the sample locations.

Response: Sediment data within 100 feet of the riverbank bank are presented in tables accompanied by a sample location figure in Appendix F (former Appendix D). The scope of the presented data and the justification for presented COI is included in the explanatory text.

Appendix F. The analysis presented in this appendix was developed prior to the 2016 dioxin removal action, during which the highest concentrations of dioxin were removed from the site. It's relevance to the final FS/SCE is unclear.

Response: See response to Specific Comment, Section 7.0.

EPA Comments

Part I Primary Comments:

1. The source control evaluation (SCE) is incomplete and needs to be revised to support a decision and potential future actions at the Facility. EPA agrees that source control is needed for groundwater and the river bank, but EPA does not agree that the extent of source control needed has been sufficiently evaluated. There are deficiencies in the evaluation of constituents of interest (COIs) and their distribution in groundwater and river bank soil, historical releases, the potential for river bank erosion, the potential for groundwater discharge to the river, and field investigation techniques and documentation that need to be corrected as summarized in the following comments.

Response: The source control evaluation for soil and groundwater has been revised according to these comments and those received by DEQ.

2. The river bank evaluation is incomplete and needs further assessment to determine where source control measures should be implemented. As described in the JSCS (and the recent river bank guide), the evaluation should include a description of soil properties, a detailed description of river bank characteristics (avoid generalizations), a description of the potential for soil to erode during extreme events and flood conditions, bank erosion rates supported by details such as the top of bank, bank full height, and toe of bank, and the potential for erosion due to wave action using site specific information (avoid generalizations).

Response: EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. Based on this determination, source control information that was included in the SCE section and additional requested materials are now presented in Appendix D.

3. The description of previous investigation and removal actions at the Facility is absent or is insufficient to understand what occurred and why. Investigations at the Facility have been ongoing since 1998, but the report just generally describes the sample locations, sampling method, and analysis. The report should be revised to describe the purpose and conclusion of previous investigations so the reader can better understand the conceptual site model and how it was developed.

Response: Details of the development of this document including response to comments from multiple previous reports have been added to Appendix A. These documents, combined with the site history provided in Section 2, provide context for development of the conceptual site model.

4. Willamette Cove is identified in the Portland Harbor ROD as a property with a contaminated river bank and adjacent to a sediment management area. The report should describe the potential for non-aqueous phase liquids (NAPL) plumes at the Facility and their potential to migrate to the Willamette River. A sheen was observed in 2007 at the Former Wharf Road Area, but the Port of Portland did not identify the source of the sheen and the lateral and vertical extent of NAPL in soil or sediment. The report should describe the delineation of NAPL at the facility and include soil boring and trench logs from previous investigations to support the delineation. Future soil and groundwater investigations should target areas where concentrations of COIs are suspected to be highest. Soil and groundwater sample intervals should target intervals where sheen and other indicators of contamination are observed.

Response: Detailed documentation of sheen and NAPL observations are recorded in previous reports and are summarized in this document. Figure 4 (former Figure 8) documents sheen and NAPL observations on both soil and groundwater at the Facility.

5. The evaluation of chemicals of potential concern (COPCs) in groundwater should be reevaluated because some COIs were eliminated without sufficient justification. For example, pentachlorophenol should be retained for further evaluation as a groundwater COPC at the West Parcel due to detections at MW-2 above the CL. MW-2 is a monitoring well within 100 feet of the mean high water and located within the former log pond. In addition, the report screens COPCs in groundwater and river bank soil by summarizing the number of detects and comparing it to the number of samples collected for the Facility. This approach does not account for the physical layout of the Facility and heterogeneity in COI distribution. For example, tetrachloroethene (PCE) was screened out of the COIs for groundwater because it was only detected in 2 of 96 samples and none of the samples were from monitoring wells, but PCE had an exceedance ratio of 3.9 and 41. The report does not show where PCE was detected at an exceedance ratio of 41 or explain the subsequent investigations that were conducted to identify the source of PCE and why it was detected at such a high exceedance ratio.

Response: The explanation of COPC evaluation has been expanded to clarify the reasons for removing/retaining COPCs, including discussion of location. Figures showing screening level exceedances in groundwater are presented in Appendix D.

Part I To be Considered Comments:

1. Section 4.1, Identification of Complete Migration Pathways, page 22. The elevations of WR-190 through WR-193 should be included in the SCE to verify that the potential outfalls do not have the potential to discharge contaminated groundwater to the Willamette River.

Response: Section 3.1 (formerly Section 4.1) discusses the elevations of each identified outfall relative to groundwater.

2. A table of groundwater elevations and well construction details should be included in the SCE so that the data can be used to verify the conclusions.

Response: A table summarizing well construction details has been added to Appendix D.

3. Section 4.1, Stormwater Pathway, page 22. The evaluation of the stormwater pathway is incomplete or needs to be better explained. Since the purpose of some potential outfalls are unknown, the outfalls

should be investigated to determine if they are discharging contaminated sediment and soil to the Willamette River.

Response: The discussion of the stormwater source control pathway has been expanded.

4. Tables of analytical results should consistently list the reporting limit for samples that are non-detect. This would help the reader evaluate if the chemical was reported as non-detect above or below the CL. The SCE should be revised to better explain when data were non-detected above the CL because this results in uncertainty in a source control decision.

Response: Data presentation has been revised to show non-detect values more clearly. The distinction between non-detect concentrations above and below the relevant CL has been added to figures in Appendix D.

5. Section 2.11, Waste Designation Evaluation, page 16. The discussion implies that toxicity characteristic leaching procedure sampling will be the primary differentiator for determination of material classifications. However, this process does not address regulatory requirements for waste classification. COIs include polycyclic aromatic hydrocarbons, dioxins/furans, polychlorinated biphenyls, and other chemicals that could result in waste being characterized as hazardous and/or regulated under the Toxic Substances Control Act. The testing framework should be reviewed and revised to account for all waste characterization requirements.

Response: The waste evaluation was revisited to ensure all waste characterization requirements were included.

Part I Matters of Style Comments:

1. Figure 9 is missing a title box and legend, and this figure should be completed so that the information can be understood.

Response: Title blocks and legends are included on all figures in the Revised FS/SCE.

2. Section 2.2, Historical Site Uses, page 4. Activities that occurred at the former log pond and the associated chemicals that may be present should be described in the SCE. This Facility feature may be important for the conceptual site model.

Response: The known history of the former log pond is included in the detailed SCE description in Appendix D.

3. Section 4.3.2, Compile Groundwater Screening Levels, page 42. This section states that TPH does not have a CL, which is incorrect. Table 17 of the Portland Harbor Superfund Site ROD lists a CL of 2.6 µg/L for TPH-Diesel (C10-C12 Aliphatic), and this value should be incorporated into the SCE.

Response: The TPH-Diesel (C10-C12 Aliphatic) CL has been added to the data screening presented in Appendix D.

4. Analytical results are not presented in a way that is easily understandable by the reader. The analytical results are grouped into a mass of tables in Appendix B, making it difficult to find information. Figures are poorly developed and generally comprise mapping of sample locations by investigation event or year. The report for the 24-acre Facility should include soil, groundwater, and NAPL plume maps to present the results of investigations and current conditions.

Response: Data presentation has been revised to clearly present information. Figures showing soil and groundwater CL exceedances, and debris, sheen, and NAPL locations are presented in Appendix D.

Part II Primary Comments:

1. The FS portion of the document should be revised to incorporate revisions to the source control evaluations and the site model based on the "Part I" comments provided on Sections 1 through 5 of the report.

Response: EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. Based on this determination, source control information, included requested revisions, that was included in the SCE section and additional requested materials are now presented in Appendix D.

2. It is not possible to determine whether the selection of the recommended upland remedy presented in Section 11.0 is consistent with the JSCS (EPA and DEQ 2005) or the selected remedy presented in the ROD. For a consistent evaluation to support the remedial decision for upland source control measures in accordance with Section 4.6 of the JSCS (EPA and DEQ 2005), alternatives should be evaluated against the established evaluation criteria as described in EPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA, EPA 540-R-93-057 (EPA 1993) and as shown in the inset to Section 4.6 on page 4-8 of the JSCS (EPA and DEQ 2005). The method for alternative evaluation presented in the report is consistent with Oregon Administrative Rule 340-122-0085, and those evaluation criteria and balancing factors are not directly comparable to the criteria and sub criteria presented in EPA 540-R-93-057. Several issues arise that cause EPA to question the efficacy of the recommended upland remedy. The comments presented as "To Be Considered" do not include an exhaustive list of potential issues but were identified to support this determination.

Response: EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. As such, the Revised FS/SCE addresses the remedy for upland soil, and does not include assessment of the riverbank.

Part II To be Considered Comments:

1. The treatment or removal of hot spots in soil is evaluated for each alternative; however, it is not evident that the evaluation of treatment or removal of hot spots is consistent with the selected remedy presented in the ROD. Section A.1.3 of the JSCS states that principal threats, as defined in the NCP, are similar to hot spots of contamination and must be treated wherever practicable (EPA and DEQ 2005). To be consistent with the ROD, all areas with chemicals listed in Table 21 of the ROD, which comprise principal threat waste (PTW), should be addressed by active remediation. Chemicals in this category have specific treatment requirements for the river bank as described in Section 14.2.9 of the ROD.

Response: Principal threat waste thresholds from Table 21 of the ROD have been incorporated into data screening conducted for riverbank source control presented in Appendix D.

2. The selected remedy in the ROD ensures that the preference for treatment is achieved for all PTW and significantly protects the river from impacts from contaminated groundwater plumes discharging into the site. The sub factors associated with the criteria reduction of toxicity, mobility, or volume through treatment presented in EPA 540-R-93-057 are not fully evaluated; therefore, it is not possible to determine whether the recommended upland remedy is consistent with the selected remedy in the ROD.

Response: EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. Additional evaluation of the factors above will be incorporated into those coordinated activities. Source control information that was included in the SCE section and additional requested materials are now presented in Appendix D.

3. Groundwater in the West Parcel exceeds CLs. Historically, sheens were observed in groundwater from monitoring wells in the West Parcel. According to Section 8.2.2, migration of groundwater to the river would be addressed with monitored natural attenuation combined with reactive capping of sediments, as needed. Although Section 9.0 and Section 11.0 state that the cleanup action for groundwater would be combined with the selected soil alternative, it is not clear that groundwater remedial components (including but not limited to additional monitoring and reactive cap components) necessary to address migration of groundwater exceeding CLs are included in the detailed evaluation or costs presented in Tables 17 through 23.

Response: EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. As such, costs for source control are not included in the cost evaluation conducted for remedial alternatives.

4. Cost estimates prepared in support of alternatives for the FS should be consistent with EPA guidance, A Guide to Developing and Documenting Cost Estimates during the Feasibility Study, EPA 540-R-00-0002 (EPA 2000). Because Section 14.2 of the ROD requires river bank actions to be consistent with the selected remedy and meet Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements, these universal cost estimating concepts, presented in EPA 540-R-00-002, should be applied to this evaluation and cleanup decision. Due to inconsistencies with EPA's cost estimating guidance (including but not limited to documentation/backup, net discount rate, and application of professional/technical services), it is not possible to evaluate if the recommended upland remedy is consistent with the selected remedy in the ROD and if the recommended upland remedy was selected without bias.

Response: EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity. As such, costs for source control are not included in the cost evaluation conducted for remedial alternatives.

Part II Matters of Style Comments:

1. Basic terminology, including but not limited to CERCLA engineering evaluation/cost analysis, PTW, and not reliably contained PTW should be consistent with the JSCS (EPA and DEQ 2005) and ROD (EPA 2017).

Response: Terminology in the SCE has been revised to be consistent with the JSCS and ROD.

Metro Comments

Section 2.4: BACKGROUND Future Site Use *The draft FS – SCE notes "as the property owner, Metro recognizes that the presence of hazardous substances may limit the use of the property, and therefore, only uses that are consistent with site cleanup goals will be implemented. Metro will agree to place restrictions on the property deeds that limit site uses to passive recreation activities (including but not limited to trails, benches, viewing areas, and in-water mitigation sites), and do not allow active uses such as designated child play areas, sports fields, or picnic areas. In addition to the deed restrictions, access to the Site will be limited to designated areas designed for pedestrian or bicycle use. These areas will be planned after the remedial action for the Facility has been completed." We agree with this section, but would change the use of "may limit" to "does limit."*

Response: Noted. "Does limit" will be changed to "may limit' in the Revised FS/SCE.

Section 5.3: SITE MODEL *The draft FS – SCE notes that the property is targeted for green space, ecological restoration, and park uses consistent with green spaces. Metro indeed understands that active recreational uses may not be suitable for the Facility and that deed restrictions would be required to limit site use. We agree with the draft notation here and understand that there will be a need to place restrictions on the property that limit site uses to passive recreation activities. Restrictions to access could be developed with a combination of signs, paved trails, and physical barriers such as railings and fencing (as is also noted in section 2.4 of the document). It is the size and scope of these elements that lead Metro to support one of the proposed alternatives primarily due to the potential to effectively support these needed actions.*

Response: The Port appreciates Metro's concern about size and scope of the selected remedy. The ability of Metro to implement the remedial measures has been noted.

Section 9.5: DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES Alternative 5 – Excavation and On-Site/Off-Site Disposal

Upon review of the proposed alternatives, Alternatives 5 and 7 would be the remedial action remedies most efficacious to Metro as site owner.

Response: Noted.

To address questions raised by both DEQ and the Port, our perspective is as follows:

- *Alternative 7 is favorable given the installation of an appropriate sediment cap. This sediment cap could be installed in a manner that would allow installation of native ground cover and shrubs. We assume testing of the cap would be required over the course of Metro's ownership.*

Response: The comment appears to be referring to the cap on the upland site. Inspection and maintenance of the cap are a part of the long-term portion of the remedy. Long-term sampling and

analysis of the cap is not typically needed. It is possible that sampling would be needed as part of repairs in the event of a breach of the cap (e.g., tree fall or significant burrowing activity).

- *Alternative 5 is favorable with the assumption there will be the required space in the upland for consolidation of contaminated soil. For in-water remedy planning, we have assumed a design involving a layback of the riverbank in specific areas. That may appear to take some of the land planned for soil consolidation space which would require examination of available area throughout the site. There is the potential of the one acre lot at the base of N Richmond that is already under cap in the form of pavement, as well as the acreage to the east of that unit. This could be utilized if necessary, dependent upon feasibility. There are other areas on site that could be acceptable for contaminated soil contamination. The goals in that case, however, would be for as small and localized an area as possible to facilitate appropriate oversight. We assume testing of the cap would be also required over the course of Metro's ownership.*

Response: During discussion with DEQ, it was determined that the size and location of the soil consolidation area would be decided during the remedial design phase, therefore the current size and location are unknown. Inspection and maintenance of the cap are a part of the long-term portion of the remedy. Long-term sampling and analysis of the cap is not typically needed. It is possible that sampling would be needed as part of repairs in the event of a breach of the cap (e.g., tree fall or significant burrowing activity).

- *Both of these remedies, of course, require site management in perpetuity. While site history shows a consistent challenge regarding public safety, a formal consolidated area of contamination with a delineated cap lends itself to public safety stewardship with physical and regulatory protections developed and implemented. This site has had 27 acres of undefined, undetermined, and vague protections, as we have worked to characterize and fully understand the extent of site wide contamination. A final upland remedy will, we hope, provide some confirmation and closure regarding which delineated area will need human and ecological risk management. The level of site management should be planned to provide protection for both the trespasser and the park user levels.*

Response: Any final remedy will consist of a combination of technologies that address human and ecological risk. The recommended alternative includes both physical barriers (soil cap) and institutional controls.

- *Metro, as property owner, would develop deed restrictions and other institutional controls to meet the requirements of remedy protection. While institutional controls may seem academic in the case of Willamette Cove, there are examples within the Portland Harbor Superfund area that could serve as models for implementation.*

Response: More detail on the implementation of institutional controls has been included in the alternatives evaluation.

Please call me at (503) 415-6325 if you have any questions.

Sincerely,

Dwight Leisle
Environmental Project Manager

c: Katy Weil, Metro
Sean Sheldrake, EPA
Eva DeMaria, EPA
Teresa Jacobs, Port
Daniel Read, Port
Herb Clough, Apex Companies
Mark Lewis, Formation Environmental
LWP File

Attachment A-10

***Recommendations for Willamette Cove Upland FS/SCE – Screening and Illustration of Contaminant Data* – January 2018**

Recommendations for Willamette Cove Upland FS/SCE –

Screening and Illustration of Contaminant Data

Upland Risk Screening – Surface Soil

For all soil in the 0-3' bgs range*, both in the site upland and riverbank extending from top of bank to mean high water*, screen against the following:

- HH (terrestrial) PRGs[i] for recreational user and transient trespasser; and
- Eco (terrestrial) PRGs for birds, mammals, invertebrates, and plants

Upland Risk Screening – Subsurface Soil

For all soil in the 0-10' bgs range, *both in the site upland and riverbank extending from top of bank to mean high water*, screen against the following:

- Construction worker RBCs (3-10'bgs).

It is DEQ's expectation that contaminant detections at the site will be screened in FS/SCE tables using the complete "residual" site data set. For contaminant detections that exceed relevant PRGs, exceedance ratios (ERs) should be developed and summarized in tables. Hot spots should also be identified in tables. From these data, figures should be developed summarizing ERs, and separately, HS information. Based on this analysis, we recommend illustrating data, at a minimum, as follows:

Upland Surface Soil (including bankline above MHW, 0-3' bgs)

1. Summed ERs for **plant** SLV exceedances
2. Summed ERs for **mammal** SLV exceedances
3. Summed ERs for **invertebrate** SLV exceedances
4. Summed ERs for **bird** SLV exceedances
5. Summed ERs for **human recreation** RBC exceedances (carcinogen)
6. Summed ERs for **human trespasser** RBC exceedances (carcinogen)
7. Summed ERs for **human recreation** RBC exceedances (non-carcinogen)
8. Summed ERs for **human trespasser** RBC exceedances (non-carcinogen)
9. ERs for dioxins, using most conservative **terrestrial eco**
10. ERs for mercury, using most conservative **terrestrial eco**
11. ERs for lead, using most conservative **terrestrial eco**
12. ERs for PCBs, using most conservative **terrestrial eco**
13. ERs for dioxins, using most conservative **human exposure**
14. ERs for mercury, using most conservative **human exposure**
15. ERs for lead, using most conservative **human exposure**
16. ERs for PCBs, using most conservative **human exposure**

Upland Subsurface Soil (including bankline above MHW, 0-10' bgs)

1. Summed ERs for **constructions worker** RBC exceedances*

Upland Hot Spots

1. Summary figure for **human health hot spots**, 0-3' bgs
2. Summary figure for ecological hot spots, 0-3' bgs
3. Summary figure for construction worker hot spots, 0-10'

In plotting ER data that represent summed ERs, DEQ recommends that two pieces of information be presented for each sampling location: a "Total ER" value derived from the summing of all individual COC ERs >1, and the name and ER for the individual contaminant with the highest ER. For example, at hypothetical location SS-X, data might be plotted as: 25 (dioxin 12). Plotting the data in this manner will not only illustrate the magnitude of the summed ERs, but present information on the individual contaminant "driver".

To aid in readability, we recommend that you consider preparation of separate figures for each of the three site parcels.

Source Control Screening – Soil

Applies to all soil extending from within 50' of top of bank to water line in the 0-3' bgs range. Data should be screened against:

- Portland Harbor ROD "Riverbank/Sediment" Cleanup Levels (Table 17 of ROD). If Table 17 values are not available, then JSCS Table 3-1 "Soil/Stormwater Sediment" values should be considered/used.
- Portland Harbor RALs (Table 21); and
- Principal threat waste (PTW) values (Table 21) or the presence of NAPL.

Similar to the presentation for upland soil excess risk and hot spots, two general map types should be developed. For exceedances of Portland Harbor ROD CLs, we recommend the use of "summed" ERs for all ERs >1, along with an accompanying ER for the contaminant with the highest individual exceedance. A separate set of figures should be developed illustrating where: a) RAL exceedances are present and b) PTW thresholds are exceeded or NAPL is present in riverbank soil. Figures should illustrate the position of sample locations relative to MHW, but *all* riverbank data should be presented. To aid in readability, we recommend that separate figures be developed for each of the three site parcels.

Source Control Screening - Groundwater

For source control screening of upland groundwater, please screen against:

- Portland Harbor ROD cleanup values (Table 17) for "Groundwater". If not available, consider
- Joint Source Control Strategy (JSCS) human health and ecological SLVs for water.

Groundwater data are included in tabular form of the FS/SCE, but are not illustrated. DEQ recommends inclusion of figures in the report showing sampling results relative to SC screening values. Maps can be prepared illustrating summed ERs for all individual COC ER >1, with the highest individual ER also presented (as above). We recommend development of separate figures for total and dissolved metals. For the East and Central Parcels, presentation can be confined to riverbank monitoring wells. For the West Parcel, results from both monitoring wells and recent one-time sampling efforts should be presented. As noted in DEQ's formal comments on the FS/SCE, figures should also be developed identifying all upland locations where either NAPL or sheen were observed, inclusive of all historical sampling events.

Finally, to support Alternative 5, which contemplates removal of 2 to 3 feet of surface soil in the Central and West Parcels, and consolidation/capping in the East Parcel, we recommend the presentation of a figure or figures illustrating data from the uppermost portion of the contemplated "leave surface" at the site (e.g., 3-6' bgs).

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[i] "PRGs" is referenced consistent with Tables 1 and 2 of the FS/SCE, and are derived from sources including DEQ's Risk-Based Decision Making and Ecological Risk Assessment guidance.

Attachment A-11

Additional Documentation on the Dioxin/Furan TEQ Removal Action Level – April – June 2018

From:	Leisle, Dwight
To:	HAFLEY Dan
Cc:	LACEY David; MCDONNELL Erin; PETERSON Jenn L (jenn.l.peterson@state.or.us); Mike.Poulsen@state.or.us; "Katy Weil" (Katy.Weil@oregonmetro.gov); Carmen Owens; Herb Clough
Subject:	RE: WC Dioxin Practicality Evaluation
Date:	Thursday, June 7, 2018 11:25:40 AM
Attachments:	image001.png WC High Concentration Dixoin Summar.pdf

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Dan

Additional discussion on the approach for dioxin/furans in the upland facility will be an agenda item for the June 20th meeting. The attached figures and table are provided for review in preparation of that discussion.

The figures show hot spots for TEQ and individual dioxin/furan congeners for both ecological and human health, as well as areas with concentrations of TEQ between 195-1000 ng/kg. The table summarizes the volumes of soil shown on the figures with depth assumptions from the Combined FS/SCE.

Please feel free to ask clarifying questions prior to the meeting to facilitate the discussion.

Thanks,
Dwight

Dwight Leisle PE, PMP
Environmental Program Manager
Port of Portland
7200 NE Airport Way Portland OR 97218
T 503-415-6325 F 503-548-5525 C 360-434-0201

From: HAFLEY Dan [mailto:Dan.HAFLEY@state.or.us]
Sent: Thursday, May 03, 2018 1:32 PM
To: Leisle, Dwight <Dwight.Leisle@portofportland.com>
Cc: LACEY David <david.j.lacey@state.or.us>; MCDONNELL Erin <Erin.K.MCDONNELL@state.or.us>; PETERSON Jenn L (jenn.l.peterson@state.or.us) <jenn.l.peterson@state.or.us>; Mike.Poulsen@state.or.us; 'Katy Weil' (Katy.Weil@oregonmetro.gov) <Katy.Weil@oregonmetro.gov>; Carmen Owens <COwens@apexcos.com>; Clough, Herb <HClough@apexcos.com>
Subject: RE: WC Dioxin Practicality Evaluation

EXTERNAL EMAIL:

Erratum

There was an error in my previous email (see red text below). The highlighted text should have read "construction worker (15,000 ng/kg)".

From: HAFLEY Dan
Sent: Tuesday, May 01, 2018 12:58 PM
To: 'Leisle, Dwight' <Dwight.Leisle@portofportland.com>
Cc: LACEY David <david.j.lacey@state.or.us>; MCDONNELL Erin <Erin.K.MCDONNELL@state.or.us>; PETERSON Jenn L (jenn.l.peterson@state.or.us) <jenn.l.peterson@state.or.us>; Mike.Poulsen@state.or.us; 'Katy Weil' (Katy.Weil@oregonmetro.gov) <Katy.Weil@oregonmetro.gov>; Carmen Owens <COwens@apexcos.com>; Clough, Herb <HClough@apexcos.com>
Subject: RE: WC Dioxin Practicality Evaluation

Dwight –

Thank you for submission of the information below, and including Appendix J of the 2017 Upland FS/SCE for the Willamette Cove site.

A few responses for your consideration and our future discussion. We have inserted footnotes (red text) in your write up below indicating where responses are provided.

1. The dioxin TEQ hot spot value approved by DEQ for removal work is applicable to upland receptors (ecological and human). Separate analysis is necessary to determine whether riverbank or beach contamination represents Principal Threat Waste (PTW), analogous to the DEQ hot spot concept.
2. While not a major point, Figure 26 of the 2017 FS/SCE would suggest that non-dioxin hot spots were not "relatively small" prior to removal actions. We look forward to presentation of data illustrating current site conditions with respect to both dioxin and non-dioxin hot spots in the site upland.
3. We believe this is a misinterpretation of rule. Both rule and guidance support the use of current site information in remedial decision-making. If the Port would like to further pursue this line of thought, we recommend that you cite specific elements of rule or statute that you consider supportive of this argument, and we will consult with our DOJ representative.
4. There are two issues of relevance in this discussion – hot spot *identification* and the extent to which hot spots will be *treated*. Hot spot screening/identification in the upland FS should be based on agreed-upon RBCs and accompanying hot spot values (Tables 1 and 2of the 2017 FS/SCE). Data representing current site conditions, including the nature and extent of hot spots, should be appropriately illustrated as indicated in our recent FS/SCE comments. The degree to which 1,000 ng/kg (2,3,7,8-TCDD TEQ) is an appropriate treatment/removal criterion is a separate question.
5. It would be helpful to reference human and ecological hot spot values presented in Tables 1 and 2 of the 2017 FS/SCE to support this statement. Hot spot values for "dioxins" are not presented in either your email or the attached Appendix J. Based on our analysis, the 1,000 ng/kg values *is* below hot spot values for transient (20,000 ng/kg), recreational trespasser (11,500 ng/kg), and recreational trespasser (1,200 ng/kg) exposure scenarios, but exceeds the mammalian hot spot value of 195 ng/kg by a factor of approximately 5. It is unclear to DEQ, at this point, to what extent the Practicability Evaluation is relevant to current site conditions

(see #3 above). This issue warrants more discussion. Given the (areal) extent of hot spot-level contamination, it is unlikely that DEQ would require removal and off-site disposal of contamination in the 195 to 1,000 ng/kg range. We *would* consider whether consolidation and capping is appropriate, and the extent to which "thin capping" might be effective as a long-term remedy.

Bottom line, we would be comfortable with applying the 1,000 ng/kg criterion for assessing the extent of upland hot spots that might pose a risk to human receptors. The value does not appear to "cover" hot spots for mammalian eco receptors. A practicability evaluation for dioxin hot spot treatment/removal can and should be included in the final FS, but we believe that it necessarily be based on current contaminant conditions. We look forward to additional discussion of this matter.

Respectfully,

Daniel J. Hafley, RG
Senior Project Manager / Hydrogeologist
Northwest Region Cleanup Section
Oregon DEQ

From: Leisle, Dwight <Dwight.Leisle@portofportland.com>
Sent: Wednesday, April 18, 2018 6:30 AM
To: HAFLEY Dan (dan.hafley@state.or.us) <dan.hafley@state.or.us>
Cc: LACEY David <david.j.lacey@state.or.us>; MCDONNELL Erin <Erin.K.MCDONNELL@state.or.us>; PETERSON Jenn L (jenn.l.peterson@state.or.us) <jenn.l.peterson@state.or.us>; Mike.Poulsen@state.or.us; 'Katy Weil' (Katy.Weil@oregonmetro.gov) <Katy.Weil@oregonmetro.gov>; Carmen Owens <COwens@apexcos.com>; Clough, Herb <HClough@apexcos.com>
Subject: WC Dioxin Practicality Evaluation

Dan,

This email presents a summary of the approach used to evaluate removal/treatment of hot spots in the original Feasibility Study (Original FS) (Apex, October 3, 2014) and the Final Removal Action Engineering Design Report (Apex, May 18, 2015) for the Willamette Cover Upland Facility (Facility). Additionally, this email addresses the reasons that the Port believes the 1,000 ng/kg dioxin action level* is still valid for use in the Revised Feasibility Study and Source Control Evaluation for the Facility (Revised FS). (1)

The hot spot evaluation for the Facility was presented in the Original FS. Except for dioxins, hot spots at the Facility were limited to relatively small areas (2). For dioxins, hot spots were present throughout much of the facility. Pursuant to DEQ's administrative rules that allow application of a "higher threshold for evaluating the reasonableness of the cost of treating hot spots of contamination," OAR 340-122-0085(5)(a)(B), Apex conducted a practicability analysis to quantify the amount of removal to be conducted. That practicability analysis identified 1,000 ng/kg as the practicable limit of dioxin removal. The Original FS for the Facility was submitted to DEQ by Apex on October 3, 2014.

For the 2015 soil removal action design, Apex targeted removal areas identified by the hot spot analysis and the practicability analysis presented in the Original FS. The areas targeted for removal included all hot spots except that dioxins were limited to soil with concentrations above the 1,000 ng/kg action level. Apex also limited its removal to areas away from the river bank for the reasons discussed in the Final Removal Action Engineering Design Report. The removal action design was submitted to DEQ by Apex on May 18, 2015 and the Removal Action Completion Report was submitted to DEQ on May 27, 2016. DEQ approved the Design Report in a letter dated May 20, 2015 and the Completion Report in an email dated February 2, 2017.

The Port understands the intent of hot spot analysis to be the prioritization of treatment or removal of higher concentration materials at a cleanup site (DEQ, Guidance for Identification of Hot Spots). Specifically, ORS 465.315(e) requires DEQ to select or approve a remedial action requiring treatment of hot spots to the extent treatment is feasible. DEQ's rules address the treatment requirement for hot spots and state that DEQ shall select or approve a remedial action that (a) is protective of present and future public health, safety, and welfare and of the environment, as specified in OAR 340- 122-0040; (b) is based on balancing of remedy selection factors, as specified in OAR 340-122-0090 (3); and (c) treats hot spots of contamination to the extent feasible, as specified in OAR 340-122-0090 (4). This treatment requirement for hot spots is subject to the remedy selection balancing factors and criteria listed in OAR 340-122-0090(4), which specifies that a higher threshold be applied in evaluating the reasonableness of costs for treating hot spots of contamination, whether such treatment occurs onsite or in conjunction with excavation and off-site disposal. However, to achieve a reasonable remedy, costs of hot spot removal or treatment must still be proportionate to the risk reduction achieved by the increased removal or treatment (3).

DEQ regulations and guidance documents indicate that a hot spot analysis should be conducted using the baseline conditions (4), as was done in the Original FS. Conducting a removal action prior to selection of final remedy does not support resetting baseline conditions at a site. In developing the Revised FS, the original baseline conditions still serve as the reference point to evaluate the

various alternatives, balancing *overall* costs with effectiveness, reliability, etc. If done otherwise, conditions would reset each time there was an interim action. In the subsequent finalization of the Revised FS (after the interim action), a new analysis would demonstrate that it is now practicable to conduct additional removal. Logically, it follows that this process could be repeated, and it would be concluded that all hot spots should be removed. If that were the intent of the rule, the rule would have simply stated that hot spots must be removed or treated.

Removal of soil above the 1,000 ng/kg dioxin action level will eliminate human health hot spots for each of the three receptor scenarios (including recreational trespasser/park user) (5) and will achieve a significant reduction in overall risk at the Facility. This reduction in risk, particularly as it relates to human health, is in line with the anticipated future use of the Facility as an open space/natural area with access restrictions controlled by developed trails and other means. Moreover, the remaining hot spots will be managed by treatment or containment depending on the selected remedy. Caps and soil amendments have been repeatedly used to address high concentration hot spots at cleanup sites in Oregon.

For the reasons presented above, we believe that the hot spot evaluation originally presented in both the 2104 FS and the 2017 Revised FS is still applicable as it relates to evaluating remedial alternatives at the Facility. The revised/proposed practicality evaluation for the Revised FS (Appendix J) is attached for reference.

* In the Original FS and the removal action design, Apex used the term remediation level to refer to the 1,000 ng/kg TEQ concentration. Going forward, the 1,000 ng/kg TEQ concentration will be referred to as a “removal action level” to address dioxin hot spots to the extent practicable.

Dwight

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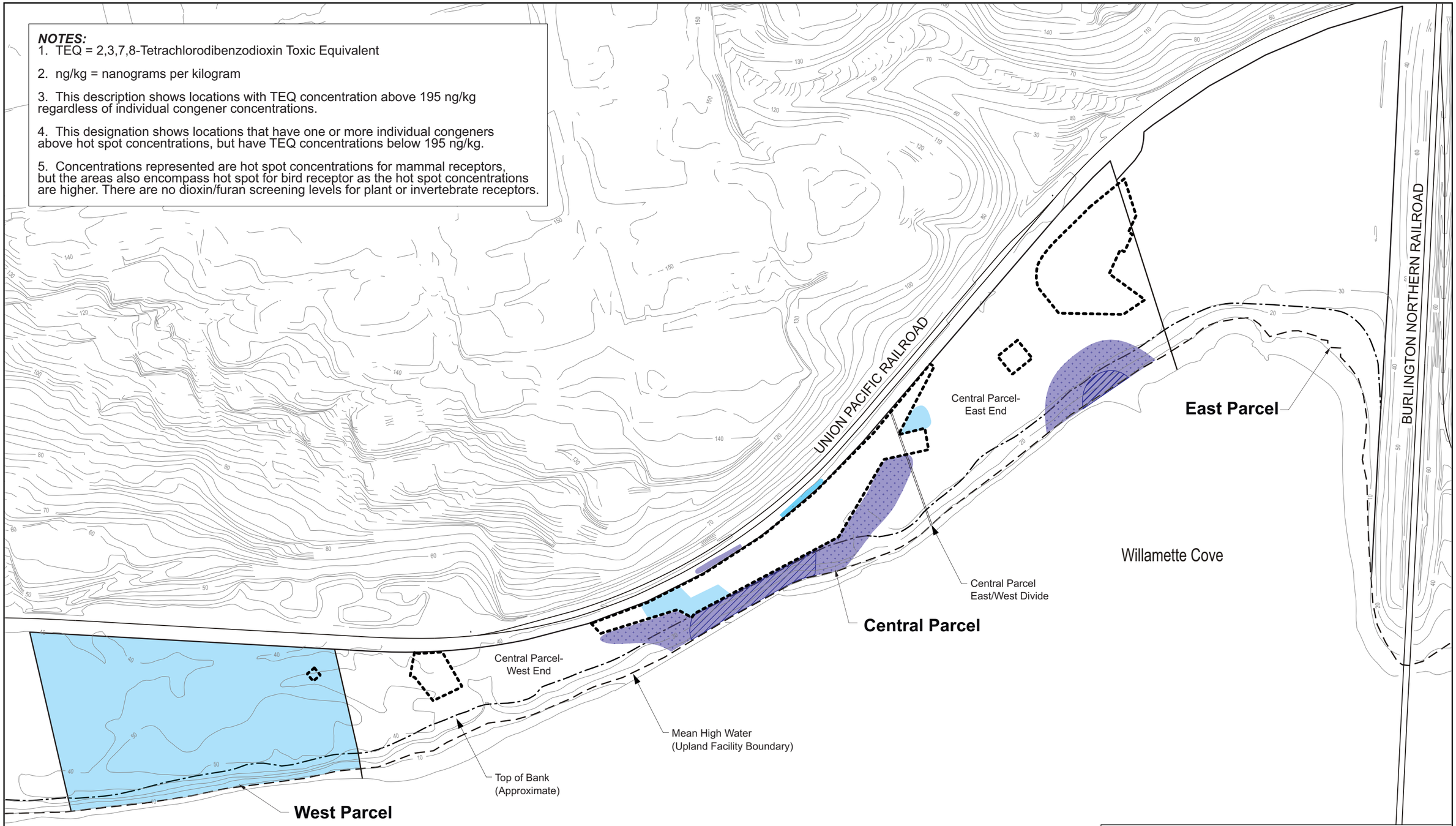
NOTES:

1. TEQ = 2,3,7,8-Tetrachlorodibenzodioxin Toxic Equivalent
2. ng/kg = nanograms per kilogram
3. This description shows locations with TEQ concentration above 195 ng/kg regardless of individual congener concentrations.
4. This designation shows locations that have one or more individual congeners above hot spot concentrations, but have TEQ concentrations below 195 ng/kg.
5. Concentrations represented are hot spot concentrations for mammal receptors, but the areas also encompass hot spot for bird receptor as the hot spot concentrations are higher. There are no dioxin/furan screening levels for plant or invertebrate receptors.



Legend:

- TEQ Hot Spot - Ecological (195 ng/kg)[3]
- 1,2,3,6,7,8-HxCDD Hot Spot - Ecological (230 ng/kg)[4]
- TEQ Concentration From 195-1,000 ng/kg
- TEQ Concentration Above 1,000 ng/kg
- Mean High Water (13.3 NAVD 88)
- Top of Bank
- 2015 Removal Action Area

0 200 400
Approximate Scale in Feet

Note: Base map prepared from an electronic file provided by Hart Crowser.

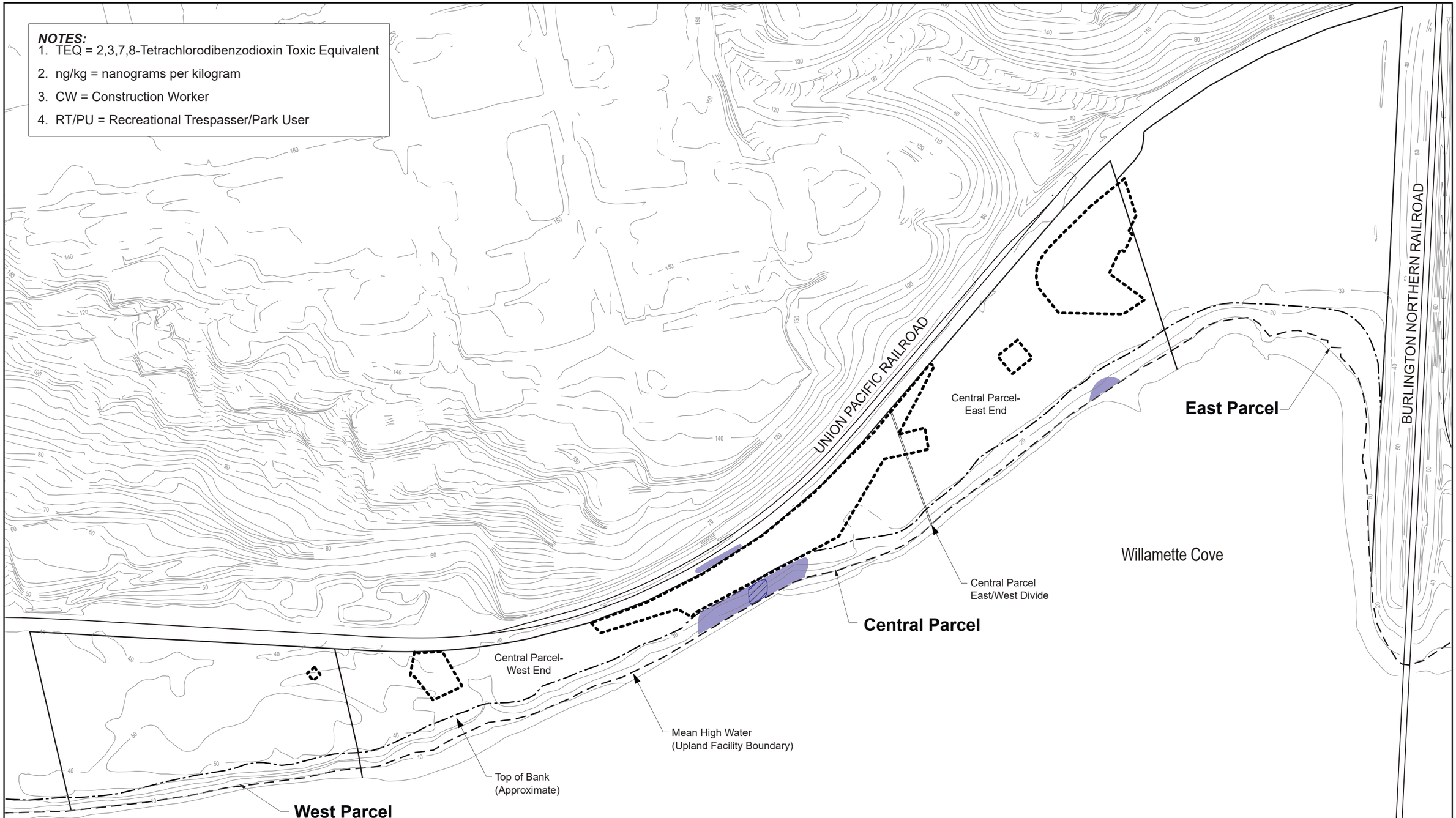
Dioxin/Furan Ecological Hot Spot Summary

Combined Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
June 2018		X

NOTES:
1. TEQ = 2,3,7,8-Tetrachlorodibenzodioxin Toxic Equivalent
2. ng/kg = nanograms per kilogram
3. CW = Construction Worker
4. RT/PU = Recreational Trespasser/Park User



Legend:

- TEQ Hot Spot - RT/PU (1,120 ng/kg)
- TEQ Hot Spot - RT/PU and CW (11,500 ng/kg)
- Mean High Water (13.3 NAVD 88)
- Top of Bank
- 2015 Removal Action Area

0 200 400
Approximate Scale in Feet

N

Note: Base map prepared from an electronic file provided by Hart Crowser.

Dioxin/Furan Human Health Hot Spot Summary

Combined Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
June 2018		X

Dioxin/Furan Soil Volumes
Willamette Cove Upland Facility

	Total		West Parcel		Central Parcel				East Parcel	
					West End		East End			
Soil Depth (feet)[5]	--		1		3		1		1	
Upland Boundary	**TOB**	**MHW**	**TOB**	**MHW**	**TOB**	**MHW**	**TOB**	**MHW**	**TOB**	**MHW**
	Volume in Cubic Yards									
ECOLOGICAL										
Total Dioxin/Furan Ecological Hot Spots	9,850	13,450	6,700	7,750	2,700	4,800	450	900	0	0
TEQ Hot Spot (195 ng/kg)[6]	2,200	4,750	0	0	1,850	3,950	350	800	0	0
1,2,3,6,7,8-HxCDD Hot Spot (230 ng/kg)[7]	7,650	8,700	6,700	7,750	850	850	100	100	0	0
TEQ Concentration from 195-1,000 ng/kg	2,200	3,400	0	0	1,850	2,700	350	700	0	0
TEQ Concentration above 1,000 ng/kg	0	1,350	0	0	0	1,250	0	100	0	0
HUMAN HEALTH										
TEQ RT/PU Hot Spot (1,120 ng/kg)	0	1,100	0	0	0	1,050	0	50	0	0
TEQ RT/PU and CW Hot Spot (11,500 ng/kg)	0	200	0	0	0	200	0	0	0	0

Notes:
1. TOB = Top of Bank
2. MHW = Mean High Water
3. TEQ = 2,3,7,8-Tetrachlorodibenzodioxin Toxic Equivalent
4. ng/kg = nanograms per kilogram
5. Depths used in volume calculations are based on discussion of vertical extent of contamination from the September 2017 Revised Feasbility Study and Source Control Evaluation
6. This includes all soil with a TEQ concentration above 195 ng/kg regardless of individual congener concentrations.
7. This includes all soil with one or more individual congeners with concentrations above hot spot levels, but with a TEQ concentration below 195 ng/kg.
8. RT/PU = Recreational Trespasser/Park User
9. CW = Construction Worker

Attachment A-12

Response to DEQ Comments, Interim Deliverables for Revised FS/SCE, Willamette Cove Upland Facility, November 2018

November 9, 2018

Dan Hafley
Department of Environmental Quality, Northwest Region
700 NE Multnomah Street
Portland, OR 97232 Metro

Subject: FINAL Revised Response to Comments
Interim Deliverables for Revised FS/SCE
Willamette Cove Upland Facility
ECSI# 2066

Dear Dan:

This letter provides the Oregon Department of Environmental Quality (DEQ) with a revised response to the comments received on Interim Deliverables for the Revised Combined Feasibility Study/Source Control Evaluation (FS/SCE) for the Willamette Cove Upland Facility (Facility). The comments were provided to the Port of Portland (Port) in a letter from DEQ dated September 5, 2018.

The Port and DEQ have conducted regular technical meetings to discuss revisions to the FS/SCE. During these meetings, the Port has provided interim deliverables for DEQ review. The Port requested DEQ provide feedback on the interim deliverables provided in the most recent technical meeting (held on August 16, 2018) in an email dated August 20, 2018. The interim deliverables provided were as follows:

- **Handout #1, Draft Agenda.**
- **Handout #2, Draft Response to DEQ Comments on 2017 FS/SCE.** A summary of the discussion or resolution pertaining to individual comments was compiled after each meeting in the Draft Response to Comments document.
- **Handout #3, Revised FS/SCE Table of Contents.** The table of contents of the 2017 FS/SCE was updated to show how the layout of the document has changed based on meeting discussions.
- **Handout #4, Draft Table 11 (Upland Chemicals of Concern).** A table summarizing the list of chemicals of concern was presented based on an updated COC Evaluation documented in a September 7, 2018 memo.
- **Handout #5a, Draft Figures 7-28 (Upland Data Presentation Figures).** Figures formerly requested by DEQ were presented.
- **Handout #5b, Draft Appendix D Tables (Upland Chemical Data Screening).** Tables of the complete current upland data set were presented, showing individual data points compared to relevant screening levels, and summed exceedance ratios at each sample location.
- **Handout #5c, Draft Appendix D Excel Files (Ecological).** Excel files were provided to allow sorting and easy viewing of data as the full dataset for the Facility is very large.

- **Handout #5d, Draft Appendix D Excel Files (Human Health).** Excel files were provided to allow sorting and easy viewing of data as the full dataset for the Facility is very large.
- **Handout #6, Draft Figure 29 (Ecological Risk Area).** A figure summarizing risk to terrestrial ecological receptors in surface soil.
- **Handout #7, Draft Figure 31 (Human Health Risk Area).** A figure summarizing risk to human receptors in surface soil.
- **Handout #8, Draft Text for Hybrid Alternative.** This text presents the components of a remedial alternative that was not included in the 2107 FS/SCE submittal. This alternative combines soil consolidation and capping to reduce risk at the facility.

The comments from DEQ are repeated (in italics) followed by the Port response.

Handout #02, Response to Comments (August 16, 2018)
Page 2, Contaminants of Concern. The discussion of residual risk, defined as conditions after the removal actions occurred, may not get to the intent of the comment. A brief discussion of the nature and magnitude of the material removed and how it relates to the site conceptual model should be included.

Response: This response was updated to reflect the above comment and the updated COC evaluation. The updated response as it will appear in the final document is presented below:

> Revisions have been made to Sections 2, 3, and 5 to more clearly present the residual, or current, risk at the Facility. This includes a summary of both the 2008 and 2015 soil removal actions, the volume and concentrations of soils removed, and how these removal actions changed the conceptual site model. In addition, the updated chemicals of concern (COC) evaluation, presented in a memo dated October 12, 2018, refines risk at the Facility, taking into consideration the soil removal actions. This information will be presented in the Revised FS/SCE and incorporated throughout the document. Additional discussion of dioxins and mercury is included to address potential sources, elevated concentrations, and how they contribute to the conceptual Facility model.

Page 2, Risk Screening. The response to comment only addresses source control screening. For completeness, include a statement confirming screening of "upland" soil includes developing exceedance quotients and hot spots for all soil landward of the mean high water line. This would also clarify responses on Page 5/6 regarding riverbank remediation and the configuration of upland alternatives, comments on Pages 7 -9, all of which refer to this response to comment.

Response: The definition and presentation of upland data at the Facility has been clarified by addition of the following text:

> As discussed during technical meetings conducted between DEQ, the Port, and Metro, upland soil at the Facility is defined as any soil landward of mean high water (MHW) within the Facility boundaries. The current upland soil dataset will include all samples collected at the Facility that have not been removed during either the 2008 or 2015 soil removal actions. The upland dataset is presented in the Revised FS/SCE as follows:

- Tables:
  - Data screening for each analyte group is summarized in Tables 1-10.
  - COCs are summarized for each receptor scenario in Table 11.
- Figures
  - Summed exceedance ratios (ERs) at each sample location and for each receptor scenario are presented on Figures 7-16.
  - The maximum ER for both ecological and human health receptors at each location are presented on Figures 17-31.
- Appendix
  - Appendix D presents the upland soil data screening. Each data point is screened against preliminary remediation goals (PRGs) developed for the Facility during the risk assessment and updated COC evaluation process. ERs are calculated and hot spots identified for each data point, and the sum of all individual ERs at each sample location are calculated.

<u>Page 3, Source Control Presentation.</u> Most upland source control information is now presented in appendices (E, F, and G), which seem to be focused on "data" presentation. It is unclear where source control evaluation results/conclusions will be summarized in text. We note inclusion of a new Section 2.11, but it is not clear that this will have much content. In addition to presentation of a "summary SCE discussion", DEQ recommends all SCE elements in separate appendices be combined into a comprehensive SCE appendix if possible.

Response: All source control information in the main text will be presented in one section. Section 3 will document source control evaluation and present results and conclusions for all source control media including soil, groundwater, and stormwater. This section will also document the process and events which lead to the inclusion of the riverbank soil as part of the in-water remedy for the Portland Harbor Superfund Site (PHSS) and refer to the appendices as necessary.

Source control observations, chemical data screening, and summary figures will be presented in Appendix E. This appendix will serve as a comprehensive appendix for source control observations, data screening, and data presentation.

<u>Page 4, Alternative 7.</u> DEQ is willing to consider a proposal for confirmatory sampling as an alternative to demarcation layer as part of the FS document, while noting that a demarcation layer has proven to be a highly reliable measure for determining cap integrity. Confirmation sampling should not replace demarcation layer in FS analysis.

Response: The language in the response was revised to clarify that confirmatory sampling will be evaluated as part of remedy options, along with a demarcation layer. The clarified response is shown below:

> As part of the subsequent discussion on this comment during technical meetings, it was agreed that the Revised FS/SCE would include evaluation of confirmation sampling, as part of long-term operation and maintenance (O&M). In addition, evaluation of a demarcation layer will include assessment of no demarcation layer, standard demarcation layer (ie. geotextile fabric), and alternative forms of demarcation such as visible soil amendment or orange construction fencing.

<u>Page 6, Alternative 7 Details.</u> The response, as discussed at the 6/20/18 meeting, is that the consolidation area will be on the West Parcel instead of the East Parcel. At the 8/16/18 meeting,

there was further discussion that the already disturbed East Parcel may be more appropriate as an on-site disposal area. Removal of contaminated material by rail was also discussed.

Response: Movement of materials by rail will be considered as part of the Revised FS/SCE. The following text was added to the response to clarify soil consolidation area placement:

> As part of the subsequent discussion on this comment, considerations for location of the soil consolidation area within the Facility were considered. Evaluation of soil consolidation area location will be included in the Revised FS/SCE for the purpose of comparing alternatives. It is likely that work on the riverbank as part of the in-water remedy will affect the possible size and location of the soil consolidation area. As such, a decision on size, shape, and location of the soil consolidation area will be finalized during remedial design.

Page 7, Bankline Stabilization. Please add the following to your response: "Riverbank and shallow in-water data from the Willamette Cove site will be addressed by presentation of analytical data, erosion analysis, etc. are presented in Appendix F of the FS/SCE for EPA consideration.

Response: The sentence has been added to the response.

Page 7, Data Uncertainty. Please add the following to your response: "Forthcoming pre-design work is expected to include additional riverbank and beach contaminant characterization work under EPA."

Response: The sentence has been added to the response.

Page 12, additional sampling results (Section 4.3.1). It is important that observations of NAPL and sheen, particularly as they relate to the inner cove and wharf road area, be included in the source control evaluation. These observations and associated analytical data will be important to EPA as they advance in-water work. DEQ expects that forthcoming pre-design work will include additional assessment of contaminant conditions, including observations of NAPL, during low water conditions.

Response: The response to this comment was expanded to note that non-aqueous phase liquid (NAPL) and sheen observations along with associated sample results will be described in the text portion of Appendix E. Sample results will be included in Appendix E tables and NAPL/sheen observations will be documented on Appendix E figures.

Page 13, historical and cultural resources (Section 5.2). Note that SHPO does not protect only tribal resources, but historical resources. Some Oregon resource designations require protection/consideration for anything over 25 years old, while the federal "trigger" is 50 years. We acknowledge the comment about the magnitude of historical filling at the site, but nevertheless feel that SHPO engagement will be important, in particular to tribal entities that will be commenting on any proposed site remedy.

Response: The Port will engage with State Historic Preservation Office (SHPO) as needed during remediation activities to protect both State and Federally designated resources.

Page 15, dioxin hot spot levels (Section 7.0). As an appendix to the RTC, please include the Apex memo which discusses all hot spot values that were discussed, not just the 1,000 ng/kg value.

Response: It is assumed that DEQ is referring to the May 1, 2018 email documenting areas and quantities of dioxin/furan concentrations within multiple ranges at the Facility. This has been added as an attachment to the Response to Comments letter. Dixon/furan concentrations and hot spots will be fully discussed in the FS, including identification and location of soil containing dioxins in the 195 to 1,000 ng/kg range, and associated with potential excavation and off-site disposal.

Pages 18/19, confirmation sampling (Section 11.0). This response could perhaps be misinterpreted as DEQ approving confirmation sampling over demarcation layer use. This is not the case. As noted in our response above for Page 4, DEQ is willing to consider a proposal for confirmatory sampling as an alternative to demarcation use, but question its long-term viability. Similarly, DEQ agreed that a pilot test might have value. We did not agree to move forward with a pilot test for the confirmation sampling approach in lieu of demarcation layer use.

Response: As part of the subsequent discussion on this comment during technical meetings, it was agreed that the Revised FS/SCE would include evaluation of confirmation sampling, as part of the long-term O&M. Confirmation sampling as part of long-term O&M as well as a demarcation layer will be evaluated to assess cap performance. Similarly, the use of a pilot test will be included as part of the confirmation sampling evaluation.

Page 19, groundwater (Section 11.0). We recommend adding text along the following lines: "Porewater data collection is expected to be completed adjacent to the West Parcel as part of forthcoming pre-design work, for which negotiations are currently underway, and in which the Port of Portland will be involved."

Response: This sentence was added to the response.

Page 19, risk analysis (Section 11.2). DEQ assumes that the residual risk assessment will be updated with the re-screening for COC identification currently on-going. It was agreed that this evaluation would be summarized in a memo which would then be an appendix to the FS.

Response: The residual risk assessment will be revised according to the updated COC evaluation memo dated November 8, 2018. Residual risk appraisal will be based on the updated COC evaluation.

Other. A number of responses note that the site riverbank is "better addressed as part of in-water activity." We recommend stating: "EPA has determined that the site riverbank, extending from top of bank to waterline, will be addressed as part of in-water activity."

Response: This language has been revised throughout the document.

Handout #03, revised Table of Contents

- *See RTC for Page 3, above, regarding presentation of SCE materials.*

Response: See response to *Page 3, Source Control Presentation* comment above for a detailed description of source control documentation and presentation. This will be reflected in the table of contents included in the Revised FS/SCE.

Handout #04, draft Table 11 (COCs)

- *The individual carcinogenic PAHs do not all need to be presented if benzo[a]pyrene toxicity equivalents are used for human exposure.*

Response: The presentation of carcinogenic polycyclic aromatic hydrocarbons (PAHs) was revised and presented in the updated COC evaluation memo. Individual carcinogenic PAHs are not presented.

Handout #05a, Figures 2-28

- *"Subsurface data" presented in tables and figures are developed for construction worker exposure only, and represent data from 0-10 feet bgs. While presented as "subsurface soil", these in fact represent both surface and subsurface soil, and there is not separate present of subsurface data that we could find. Associated figures, for example Figure 15, suggest that the "subsurface soil" data set is robust, when in fact the data set is small. Two comments related to this:*
    - *We recommend that the "true" subsurface data set somehow be represented in the FS and discussed, as this has an obvious bearing on remedy selection and the likelihood that removal of surface soil will eliminate contamination exceeding human health risk-based concentrations.*
    - *Robust confirmatory sampling will be necessary to support remedial action that contemplates surface soil removal, to confirm that "leave surface" contaminant levels achieve remedial goals. DEQ has previously recommended that the Port/Metro consider additional sampling to support remedial design work. Given the size of the site, incremental sampling should be considered.*

Response: Data screened against construction worker PRGs are presented for both surface (0-3 feet below ground surface [bgs]) and subsurface (3-10 feet bgs) to allow distinction between the data sets. Figures showing the separate surface and subsurface data for mercury compared to construction worker PRGs are shown in Attachment A. Additional sampling to support remedial design work will be completed as necessary based on the chosen alternative.

- *Figures and sample labels identifying "TEQ" should be "Dioxin TEQ" unless otherwise obvious.*

Response: The use of TEQ is preceded by Dioxin or other relevant qualifiers within the text and figures.

- *As we believe was discussed, it would be helpful to include ISM sampling results and associated risk screening ERs, in particular for the West and East parcel DUs where discrete/ composite data are minimal.*

Response: Incremental sampling methodology (ISM) sample results will be added to the figures, noting which ISM samples are no longer considered representative due to soil removal.

- *A decision should be made on significant digits in presenting ER data. Rounding to the nearest tenth or whole integer is probably adequate.*

Response: Exceedance ratios are rounded to the nearest tenth throughout the tables and figures.

- *Some "primary" figures, for example 17 and 21, show only data from the Central Parcel, presumably because there are no data from the West and East Parcel areas that exceed PRGs, or detected contaminants were not identified as COCs (based on calculated 90% UCL data). We find this a bit confusing, and are concern that outside readers may be as well. Let's discuss.*

Response: All sample locations have been added to the figures with a designation noting the locations that do not exceed PRGs or that have no data for the analyte of interest.

- *Figure 11a. We discussed at the 8/16/18 meeting that the figures should clarify that no ER means the COCs were not detected. This figure has both BAPEQ and benzo[a]pyrene. It is best to consistently show benzo[a]pyrene toxicity equivalents (BAPEQ).*

Response: A note has been added to figures clarifying that sample locations without an ER did not have detectable concentrations of COCs, or have an ER less than 0.1. Figures for PAHs depict only benzo(a)pyrene toxic equivalents (BaPEq).

- *The figures do not provide exceedance ratios for all samples that fall above the mean high water line (e.g. Figure 8d: WCSSJ, WC-SSI, WC-SSN, WE-SSH). Please clarify.*

Response: There were no exceedances of COCs in these samples. This has been clarified on the figures.

- *DEQ is waiting on a submittal of the (updated) COC identification memo. Once COCs and associated risk-based screening values have been identified, updated figures and tables should be presented including all relevant "upland" samples.*

Response: The updated COC evaluation memo was submitted on November 8, 2018. Updated figures and tables will be presented to DEQ prior to submittal of the Revised FS/SCE.

- *The screening tables do not include all chemicals that have an HQ>1 in the calculation of the summed ERs.*

Response: Only COCs were considered in the calculation of summed ERs.

- *Let's discuss whether additional "color coding" of the data would be useful beyond that for "maximum ER" in figures 17 through 28.*

Response: Data on Figures 17 through 28 will be color coded based on the quantity of the summed ER. ERs ranging from 0-9.99, 10-99.99, and greater than 100 will be distinguished.

Handouts #05b to 05c of Appendix D – updated soil data screening
Table D-2 Human Health PRGs. DEQ considers it acceptable now to use the dioxin/furan TEQ, and remove the individual congeners from the table. Similarly, the benzo[a]pyrene TEQ can be used, and the individual cPAHs removed.

Response: Individual dioxin/furans and carcinogenic PAHs (cPAHs) have been removed from the tables.

<u>Table D-4a Human Health Exceedance Ratios.</u> The exceedance ratio heading for "TR/PU PRG" should be "RT/PU PRG". In the columns to the right of the table, the columns labeled "hot spot" are presumably exceedance ratios for hot spots, and should be labeled accordingly. It might be helpful to have an additional heading at the top identifying the columns for RT/PU, TT, and CW.

Response: The labeling error has been corrected. The columns to the right of the table are intended to note the locations that have concentrations exceeding hot spot values with an "X". This has been clearly labeled in the tables.

<u>Table D-4d RT/PU Exceedance Ratios by Location.</u> Individual dioxins/furans can be eliminated and replaced by dioxin TEQ. Copper and mercury have PRGs, but are not identified as COCs. In this case ERs are not calculated. Alternatively, because PRGs are available, ERs could be calculated. It would be reasonable to omit any ERs from figures if the value is low, such as below 0.01.

Response: Individual dioxin/furan congeners have been removed from the tables. Analytes that are not COCs are not considered in the summed ER calculations. As ERs are now rounded to the tenth, sample locations with an ER below 0.1 have been removed from the figures.

<u>Appendix D-5.</u> For ecological risk, individual dioxins / furans cannot be eliminated and replaced with dioxin TEQ. In reviewing the Appendix D-5 Tables, only dioxin TEQ is identified as a COC and not individual congeners. For this site, the congener specific food chain (bioaccumulative) PRGs were developed with the toxicity equivalency factors already applied. Therefore, in order to provide a meaningful ER, each of the congener specific exceedance ratios need to be added to the receptor ER summations. Currently, Table D-3e exceedances do not include the congener ERs. In some cases, congener specific ERs are greater than dioxin TEQ.

Response: Individual congener ERs have been included in the summed ER calculations.

Handouts #06 and #07 – summary figures.

- *As noted during our August meeting, we do not find the figures to be as useful as, say, ER summary figures for human and ecological risk, but nevertheless understand why they have been prepared and approve their inclusion.*

Response: Noted.

- *Both figures contain show lines, other than those delineating the individual parcels, the meaning of which is unclear and that may cause confusion. Please clarify.*

Response: Lines delineating parcel and risk area boundaries have been distinguished.

Handout #08 – draft text for hybrid alternative

Thank you for inclusion of this additional remedial alternative, which addresses DEQ's concern about the adequacy of the "thin cap" option, while including hot spot removal and on-site soil consolidation. A few comments to consider:

<u>Alternative Description and Analysis.</u> There are now nine alternatives in the FS. In reviewing the 2017 alternative discussion, in combination with that for new Alternative 9, we are having

some difficulty distinguishing the individual characteristics of the alternatives, and are concerned that this may be an issue with the interested public. In retrospect, we should have perhaps recommended reducing/consolidating the alternatives for clarity.

In "laying out" the various alternatives and their merits/drawbacks as part of the upcoming public outreach process, it will be important that differences between alternatives be clearly understood. We recommend preparation of an additional table for the FS, along the lines of Table 25, which identifies the main remedial elements/distinguishing characteristics of each alternative. This would include not only the core remedial elements (hot spot excavation or not, thin versus normal capping, on-site consolidation or not), but volume estimates for contaminated that is "moved" (relocated on-site or disposed of off-site) and clean materials imported for backfilling or capping. Similarly, please consider preparing "mock ups" (illustrations) for, say, the top three remedial alternatives that are public-friendly. Typical cross sections are presented in Figure 28 of the 2017 FS (each for multiple alternatives). While useful, these might not be easily understandable by the public as they reference multiple alternatives. Illustrations would include information on soil consolidation area(s), thickness of cap (1- versus 2-foot), etc.

Response: A table summarizing the elements of each remedial alternative has been added to the Revised FS/SCE and is included as Attachment B of this letter. In addition, alternatives that are similar have been grouped together and an 'a' and 'b' distinction has been added, similar to the presentation of Alternative 3a and 3b in the 2017 FS, to reduce the number of alternatives. To avoid confusion, particularly regarding the current Alternative 9, the remedial alternatives will continue to be referred to with the current numbering scheme. In the final Revised FS/SCE submittal, the change in alternative numbers shown in Attachment B will be presented and documented. The Revised FS/SCE will include a separate figure for each remedial alternative. Figures for the recommended alternative(s) will be created with the intent of being easily understandable by the general public.

<u>Human Health Risk Assumptions.</u> The exposure assumptions in the risk assessment assumed limited exposure. Future site development such as play areas, sports fields, and picnic areas are not contemplated by the park user exposure assessment.

Response: The text for the hybrid alternative proposes the Facility have restrictions that limit use to passive activities, and do not allow active uses as described in the comment.

<u>Monitoring.</u> Expectations for monitoring will require additional discussion. Alternative 9 currently envisions "A minimum of five years of active inspection and maintenance. Long term annual inspection would be required thereafter at least on an annual basis." Depending on the final remedy, at some point it might be reasonable to go to five year monitoring. Details can be worked out in remedy design.

Response: Annual monitoring of cap integrity for fifteen years will be incorporated into the FS for evaluation purposes. The intent to clarify details during remedy design will be noted.

<u>Basis for Alternative 9.</u> If a demarcation layer and (generally) two feet of overlying clean fill are envisioned to address residual ecological risk, it is not clear that separate consolidation and capping of non-hot spot soil exceeding human health criteria would be necessary or practical.

Response: It is noted that the two foot cap may be robust enough to contain soil exceeding human health criteria, which makes this alternative similar to other remedial alternatives. To

evaluate a distinct remedial option, the alternative will be revised to consider the consolidation of soil above human health risk criteria and a one or two foot cap over soil exceeding ecological risk criteria. The combination of soil consolidation and a one to two foot cap combines elements from Alternative 5 and Alternative 7 to produce a unique option. The use of a one or two foot cap will be guided by ecological risk. A decision matrix showing the process that will be used to distinguish areas with a one foot and two foot cap is included as Attachment C. The matrix will lays out a straightforward decision process, using soil concentrations and exceedance rations to guide cap application and thickness. An overview of this Revised Alternative 9 will be presented to DEQ with descriptive text, figure, and cost tables.

Please call me at (503) 415-6325 if you have any questions.

Sincerely,

Dwight Leisle
Environmental Project Manager

c: Katy Weil, Metro
Sean Sheldrake, EPA
Eva DeMaria, EPA
Teresa Jacobs, Port
Suzanne Barthelmess, Port
Herb Clough, Apex Companies
Mark Lewis, Formation Environmental
LWP File

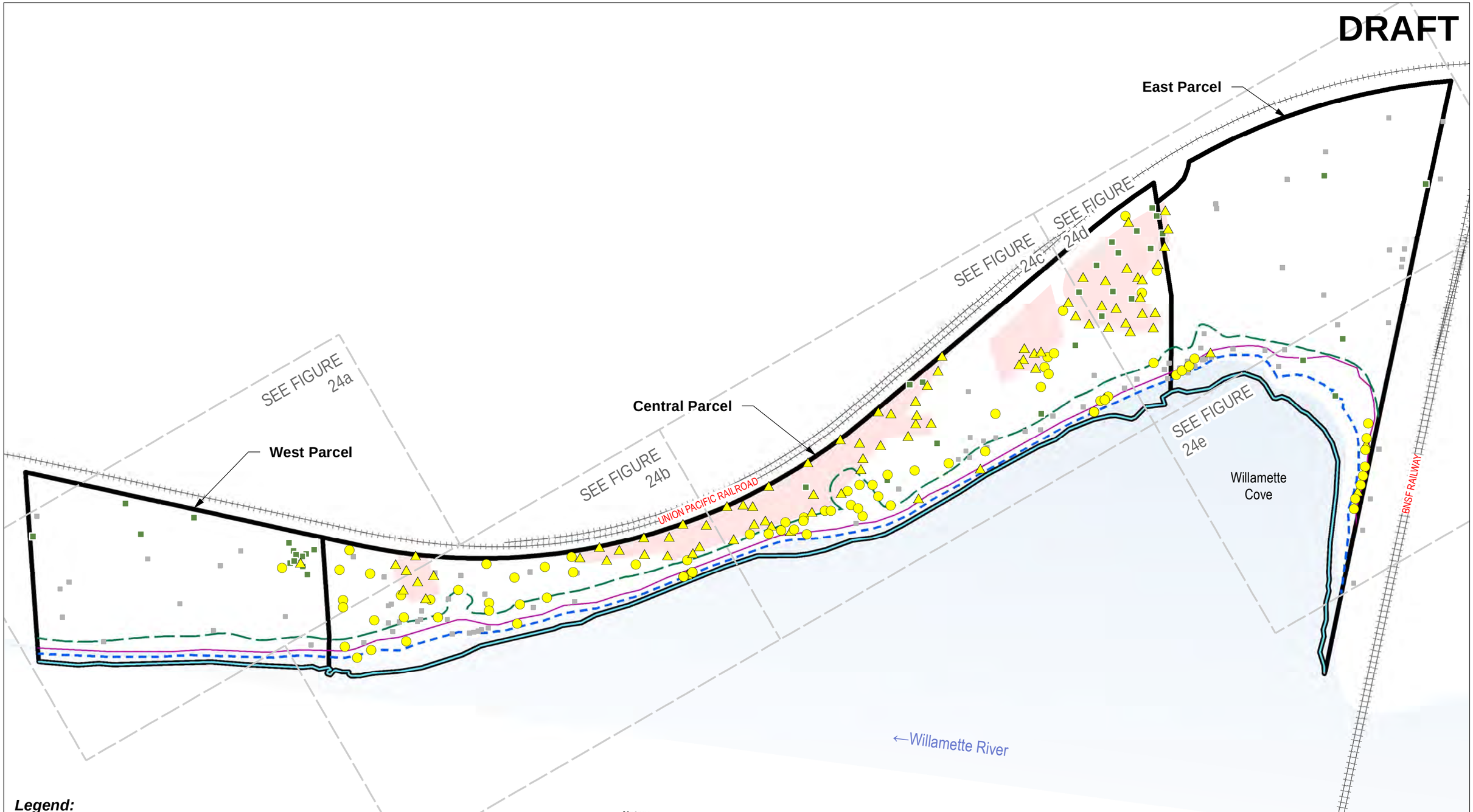
Attachments

A Maximum ERs for Surface and Subsurface Mercury
B Summary of Remedial Alternatives
C Cap Thickness Decision Matrix – Alternative 9

Attachment A

Maximum ERs for Surface and Subsurface Mercury

DRAFT



Legend:

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- Composite Sample Concentration Above CW PRG (110 mg/kg)
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- Concentration Less Than MDL, MDL Below Screening Level
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- RA3-B16 — Sample ID; (0.1) — ER[1]

Notes:

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7. Surface soil is represented by samples meeting all of the following: within the depth range of 0 to 3 feet below ground surface; located within the Facility boundary; located where the surface elevation is at or above mean high water; and sample location was not removed during a removal action.

0 200 400

Approximate Scale in Feet

N

Maximum ERs - Human Health PRGs
Mercury in Surface Soil

Combined Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

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October 2018		24

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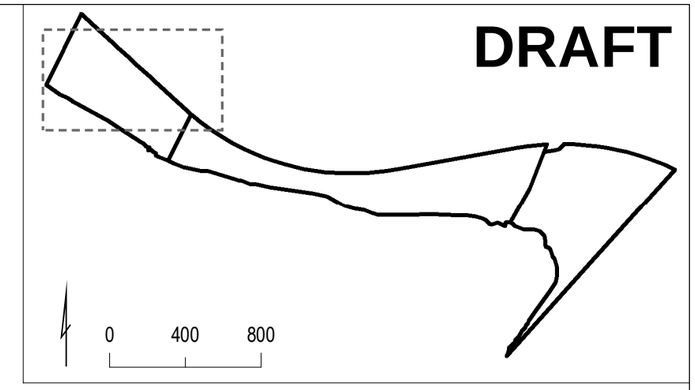

UNION PACIFIC RAILROAD

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0 60 120 N

Approximate Scale in Feet

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Maximum ERs - Human Health PRGs
Mercury in Surface Soil - 1 of 5

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Project Number	1056-10	Figure
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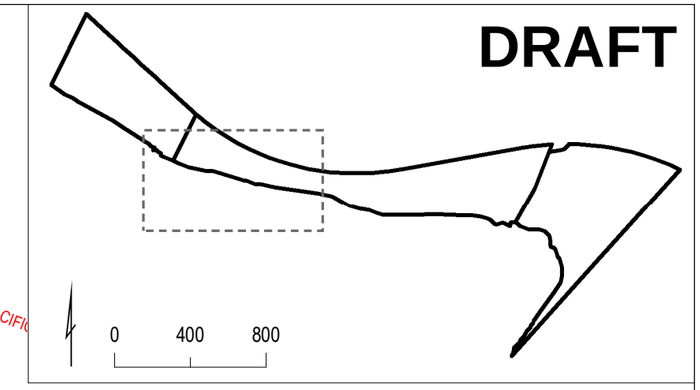

UNION PACIFIC

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0 60 120 N

Approximate Scale in Feet

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Maximum ERs - Human Health PRGs
Mercury in Surface Soil - 2 of 5

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Project Number	1056-10	Figure
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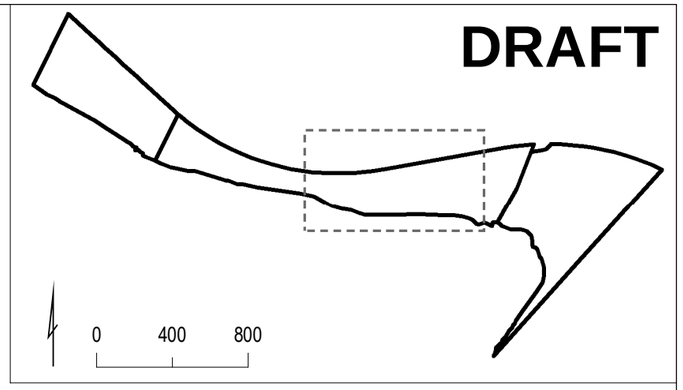

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RA3-B16 — Sample ID
(0.1) — ER[1]

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0 60 120 N

Approximate Scale in Feet

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Maximum ERs - Human Health PRGs
Mercury in Surface Soil - 3 of 5

Combined Feasibility Study and Source Control Evaluation
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Project Number	1056-10	Figure
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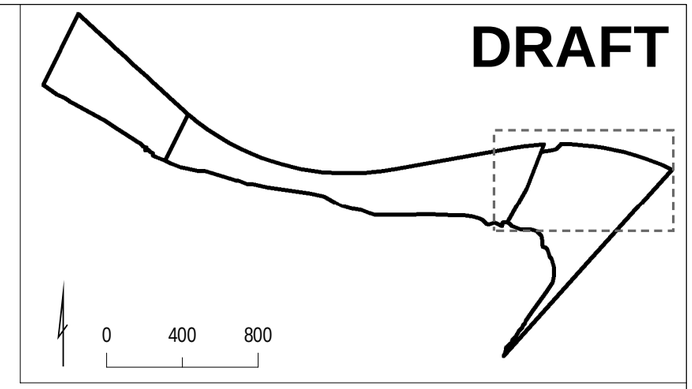

UNION PACIFIC RAILROAD

BNSF RAILWAY

Legend:

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0 60 120 N

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Maximum ERs - Human Health PRGs
Mercury in Surface Soil - 4 of 5

Combined Feasibility Study and Source Control Evaluation
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Project Number	1056-10	Figure
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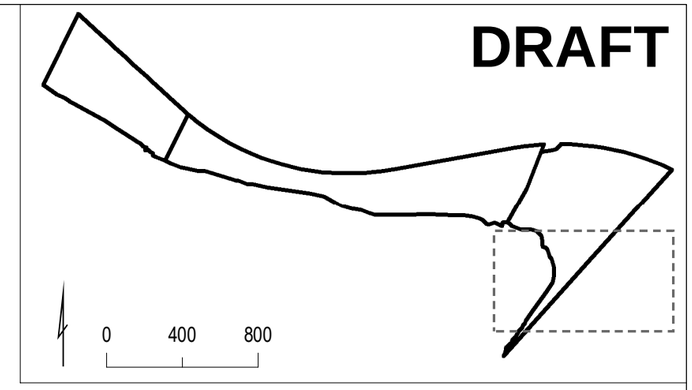

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Maximum ERs - Human Health PRGs
Mercury in Surface Soil - 5 of 5

Combined Feasibility Study and Source Control Evaluation
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Project Number	1056-10	Figure
October 2018		24e

DRAFT

East Parcel

Central Parcel

West Parcel

SEE FIGURE 25a

SEE FIGURE 25b

SEE FIGURE 25c

SEE FIGURE 25d

SEE FIGURE 25e

UNION PACIFIC RAILROAD

BNSF RAILWAY

Willamette Cove

←Willamette River

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0 200 400
Approximate Scale in Feet

N

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Maximum ERs - Human Health PRGs
Mercury in Subsurface Soil

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Portland, Oregon

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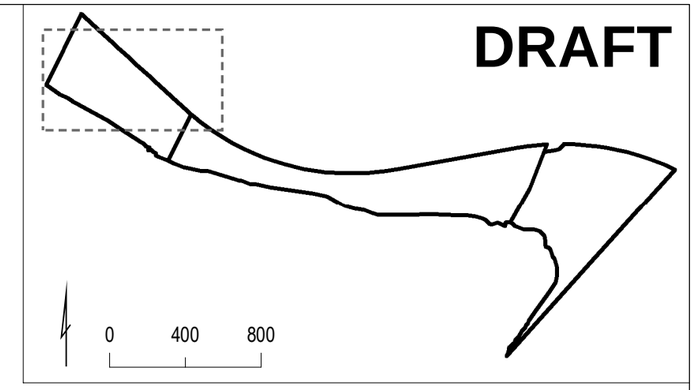
Project Number	1056-10	Figure
October 2018		25



UNION PACIFIC RAILROAD

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0 60 120
Approximate Scale in Feet

N

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Maximum ERs - Human Health PRGs
Mercury in Subsurface Soil - 1 of 5

Combined Feasibility Study and Source Control Evaluation
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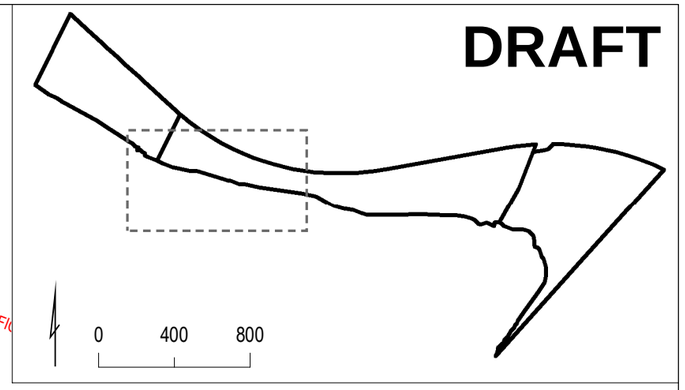

UNION PACIFIC

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0 60 120 N

Approximate Scale in Feet

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Maximum ERs - Human Health PRGs
Mercury in Subsurface Soil - 2 of 5

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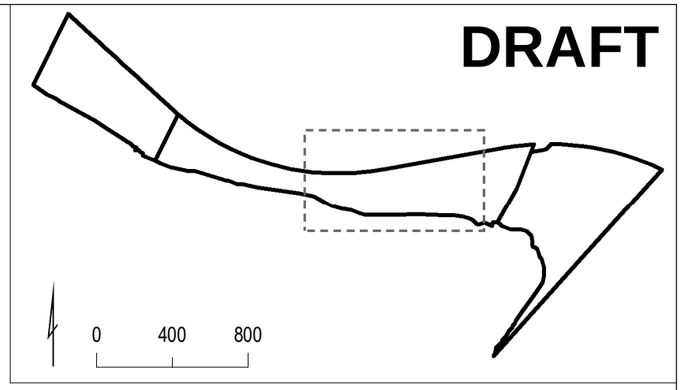
Project Number	1056-10	Figure
October 2018		25b



UNION PACIFIC RAILROAD

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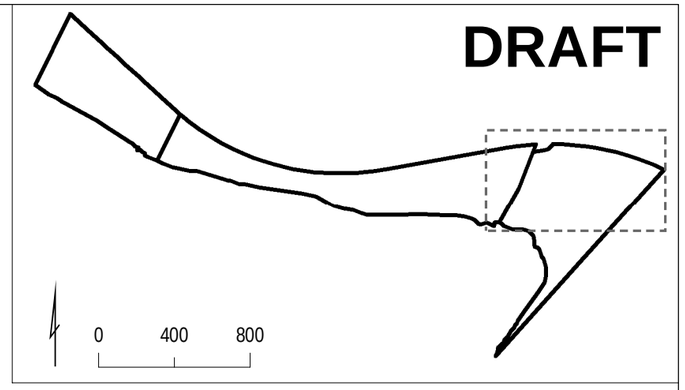
Maximum ERs - Human Health PRGs
Mercury in Subsurface Soil - 3 of 5

Combined Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
October 2018		25c



UNION PACIFIC RAILROAD

BNSF RAILWAY

Legend:

- Composite Sample Concentration Above CW Hot Spot Concentration (1,110 mg/kg)
- Discrete Sample Concentration Above CW Hot Spot Concentration (1,110 mg/kg)
- Composite Sample Concentration Above CW PRG (110 mg/kg)
- Discrete Sample Concentration Above CW PRG (110 mg/kg)
- Composite Sample Concentration Above MDL
- Discrete Sample Concentration Above MDL
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Sample Location Not Analyzed For Constituent

- Parcel Boundary
- Removal Action Area
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

RA3-B16 — Sample ID
(0.1) — ER[1]

Notes:

1. ER = Exceedance Ratio - ERs are rounded to the nearest tenth. ERs less than 0.1 are not shown.
2. mg/kg = Milligrams Per Kilogram
3. PRG = Preliminary Remediation Goal, Ecological Residual Risk Assessment, Formation Environmental, January 2014
4. MDL = Method Detection Limit
5. CW = Construction Worker
6. ERs calculated using lowest applicable PRG (CW).
7. Subsurface soil is represented by samples meeting all of the following: within the depth range of 3 to 10 feet below ground surface; located within the Facility boundary; located where the surface elevation is at or above mean high water; and sample location was not removed during a removal action.

0 60 120
Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Maximum ERs - Human Health PRGs
Mercury in Subsurface Soil - 4 of 5

Combined Feasibility Study and Source Control Evaluation
Port of Portland
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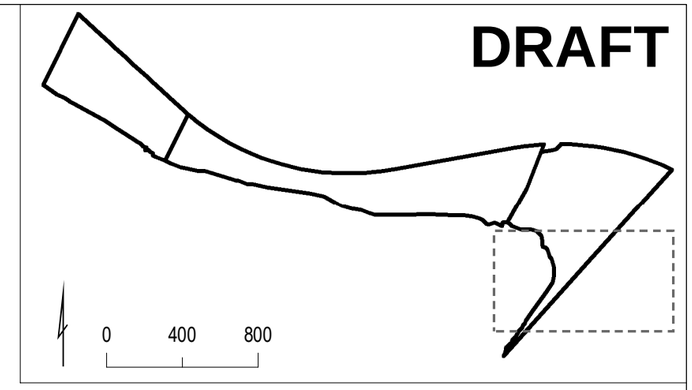
Project Number	1056-10	Figure
October 2018		25d



BNSF RAILWAY

Legend:

- Composite Sample Concentration Above CW Hot Spot Concentration (1,110 mg/kg)
- Discrete Sample Concentration Above CW Hot Spot Concentration (1,110 mg/kg)
- Composite Sample Concentration Above CW PRG (110 mg/kg)
- Discrete Sample Concentration Above CW PRG (110 mg/kg)
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- Concentration Less Than MDL, MDL Below Screening Level
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- RA3-B16 — Sample ID
- (0.1) — ER[1]

Notes:

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4. MDL = Method Detection Limit
5. CW = Construction Worker
6. ERs calculated using lowest applicable PRG (CW).
7. Subsurface soil is represented by samples meeting all of the following: within the depth range of 3 to 10 feet below ground surface; located within the Facility boundary; located where the surface elevation is at or above mean high water; and sample location was not removed during a removal action.

0 60 120

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Maximum ERs - Human Health PRGs
Mercury in Subsurface Soil - 5 of 5

Combined Feasibility Study and Source Control Evaluation
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Attachment B

Summary of Remedial Alternatives

Summary of Remedial Alternatives
Willamette Cove Upland Facility

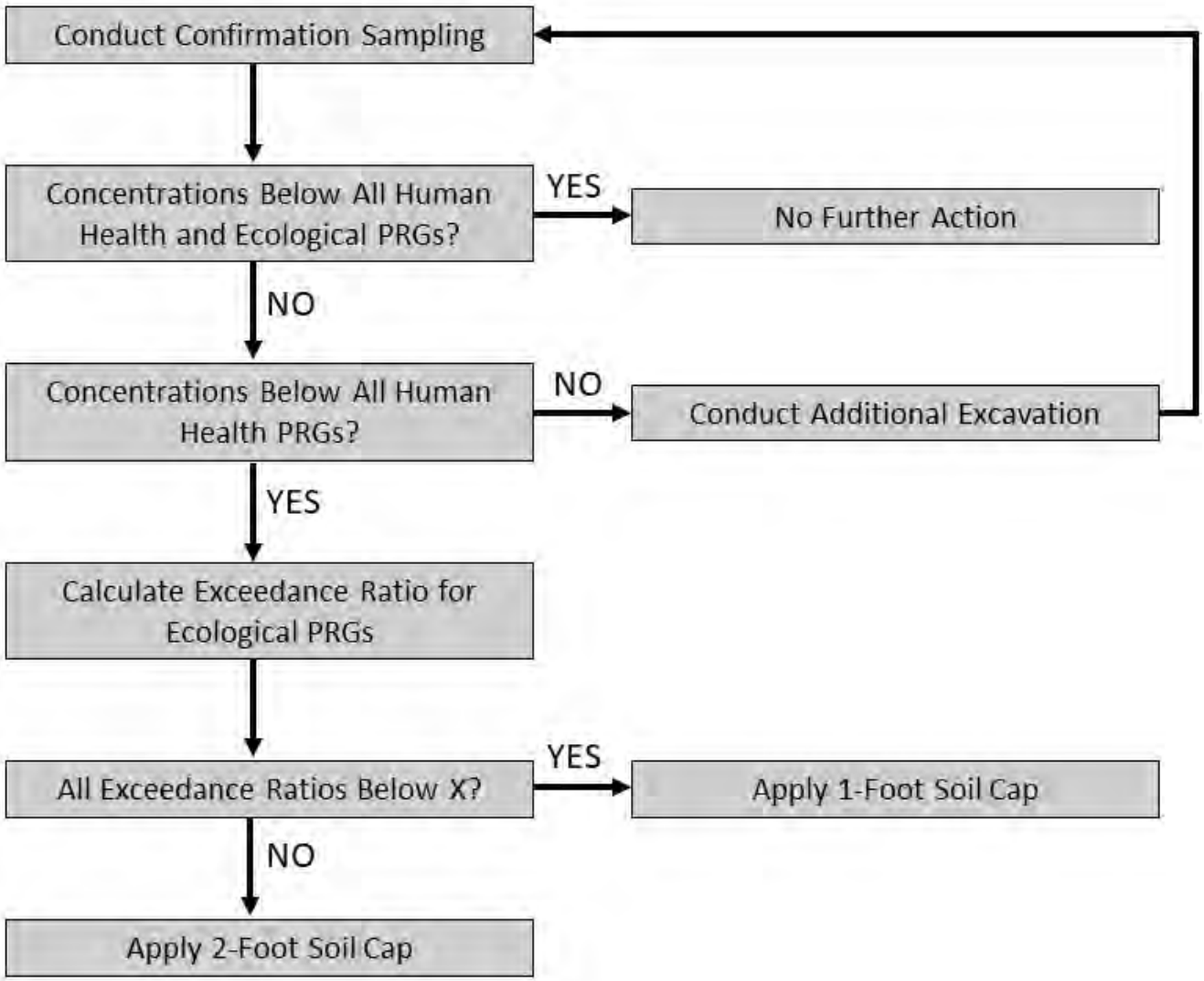
Alternative	Description	High Concentration Soil			Soil Above Human Health Risk Levels			Soil Above Ecological Risk Levels			Native Trees Retained	Institutional Controls
		Remove	Consolidate	Cap	Remove	Consolidate	Cap	Remove	Consolidate	Cap		
Alternative 1 - No Action												
1 (1)[1] **No Action**	▪ No action will be taken.											
Alternative 2 - Cap												
2a (2) **Standard Cap**	▪ A two-foot soil cap will be placed across the Site. ▪ All trees will be removed.			✓			✓			✓		✓
2b (8) **Amended Cap**	▪ A one-foot cap amended with organic matter will be placed across the Site. ▪ Native trees will be retained.			✓			✓			✓	✓	✓
Alternative 3 - Excavation												
3a (3a) **Standard Excavation with Off-Site Disposal**	▪ Standard excavation will be used to remove all soil with concentrations above human health and ecological risk levels. ▪ Soil will be disposed of in an off-Site landfill. ▪ All trees will be removed.	✓			✓			✓				
3b (3b) **Alternative Excavation with Off-Site Disposal**	▪ Alternative excavation will be used to remove soil with concentrations above human health and ecological risk levels. ▪ Soil will be disposed of in an off-Site landfill. ▪ Native trees will be retained.	✓			✓			✓			✓	
3c (4) **Standard Excavation with On-Site Consolidation**	▪ Standard excavation will be used to remove all soil with concentrations above human health and ecological risk levels. ▪ Soil will be placed in an on-Site consolidation area. The soil consolidation area will be capped with two-feet of soil. ▪ All trees will be removed.		✓			✓			✓			✓
3d (5) **Standard Excavation with Off-Site Disposal/On-Site Consolidation**	▪ Standard excavation will be used to remove all soil with concentration above human health and ecological risk levels. ▪ Soil with high concentrations will be disposed of in an off-Site landfill. ▪ Remaining soil with concentrations above human health and ecological risk levels will be placed in an on-Site consolidation area. The soil consolidation area will be capped with two-feet of soil. ▪ All trees will be removed.	✓				✓			✓			✓
Alternative 4 - Focused Excavation with Cap												
4a (6) **Focused Standard Excavation with Off-Site Disposal and Cap**	▪ Standard excavation will be used to remove soil with high concentrations. ▪ Soil with high concentrations will be disposed of in an off-Site landfill. ▪ A two-foot soil cap will be placed across the Site. ▪ All trees will be removed.	✓					✓			✓		✓
4b (7) **Focused Alternative Excavation with Off-Site Disposal and Amended Cap**	▪ Alternative excavation will be used to remove soil with high concentrations. ▪ Soil with high concentrations will be disposed of in an off-Site landfill. ▪ A one-foot cap amended with organic matter will be placed across the Site. ▪ Native trees will be retained.	✓					✓			✓	✓	✓
4c (9) **Focused Alternative Excavation with Off-Site Disposal/On-Site Consolidation and Cap**	▪ Alternative excavation will be used to remove soil with high concentrations. ▪ Soil with high concentrations will be disposed of in an off-Site landfill. ▪ Remaining soil with concentrations above human health risk levels will be placed in an on-Site consolidation area. The soil consolidation area will be capped with two-feet of soil. ▪ A one- to two-foot soil cap will be placed across remaining areas with soil concentrations above ecological risk levels. ▪ Native trees will be retained.	✓				✓				✓	✓	✓

Notes:

1. **1**(1) = **New alternative numbering system to be used in future Revised FS/SCE submittal** (Old alternative numbering system used in 2017 FS/SCE)
2. High Concentrations Soil is defined as soil with a dioxin TEQ concentrations above the removal action level and/or soil with concentrations above hot spot levels for analytes other than dioxin/furans.
3. Native Trees are defined as Madrone, big leaf maple, and Oregon white oak with a diameter greater than six inches at breast height.
4. Organic matter will consist of a high concentration carbon material such as activated carbon or biochar with a large surface area for sorption and immobilization of large organic molecules.
5. Standard excavation is defined as excavation with large equipment without the consideration to the size or type of vegetation removed.
6. Alternative excavation is defined as excavation with varying types of equipment and in consultation with an arborist as necessary to protect native trees.
7. Focused excavation is defined as excavation targeting soil above a defined threshold concentration. This can be combined with either standard or alternative excavation techniques.

Attachment C

Cap Decision Thickness Matrix – Alternative 9



Cap Thickness Decision Matrix

Alternative 9 -

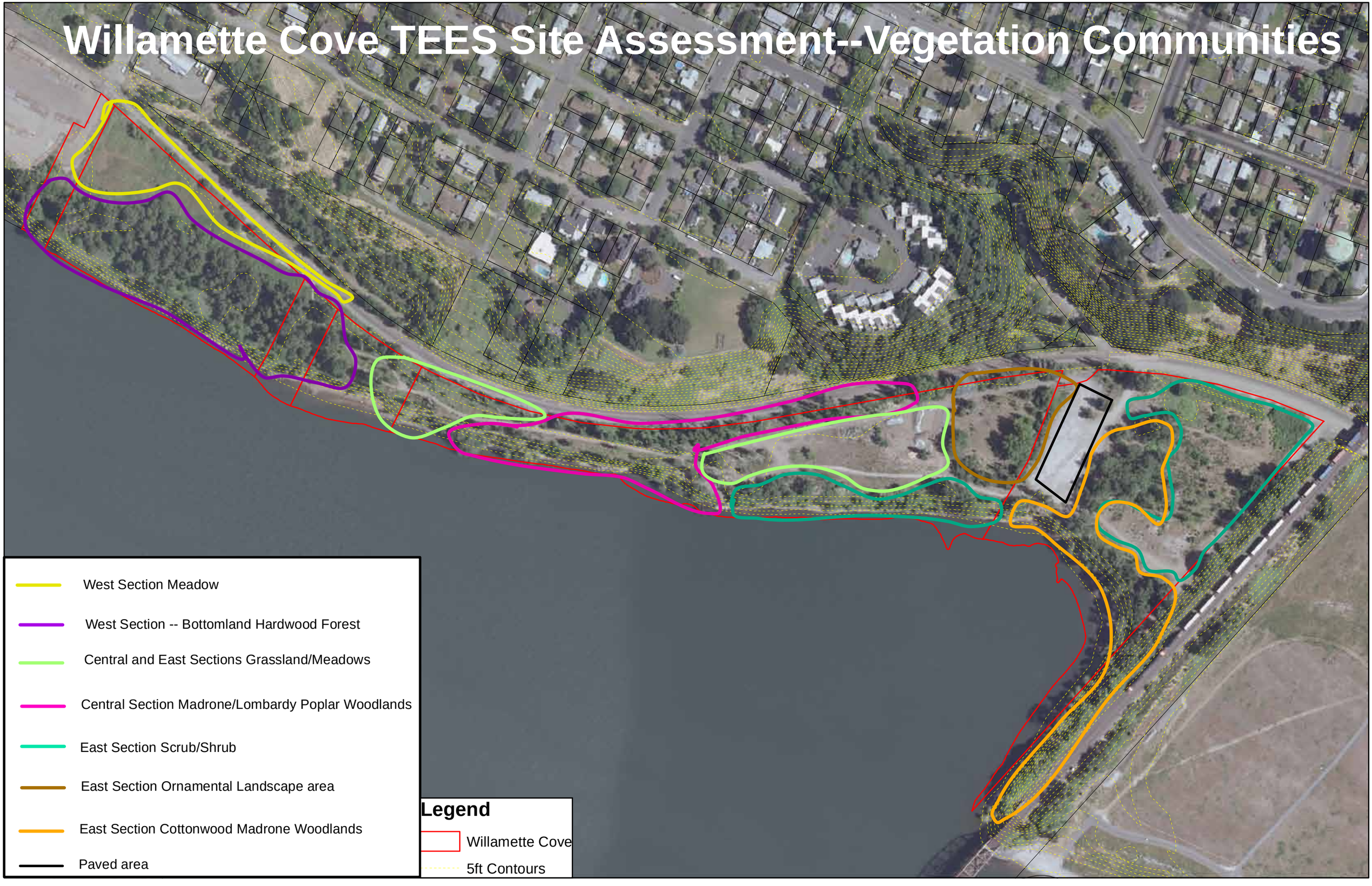
Focused Alternative Excavation with Off-Site Disposal/On-Site Consolidation and Cap

Appendix B

Major Vegetation Communities at Willamette Cove

(Source: *Willamette Cove Trail Alignment Refinement Report, January 12, 2010)*

Willamette Cove TEES Site Assessment--Vegetation Communities



Appendix C

Sample Location Figures

Appendix C – Sample Location Figures

Figures

C-1 Discrete Soil Sample Locations
C-2 Composite Soil Sample Locations
C-3 ISM Soil Sample Locations
C-4 Groundwater Sample Locations

DRAFT

East Parcel

Central Parcel

West Parcel

SEE FIGURE C-1a

SEE FIGURE C-1b

SEE FIGURE C-1c

SEE FIGURE C-1d

SEE FIGURE C-1e

UNION PACIFIC RAILROAD

BNSF RAILWAY

Willamette Cove

←Willamette River

Legend:

- Discrete Sample Location
- Sample Locations Removed During 2008/2015 Soil Removal Actions
- Parcel Boundary
- Removal Action Area
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Discrete Soil Sample Locations

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Port of Portland
Portland, Oregon

Apex Companies, LLC
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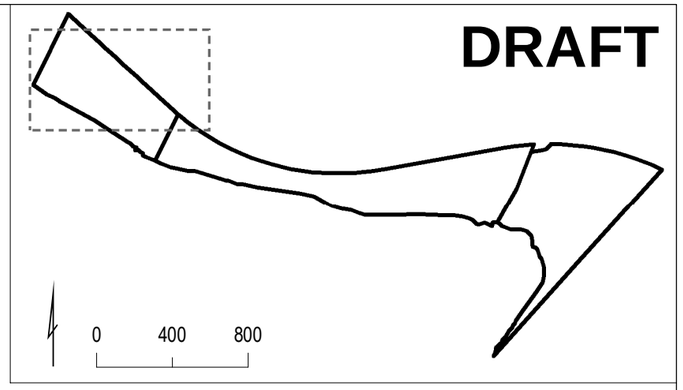
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-1



UNION PACIFIC RAILROAD

Legend:

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- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 60 120

Approximate Scale in Feet

N

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Discrete Soil Sample Locations - 1 of 5

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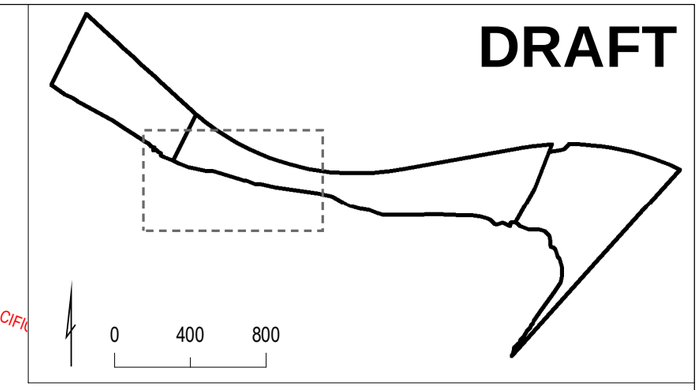
Project Number	1056-10	Figure
March 2019		C-1a



UNION PACIFIC

Legend:

- Discrete Sample Location
- Sample Locations Removed During 2008/2015 Soil Removal Actions
- Parcel Boundary
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- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 60 120

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Discrete Soil Sample Locations - 2 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
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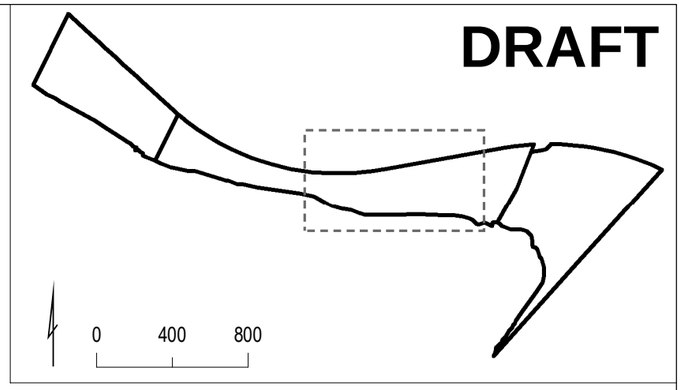
Project Number	1056-10	Figure
March 2019		C-1b



UNION PACIFIC RAILROAD

Legend:

- Discrete Sample Location
- Sample Locations Removed During 2008/2015 Soil Removal Actions
- Parcel Boundary
- Removal Action Area
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
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- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 60 120
Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Discrete Soil Sample Locations - 3 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
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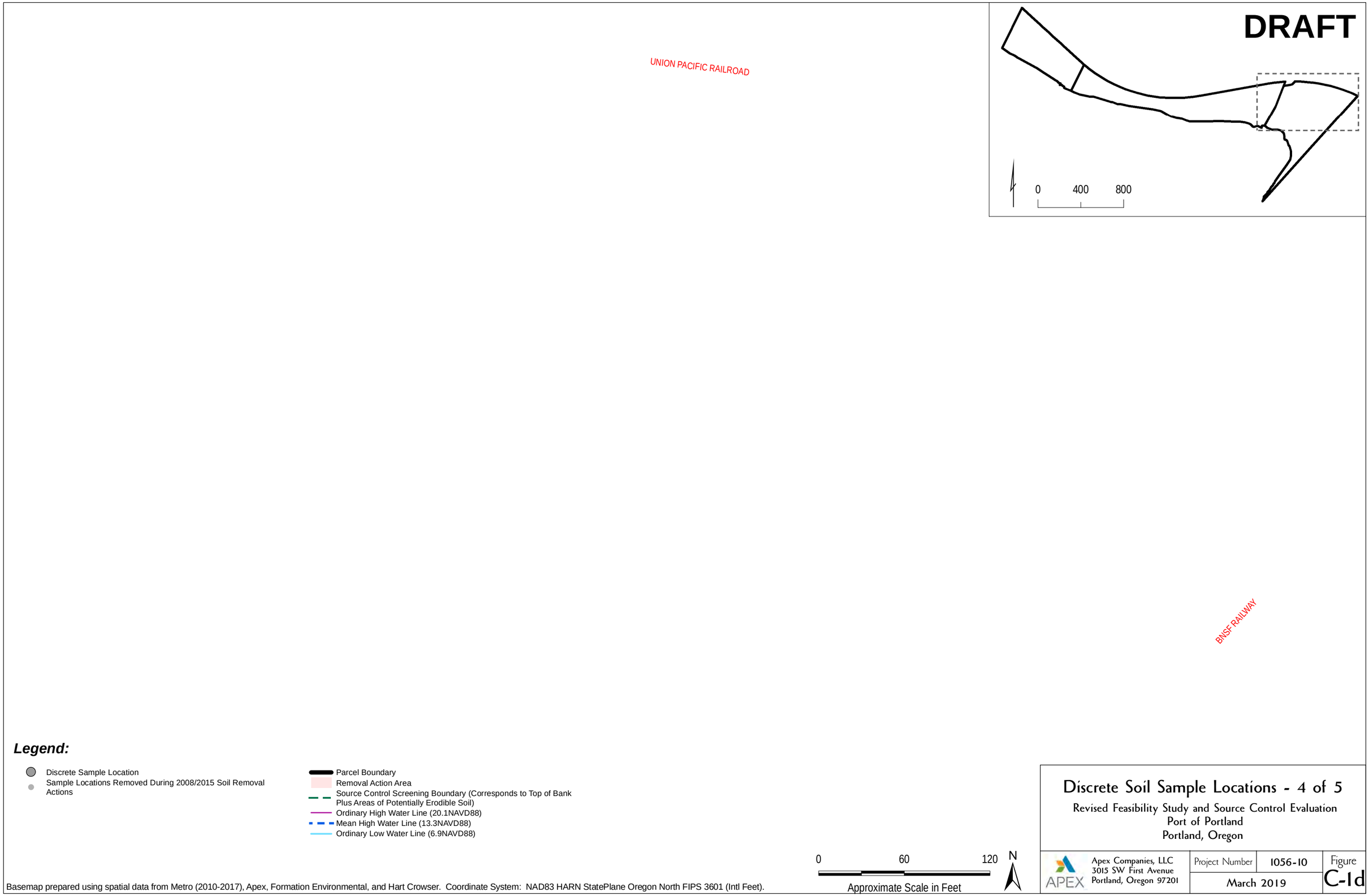
Project Number	1056-10	Figure
March 2019		C-1c



Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Discrete Soil Sample Locations - 4 of 5

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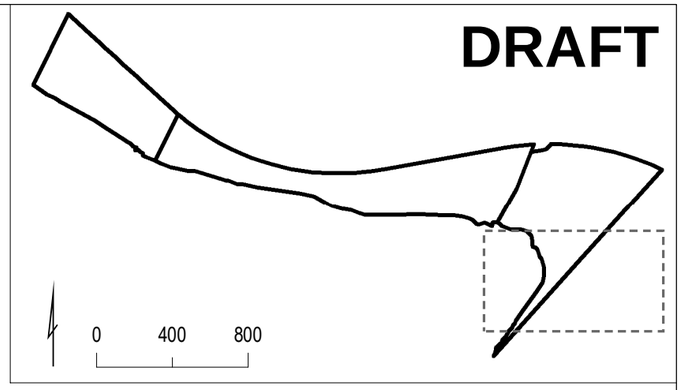
Project Number	1056-10	Figure
March 2019		C-1d



Legend:

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- Ordinary Low Water Line (6.9NAVD88)

0 60 120 N

Approximate Scale in Feet

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Discrete Soil Sample Locations - 5 of 5

Revised Feasibility Study and Source Control Evaluation
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DRAFT

East Parcel

Central Parcel

West Parcel

SEE FIGURE C-2a

SEE FIGURE C-2b

SEE FIGURE C-2c

SEE FIGURE C-2d

SEE FIGURE C-2e

UNION PACIFIC RAILROAD

BNSF RAILWAY

Willamette Cove

←Willamette River

Legend:

- Composite Sample Location
- Center of Entire or Significant Portion of Sample Location Removed During 2008/2015 Soil Removal Actions
- Parcel Boundary
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- Ordinary Low Water Line (6.9NAVD88)

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Composite Soil Sample Locations

Revised Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

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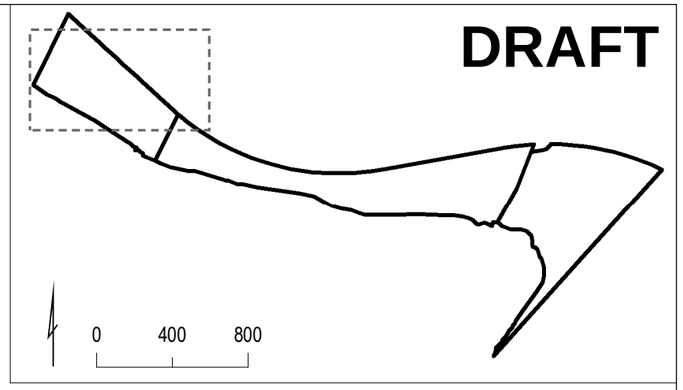
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-2



UNION PACIFIC RAILROAD

Legend:

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0 60 120

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Composite Soil Sample Locations - 1 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
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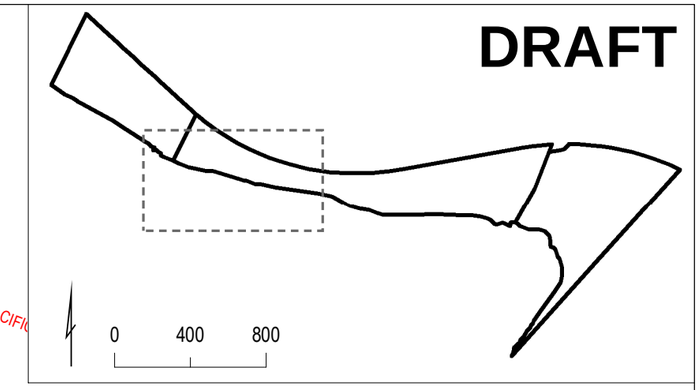
Project Number	1056-10	Figure
March 2019		C-2a



UNION PACIFIC

Legend:

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0 60 120 N

Approximate Scale in Feet

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Composite Soil Sample Locations - 2 of 5

Revised Feasibility Study and Source Control Evaluation
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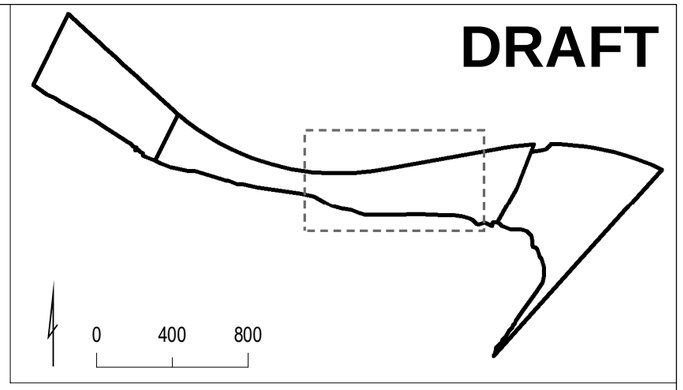
Project Number 1056-10

March 2019

Figure C-2b



UNION PACIFIC RAILROAD

Legend:

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- Center of Entire or Significant Portion of Sample Location Removed During 2008/2015 Soil Removal Actions
- Parcel Boundary
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0 60 120

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Composite Soil Sample Locations - 3 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
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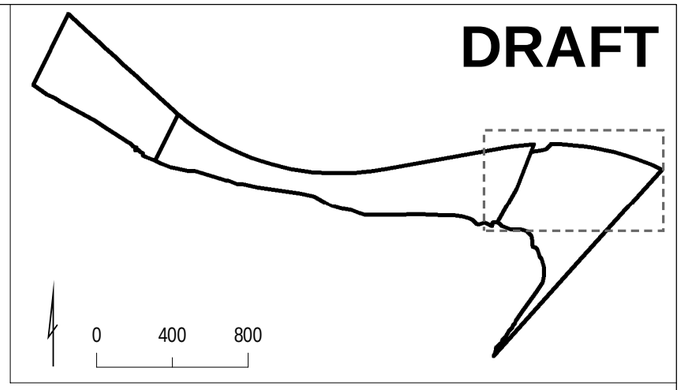
Project Number 1056-10

March 2019

Figure C-2c



UNION PACIFIC RAILROAD

BNSF RAILWAY

Legend:

- Composite Sample Location
- Center of Entire or Significant Portion of Sample Location Removed During 2008/2015 Soil Removal Actions
- Parcel Boundary
- Removal Action Area
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- Ordinary Low Water Line (6.9NAVD88)

0 60 120

Approximate Scale in Feet

N

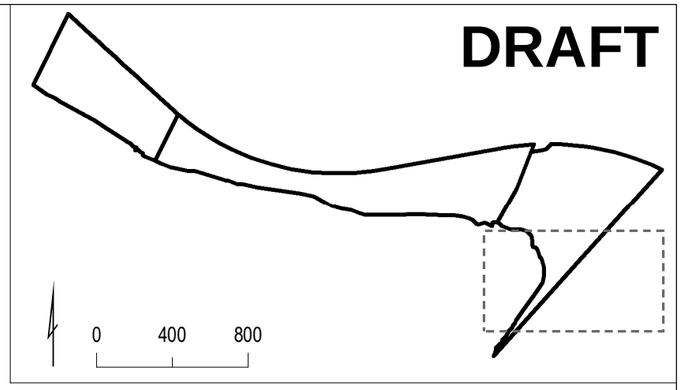
Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Composite Soil Sample Locations - 4 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-2d



BNSF RAILWAY

Legend:

- Composite Sample Location
- Center of Entire or Significant Portion of Sample Location Removed During 2008/2015 Soil Removal Actions
- Parcel Boundary
- Removal Action Area
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 60 120 N

Approximate Scale in Feet

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Composite Soil Sample Locations - 5 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

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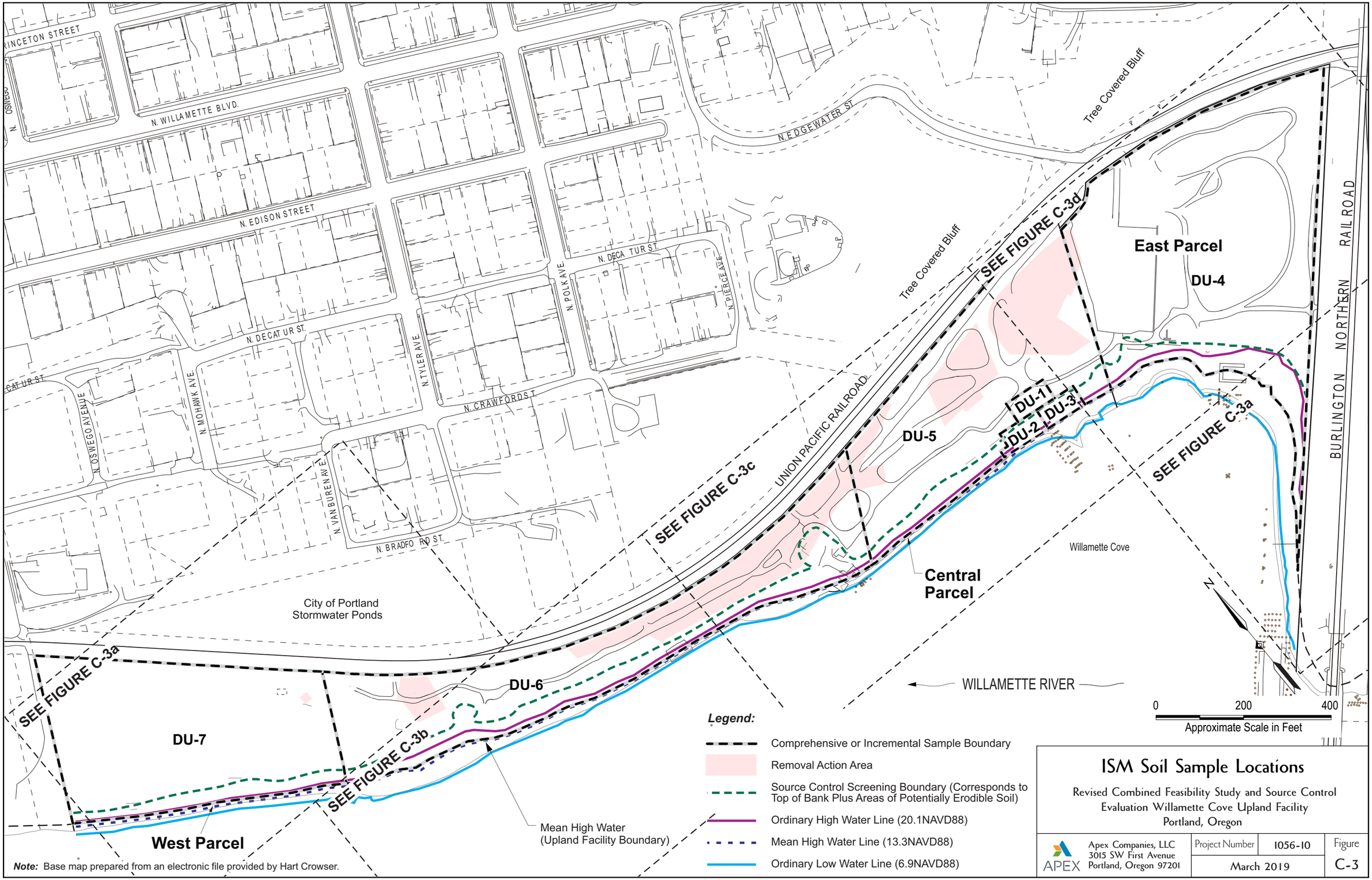
Project Number	1056-10	Figure
March 2019		C-2e

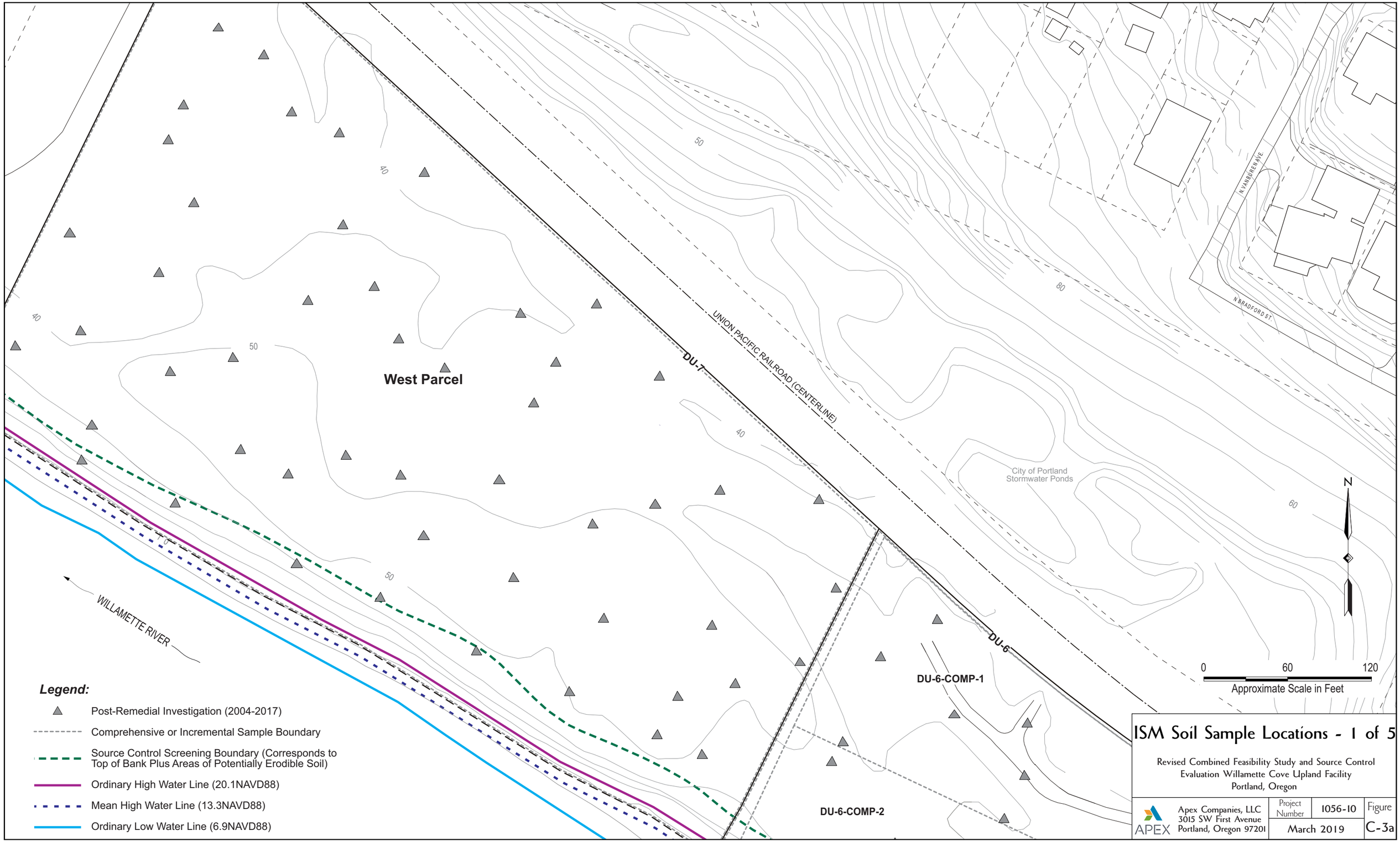


Note: Base map prepared from an electronic file provided by Hart Crowser.

ISM Soil Sample Locations

Revised Combined Feasibility Study and Source Control Evaluation Willamette Cove Upland Facility
Portland, Oregon

APEX	Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number 1056-10 March 2019	Figure C-3



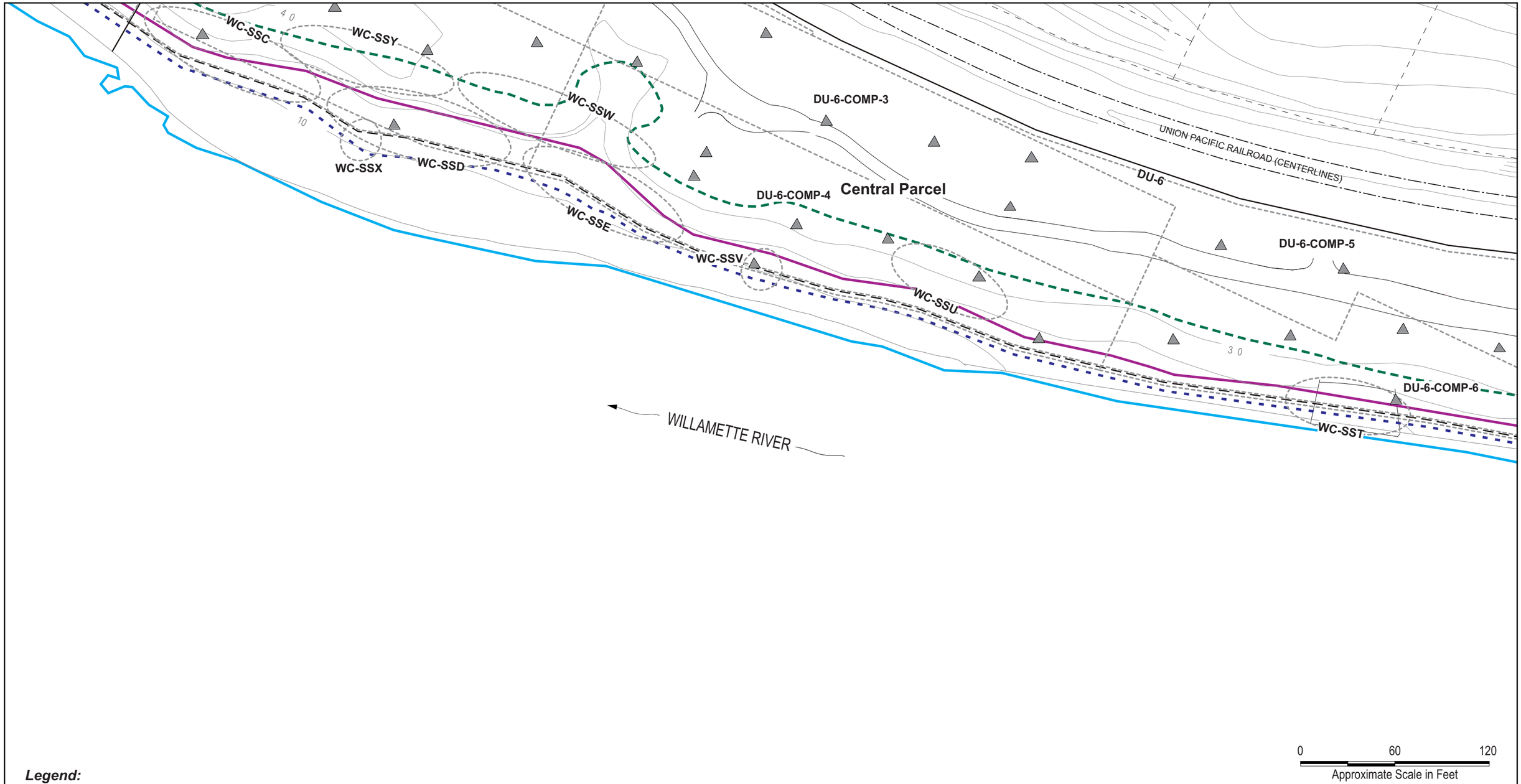
ISM Soil Sample Locations - 1 of 5

Revised Combined Feasibility Study and Source Control Evaluation Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-3a



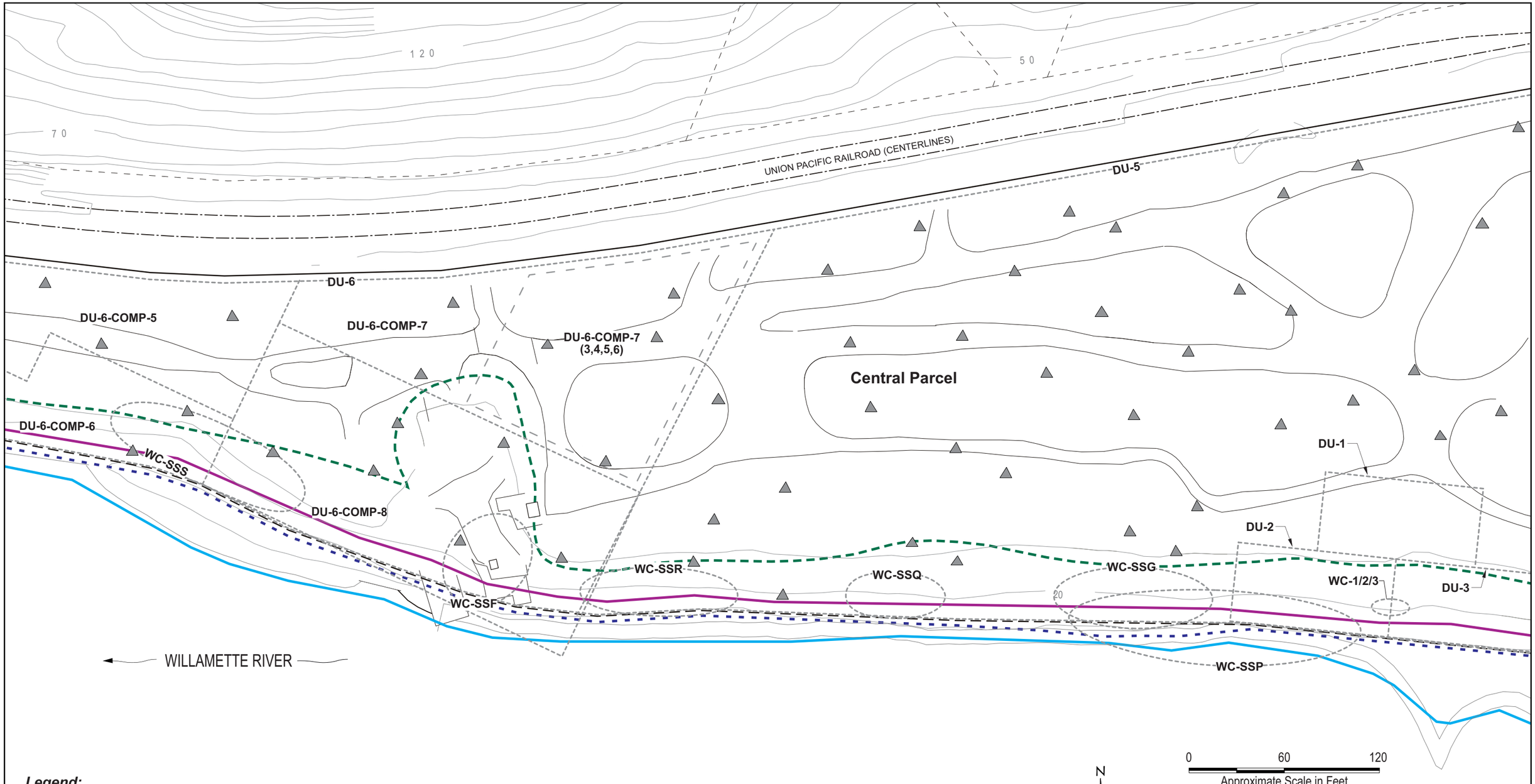
Legend:

- Post-Remedial Investigation (2004-2017)
- Comprehensive or Incremental Sample Boundary
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

ISM Soil Sample Locations - 2 of 5

Revised Combined Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX	Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number 1056-10 March 2019	Figure C-3b



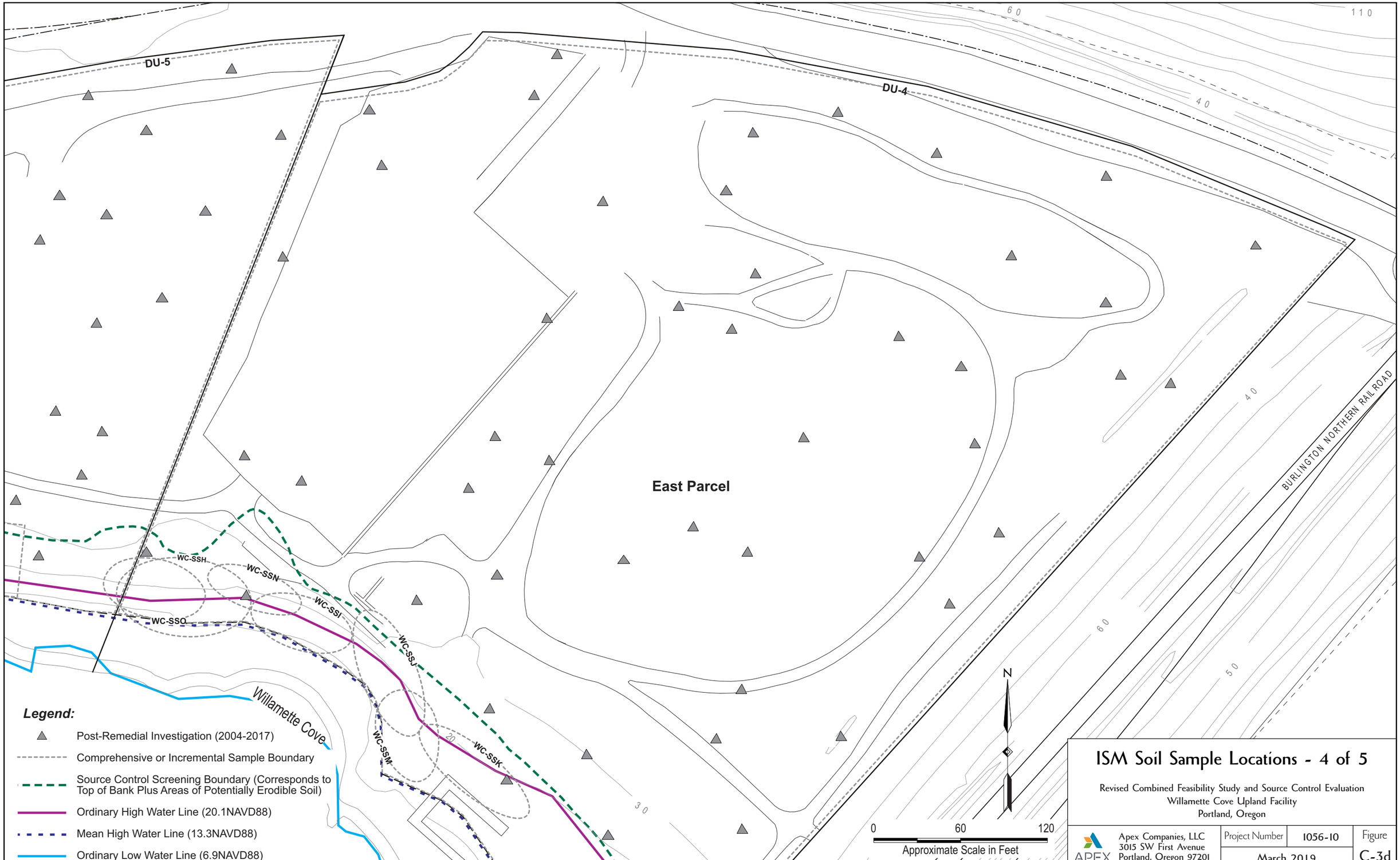
Legend:

- Post-Remedial Investigation (2004-2017)
- Comprehensive or Incremental Sample Boundary
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

ISM Soil Sample Locations - 3 of 5

Revised Combined Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX	Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number 1056-10 March 2019	Figure C-3c

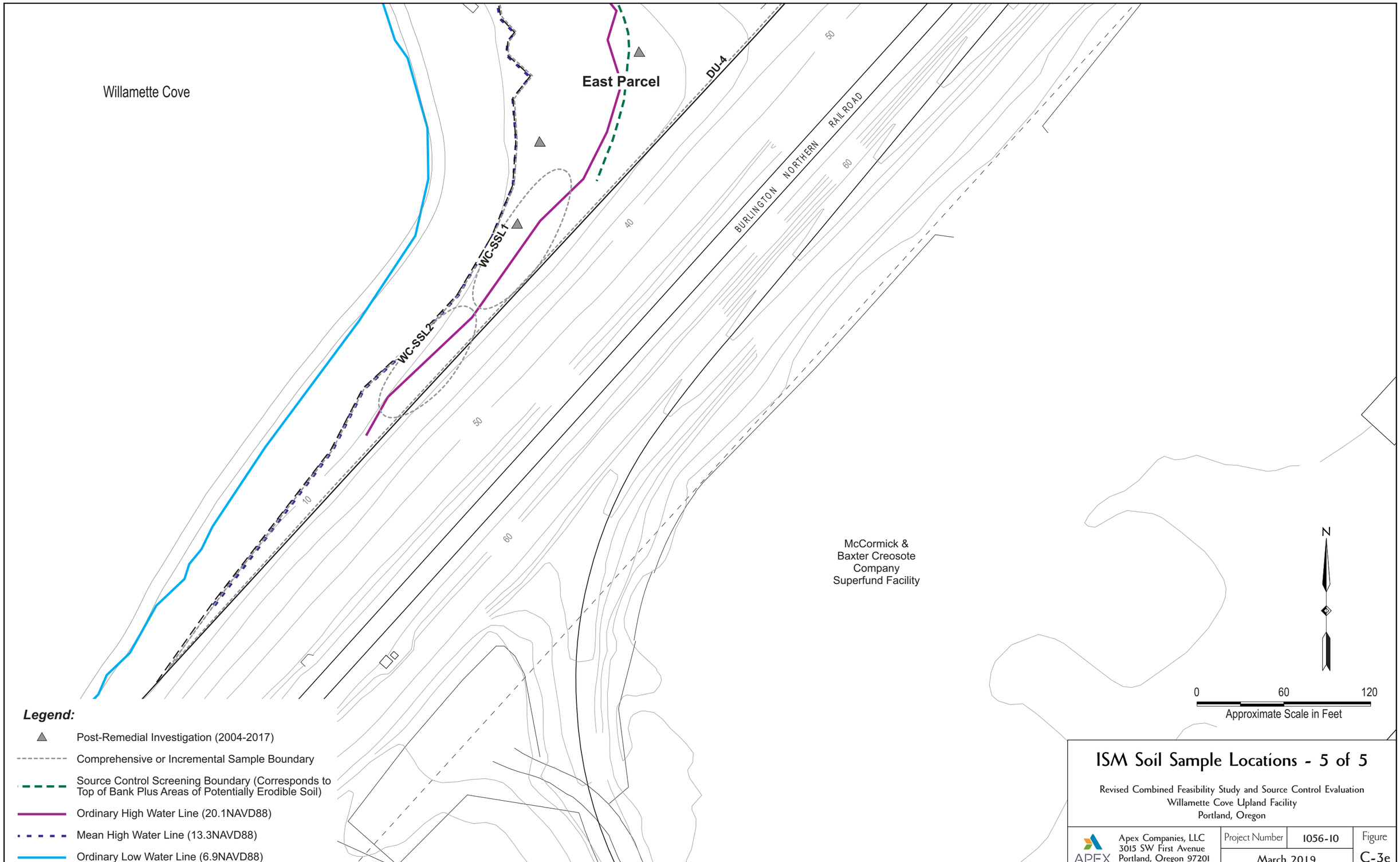


ISM Soil Sample Locations - 4 of 5

Revised Combined Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-3d



ISM Soil Sample Locations - 5 of 5

Revised Combined Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX	Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number 1056-10 March 2019	Figure C-3e

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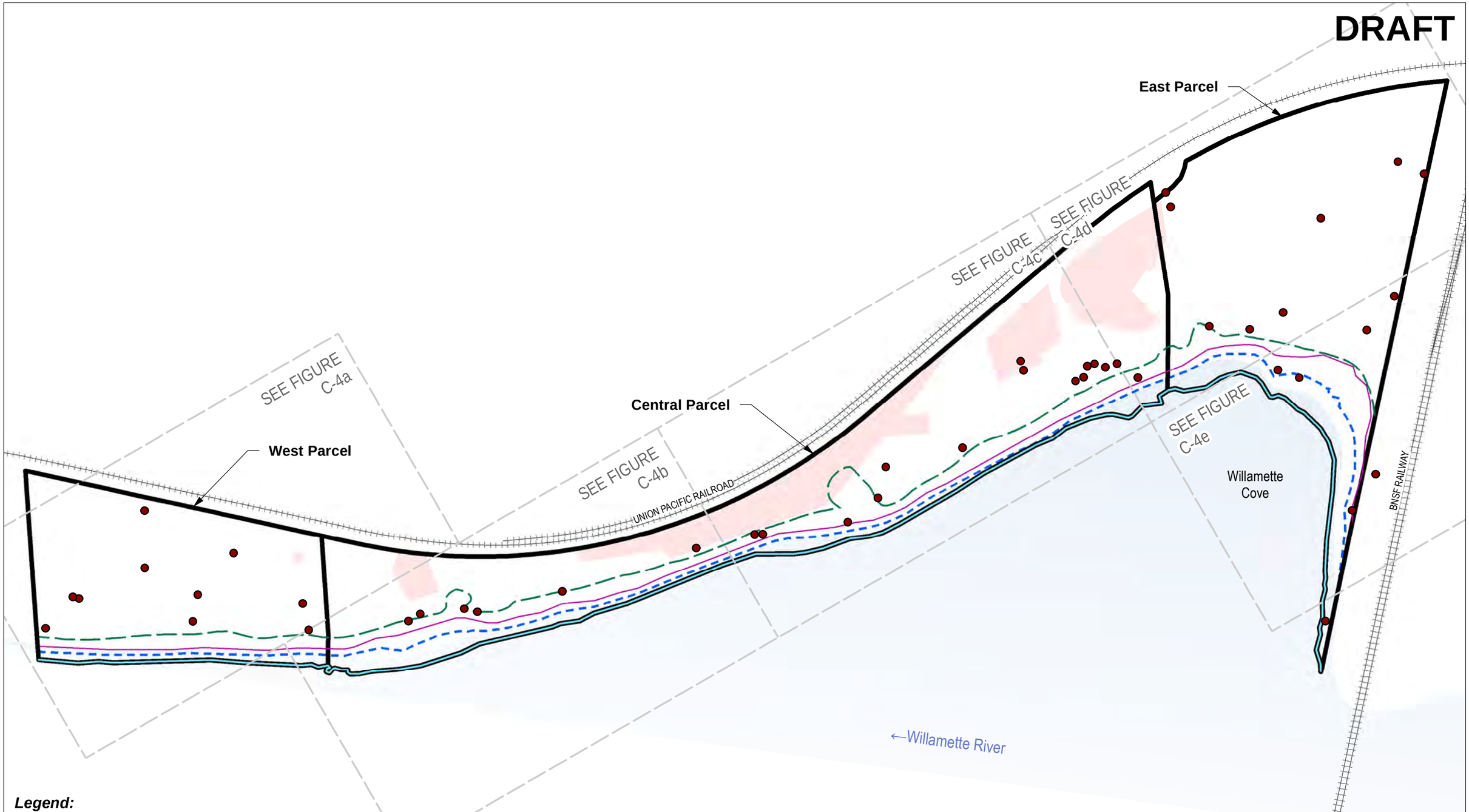


Legend:

- Groundwater Sample Location
- Parcel Boundary
- Removal Action Area
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 200 400
Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Groundwater Sample Locations

Revised Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-4

Legend:

- Groundwater Sample Location
- Parcel Boundary
- Removal Action Area
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 60 120
Approximate Scale in Feet
N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Groundwater Sample Locations - 1 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-4a

Legend:

- Groundwater Sample Location
- Parcel Boundary
- Removal Action Area
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 60 120 Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

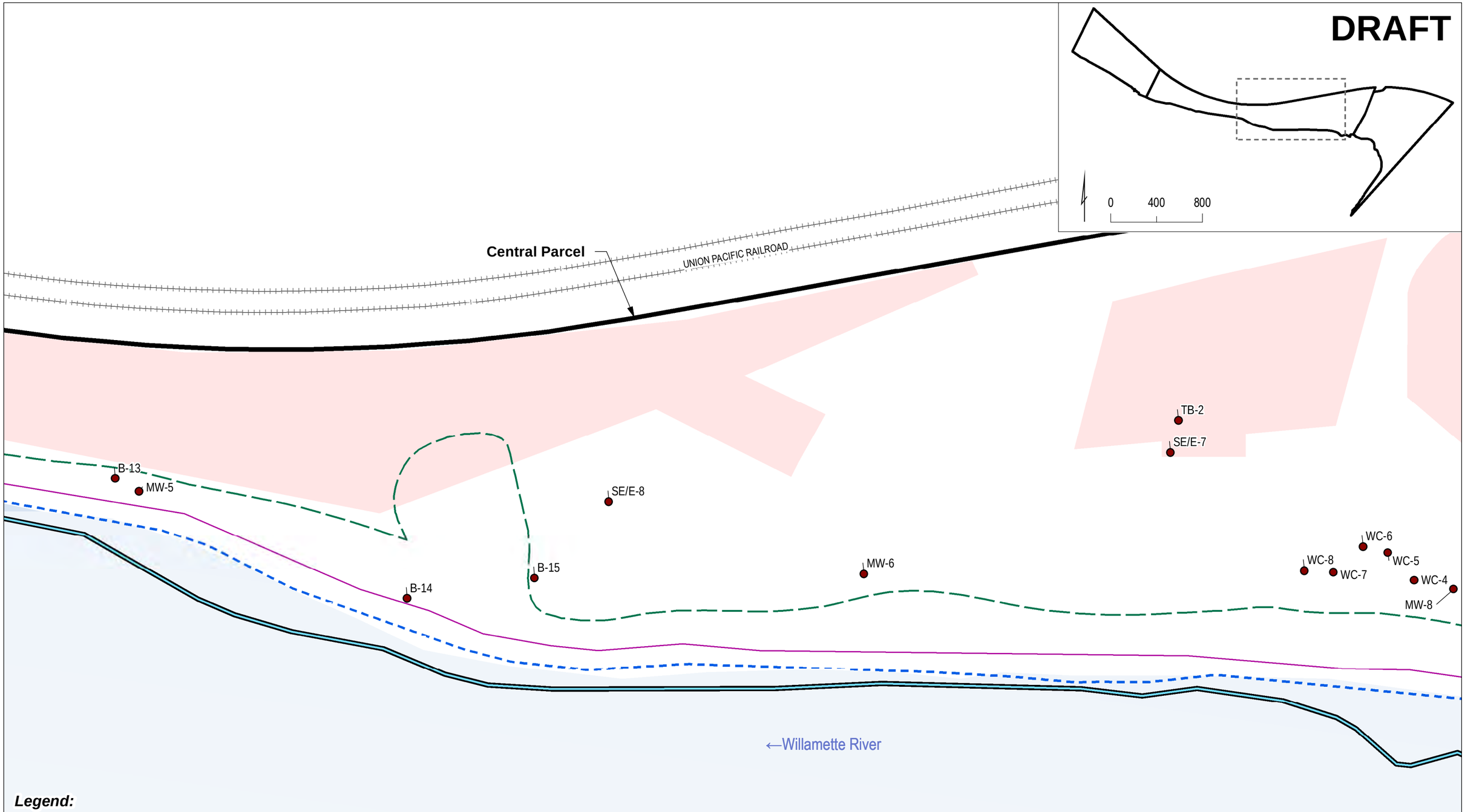
Groundwater Sample Locations - 2 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-4b



Legend:

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- Parcel Boundary
- Removal Action Area
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 60 120 N

Approximate Scale in Feet

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

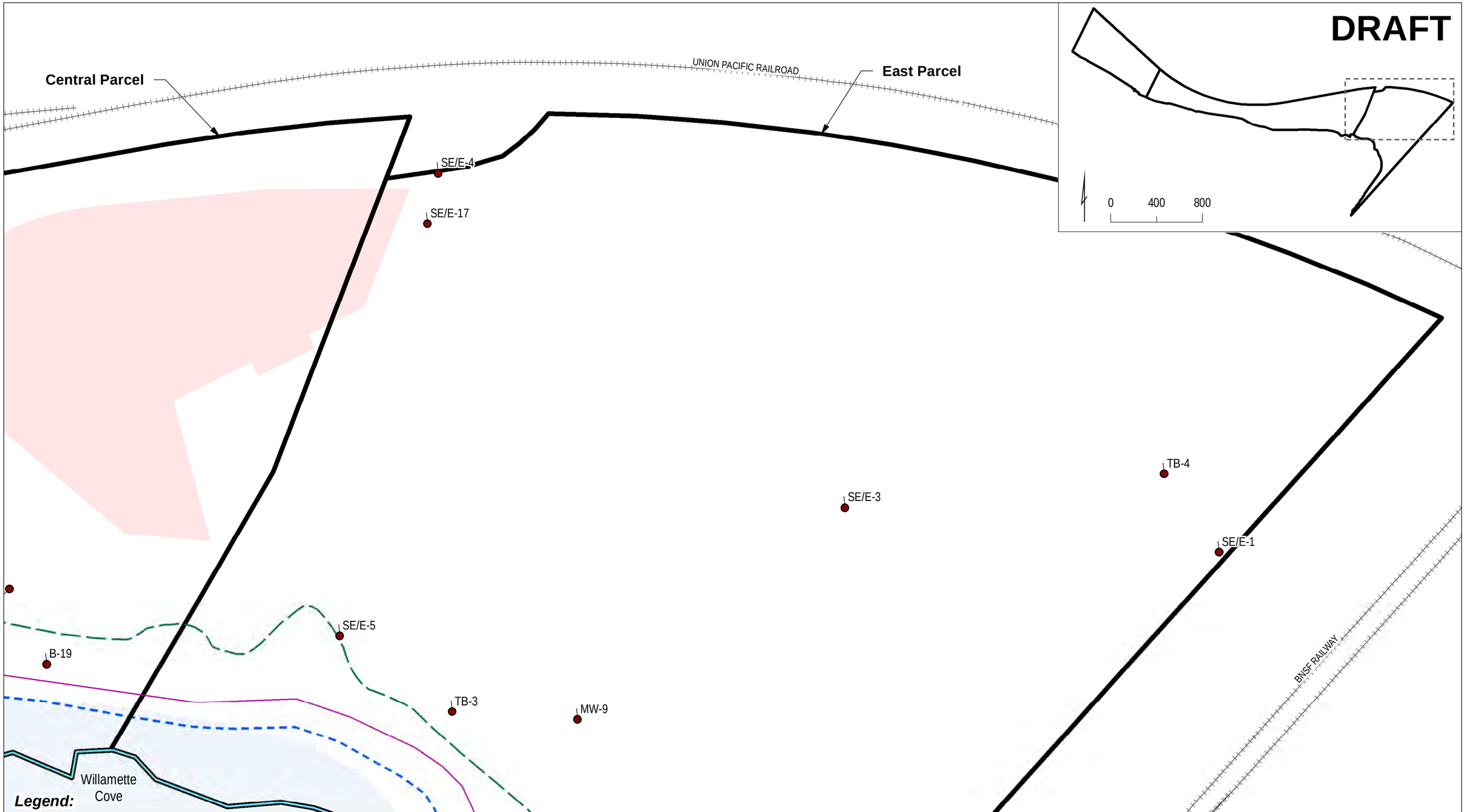
Groundwater Sample Locations - 3 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-4c



Legend:

- Groundwater Sample Location
- Parcel Boundary
- Removal Action Area
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 60 120
Approximate Scale in Feet

N

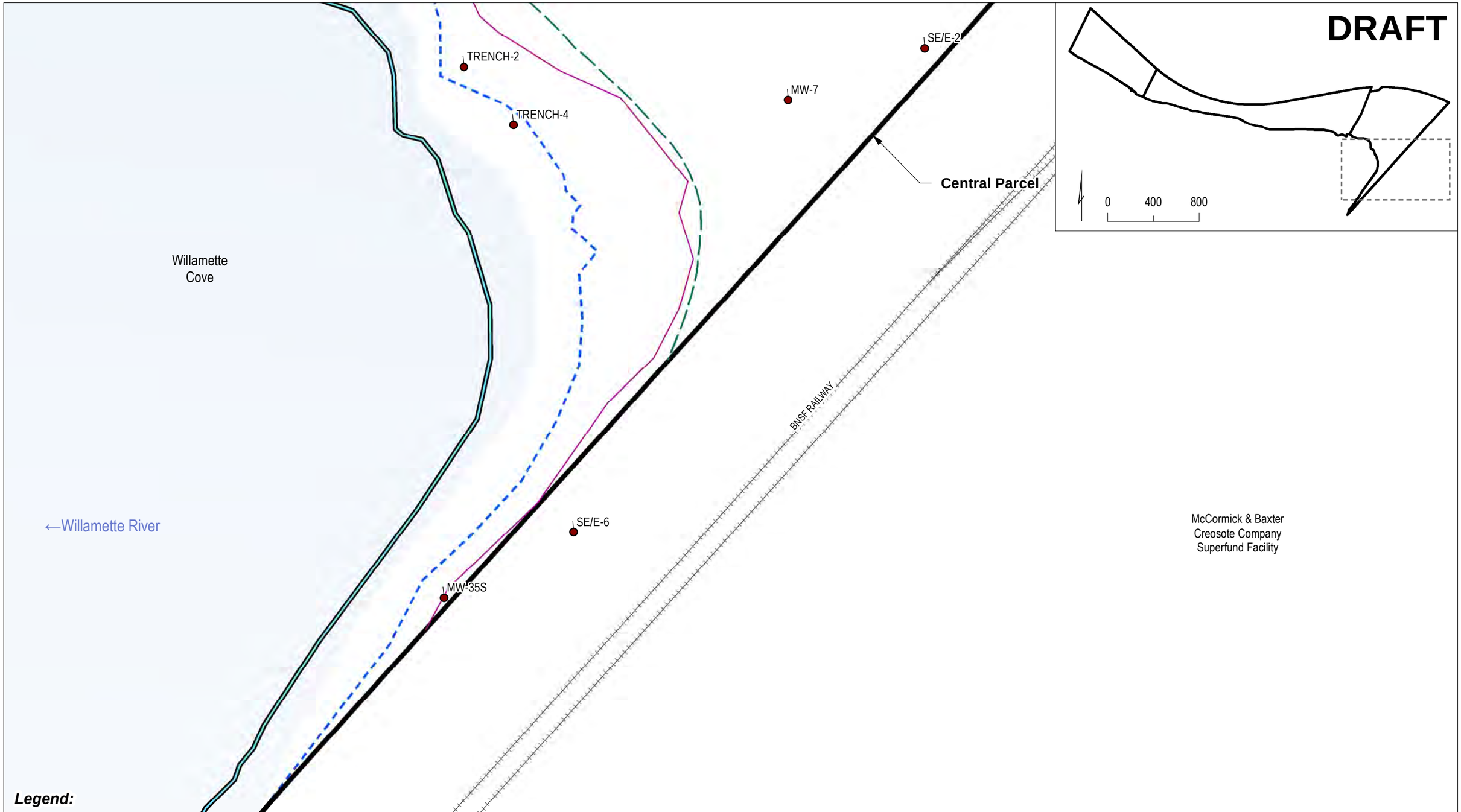
Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Groundwater Sample Locations - 4 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-4d



Legend:

- Groundwater Sample Location
- Parcel Boundary
- Removal Action Area
- Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

0 60 120
Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser. Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Groundwater Sample Locations - 5 of 5

Revised Feasibility Study and Source Control Evaluation
Port of Portland
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		C-4e

Appendix D

Source Control Observations, Data, and Figures

Appendix D – Source Control Observation, Data, and Figures

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1.0 Introduction

As presented in the Record of Decision (ROD) for the Portland Harbor Superfund Site (PHSS), the U.S. Environmental Protection Agency (EPA) has determined that the riverbank at the Facility, extending from top of bank to waterline, will be addressed as part of in-water activity. Based on this designation by the EPA, detailed source control information including riverbank survey and reconnaissance results, debris/sheen observations, river stage evaluation, and comparison of Facility data to relevant PHSS screening levels in tables and figures is presented in this Appendix for EPA consideration. This appendix reiterates and expands on the information summarized in Section 3 of the main body of the report (report).

2.0 Identification of Complete Migration Pathways

In accordance with the Joint Source Control Strategy (JSCS) guidance document (DEQ/EPA 2005), migration pathways discussed below include over-water activities, stormwater, preferential migration of groundwater along stormwater conveyances, riverbank erosion, and groundwater.

Over-Water Activities. There are no over-water activities at the Facility, so this pathway is not further evaluated.

Stormwater Pathway. Current and former potential stormwater outfalls are described in Section 2.7 of the report. There are no stormwater conveyances draining the Facility, and there are currently no improvements on the Facility. Therefore, this pathway is incomplete and not further evaluated.

Stormwater Conveyances as Preferential Groundwater Migration Pathway. The potential stormwater outfalls described in Section 2.7 of the report were evaluated (Port and Metro, 2006 and Ash Creek, 2012a) to assess the approximate elevation of the pipelines with the following conclusions.

- OF-49 – City of Portland online databases (www.portlandmaps.com) were reviewed and the elevation of the pipe where it crosses the Facility is 29.3 feet.
- WR-189 – Based on the site reconnaissance, this pipe is located approximately 3 feet higher than OF-49.
- WR-190 – This concrete pipe is located above the typical high-water level (i.e., above elevation 20 feet).
- WR-191 through WR-193 – These observed pipes were near the typical high-water level (i.e., approximately elevation 20 feet).

In summary, the elevations of actual or potential stormwater pipes at the facility range from 20 to 32 feet. The potential outfalls are located between MW-3 and MW-9. As discussed in Section 2.6, the groundwater elevation at the Facility ranged from 7 to 14 feet as measured in these monitoring wells. That water level range is below the depth of potential historical stormwater pipes. In addition, as the outfalls are not currently active, with the exception of OF-49, it is unlikely that they are discharging sediment. Therefore, this pathway is incomplete and is not further evaluated.

Riverbank Soil Pathway. The riverbank may be subjected to erosive forces from river currents, wind waves, and boat wakes. If erodible soil and chemical constituents are co-located in soil on the riverbank, these have the potential to migrate to the river or cove. The riverbank erosion pathway is carried forward for further evaluation.

Groundwater Pathway. The overall groundwater gradient is toward the Willamette River. Constituents present in groundwater, if any, therefore have the potential to migrate to the river. This pathway is carried forward for further evaluation.

3.0 Riverbank Soil Source Control Evaluation

3.1. Riverbank Soil Erosion Evaluation

This section presents an analysis of the potential for erosion of the Facility riverbank. The analysis included the following elements:

- Assessing the overall stability of the existing riverbank;
- Conducting a visual reconnaissance of the riverbank;
- Assessing potential for erosion of the bank from river action; and
- Assessing the potential for erosion of surface soil from overland flow.

3.1.1 Slope Stability Assessment

The overall stability of the riverbank at the Facility was qualitatively assessed during the RI (Hart Crowser, 2003). A licensed engineering geologist conducted a reconnaissance of the riverbank to assess overall stability. The following summarizes conclusions from that assessment:

- The riverbank was created with sand/silt fill protected with riprap, boulders, and broken concrete.
- The constructed riverbank has slopes ranging from one half horizontal to one vertical (0.5H:1V) to 1.5H:1V.

- Beach slopes subject to saturation and moving water tend to stabilize at about 4H:1V or flatter.
- Slope creep as evidenced by curved tree trunks was observed at one area (approximately 25 feet wide) on the East Parcel.

Based on these observations, the eastern two-thirds of the Central Parcel and the entire East Parcel have riverbank slopes of 2H:1V or flatter. Historically, these areas were primarily engineered slopes including riprap protection (Central Parcel) or areas with flat slopes covered by buildings (East Parcel). The western third of the Central Parcel and the area near the boundary of the Central and East Parcels have slopes varying between approximately 0.5H:1V to 1.3H:1V. The portion of the slope that is 1H:1V or steeper comprises the western 400 feet of the Central Parcel and the Central/East Parcel boundary. The West Parcel generally has slopes near 1H:1V with portions of the slope as steep as 0.7H:1V. Slopes of 2H:1V are common in developed areas throughout Portland Harbor and are generally not susceptible to slope movement. The steeper slopes at the Facility have the potential for slope movement, especially if undercut by erosion (see Section 3.1.3 below).

3.1.2 Riverbank Reconnaissance

On September 4 through September 6, 2012, Ash Creek Associates (a division of Apex) conducted a visual reconnaissance of the Facility riverbank. Additional visual reconnaissance was conducted on July 28 (from the land) and August 10, 2017 (from a boat), to provide updated information on the condition of the riverbank following sustained high river levels over the 2016/2017 winter. The following is a comprehensive discussion of these and previous riverbank reconnaissance efforts. Figures D-1 through D-3 show the results of the visual mapping, identifying geomorphic features and surface cover and locations of photographs documenting the observations (photographs are presented in Attachment D-1 of this appendix). Figure D-4 summarizes debris, sheen, and non-aqueous phase liquid (NAPL) observations.

West Parcel. The riverbank is relatively steep, heavily armored, and covered with thick vegetation (Photographs 1 and 2). Because of the thick vegetation, the riverbank could not be safely accessed by foot. On November 21, 2005, a visual reconnaissance of the riverbank was conducted from a boat. No areas of bank instability, erosion, or bare soil were observed (Port and Metro, 2006). A subsequent reconnaissance with DEQ identified two areas where patches of soil were observed between the riprap (Figure D-6). These areas were targeted for sampling, but because of access difficulty, the areas were not sampled. The West Parcel appeared unchanged during the 2017 reconnaissance activities.

Central Parcel. The following discussion of the Central Parcel is referenced to the stationing shown on Figures D-1 and D-2.

- Station "C" 0+00 to 3+50. The riverbank on the western edge of the Central Parcel is characterized by a relatively flat sandy beach area below the ordinary high water line (OHW – identified based on

visual assessment of the location where predominantly upland vegetation was present), bordered by a steep bank at and above the OHWL, and nearly complete riprap armoring between the beach and the water (Photographs 3 and 4). The bank near and above the OHW includes an erosional scarp feature near the top of the slope with colluvium at the base of the scarp (Photographs 5 through 9). The scarp extends nearly the full length of this section and varies from 10 to 15 feet high (from the beach to the top of slope). The area above the scarp is densely vegetated with grasses, bushes, shrubs, vines, and larger trees. The colluvium is covered in moderately dense vegetation, including grasses, bushes, and small trees. The sandy beach area is generally void of vegetative cover. Scattered metal, brick, and concrete debris are present on the beach. A gully leads down to the sandy beach in this area. The gully appears to be a footpath and does not appear to represent a drainage point for the upland (Hart Crowser, 2003). Outfall OF-49 is located in this stretch, just west of the erosion scarp. During the 2017 reconnaissance activities, the slope movement and erosion previously noted were still present and ongoing. The crest of the slope has generally been maintained but steepening of the slopes (resulting in overhang at the crest) is ongoing. Signs of recent movement and erosion associated with the high-water events of 2017 were evident throughout. The lateral extent of the stability issues was essentially the same as noted during previous reconnaissance events.

- Station "C" 3+50 to 5+90. The riverbank in this area is generally characterized by the presence of riprap armoring below the OHWL and a densely vegetated upper bank. Two scarp features (a western scarp and an eastern scarp) were observed in the riverbank of this area. The western scarp is a continuation of the scarp observed between Stations 0+00 and 3+50. The eastern scarp is above the OHWL, approximately 80 feet in length, and roughly 15 feet high along the scarp face. Below the eastern scarp, patches of sand are present in the riprap (Photograph 10). WR-190 is located at approximately Station "C" 5+40. During the 2017 reconnaissance activities, no additional erosion or slope movement was noted.
- Station "C" 5+90 to 9+70. This section of the riverbank consists of a generally uniform slope with riprap armoring on the lower portion (below the OHWL) and vegetation on the upper portion (above the OHWL). Vegetation consists of dense grasses, bushes, vines, and trees. A wooden bulkhead formed from closely spaced piling is present at the toe of the riprap slope in this area (Photograph 11; Figure D-1). During the RI reconnaissance, several sinkholes were observed in the upland area between Station "C" 7+20 and 7+60. The sinkholes ranged from 1 to 3 feet in diameter and 1 to 2 feet deep. These are typically caused by soil being washed out from between and behind the riprap and concrete fills. During bank reconnaissance to identify locations for riverbank sampling, small patches of soil were observed between the riprap (sample location WC-SST at approximately Station "C" 8+00). There were no other erosional features observed in this area. This area appeared unchanged during the 2017 reconnaissance activities. The sinkhole was obscured by vegetation and no longer evident.

- Station "C" 9+70 to 19+30. The riverbank along the eastern half of the Central Parcel consists of a generally uniform slope with mostly intact riprap armoring on the lower portion (below the OHWL) and vegetation on the upper portion (above the OHWL). Vegetation consists of dense grasses, bushes, vines, and trees. Several small scarp features (including exposed tree roots, overhanging foundation, and exposed piling) were identified along this portion of the riverbank above the OHWL (Photographs 12 through 16). The riprap includes occasional larger concrete debris (Photograph 10). Scattered patches of sand are present in the riprap (Photograph 15). These scattered patches were observed in prior bank reconnaissance work and riverbank samples were collected (sample locations WC-SSR, WC-SSQ, and WC-SSP). In general, the erosion features are small (scarps are less than 40 feet in length and 5 to 10 feet in height, or less) and discontinuous, with the majority of the riverbank appearing to have intact riprap armoring and dense vegetation (Photograph 17). The steel pipes associated with WR-191 and WR-192 are located between Stations "C" 15+50 and 18+00. This area appeared unchanged during the 2017 reconnaissance activities.

East Parcel. This area is characterized by a large relatively flat beach area bordered by steeper banks and dense vegetation above the OHWL. The following discussion of the East Parcel bank above the beach is referenced to the stationing shown on Figure D-3.

- Station "E" 0+00 to 1+50. The bank in this area features two scarps. A relatively small scarp extends on the parcel from the Central Parcel (Photograph 18). A larger scarp, approximately 90 feet long and 5 to 15 feet in height, is present toward the top of the bank. Collapsed pavement was observed at the top of this slope during the RI reconnaissance. The slope beneath the scarp is partially armored with riprap and large concrete debris (Photograph 19). Vegetation on the bank generally consists of grasses, bushes, vines, and trees mostly observed above the scarp face.
- Station "E" 1+50 to 4+40. The bank in this area is not as high as other areas of the Facility, and the bank is reinforced with large concrete blocks (Photograph 20 and 22). A patch of bare soil is present in the middle of this area (Photograph 21). The steel pipe associated with WR-193 is located near Station "E" 2+00.
- Station "E" 4+40 to 9+60. This area features an articulated block armored cap on the beach area with vegetation or large riprap at the upper edge of the cap (Photographs 23, 25, 26, and 27). A scarp is present extending 220 feet south from a concrete structure at the base of the Burlington Northern Santa Fe (BNSF) embankment (Photographs 24 and 25). The scarp is covered in dense vegetation, including bushes, vines, and large trees. The toe of the scarp has been covered with riprap (Photograph 26). The scarp face varies in height from approximately 15 to 20 feet high (from the toe of the riprap to the top of the scarp). The presence of riprap at the scarp toe and vegetation on the scarp suggest that the scarp is no longer actively eroding.

The East Parcel appeared unchanged during the 2017 reconnaissance activities.

3.1.3 Assessment of Potential for Erosion from River Action

Erosion from river action has two primary components: (1) bed shear resulting from the natural motion of the flowing water; and (2) wave action caused primarily from boat wakes.

Bed Shear. Figure D-5 presents bed shear estimates at the Facility adapted from modeling conducted as part of the *Portland Harbor RI/FS Comprehensive Round 2 Report* (LWG, 2007). The Facility is located on the north side between River Mile 6.4 and 6.9. Under both the high-flow and low-flow scenarios, bed shear is at the lowest modeled level except for the western end of the Central Parcel and the West Parcel. Under both scenarios, but especially under the high-flow scenario, bed shear is relatively higher at the west end of the Facility (e.g., modeled bed shear is 20 times greater at the west end of the Facility than within the cove). These results suggest that erosion of the bank from natural river flow is possible at the west end of the Facility under high-flow conditions.

Wave Action. In general, waves impacting unprotected riverbank may cause soil erosion depending on such factors as soil type, slope steepness, and wave height. The riverbank below the OHWL is generally covered with riprap. The majority of the riverbank above the OHWL is generally covered with dense grasses/vegetation. These surface covers are typically sufficient to withstand erosion from wave action. Portions of the riverbank, however, have visible erosion scarps or bare soil. When the river level is near the elevation of the erosion scarps or bare soil wave action could cause erosion.

3.1.4 Assessment of Potential for Erosion from Overland Flow

Based on the following factors, the potential for erosion from overland flow is low.

- As part of the RI (Hart Crowser, 2003), a licensed engineering geologist conducted a reconnaissance of the Facility during rainy weather. Standing water was observed on impermeable surfaces such as concrete slabs. The soils were observed to consist of relatively sandy material that allowed infiltration. Runoff on the bank surface was in the form of small rivulets that did not cause erosion.
- The detailed bank reconnaissance documented in Section 3.1.2 above identified areas of erosion or bare soil. None of the identified features were associated with erosion from overland flow.

3.1.5 Summary of Riverbank Erosion Potential

Figure D-6 summarizes the multiple lines of evidence evaluated for erosion potential of the Facility riverbank, demonstrating that much of the riverbank is stable and not subject to erosion. Features identified on the figure are steep riverbanks, locations where bed shear from river flow is elevated relative to low-flow conditions, and

locations where bare soil or scarps were observed. The following summarizes the overall potential for erosion of the riverbank at the Facility.

West Parcel. The West Parcel has low potential for erosion or bank movement. Although the riverbank is relatively steep, and the shoreline is subject to relatively high bed shear during high-flow conditions, the riverbank is heavily armored and covered with thick vegetation. Furthermore, the riverbank location has been unchanged since it was constructed more than 30 years ago.

Central Parcel. There is potential for erosion of the riverbank in the Central Parcel, summarized as follows.

- West 600 Feet. The western 300 feet of the Central Parcel riverbank exhibits evidence of erosion including oversteepened slopes and exposed bare soil and scarps. The erosion is likely associated with river action, primarily river currents, but exposed soil would also be subject to erosion from boat wakes, depending on the river level. The next 300 feet of riverbank to the east exhibits several areas of bare soil and scarps.
- East 1,000 Feet. The eastern 1,000 feet of the Central Parcel riverbank has scattered areas of bare soil and scarps. These areas are in the more protected portion of the Facility so would be subject to erosion primarily from boat wakes when the river levels correspond to the bare areas or scarps. Given that the scarps are generally above the OHWL, erosion events would be limited to periods of higher water so would be infrequent. The riverbank is relatively less steep so has low potential for bank movement.

East Parcel. The initial 80 feet of riverbank (beginning at the border with the Central Parcel) exhibits evidence of erosion including oversteepened slopes and exposed bare soil and scarps. The remainder of the East Parcel riverbank has scattered areas of bare soil and scarps. These areas would be subject to erosion primarily from boat wakes when the river levels correspond to the bare areas or scarps. A relatively tall scarp present along the BNSF embankment has large riprap at the toe and significant vegetation growth, suggesting that this scarp is no longer actively eroding.

3.2 Riverbank Soil Characterization

For this source control evaluation, soil with the potential to erode to the river was characterized. To define this area, a reconnaissance was performed to document the location of the top of bank (TOB) and areas above the TOB with the potential to erode. These areas were incorporated into an Upper Source Control Screening Boundary (SCSB: Figure D-4). Soil from the Upper SCSB to -2 feet (ft) Columbia River Datum (CRD; Lower SCSB) are considered riverbank soil. The PHSS ROD defines the riverbank of the Facility as TOB to the waterline, therefore, this evaluation fully characterizes the riverbank for coordination with PHSS in-water work. The evaluation consists of compiling relevant riverbank soil data and screening levels, screening data, identifying contaminants of potential concern (COPCs) and contaminants of concern (COCs), and evaluating

the potential for adverse effects on sediment. This evaluation considers the entire Facility. However, due to rip rap and dense vegetation on the West Parcel, no riverbank bank soil data is available from that parcel.

3.2.1 Identify Soil COPCs

To identify COPCs for riverbank soil, data were compared to relevant screening levels from the PHSS ROD. These screening levels consist of:

- River Bank Soil/Sediment Cleanup Levels (CLs) from Table 17 of the PHSS ROD;
- Remedial Action Levels (RALs) from Table 21 of the PHSS ROD; and
- Principal Threat Waste (PTW) from Table 21 of the PHSS ROD.

In addition, JSCS Screening Level Values (SLVs; DEQ/EPA 2005) for upland soil/stormwater sediment were considered for analytes with no applicable CL. Relevant screening levels are listed in Table D-1. Data screened against CLs, RALs, PTW, and SLVs are presented in Table D-2. Analytes that exceeded a relevant screening level are retained as COPCs. Table D-3 summarizes the retained analytes and which screening levels were exceeded.

In addition to COPCs identified through riverbank soil data screening, COIs for sediments adjacent to the Facility identified in Section 2.10 of the report were assessed for inclusion as COPCs. Identified adjacent sediment COIs include:

- Cadmium;
- Copper;
- Mercury;
- Zinc;
- PAHs;
- Bis(2-ethylhexyl)phthalate (BEHP);
- Carbazole;
- PCBs;
- DDx; and
- Dioxins/furans

Cadmium, copper, mercury, zinc, PAHs, PCBs, and dioxin/furans are already retained as riverbank soil COPCs based on soil data screening. Two riverbank samples were analyzed for BEHP with results below detection limits. Carbazole was not analyzed during riverbank soil analysis. One sample was analyzed for

4,4'-dichlorodiphenyltrichloroethane (4,4'-DDT), 4,4'-dichlorodiphenyldichloroethylene (4,4'-DDE), and 4,4'-dichlorodipheyldichloroethane (4,4'-DDD) with results below detection limits. Therefore, no additional COPCs were added based on consideration of adjacent sediment COIs. The riverbank soil COPCs are summarized below:

- Metals – Antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc;
- PAHs – Multiple individual PAHs, carcinogenic PAHs (cPAHs) and total PAHs;
- TPH-diesel range;
- PCBs – Aroclor 1260 and total PCBs; and
- Dioxins/furans – Multiple congeners.

3.2.2 Evaluate Potential for Adverse Effects on Sediment

In accordance with the JSCS guidance, the following evaluation uses multiple lines of evidence to be considered independently and collectively to identify the potential for adverse effects on sediments from riverbank soil. These include the following.

- Factors related to COPC properties and concentrations
  - Contaminant concentrations relative to CLs and/or SLV
  - Regional background soil concentrations of metals
  - Presence of persistent bioaccumulative chemicals
  - In-water sediment data in proximity to source area
- Factors related to physical properties of the riverbank
  - Site surface conditions (e.g., exposed soil, paved, slope)
  - Riverbank stability (e.g., potential for erosion under extreme rainfall events, potential for erosion under flood conditions, bank erosion rates)
  - Soil properties (e.g., soil type, compaction, erodibility, permeability)
  - Evaluation of potential soil erosion and contaminant transport (e.g., modeling, quantitative erosion calculations)
- Extent of impacted soil and proximity to the river
- Estimate of potential contaminant loading to the river

Using the screening level factors related to the COPC properties and concentrations listed above, this section evaluates each of the COPCs to identify COCs for riverbank soil. For the COPC screening, it is recognized

that if riverbank soil is eroded into the river sediments, the concentrations of COPCs will not remain constant. The process of eroding and transporting soil to the river will disperse the soil fraction carrying the COPCs over a wider area in the sediments than in the riverbank, reducing overall concentrations. Therefore, riverbank soil concentrations that only slightly exceed screening levels are generally not considered to be at levels of concern. Other factors such as frequency of detection, background concentrations, and adjacent sediment data are also considered on a qualitative or semi-quantitative basis when evaluating potential COPCs.

Metals.

- Antimony – Antimony was detected above the SLV in 3 of 52 riverbank soil samples. Antimony is not bioaccumulative. Antimony is not identified as a COI in sediments in adjacent to the Facility. Based on these factors, antimony is not retained for further evaluation.
- Arsenic – Arsenic was detected above the regional default background concentration in 19 samples and above the CL in 49 of 55 total samples. Arsenic is bioaccumulative. Arsenic is not identified as a COI in sediments in adjacent to the Facility. However, based on the number of detections above the CL, arsenic is retained for further evaluation.
- Cadmium – Cadmium was detected above the regional default background concentration and the CL in 16 of 51 riverbank soil samples. Cadmium is bioaccumulative and is identified as a COI in sediments adjacent to the Facility. Cadmium is retained for further evaluation.
- Chromium – Chromium was detected above the regional default background concentration and the SLV in 1 of 55 samples. Chromium is not bioaccumulative and is not identified as a COI in sediments adjacent to the Facility. Chromium is not retained for further evaluation.
- Copper – Copper was detected above the regional default background concentration and SLV in 24 of 34 riverbank soil samples. Copper is not bioaccumulative. Copper is identified as a COI in sediments adjacent to the Facility. Copper is retained for further evaluation.
- Lead – Lead was detected above the regional background concentration in 41 of 57 samples and above the CL in 1 of the 57 samples. Lead is bioaccumulative. Lead is not identified as a COI in sediments in adjacent to the Facility. Based on the number of samples exceeding regional background concentration and lead being bioaccumulative, lead is retained for further evaluation.
- Mercury – Mercury was detected above the regional default background concentration and screening levels in 48 of 66 samples. Mercury is bioaccumulative. Mercury is not identified as a COI in sediments in adjacent to the Facility. Based on number of detections above screening levels and mercury being bioaccumulative, mercury is retained for further evaluation.
- Nickel – Nickel was detected above the regional default background concentration and the SLV in a total of 11 of 55 riverbank soil samples. Nickel is not bioaccumulative. Nickel is not identified as a

COI in sediments in adjacent to the Facility. Based on nickel not being bioaccumulative and not being a COI in sediments, this metal is not retained for further evaluation.

- Silver – Silver was detected above the regional default background concentration in 5 samples and the SLV in 1 of 49 riverbank soil samples. Silver is bioaccumulative. Silver is not identified as COI in sediments in adjacent to the Facility. Based on having only one detection above the SLV and silver not being a COI in sediments, silver is not retained for further evaluation.
- Zinc – Zinc was detected above the regional default background concentration and CLs in 35 of 55 samples. Zinc is not bioaccumulative. Zinc is identified as a COI in sediments in sediments adjacent to the Facility. Based on zinc being a COI in sediments, zinc is retained for further evaluation.

PAHs. At least one individual PAH was detected above SLVs or CLs in 37 of 42 riverbank soil samples. Fluoranthene and pyrene are bioaccumulative. PAHs are identified as COI in sediments adjacent to the Facility. As PAHs detections above screening levels in many samples, some PAHs being bioaccumulative, and PAHs being COI in sediments, PAHs are retained for further evaluation.

TPH-Diesel. There are no CLs or SLVs for TPH-gasoline or TPH-oil. There is a CL of 91 mg/kg for TPH-diesel. TPH-diesel was detected above the CL in 7 of 19 riverbank samples. TPH-diesel is not bioaccumulative. TPH-diesel is not identified as a COI in sediments adjacent to the Facility, but TPH is an indicator for PAHs that are a COI in sediments adjacent to the Facility. Based on TPH-diesel being an indicator for PAHs that are a COI in sediments, TPH-diesel is retained for further evaluation.

PCBs. Aroclor 1260 was detected above the SLVs in 5 of 9 samples. Total PCBs were detected above the CL in 9 of 13 samples, above the RAL in 7 of 13 samples, and above the PTW threshold in 5 of 13 samples. PCBs are identified as COI in sediments adjacent to the Facility. Based on the exceedance of PHSS screening levels for total PCBs, this analyte is retained for further evaluation.

Dioxins/Furans. At least one individual dioxin/furan was detected above CLs or SLVs in each of the 8 riverbank soil samples analyzed for dioxin/furans. Dioxins/furans are bioaccumulative and are identified as COI in sediments adjacent to the Facility. Dioxins/furans are retained for further evaluation.

Based on the above discussion, the following analytes are considered COCs for riverbank soil at the Facility. Figures D-7 through D-16 present riverbank soil sample locations that exceed PHSS ROD screening levels for each COC. These exceedances are summarized on Figure D-17.

- Metals (arsenic, cadmium, copper, lead, mercury, zinc);
- PAHs;
- TPH-diesel;

- Total PCBs; and
- Dioxins/furans.

As the upland remedy for the Facility will be coordinated with the riverbank and in-water work associated with the PHSS, tables and figures summarizing the risk for upland receptors in riverbank soil is presented in this Appendix. Preliminary remediation goals (PRGs) for the Facility upland were applied from the Facility boundaries to mean high water (MHW). As the riverbank soil screening is applied to TOB, the upland and riverbank screening overlap between the SCSB and TOB. Tables D-4 to D-6 summarize the riverbank soil samples that exceed upland ecological and human health PRGs between the SCSB and TOB. Figures D-18 through D-31 present areas of the riverbank between the SCSB and TOB that exceed upland PRGs for the riverbank soil COCs. The risk to upland receptors present in the riverbank is summarized on Figure D-32.

3.3 Lines of Evidence Related to Physical Properties of the Riverbank

Section 3.1.2 above presents evaluation of the physical characteristics of the Facility riverbank. Figure D-6 and the following summarize the conclusions of that evaluation.

- West Parcel. The West Parcel has low potential for erosion or bank movement. The riverbank is heavily armored and covered with thick vegetation. Two small areas of bare soil were observed between the rip rap boulders.
- Central Parcel. There is potential for erosion of the riverbank in the Central Parcel, summarized by area below. The erosion toward the west is likely associated with river action, primarily river currents, but exposed soil would also be subject to erosion from boat wakes. Erosion in the central and east portions of the Central Parcel is likely associated with boat wakes.
    - The western 300 feet of the Central Parcel riverbank exhibits evidence of erosion including oversteepened slopes and exposed bare soil and scarps.
    - From 300 to 600 feet from the western end of the Central Parcel, the riverbank exhibits several areas of bare soil and scarps. In general, the bare soil and scarps are located between the OLWL of 6.9 feet) and the OHWL of 20.1 feet.
    - The eastern 1,000 feet of the Central Parcel riverbank has scattered areas of bare soil and scarps. These are generally located above the OHWL with a notable exception near Station “C” 10+00.
- East Parcel. The initial 80 feet of riverbank (beginning at the border with the Central Parcel) exhibits evidence of erosion including oversteepened slopes and exposed bare soil and scarps. The remainder of the East Parcel riverbank has scattered areas of bare soil and scarps. The bare soil and scarps are located above the OHWL. A relatively tall scarp present along the BNSF embankment has large riprap at the toe and significant vegetation growth, suggesting that this scarp

is no longer actively eroding. These areas are in the more protected portion of the Facility so would be subject to erosion primarily from boat wakes when the river levels correspond to the bare areas or scarps. Given that the scarps are generally above the OHWL, erosion events would be limited to periods of higher water so would be infrequent. The riverbank is relatively less steep so has low potential for bank movement.

The overall conclusion is that the western 600 feet of the Central Parcel is potentially subject to erosion from river currents and boat wakes, and the eastern 1,000 feet of the Central Parcel plus the East Parcel are subject to erosion from boat wakes at scattered areas of bare soil/scarps. The toe elevations of the areas subject to erosion on the western 600 feet of the Central Parcel range from 7 feet to 22 feet, with the majority of the erodible areas above 9 feet. Using river stage level data collected over the past 29 years, the river level exceeds elevation 9 feet approximately 58 percent of the time. Allowing for vessel wakes up to 2 feet in height, the river level is within the range to potentially induce further erosion (i.e., above elevation 7 feet) approximately 87 percent of the time.

The toe elevations of the erodible areas on the eastern 1,000 feet of the Central Parcel plus the East Parcel are located at approximately 20 feet with the exception of the area located below the OHWL, which is at 12 feet. The river level exceeds elevation 12 feet 22 percent of the time, and 20 feet approximately 1.7 percent of the time. Allowing for vessel wakes up to 2 feet in height, the river level is within the range to potentially induce further erosion (i.e., above elevation 10 and 18 feet) approximately 42 and 2.8 percent of the time. Evaluation of river stage data is presented in Attachment D-2 of this appendix.

3.4 Summary of Riverbank Areas Targeted for Source Control

Figure D-33 summarizes potential for adverse effects on sediments from riverbank soil. The figure shows potential for riverbank erosion together with the location of COCs. In general, throughout the Facility, one or more COCs are present in riverbank soils at concentrations that have the potential to adversely affect sediments if the soil were to erode into the river.

On Figure D-6, erosion potential is divided into three levels of concern summarized below with the corresponding recommendation for evaluation of source control measures.

- Protected – In these areas, the riverbank is armored and well protected. There are no indications of slope failure. There may be occasional small patches of bare soil between rip rap boulders.
- Occasional Observed Erosion – The riverbank in these areas is generally armored, vegetated, and/or sloped to be relatively stable, but there are occasional areas of erosion or bare soil.
- Observed Erosion – In these areas, the riverbank shows clear signs of erosion such as exposed roots, over-steepened slopes, and bare soil.

4.0 Groundwater Source Control Evaluation

This section evaluates groundwater for potential to have adverse effects on surface water or sediments. The evaluation process consisted of the following steps.

- Summarize and compile relevant groundwater data;
- Compile screening levels;
- Screen data against lowest relevant screening levels to identify COPCs in groundwater;
- Screen COPCs against relevant screening levels for applicable pathways and receptors to identify COCs in groundwater; and
- Evaluate potential for adverse effects on surface water or sediments.

4.1 Groundwater Observations, Sampling, and Data

NAPL or Sheen Observations. Observations of oil sheen or NAPL during site investigations are described as follows.

- A petroleum NAPL seep was present in the cove adjacent to the southern portion of the East Parcel. Figure D-4 shows the location of the former seep. The seep originated from historical releases at the McCormick & Baxter Superfund Facility south of the BNSF railroad embankment. This area was capped as part of the McCormick & Baxter Superfund cleanup and the seep is no longer present.
- Beginning in December 1988, a site investigation was performed prior to sale of the property to PDC. Geophysical traverses were performed over a portion of the upland area to assess for buried objects such as USTs. Buried drainage pipes and sumps were found, but no USTs were located. Explorations included 19 soil borings (SE/E-1 through SE/E-13) and four hand-augered soil borings (HA-1 through HA-4). Oil sheens were observed on grab groundwater samples collected from borings SE/E-12, SE/E-13, and SE/E-19 on the West Parcel, and from borings SE/E-9 and SE/E-10 on the Central Parcel. An oil sheen was observed on river water in the area of the NAPL seep described above.
- During construction of the McCormick & Baxter cap in the cove, a sheen was observed on the water in the innermost portion of the cove adjacent to the East Parcel. Test pits were completed and petroleum NAPL was observed in one test pit. The extent of NAPL was confined to the zone between MHW and ordinary low water line (OLWL). The soil where the NAPL was observed was removed and disposed of off-site (Ash Creek, 2005).
- In 2007, DEQ observed on the beach in the Former Wharf Road area of the Central Parcel gray silty surface sediment that had an apparent sheen when disturbed or dropped into water. This material was investigated, and it was concluded that it did not originate from the upland area of the Facility.

- During two groundwater sampling events in 2002, slight sheens were observed on water from monitoring wells MW-1 (February and May) and MW-3 (May only) on the West Parcel, and from monitoring well MW-4 (May only) at the west end of the Central Parcel. In six subsequent sampling events in 2005 and 2016, sheens were not observed on water from the monitoring wells.

Groundwater Sampling. Borings and test pits were completed to assess groundwater during multiple site investigations. Grab samples were collected from soil borings and test pits across the Facility during several phases of sampling prior to 2003 (leading up to the RI). Groundwater samples were collected from test pits to assess conditions at the Wharf road area in the Central Parcel and inner cove on the East Parcel in 2010. Samples were collected from borings on the West Parcel to assess the former log pond area in 2016 and 2017.

Monitoring wells have been installed and sampled along the TOB across the Facility. Well installation details are show in Table D-7. One monitoring well installed as part of the McCormick & Baxter site investigation on the East Parcel (MW-35s) was sampled for investigation of the Facility in 1999. Seven groundwater monitoring wells were installed in 2002 as part of the RI (MW-1 through MW-7). These wells were sampled in 2002, 2005, and 2016. Two monitoring wells (MW-8 and MW-9) were installed and sampled in 2016 to expand the source control evaluation.

The groundwater sample locations are shown on Figure C-4 in Appendix C.

4.2 Groundwater Characterization

All groundwater data collected during investigations at the Facility were considered during the characterization. The characterization consists of compiling relevant screening levels, screening data, identifying COPCs and COCs, and evaluating the potential for adverse effects on sediment and surface water.

4.2.1 Identify Groundwater COPCs

The following screening levels were used to assess groundwater with the potential to migrate to surface water or sediments.

- Groundwater Cleanup Levels (CLs) from Table 17 of the PHSS ROD; and
- JSCS SLVs for Water.

Table D-8 lists the groundwater screening levels. Table D-9 presents groundwater data compared to the screening levels listed above. For COPC screening purposes, it was assumed that the groundwater would be transported to surface water without a change in concentration of the analyte. This assumption is conservative and adds uncertainty to the evaluation. Analytes that exceeded a relevant screening level were

retained as COPCs. Table D-3 summarizes the retained analytes and which screening levels were exceeded. The COPCs thus identified include the following:

- Metals – Aluminum, antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, vanadium, and zinc;
- PAHs – Each individual PAH plus cPAHs;
- TPH-diesel[1];
- PCBs – Aroclor 1254 and total PCBs;
- Dioxin/Furans – 2,3,7,8-TCDD and dioxin/furan TEQ;
- Pesticides – 4,4'-DDD;
- SVOCs – BEHP, butylbenzyl phthalate, dibenzofuran, diethyl phthalate, di-n-butyl phthalate, and pentachlorophenol; and
- VOCs – Benzene, chlorobenzene, chloromethane, tetrachloroethylene (PCE), and trichloroethylene (TCE).

4.2.2 Evaluate Potential for Adverse Effects on Surface Water or Sediments

In accordance with the JSCS guidance, the following evaluation considers multiple lines of evidence to be considered independently and collectively to identify the potential for adverse effects on surface water or sediments from groundwater. These include the following.

- Factors related to COPC properties and concentrations
  - Contaminant concentrations (magnitude of exceedance above the CL or SLV)
  - Regional background groundwater concentrations of metals
  - Potential presence of NAPL or sheen
  - Presence of bioaccumulative chemicals
  - Consideration of available in-water data (e.g., sediment, bioassay)
- Factors related to fate and transport of COPCs in groundwater
  - Nature and extent of groundwater COPCs in each affected water-bearing zone
  - Location of wells within the groundwater plume

[1] The CL for TPH-diesel is specific to the C10-C12 aliphatic range. No groundwater results for the Facility are reported specifically for this range, but the screening level was applied to be conservative.

  - Stability of the groundwater plume (e.g., predictive modeling)
  - Potential hydraulic connection between site groundwater and surface water and sediments
  - Fate and transport of groundwater COPCs
- Estimate of potential contaminant loading to the river
- Potential for groundwater discharge to result in an accumulation in sediments above protective concentrations (i.e., potential for groundwater discharge to result in sediment contamination or recontamination following sediment cleanup).

Using the screening level factors and concentrations related to the COPC listed above, this section assesses each of the COPCs to identify COPCs for further evaluation. For the COPC screening, it is recognized that as groundwater moves to the river, the concentrations of COPCs will not remain constant. Therefore, groundwater concentrations that only slightly exceed screening levels are generally not considered to be at levels of concern. More than 95% of samples collected at the Facility included analysis of both total and dissolved fractions for metals. Total and dissolved fractions were analyzed for PAHs, PCBs, and dioxin/furans at select monitoring wells during one event. Dissolved fraction concentrations are considered more representative of concentrations that will be encountered by sediment and surface water. Monitoring wells are located near the TOB along the length of the Facility except for the portion of the East Parcel near the BNSF railroad. Based on both the locations of the monitoring wells and the quality of the samples collected from wells, data from monitoring wells are considered more representative of COPC concentrations in groundwater than data from grab samples. Other factors such as frequency of detection and adjacent sediment data are also considered on a qualitative or semi-quantitative basis when evaluating potential COPCs.

Metals.

- Aluminum. There is no CL for aluminum. Aluminum was detected above the SLV in 21 of 46 total aluminum samples and 9 of 46 dissolved aluminum samples. Aluminum is not bioaccumulative. Aluminum is not identified as a COI in sediments adjacent to the Facility. Based on the non-bioaccumulative properties of aluminum, and it not being a COI for sediment adjacent to the Facility, aluminum is not retained for further evaluation.
- Antimony. There is no CL for antimony. Antimony was not detected above the SLV in total antimony samples and was above in 1 of 95 dissolved antimony samples. Antimony is not bioaccumulative. Antimony is not identified as a COI in sediments adjacent to the Facility. Based on the low number of detections, antimony not being bioaccumulative, and antimony not being a COI in sediments adjacent to the Facility, antimony is not retained for further evaluation.
- Arsenic. Arsenic was detected above the CL in 89 of 98 total arsenic samples and 65 of 101 dissolved arsenic samples. Arsenic is bioaccumulative. Arsenic is not identified as a COI in

sediments adjacent to the Facility. Based on arsenic being bioaccumulative, and the high frequency of CL exceedances, arsenic is retained for further evaluation.

- Cadmium. Cadmium was detected above the CL in 19 of 98 total cadmium samples and 5 of 104 dissolved cadmium samples. Sixty-six of 104 dissolved samples were collected from monitoring wells. The monitoring wells are located adjacent to the TOB at the Facility, representing groundwater close to sediment and surface water. Two of 66 dissolved samples exceeded the cadmium CL. This low number of detections along the TOB suggests that cadmium is not migrating with groundwater to sediment and surface water. Cadmium is bioaccumulative and is identified as a COI in sediments adjacent to the Facility. Based on low number of CL exceedances in dissolved samples from monitoring wells, cadmium is not retained for further evaluation.
- Chromium. Chromium was detected above the CL in 42 of 98 total chromium samples and 3 of 104 dissolved chromium samples. Chromium was not detected above CLs in dissolved samples from monitoring wells. Chromium is not bioaccumulative. Chromium is not identified as a COI in sediments adjacent to the Facility. Based on the lack of dissolved chromium in monitoring wells, chromium not being bioaccumulative, and chromium not being a COI in sediments adjacent to the Facility, chromium is not retained for further evaluation.
- Copper. Copper was detected above the CL in 64 of 98 total copper samples and 13 of 104 dissolved copper samples. Five of the dissolved copper samples above the CL were from monitoring wells. Copper is not bioaccumulative. Copper is identified as a COI in sediments adjacent to the Facility. Based on the low number of dissolved samples above the CL in monitoring wells, and copper not being bioaccumulative, copper is not retained for further evaluation.
- Lead. Lead was detected above the CL in 65 of 98 samples. Lead was detected above the CL in 20 of 104 dissolved samples, with 6 of those detections from a monitoring well sample. Lead is bioaccumulative. Lead is not identified as a COI in sediments adjacent to the Facility. Based on the low number of CL exceedances in dissolved monitoring well samples and lead not being a COI in sediments adjacent to the Facility, lead is not retained for further evaluation.
- Mercury. There is no CL for mercury. Mercury was detected above the SLV in 20 of 98 total mercury samples and none of 101 dissolved mercury samples. Mercury is bioaccumulative. Mercury is not identified as a COI in sediments adjacent to the Facility. Based on lack of SLV exceedance in dissolved samples and mercury not being a COI in sediments adjacent to the Facility, mercury is not retained for further evaluation.
- Nickel. There is no CL for nickel. Nickel was detected above the SLV in 43 of 98 total nickel samples and 1 of 101 dissolved nickel samples. Nickel is not bioaccumulative. Nickel is not identified as a COI in sediments adjacent to the Facility. Based on the small number of detections in dissolved samples, nickel not being bioaccumulative, and nickel not being a COI in sediments adjacent to the Facility, nickel is not retained for further evaluation.

- Selenium. There is no CL for selenium. Selenium was detected above the SLV in 3 of 92 total selenium samples and 2 of 95 dissolved selenium samples. Selenium is bioaccumulative. Selenium is not identified as a COI in sediments adjacent to the Facility. Based on the low number of CL exceedances and selenium not being a COI in sediments adjacent to the Facility, selenium is not retained for further evaluation.
- Silver. There is no CL for silver. Silver was detected above the SLV in 13 of 92 total silver samples and 2 of 95 dissolved silver samples. Silver is not bioaccumulative. Silver is not identified as a COI in sediments adjacent to the Facility. Based on the low number of SLV exceedances, silver not being bioaccumulative, and silver not being a COI in sediments adjacent to the Facility, silver is not retained for further evaluation.
- Vanadium. Vanadium was detected above the CL in 10 of 46 total vanadium samples and 1 of 46 dissolved vanadium samples. Vanadium is not bioaccumulative. Vanadium is not identified as a COI in sediments adjacent to the Facility. Based on the low number of CL exceedances in dissolved samples, vanadium not being bioaccumulative, and not being a COI in sediments adjacent to the Facility, vanadium is not retained for further evaluation.
- Zinc. Zinc was detected above the CL in 47 of 98 total zinc samples and 7 of 101 dissolved zinc samples. One dissolved zinc exceedance was from a monitoring well sample. Zinc was detected above the CL in one dissolved sample from a monitoring well. Zinc is not bioaccumulative. Zinc is identified as a COI in sediments adjacent to the Facility. Based on the lack CL exceedances in dissolved samples from monitoring wells and zinc not being bioaccumulative, zinc is not retained for further evaluation.

TPH-Diesel. TPH-diesel was detected above the C10-C12 aliphatic range CL in 10 of 41 samples. TPH is not bioaccumulative. TPH is not identified as a COI in sediments adjacent to the Facility, but TPH is an indicator for PAHs that are COI in sediments adjacent to the Facility. Based on the conservative nature of the CL as applied to TPH-diesel, TPH-diesel not being bioaccumulative, not a COI for sediment adjacent to the Facility, and the robust PAH dataset making it unnecessary as an indicator compound, TPH is not retained for further evaluation.

SVOCs. SVOCs were analyzed for both grab samples from borings and from monitoring wells. Results for individual COPC SVOCs are discussed below.

- BEHP. There is no CL for BEHP. BEHP was detected above the SLV in 4 of 62 samples. No SLV exceedances were detected in monitoring wells samples. BEHP is not bioaccumulative. BEHP is identified as a COI in sediments adjacent to the Facility. Based on the lack of CL exceedances in monitoring wells, BEHP is not retained for further evaluation.
- Dibenzofuran. There is no CL for dibenzofuran. Dibenzofuran was detected above the SLV in 1 of 60 groundwater samples . Dibenzofuran was not detected above the SLV in samples collected from

monitoring wells. Dibenzofuran is not bioaccumulative. Dibenzofuran is not identified as a COI in sediments adjacent to the Facility. Based on the lack of SLV exceedances in monitoring wells, dibenzofuran not being bioaccumulative, and dibenzofuran not being a COI in sediments adjacent to the Facility, dibenzofuran is not retained for further evaluation.

- Pentachlorophenol. Pentachlorophenol was detected above the CL in 8 of 71 groundwater samples. The 8 samples with CL exceedances are located within the former log pond area. Pentachlorophenol is bioaccumulative and is not identified as a COI in sediments adjacent to the Facility. Based on pentachlorophenol being bioaccumulative and the concentrated detection of concentrations in the former log pond area, pentachlorophenol is retained for further evaluation in the West Parcel.
- Butylbenzyl phthalate. There is no CL for butylbenzyl phthalate. Butylbenzyl phthalate was detected above the SLV in 1 of 62 groundwater samples. Butylbenzyl phthalate was not detected above the SLV in samples collected from monitoring wells. Butylbenzyl phthalate is not bioaccumulative. Butylbenzyl phthalate is not identified as a COI in sediments adjacent to the Facility. Based on the low number of SLV exceedances, butylbenzyl phthalate not being bioaccumulative and not being a COI in sediments adjacent to the Facility, butylbenzyl phthalate is not retained for further evaluation.
- Di-n-butyl Phthalate (DBP). There is no CL for DBP. DBP was detected above SLVs in 1 of 62 groundwater samples . DBP was not detected above the SLV in samples collected from monitoring wells. DBP is not bioaccumulative. DBP is not identified as a COI in sediments adjacent to the Facility. Based on the low number of CL exceedances, DBP not being bioaccumulative, and not being a COI in sediments adjacent to the Facility, DBP is not retained for further evaluation.
- Diethyl Phthalate. There is no CL for diethyl phthalate. Diethyl phthalate was detected above the SLV in 1 of 62 groundwater samples. Diethyl phthalate was not detected above the SLV in samples collected from monitoring wells. Diethyl phthalate is not bioaccumulative. Diethyl phthalate is not identified as a COI in sediments adjacent to the Facility. Based on the low number of CL exceedances, lack of exceedances in monitoring wells, diethyl phthalate not being bioaccumulative, and not being identified as a COI in sediments adjacent to the Facility, diethyl phthalate is not retained for further evaluation.

4,4'-DDD. 4,4'DDD was detected above the CL in 2 of 16 samples. Both samples were collected from the same monitoring well, MW 2, located within the former log pond. DDx is identified as COI in sediments adjacent to the Facility. Based on the CL exceedances in a monitoring well, location in the former log pond area, and DDx being COI in sediments adjacent to the Facility, 4,4'-DDD is retained for further evaluation in the West Parcel.

PAHs. As each individual PAH was detected above the CL or SLV in at least one sample, the PAHs are evaluated as a group, rather than on an individual basis. Of individual CL or SLV exceedances, 342 of 438 occur within or directly east of the former log pond area. Fluoranthene and pyrene are bioaccumulative. PAHs are identified as COI in sediments adjacent to the Facility. Based on frequent detection in the area of the former log pond, some PAHs being bioaccumulative, and PAHs being COI in sediments adjacent to the Facility, PAHs are retained for further evaluation in the West Parcel.

PCBs. Total PCBs were detected above the CL in 16 of 81 groundwater samples and 3 of 34 samples exceeded the SLV for Aroclor 1254. Fifteen of 16 CL exceedances are located on the West Parcel in the area of the former log pond. PCBs are bioaccumulative. PCBs are identified as COI in sediments adjacent to the Facility. Based on the number of CL exceedances in the former log pond area, PCBs being bioaccumulative, and PCBs being a COI in sediments adjacent to the Facility, total PCBs are retained for further evaluation in the West Parcel. The three samples with Aroclor 1254 SLV exceedances also have total PCB CL exceedances and Aroclor 1254 is considered in the total PCB calculation. Therefore, Aroclor 1254 is not evaluated further.

VOCs. Results for individual COPC VOCs are discussed below.

- Benzene. Benzene was detected above the CL in 3 of 85 groundwater samples. Benzene was detected in two samples collected from monitoring wells. Benzene is not bioaccumulative. Benzene is not identified as a COI in sediments adjacent to the Facility. Based on the low number of CL exceedances, benzene not being bioaccumulative, and benzene not being a COI in sediments adjacent to the Facility, benzene is not retained for further evaluation.
- Chlorobenzene. Chlorobenzene was detected above the CL in 4 of 86 groundwater samples. Chlorobenzene is not bioaccumulative. Chlorobenzene is not identified as a COI in sediments adjacent to the Facility. Based on the low number of CL exceedances, chlorobenzene not being bioaccumulative, and chlorobenzene not being a COI in sediments adjacent to the Facility, chlorobenzene is not retained for further evaluation.
- Chloromethane. There is no CL for chloromethane. Chloromethane was detected above the SLV in 1 of 96 groundwater samples . Chloromethane is bioaccumulative. Chloromethane is not identified as a COI in sediments adjacent to the Facility. Based on the low number of SLV exceedances, and chloromethane not being a COI in sediments adjacent to the Facility, chloromethane is not retained for further evaluation.
- Naphthalene. There is no CL for naphthalene. Naphthalene was detected above the SLV in 10 of 93 groundwater samples. Nine of the 10 samples detected above the SLV were collected from monitoring well MW-2. The highest concentration, was in 2002 and concentrations have decreased over time. Naphthalene is bioaccumulative in aquatic organisms. Naphthalene is not identified as a COI in sediments adjacent to the Facility. Based on the decreasing trend in concentration, and

naphthalene not being a COI in sediments adjacent to the Facility, naphthalene is not retained for further evaluation.

- PCE. PCE was detected above CL in 2 of 96 groundwater samples. PCE was not detected in samples collected from monitoring wells. PCE is not bioaccumulative. PCE is not identified as a COI in sediments adjacent to the Facility. Based on PCE not being detected in monitoring wells, PCE not being bioaccumulative, and PCE not being a COI in sediments adjacent to the Facility, PCE is not retained for further evaluation.
- TCE. TCE was detected above the CL in 2 of 96 groundwater samples. TCE was not detected in samples collected from monitoring wells. TCE is not bioaccumulative. TCE is not identified as a COI in sediments adjacent to the Facility. Based on TCE not being detected in monitoring wells, TCE not being bioaccumulative, and TCE not being a COI in sediments adjacent to the Facility, TCE is not retained for further evaluation.

Dioxin/Furans. Dixon/Furan TEQ was detected above the SLV in 7 of 14 samples and 2,3,7,8-TCDD was detected above the SLV in 2 of 13 samples. Six of the 7 dioxin/furan TEQ and both of the 2,3,7,8-TCDD sample exceedances are located on the West Parcel in the area of the former log pond. The December 2016 groundwater sample from MW-3 was analyzed for total and dissolved dioxin/furans to assess the mobility of the dioxin/furans in groundwater in the West Parcel. Dioxin/furans were not detected in the dissolved sample from MW-3. Dioxins are bioaccumulative and are identified as a COI in sediments adjacent to the Facility. Based on lack of detections in the dissolved fraction of groundwater, dioxin/furans are not retained for further evaluation.

Based on the above discussion, groundwater on the Central and East Parcels does not have potential to adversely impact sediments or surface water adjacent to the Facility. Groundwater on the West Parcel does have the potential to adversely impact sediments and surface water. The following analytes are considered COCs for groundwater on the West Parcel at the Facility. Figure D-34 presents the locations of groundwater samples with CL exceedances on the West Parcel for groundwater COCs.

- Arsenic;
- Pentachlorophenol;
- PAHs;
- 4,4'-DDD; and
- Total PCBs.

4.3 Groundwater Source Control Evaluation Conclusions

Based on the above analysis, groundwater on the West Parcel (corresponding to the location of the former log pond fill) has the potential for adverse effects on surface water and sediment. The COCs in groundwater are arsenic, pentachlorophenol, PAHs and PCBs and to a lesser extent possibly 4,4'-DDD.

Table D-1
Riverbank Soil - Source Control Screening Levels
Willamette Cove Upland Facility
Portland, Oregon

Analyte Group	Analyte	PHSS Cleanup Level	JSCS Screening Level Value[4]	PHSS Remedial Action Level	PHSS Principal Threat Waste
		Concentration in mg/kg			
Aroclors	Aroclor 1016	--	0.53	--	--
Aroclors	Aroclor 1248	--	1.5	--	--
Aroclors	Aroclor 1254	--	0.3	--	--
Aroclors	Aroclor 1260	--	0.2	--	--
Aroclors	Total PCBs	0.009	--	0.075	0.2
Butyltin	Tributyltin	3.08	--	--	--
Dioxins_Furans	1,2,3,4,6,7,8-HpCDD	--	6.90E-04	--	--
Dioxins_Furans	1,2,3,4,6,7,8-HpCDF	--	6.90E-04	--	--
Dioxins_Furans	1,2,3,4,7,8,9-HpCDF	--	6.90E-04	--	--
Dioxins_Furans	1,2,3,4,7,8-HxCDF	4.00E-07	--	--	4.00E-05
Dioxins_Furans	1,2,3,6,7,8-HxCDF	--	2.70E-06	--	--
Dioxins_Furans	1,2,3,7,8,9-HxCDF	--	2.70E-06	--	--
Dioxins_Furans	1,2,3,7,8-PeCDD	2.00E-07	--	8.00E-07	1.00E-05
Dioxins_Furans	1,2,3,7,8-PeCDF	--	2.60E-06	--	--
Dioxins_Furans	2,3,4,6,7,8-HxCDF	--	2.70E-06	--	--
Dioxins_Furans	2,3,4,7,8-PeCDF	3.00E-07	--	2.00E-04	2.00E-04
Dioxins_Furans	2,3,7,8-TCDD	2.00E-07	--	6.00E-07	1.00E-05
Dioxins_Furans	2,3,7,8-TCDF	4.07E-07	--	--	6.00E-04
Dioxins_Furans	OCDD	--	2.30E-02	--	--
Dioxins_Furans	OCDF	--	2.30E-02	--	--
Metals	Antimony	--	64	--	--
Metals	Arsenic	3	--	--	--
Metals	Cadmium	0.51	--	--	--
Metals	Chromium	--	111	--	--
Metals	Copper	359	--	--	--
Metals	Lead	196	--	--	--
Metals	Mercury	0.085	--	--	--
Metals	Nickel	--	48.6	--	--
Metals	Selenium	--	5	--	--
Metals	Silver	--	5	--	--
Metals	Zinc	459	--	--	--
PAHs	Acenaphthene	--	0.3	--	--
PAHs	Acenaphthylene	--	0.2	--	--
PAHs	BaP Eq	0.012	--	--	106
PAHs	Benzo(a)anthracene	--	1.05	--	--
PAHs	Benzo(a)pyrene	--	1.45	--	--
PAHs	Benzo(g,h,i)perylene	--	0.3	--	--
PAHs	Benzo(k)fluoranthene	--	13	--	--
PAHs	Chrysene	--	1.29	--	--
PAHs	Dibenzo(a,h)anthracene	--	1.3	--	--
PAHs	Fluoranthene	--	2.23	--	--
PAHs	Fluorene	--	0.536	--	--
PAHs	Indeno(1,2,3-cd)pyrene	--	0.1	--	--
PAHs	Phenanthrene	--	1.17	--	--
PAHs	Pyrene	--	1.52	--	--
PAHs	Total PAHs	23	--	13	--
Pesticides	4,4'-DDD	0.114	--	--	--
Pesticides	4,4'-DDE	0.226	--	--	--
Pesticides	4,4'-DDT	0.246	--	--	--

Table D-1
Riverbank Soil - Source Control Screening Levels
Willamette Cove Upland Facility
Portland, Oregon

Analyte Group	Analyte	PHSS Cleanup Level	JSCS Screening Level Value[4]	PHSS Remedial Action Level	PHSS Principal Threat Waste
		Concentration in mg/kg			
Pesticides	Aldrin	0.002	--	--	--
Pesticides	Chlordane (technical)	0.0014	--	--	--
Pesticides	Dieldrin	0.00007	--	--	--
Pesticides	Endrin	--	0.207	--	--
Pesticides	gamma-Hexachlorocyclohexane	0.005	--	--	--
Pesticides	Heptachlor	--	0.01	--	--
Pesticides	Heptachlor epoxide	--	0.016	--	--
Pesticides	Total of 4,4'-DDD, -DDE, -DDT	0.0061	--	0.16	7.05
Petroleum	Diesel Range Hydrocarbons	91	--	--	--
SVOCs	2-Methylnaphthalene	--	0.2	--	--
SVOCs	Bis(2-ethylhexyl)phthalate	0.135	--	--	--
SVOCs	Carbazole	--	1.6	--	--
SVOCs	Diethyl phthalate	--	0.6	--	--
SVOCs	Di-n-butylphthalate	--	0.06	--	--
SVOCs	Hexachlorobenzene	--	0.019	--	--
SVOCs	Hexachlorocyclopentadiene	--	0.4	--	--
SVOCs	Pentachlorophenol	--	0.25	--	--
SVOCs	Phenol	--	0.05	--	--
VOCs	1,2,4-Trichlorobenzene	--	9.2	--	--
VOCs	1,2-Dichlorobenzene	--	1.7	--	--
VOCs	1,3-Dichlorobenzene	--	0.3	--	--
VOCs	1,4-Dichlorobenzene	--	0.3	--	--
VOCs	Anthracene	--	0.845	--	--
VOCs	Chlorobenzene	--	--	--	0.32
VOCs	Hexachlorobutadiene	--	0.6	--	--
VOCs	Naphthalene	--	0.561	--	140
VOCs	Tetrachloroethene	--	0.5	--	--
VOCs	Trichloroethene	--	2.1	--	--

Table D-1
Riverbank Soil - Source Control Screening Levels
Willamette Cove Upland Facility
Portland, Oregon

Notes:

1. Riverbank Soil includes all samples between the Source Control Screening Boundary (top of bank plus areas of potentially erodible soil) to -2 feet Columbia River Datum from 0-3 feet bgs.
2. PHSS = Portland Harbor Superfund Site
3. Cleanup Levels from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
4. JSCS Screening Level Value = Joint Source Control Strategy Screening Level Values from Portland Harbor Joint Source Control Stratey, DEQ, 2005. Riverbank soil screened against JSCS SLVs if no PHSS Cleanup Level available.
5. Remedial Action Level from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
6. Prinicipal Threat Waste from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
7. mg/kg = milligrams per kilogram
8. PCBs = Polychlorinated Biphenyls.
9. Total PCBs is calculated as the sum of all detected values.
10. BaP Eq = Benzo(a)pyrene Equivalent
11. PAHs = Polycyclic Aromatic Hydrocarbons
12. SVOCs = Semi-volatile Organic Compounds
13. VOCs = Volatile Organic Compounds

Table D-3
Riverbank Soil COC Summary
Willamette Cove Upland Facility
Portland, Oregon

Analyte	Riverbank Soil					Groundwater		
	COPC				COC	COPC		COC
	CL	SLV	RAL	PTW		CL	SLV	
Metals								
Aluminum							X	
Antimony		X					X	
Arsenic	X				X	X		
Cadmium	X				X	X		
Chromium		X				X		
Copper	X				X	X		
Lead	X				X	X		
Mercury	X						X	
Nickel		X					X	
Selenium							X	
Silver		X					X	
Vanadium						X		
Zinc	X				X	X		
PAHs								
2-Methylnaphthalene		X			X		X	X
Acenaphthylene		X			X		X	X
Anthracene		X			X	X		X
BaP Eq	X				X	X		X
Benzo(a)anthracene		X			X	X		X
Benzo(a)pyrene		X			X	X		X
Benzo(b)fluoranthene						X		X
Benzo(g,h,i)perylene		X			X	X		X
Benzo(k)fluoranthene		X			X	X		X
Chrysene		X			X	X		X
Dibenzo(a,h)anthracene		X			X	X		X
Fluoranthene		X			X		X	X
Fluorene		X			X		X	X
Indeno(1,2,3-cd)pyrene		X			X			
Naphthalene							X	X
Phenanthrene		X			X		X	X
Pyrene		X			X		X	X
Total PAHs	X				X			
Total PAHs			X		X			
Petroleum Hydrocarbons								
TPH-Diesel	X				X	X		
PCBs								
Aroclor 1254							X	
Aroclor 1260		X						
Total PCBs	X		X	X	X	X		X

Table D-3
Riverbank Soil COC Summary
Willamette Cove Upland Facility
Portland, Oregon

Analyte	Riverbank Soil					Groundwater		
	COPC				COC	COPC		COC
	CL	SLV	RAL	PTW		CL	SLV	
Dioxin/Furans								
1,2,3,4,6,7,8-HpCDD		X			X			
1,2,3,4,6,7,8-HpCDF		X			X			
1,2,3,4,7,8-HxCDF	X			X	X			
1,2,3,6,7,8-HxCDF		X			X			
1,2,3,7,8,9-HxCDF		X			X			
1,2,3,7,8-PeCDD	X		X	X	X			
1,2,3,7,8-PeCDF		X			X			
2,3,4,6,7,8-HxCDF		X			X			
2,3,4,7,8-PeCDF	X		X	X	X			
2,3,7,8-TCDD	X		X	X	X		X	
2,3,7,8-TCDF	X				X			
OCDD		X			X			
Dixoin/Furan TEQ							X	
Pesticides								
4,4'-DDD						X		X
SVOCs								
2-Methylnaphthalene							X	
Bis(2-ethylhexyl) phthalate							X	
Butylbenzyl phthalate							X	
Dibenzofuran							X	
Diethyl Phthalate							X	
Di-n-butyl phthalate							X	
Pentachlorophenol						X		X
VOCs								
Benzene						X		
Chlorobenzene						X		
Chloromethane							X	
Tetrachloroethene						X		
Trichloroethene						X		

Table D-3
Riverbank Soil COC Summary
Willamette Cove Upland Facility
Portland, Oregon

Notes:

1. COC = Contaminant of Concern
2. COPC = Contaminant of Potential Concern
3. CL = Cleanup Levels from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
4. SLV = Screening Level Value from Joint Source Control Strategy
5. RAL = Remedial Action Level from Record of Decision, Portland Harbor Superfund site, EPA, January 2017.
6. PTW = Principal Threat Waste Threshold from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
7. Riverbank Soil includes all samples between the Source Control Screening Boundary (top of bank plus areas of potentially erodible soil) to -2 feet Columbia River Datum from 0-3 feet bgs.
8. PCBs = Polychlorinated Biphenyls.
9. PAHs = Polycyclic Aromatic Hydrocarbons
10. BaP Eq = Benzo(a)pyrene Equivalent
11. SVOCs = Semi-volatile Organic Compounds
12. VOCs = Volatile Organic Compounds

Table D-7
Monitoring Well Construction Details
Willamette Cove Upland Facilit
Portland, Oregon

Well ID	Date Installed	TOC Elevation (feet)	Depth to Bottom (feet bgs)	Screened Interval (feet bgs)
MW-1	1/21/2002	35.74	41.5	25-40
MW-2	1/22/2002	44.04	41.5	25-40
MW-3	1/23/2002	41.97	43.0	27-42
MW-4	1/23/2002	35.20	36.5	19-34
MW-5	1/24/2002	36.03	37.0	22-37
MW-6	1/25/2002	35.95	37.0	22-37
MW-7	1/28/2002	34.57	35.0	20-35
MW-8	2/9/2016	35.69	38.00	23-38
MW-9	2/9/2016	33.31	33	18-33

Notes:
1. TOC = top of casing
2. Elevations relative to City of Portland datum.
3. bgs = below ground surface.
4. Elevation for wells MW-2, MW-8, and MW-9 are from survey on June 16, 2016. All other well elevations from survey conducted in 2002.

Table D-8
Groundwater - Source Control Screening Levels
Willamette Cove Upland Facility
Portland, Oregon

Analyte Group	Analyte	PHSS Cleanup Level	JSCS Screening Level Value
		Concentration in µg/L	
Aroclors	Aroclor 1016	--	0.96
Aroclors	Aroclor 1221	--	0.034
Aroclors	Aroclor 1232	--	0.034
Aroclors	Aroclor 1242	--	0.034
Aroclors	Aroclor 1248	--	0.034
Aroclors	Aroclor 1254	--	0.033
Aroclors	Aroclor 1260	--	0.034
Aroclors	Total PCBs	0.014	--
Dioxins_Furans	2,3,7,8-TCDD	--	5.1E-09
Dioxins_Furans	Dixoin/Furan TEQ	--	5.1E-09
Metals	Aluminum	--	50
Metals	Antimony	--	6
Metals	Arsenic	0.018	--
Metals	Cadmium	0.091	--
Metals	Chromium	11	--
Metals	Copper	2.74	--
Metals	Lead	0.54	--
Metals	Mercury	--	0.77
Metals	Nickel	--	16
Metals	Selenium	--	5
Metals	Silver	--	0.12
Metals	Vanadium	20	--
Metals	Zinc	36.5	--
Natural Attenuation Parameters	Arsenic III	--	190
PAHs	Acenaphthene	23	--
PAHs	Acenaphthylene	--	0.2
PAHs	Anthracene	0.73	--
PAHs	BaP Eq	0.00012	--
PAHs	Benzo(a)anthracene	0.0012	--
PAHs	Benzo(a)pyrene	0.00012	--
PAHs	Benzo(b)fluoranthene	0.0012	--
PAHs	Benzo(g,h,i)perylene	--	0.2
PAHs	Benzo(k)fluoranthene	0.0013	--
PAHs	Chrysene	0.0013	--
PAHs	Dibenzo(a,h)anthracene	0.00012	--
PAHs	Fluoranthene	--	0.2
PAHs	Fluorene	--	0.2
PAHs	Indeno(1,2,3-cd)pyrene	0.0012	--
PAHs	Phenanthrene	--	0.2
PAHs	Pyrene	--	0.2
Pesticides	2,4'-DDD	0.000031	--

Table D-8
Groundwater - Source Control Screening Levels
Willamette Cove Upland Facility
Portland, Oregon

Analyte Group	Analyte	PHSS Cleanup Level	JSCS Screening Level Value
		Concentration in µg/L	
Pesticides	2,4'-DDE	0.000018	--
Pesticides	2,4'-DDT	0.000022	--
Pesticides	4,4'-DDD	0.000031	--
Pesticides	4,4'-DDE	0.000018	--
Pesticides	4,4'-DDT	0.000022	--
Pesticides	Aldrin	--	0.00005
Pesticides	alpha-BHC	--	0.0049
Pesticides	beta-BHC	--	0.017
Pesticides	delta-BHC	--	0.037
Pesticides	Dieldrin	--	0.000054
Pesticides	Endosulfan I	--	0.051
Pesticides	Endosulfan II	--	0.051
Pesticides	Endosulfan Sulfate	--	89
Pesticides	Endrin	--	0.036
Pesticides	Endrin Aldehyde	--	0.3
Pesticides	gamma-BHC (Lindane)	--	0.052
Pesticides	Heptachlor	--	0.000079
Pesticides	Heptachlor Epoxide	--	0.000039
Pesticides	Methoxychlor	--	0.03
Pesticides	Total Chlordane	--	0.00081
Pesticides	Toxaphene	--	0.0002
Pesticides	trans-Nonachlor	--	0.19
Phenols	Dinoseb	--	7
SVOCs	2,3,4,6-Tetrachlorophenol	--	1100
SVOCs	2,4,5-Trichlorophenol	50	--
SVOCs	2,4,6-Trichlorophenol	--	2.4
SVOCs	2,4-Dichlorophenol	--	110
SVOCs	2,4-Dimethylphenol	--	730
SVOCs	2,4-Dinitrophenol	--	73
SVOCs	2,4-Dinitrotoluene	--	3.4
SVOCs	2,6-Dinitrotoluene	--	37
SVOCs	2-Chloronaphthalene	--	490
SVOCs	2-Chlorophenol	--	30
SVOCs	2-Methyl-4,6-dinitrophenol	--	150
SVOCs	2-Methylnaphthalene	--	0.2
SVOCs	2-Methylphenol	--	13
SVOCs	2-Nitroaniline	--	110
SVOCs	2-Nitrophenol	--	150
SVOCs	3,3'-Dichlorobenzidine	--	0.028
SVOCs	3-Nitroaniline	--	3.2
SVOCs	4-Chloroaniline	--	150

Table D-8
Groundwater - Source Control Screening Levels
Willamette Cove Upland Facility
Portland, Oregon

Analyte Group	Analyte	PHSS Cleanup Level	JSCS Screening Level Value
		Concentration in µg/L	
SVOCs	4-Chlorophenyl Phenyl Ether	--	0.06
SVOCs	4-Methylphenol	--	180
SVOCs	4-Nitroaniline	--	3.2
SVOCs	4-Nitrophenol	--	150
SVOCs	Aniline	--	12
SVOCs	Benzoic Acid	--	42
SVOCs	Benzyl Alcohol	--	8.6
SVOCs	Bis(2-chloroethyl) Ether	--	0.06
SVOCs	Bis(2-ethylhexyl) phthalate	--	2.2
SVOCs	Butylbenzyl phthalate	--	3
SVOCs	Carbazole	--	3.4
SVOCs	Dibenzofuran	--	3.7
SVOCs	Diethyl Phthalate	--	3
SVOCs	Dimethyl Phthalate	--	3
SVOCs	Di-n-butyl phthalate	--	3
SVOCs	Di-n-octyl Phthalate	--	3
SVOCs	Hexachlorobenzene	--	0.00029
SVOCs	Hexachlorocyclopentadiene	--	5.2
SVOCs	Hexachloroethane	--	3.3
SVOCs	Isophorone	--	71
SVOCs	Nitrobenzene	--	3.4
SVOCs	N-Nitrosodimethylamine	--	0.00042
SVOCs	N-Nitrosodi-n-propylamine	--	0.0096
SVOCs	N-Nitrosodiphenylamine	--	6
SVOCs	Pentachlorophenol	0.03	--
SVOCs	Phenol	--	2560
VOCs	1,1,1,2-Tetrachloroethane	--	2.5
VOCs	1,1,1-Trichloroethane	--	11
VOCs	1,1,2,2-Tetrachloroethane	--	0.33
VOCs	1,1,2-Trichloroethane	--	1.2
VOCs	1,1-Dichloroethane	--	47
VOCs	1,1-Dichloroethene	7	--
VOCs	1,2,3-Trichloropropane	--	0.0095
VOCs	1,2,4-Trichlorobenzene	--	8.2
VOCs	1,2-Dibromoethane	--	0.033
VOCs	1,2-Dichlorobenzene	--	49
VOCs	1,2-Dichloroethane	--	0.73
VOCs	1,2-Dichloropropane	--	0.97
VOCs	1,3-Dichlorobenzene	--	14
VOCs	1,4-Dichlorobenzene	--	2.8
VOCs	2-Butanone	--	7100

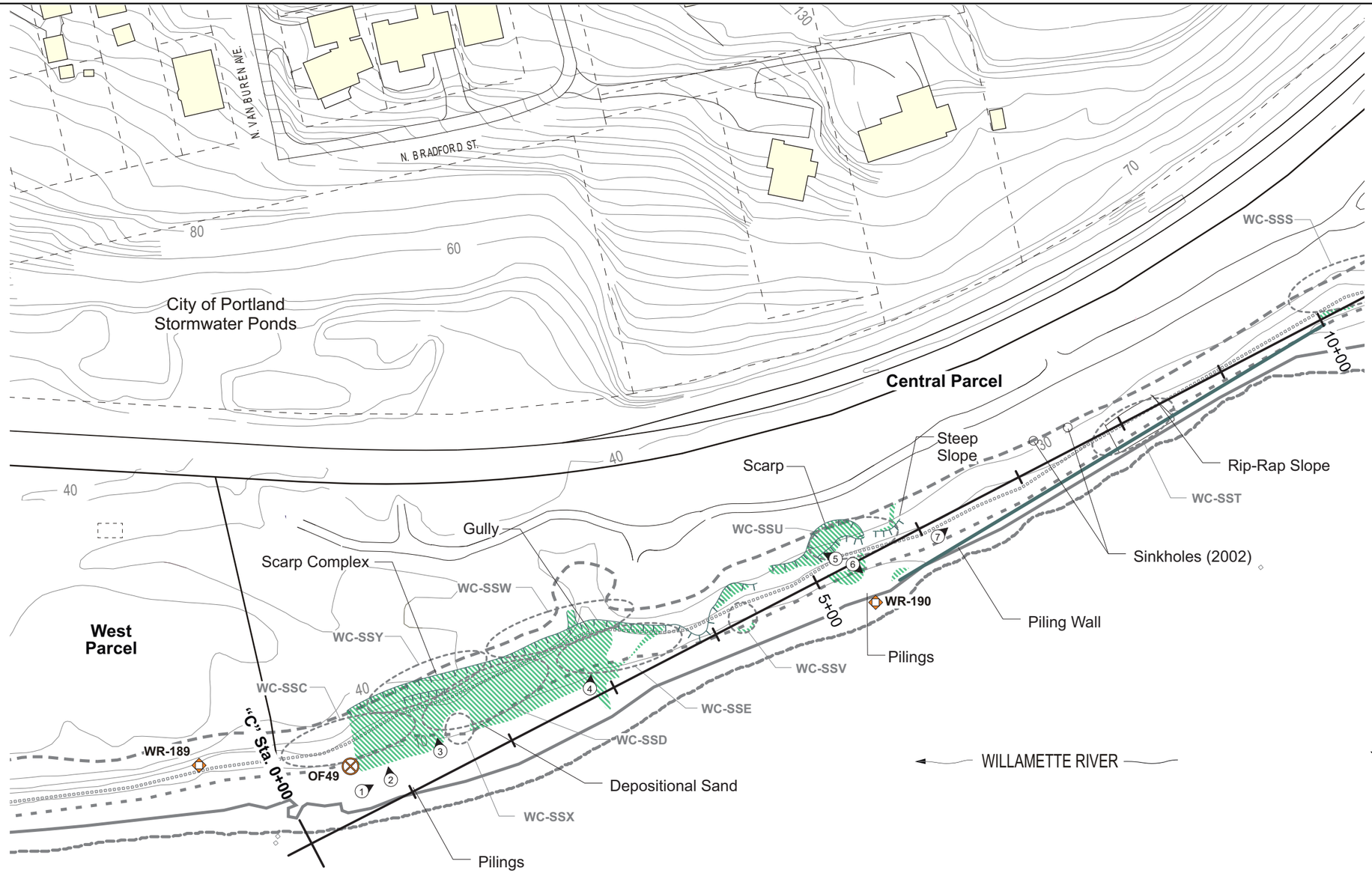
Table D-8
Groundwater - Source Control Screening Levels
Willamette Cove Upland Facility
Portland, Oregon

Analyte Group	Analyte	PHSS Cleanup Level	JSCS Screening Level Value
		Concentration in µg/L	
VOCs	2-Hexanone	--	99
VOCs	4-Methyl-2-pentanone	--	170
VOCs	Acetone	--	1500
VOCs	Benzene	0.44	--
VOCs	Bromodichloromethane	--	1.1
VOCs	Bromoform	--	8.5
VOCs	Bromomethane	--	8.7
VOCs	Carbon disulfide	--	0.92
VOCs	Carbon tetrachloride	--	0.51
VOCs	Chlorobenzene	64	--
VOCs	Chloroethane	--	23
VOCs	Chloroform	--	0.17
VOCs	Chloromethane	--	2.1
VOCs	cis-1,2-Dichloroethene	9.9	--
VOCs	cis-1,3-Dichloropropene	--	0.055
VOCs	Dibromochloromethane	--	0.79
VOCs	Dibromomethane	--	61
VOCs	Dichlorodifluoromethane	--	390
VOCs	Ethylbenzene	7.3	--
VOCs	Hexachlorobutadiene	--	0.86
VOCs	Isopropylbenzene	--	660
VOCs	m,p-Xylene	--	1.8
VOCs	Methylene chloride	--	8.9
VOCs	Methyl-tert-butyl-ether	--	37
VOCs	Naphthalene	--	0.2
VOCs	o-Xylene	--	13
VOCs	Styrene	--	100
VOCs	Tetrachloroethene	0.24	--
VOCs	Toluene	9.8	--
VOCs	Total Xylenes	13	--
VOCs	trans-1,2-Dichloroethene	--	110
VOCs	trans-1,3-Dichloropropene	--	0.055
VOCs	Trichloroethene	0.6	--
VOCs	Trichlorofluoromethane	--	1300
VOCs	Vinyl acetate	--	16
VOCs	Vinyl chloride	0.022	--

Table D-8
Groundwater - Source Control Screening Levels
Willamette Cove Upland Facility
Portland, Oregon

Notes:

1. PHSS = Portland Harbor Superfund Site
2. Cleanup Levels from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
3. JSCS Screening Level Value = Joint Source Control Strategy Screening Level Values from Portland Harbor Joint Source Control Stratey, DEQ, 2005. Riverbank soil screened against JSCS SLVs if no PHSS Cleanup Level available.
4. µg/L = micrograms per liter
5. Dioxin/Furan TEQ = 2,3,7,8-Tetrachlorodibenzodioxin Toxic Equivalent
6. PCBs = Polychlorinated Biphenyls.
7. Total PCBs is calculated as the sum of all detected values.
8. BaP Eq = Benzo(a)pyrene Equivalent
9. PAHs = Polycyclic Aromatic Hydrocarbons
10. SVOCs = Semi-volatile Organic Compounds
11. VOCs = Volatile Organic Compounds



Legend:

- Bare Soil Area (Approximate)
- Scarp (Approximate)
- Photograph Location, Number, and Direction Taken
- **"C" Sta. 0+00** Station Along Central Parcel Shoreline
- WC-SSC Composite Sample Location
- **OF49** City of Portland Outfall
- **WR-189** Potential Historical Outfall (Inactive)
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary

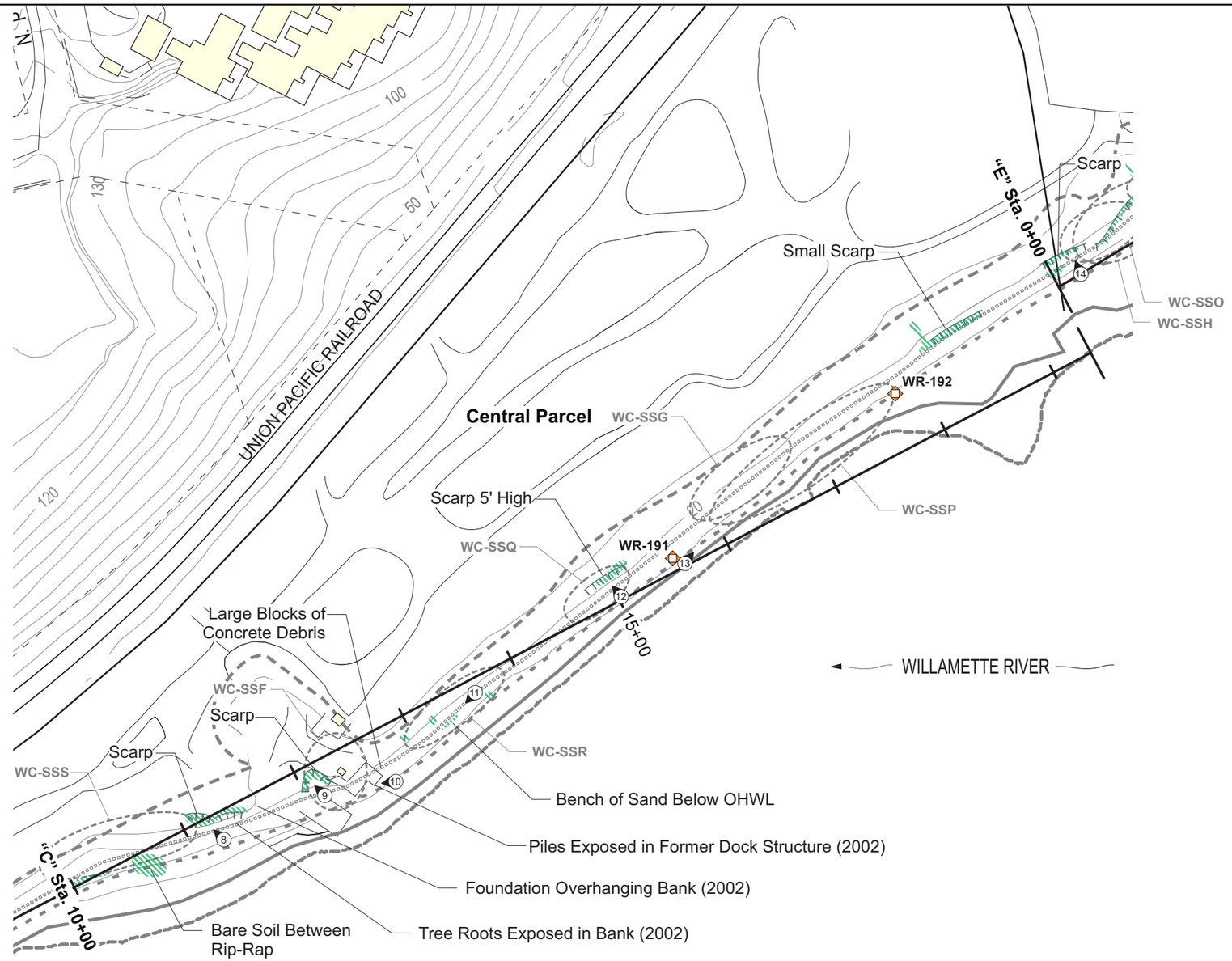
Note: Base map prepared from an electronic file provided by Hart Crowser.

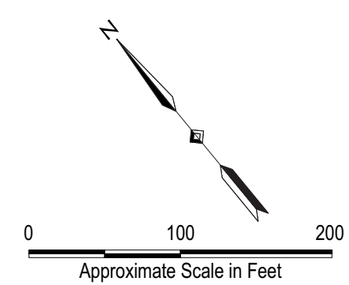
Riverbank Reconnaissance - Central Parcel (West)

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-1





Legend:

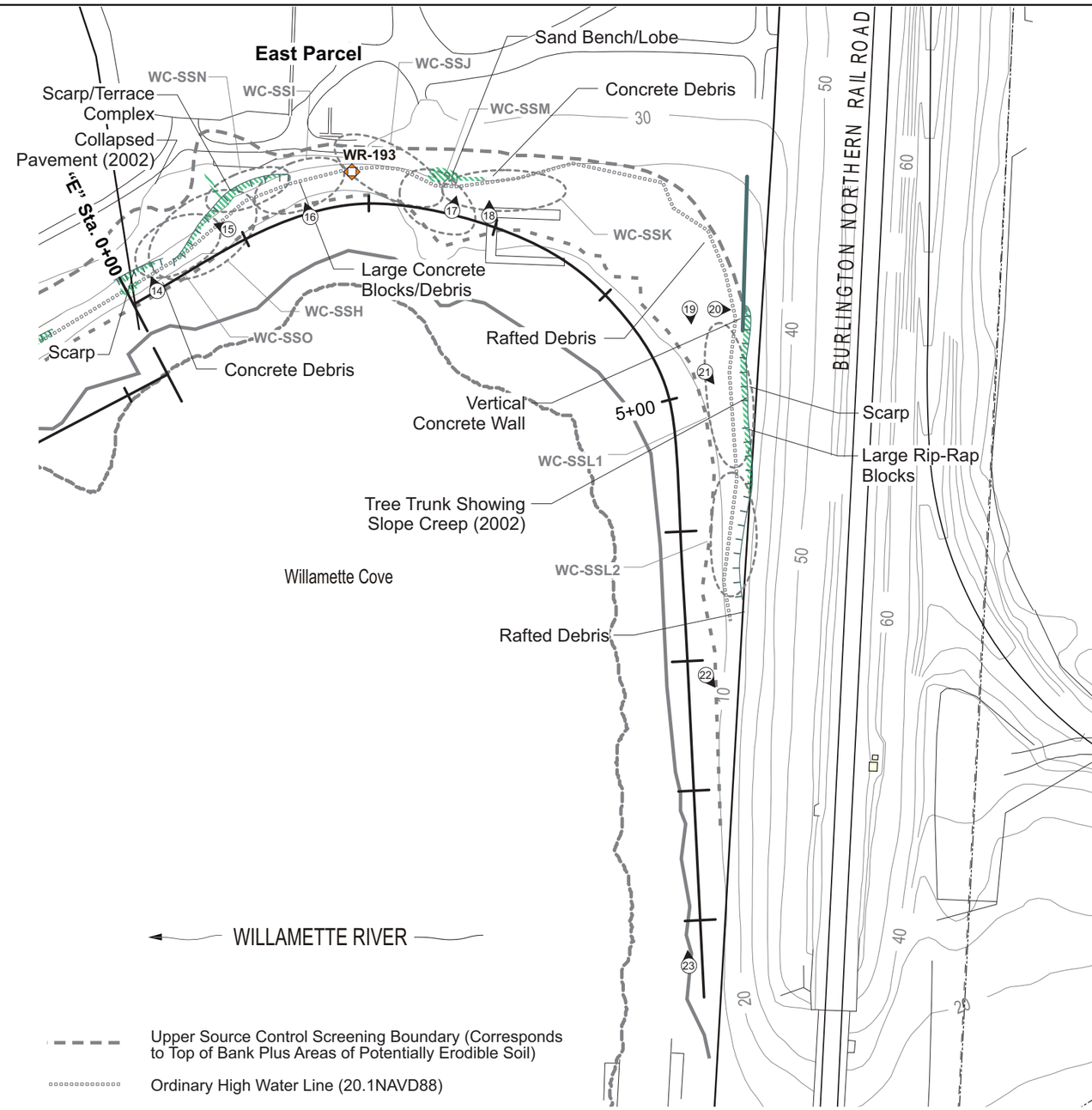
- Bare Soil Area (Approximate)
- Scarp (Approximate)
- Photograph Location, Number, and Direction Taken
- **"C" Sta. 10+00** Station Along Central Parcel Shoreline
- **"E" Sta. 0+00** Station Along East Parcel Shoreline
- **WR-191** Potential Historical Outfall (Inactive)
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary

Note: Base map prepared from an electronic file provided by Hart Crowser.

Riverbank Reconnaissance - Central Parcel (East)

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX	Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number 1056-10 March 2019	Figure D-2



Legend:

- Bare Soil Area (Approximate)
- Scarp (Approximate)
- Photograph Location, Number, and Direction Taken
- **"C" Sta. 10+00** Station Along Central Parcel Shoreline
- **"E" Sta. 0+00** Station Along East Parcel Shoreline
- **WR-193** Potential Historical Outfall (Inactive)
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary

Note: Base map prepared from an electronic file provided by Hart Crowser.

Riverbank Reconnaissance - East Parcel

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
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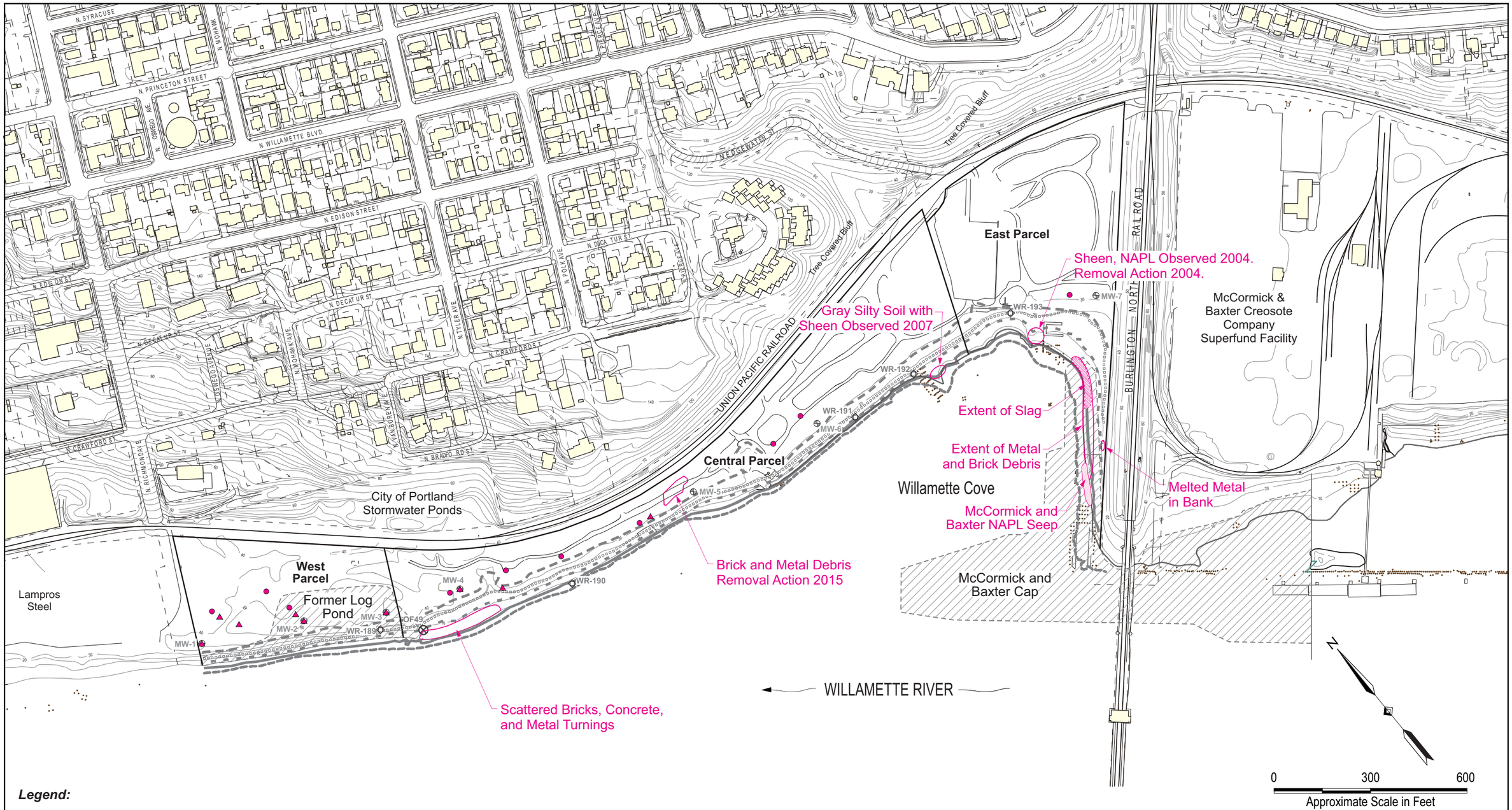
Project Number	1056-10	Figure
March 2019		D-3



Legend:

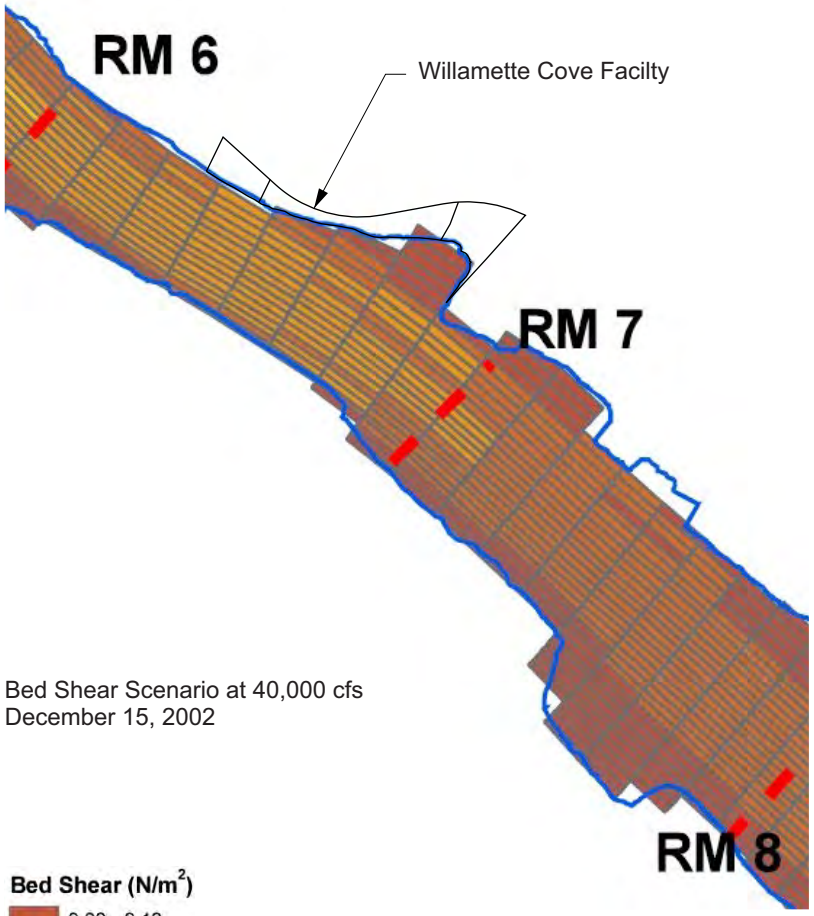
- MW-1 ⊕ Monitoring Well Location
- OF49 ⊗ City of Portland Outfall
- WR-189 ◇ Potential Historical Outfall (Inactive)
- ▲ Sheen Observed in Groundwater
- ● Sheen Observed in Soil
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary

Note: Base map prepared from an electronic file provided by Hart Crowser.

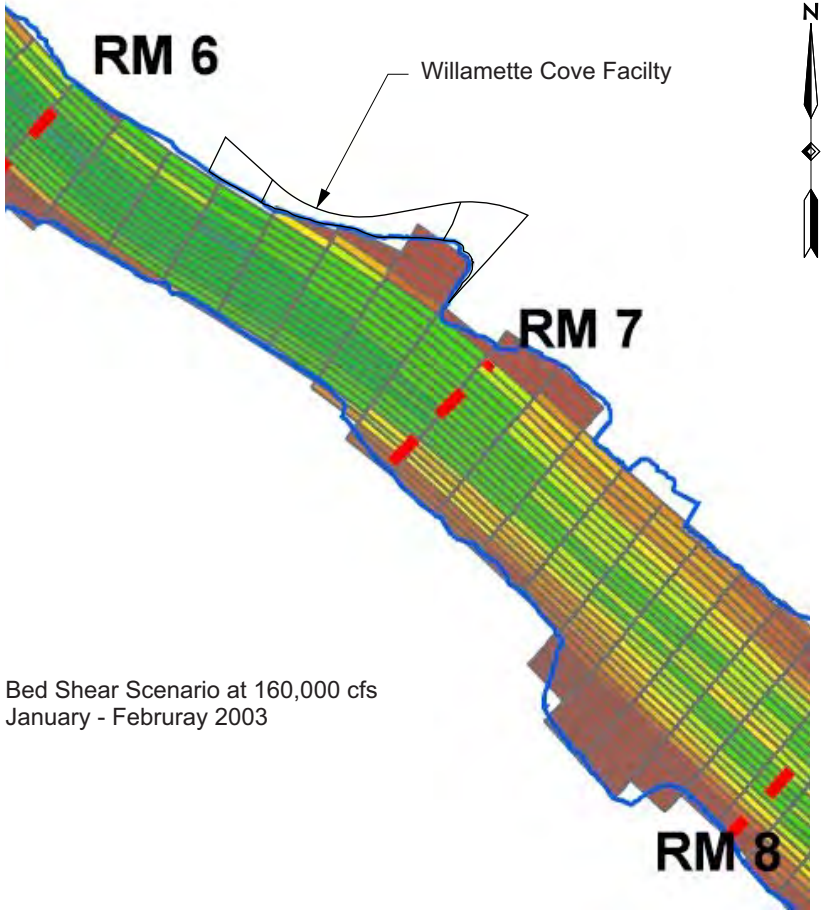
Debris, Sheen, and NAPL Observations

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX	Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number 1056-10 March 2019	Figure D-4



Bed Shear Scenario at 40,000 cfs
December 15, 2002



Bed Shear Scenario at 160,000 cfs
January - Februray 2003

N

Bed Shear (N/m^2)

- 0.00 - 0.10
- 0.11 - 0.40
- 0.41 - 0.70
- 0.71 - 1.00
- 1.01 - 1.50
- 1.51 - 2.00
- 2.01 - 3.00
- 3.01 - 4.00
- 4.01 - 5.00
- 5.01 - 6.00
- 6.01 - 8.00
- 8.01 - 55.00

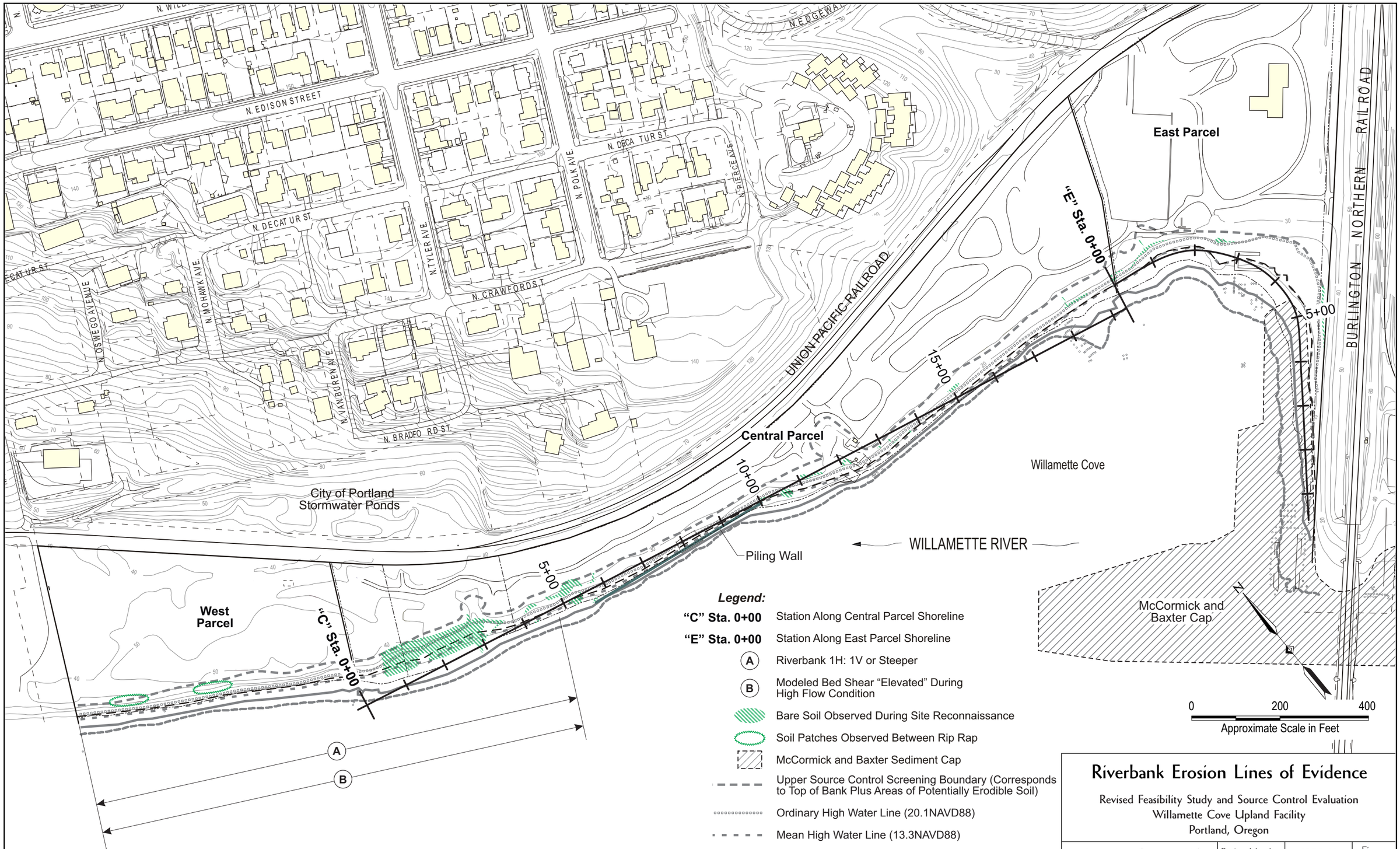
0 1,000 2,000
Approximate Scale in Feet

Note: Figure adapted from Map 3.1-8 of 8-29-11
Note: Portland Harbor RI submitted to EPA.

Projected Bed Shear from Hydromodel

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number	1056-10	Figure D-5
	March 2019		



Legend:

"C" Sta. 0+00	Station Along Central Parcel Shoreline
"E" Sta. 0+00	Station Along East Parcel Shoreline
(A)	Riverbank 1H: 1V or Steeper
(B)	Modeled Bed Shear "Elevated" During High Flow Condition
	Bare Soil Observed During Site Reconnaissance
	Soil Patches Observed Between Rip Rap
	McCormick and Baxter Sediment Cap
	Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
	Ordinary High Water Line (20.1NAVD88)
	Mean High Water Line (13.3NAVD88)
	Ordinary Low Water Line (6.9NAVD88)
	Lower Source Control Screening Boundary

Note: Base map prepared from an electronic file provided by Hart Crowser.

Riverbank Erosion Lines of Evidence

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
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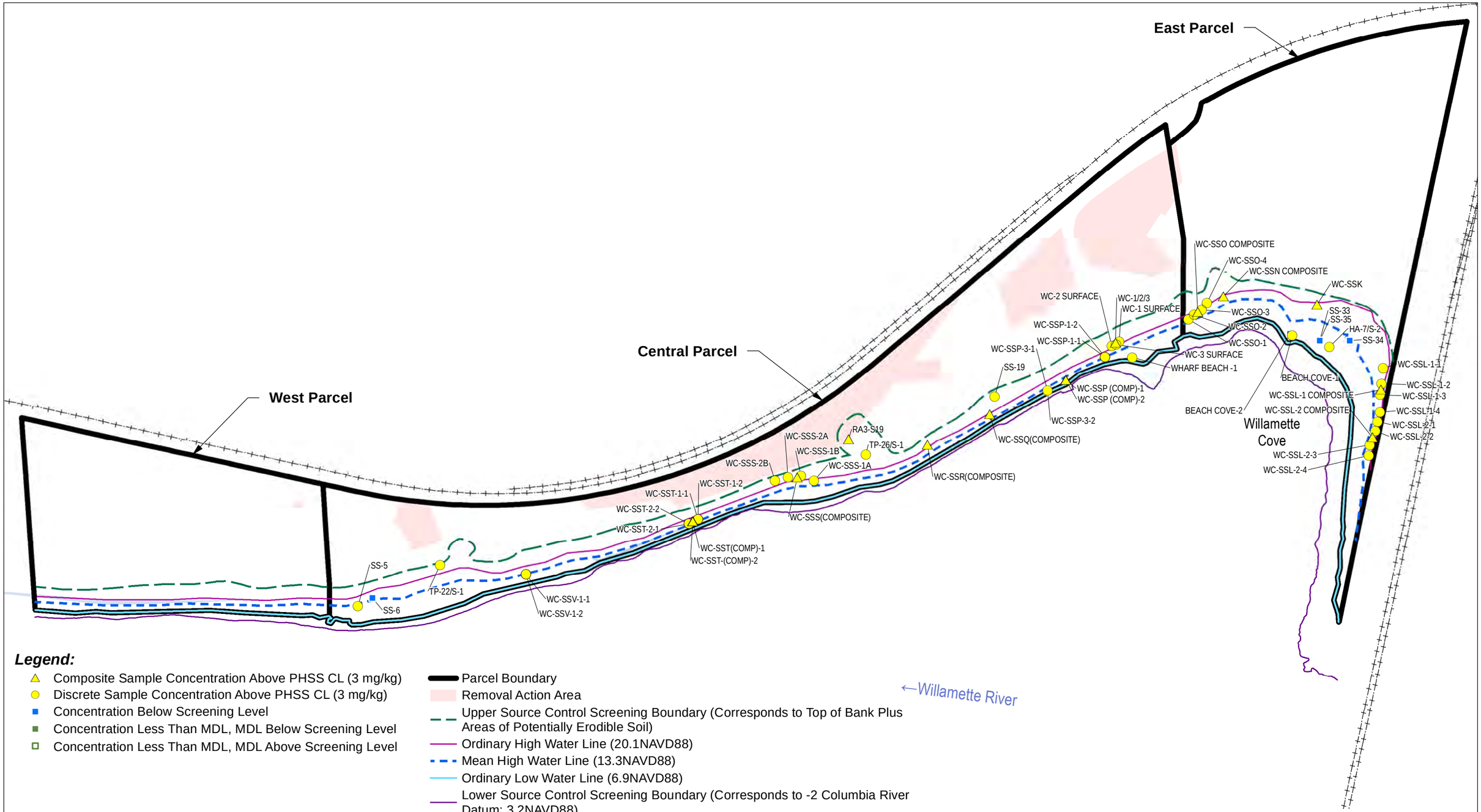
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-6



Legend:

- Composite Sample Concentration Above PHSS CL (3 mg/kg)
- Discrete Sample Concentration Above PHSS CL (3 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. CL = Portland Harbor Superfund Site Cleanup Level
3. MDL = Method Detection Limit
4. Sample locations shown are those from Upper Source Control Screening Boundary to Lower Source Control Screening Boundary.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

CL Exceedances - Arsenic in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

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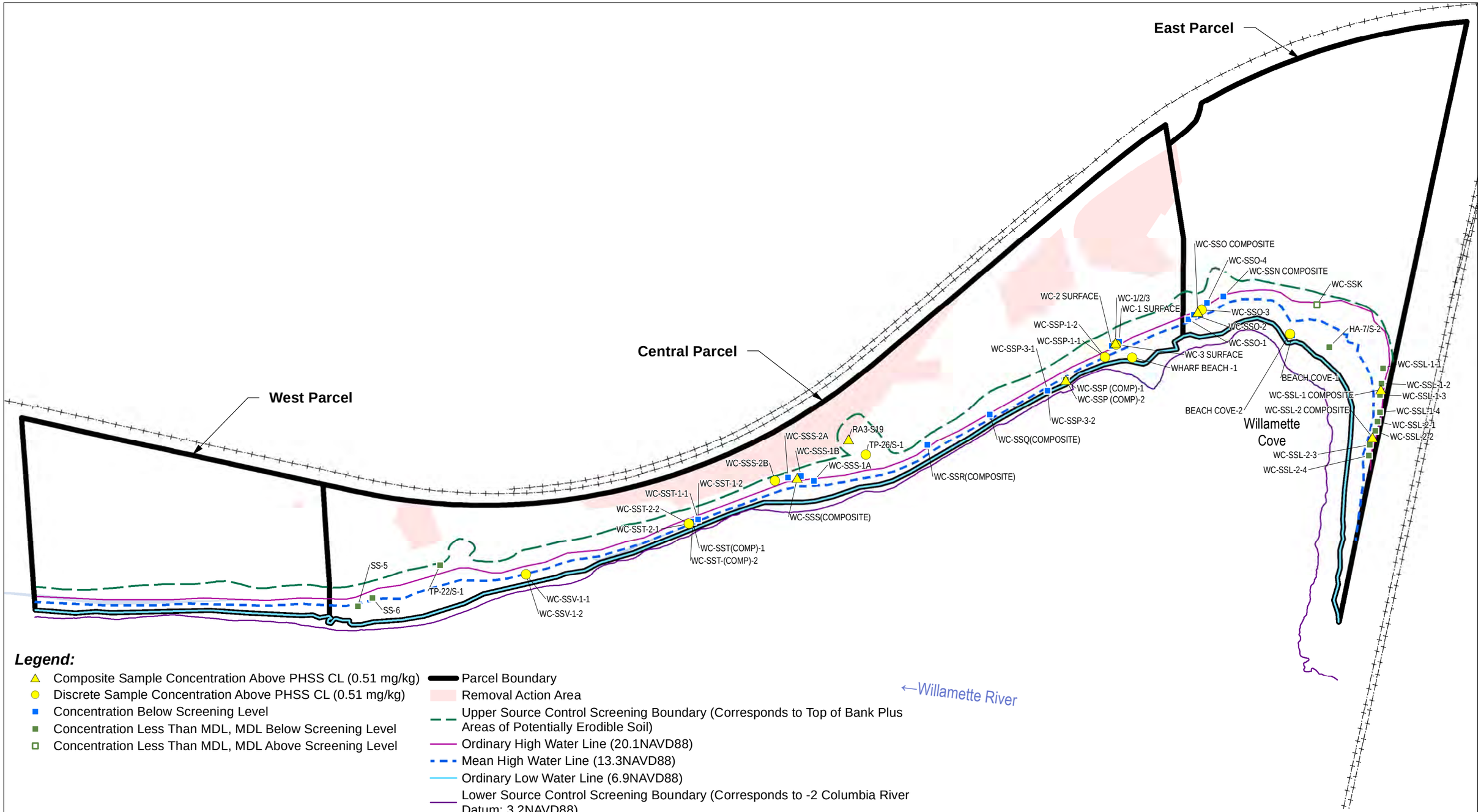
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-7



Legend:

- Composite Sample Concentration Above PHSS CL (0.51 mg/kg)
- Discrete Sample Concentration Above PHSS CL (0.51 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. CL = Portland Harbor Superfund Site Cleanup Level
3. MDL = Method Detection Limit
4. Sample locations shown are those from Upper Source Control Screening Boundary to Lower Source Control Screening Boundary.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

CL Exceedances - Cadmium in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

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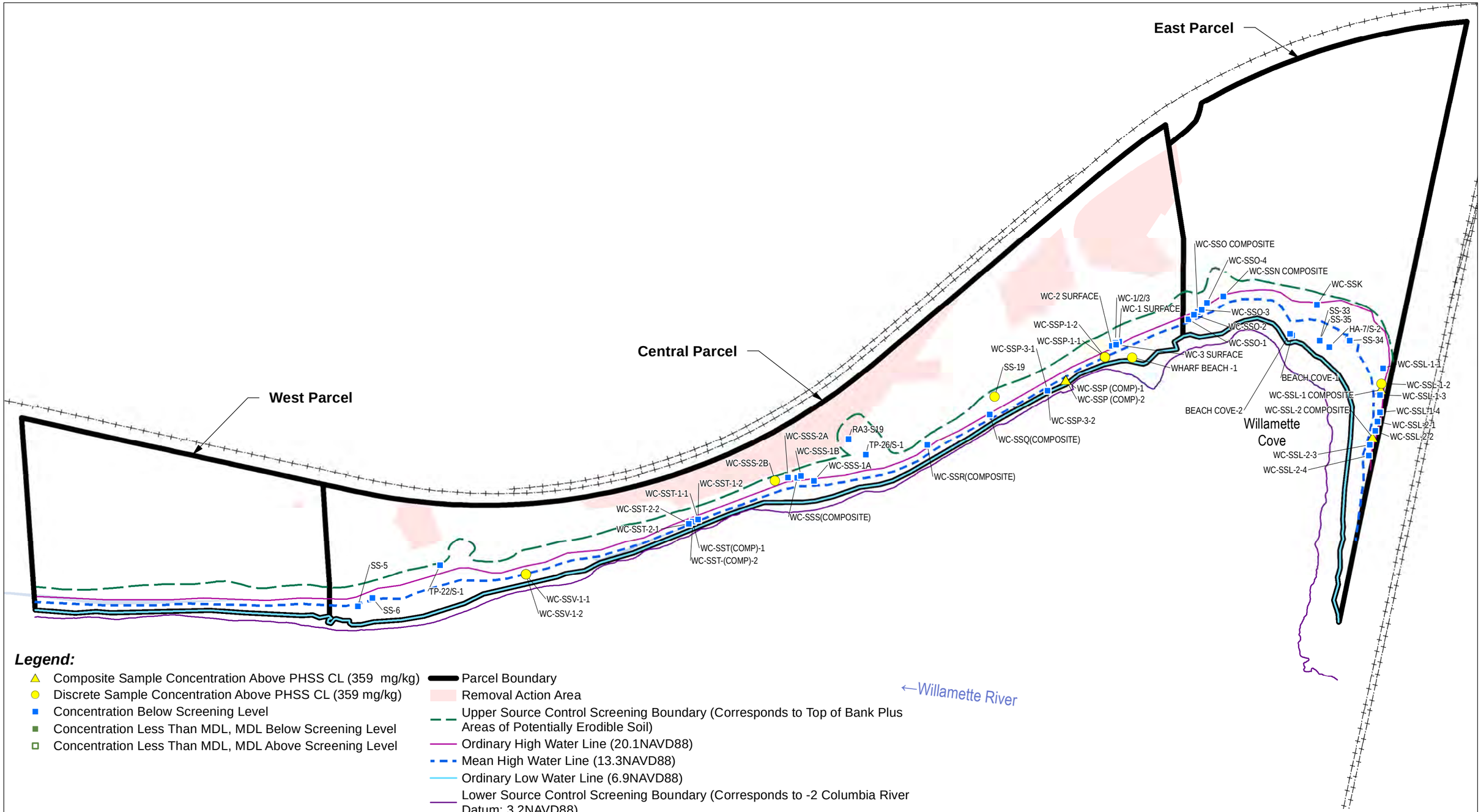
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-8



Legend:

- Composite Sample Concentration Above PHSS CL (359 mg/kg)
- Discrete Sample Concentration Above PHSS CL (359 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. CL = Portland Harbor Superfund Site Cleanup Level
3. MDL = Method Detection Limit
4. Sample locations shown are those from Upper Source Control Screening Boundary to Lower Source Control Screening Boundary.

0 200 400

Approximate Scale in Feet

N

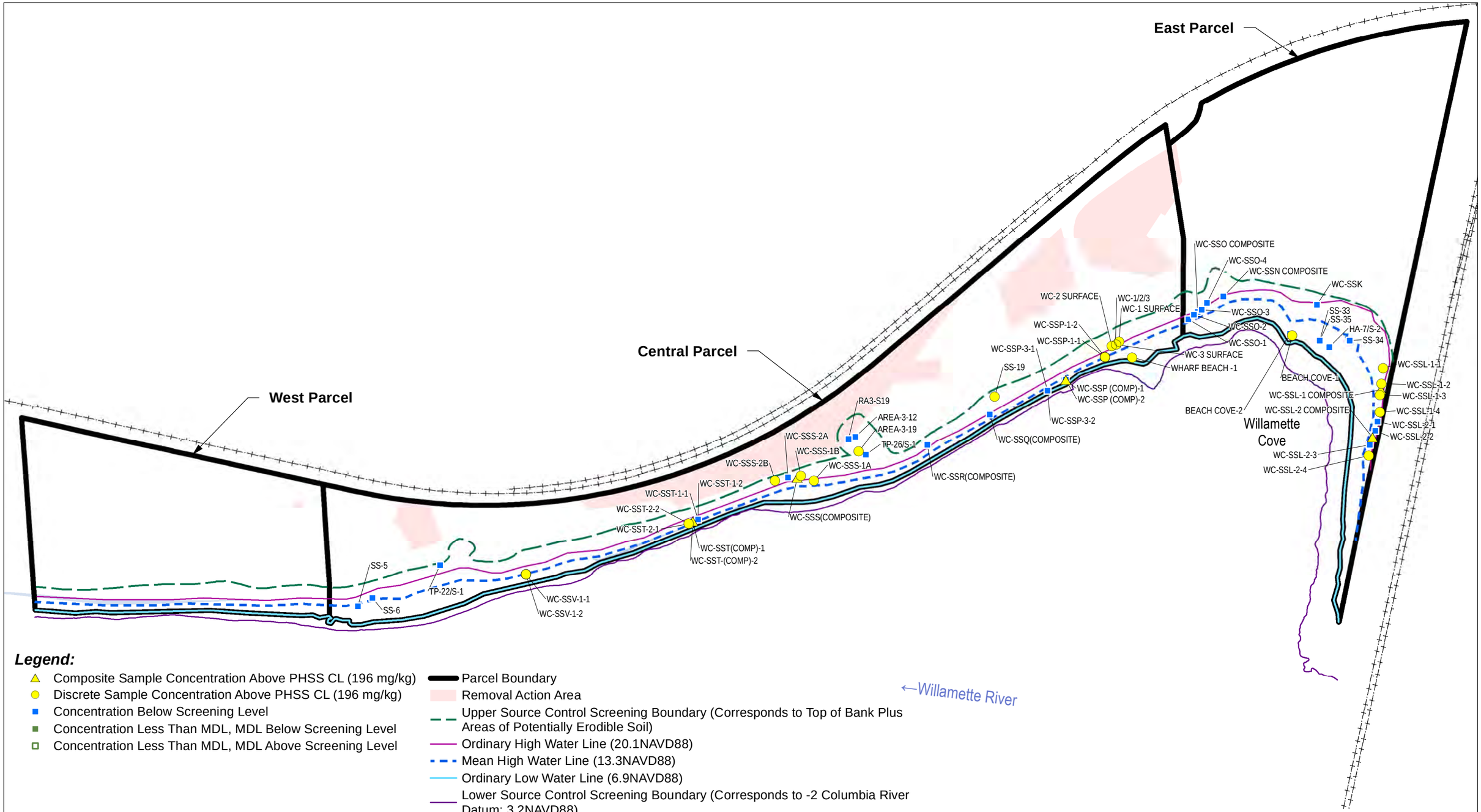
Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

CL Exceedances - Copper in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-9



Legend:

- Composite Sample Concentration Above PHSS CL (196 mg/kg)
- Discrete Sample Concentration Above PHSS CL (196 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. CL = Portland Harbor Superfund Site Cleanup Level
3. MDL = Method Detection Limit
4. Sample locations shown are those from Upper Source Control Screening Boundary to Lower Source Control Screening Boundary.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

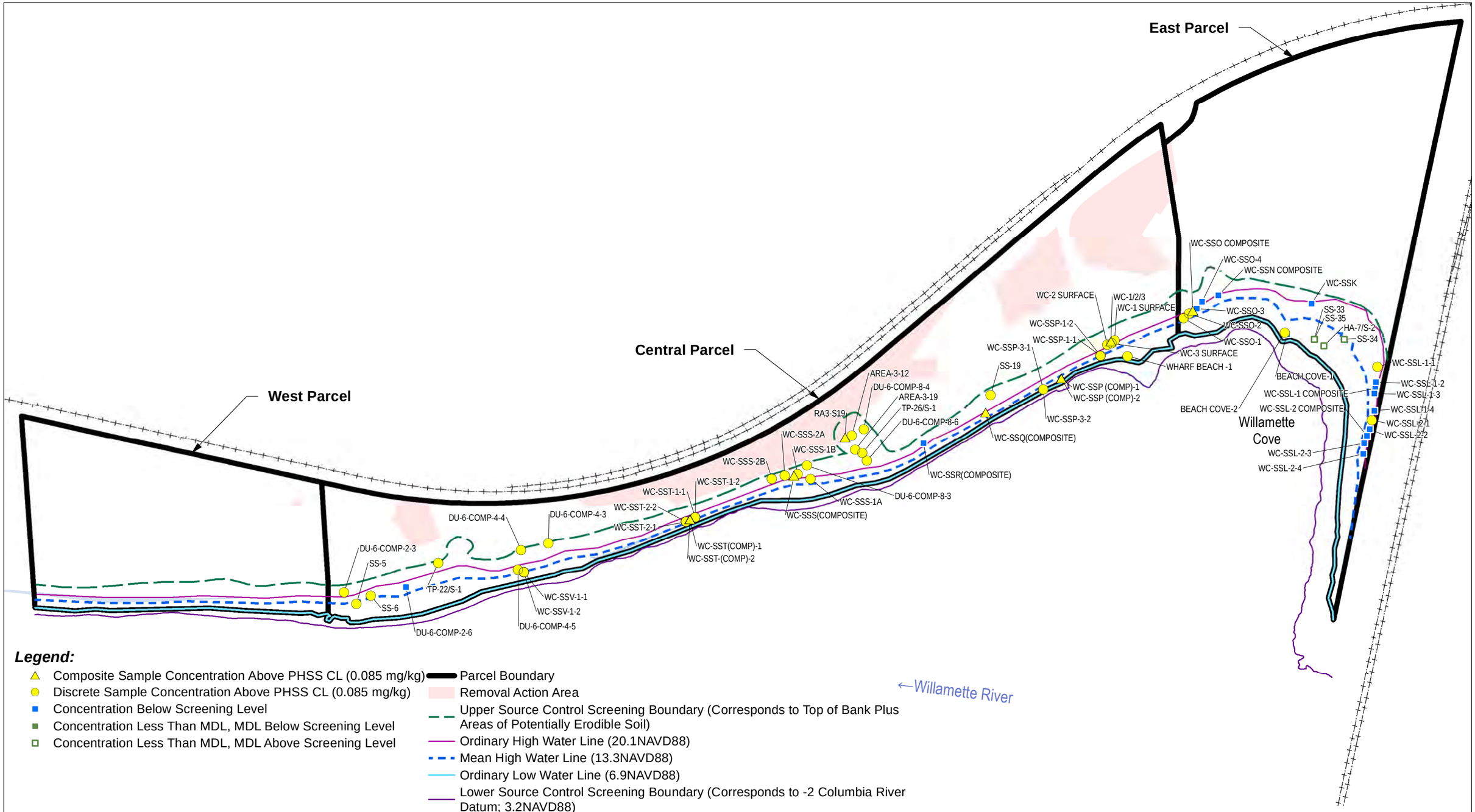
CL Exceedances - Lead in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-10



Legend:

- Composite Sample Concentration Above PHSS CL (0.085 mg/kg)
- Discrete Sample Concentration Above PHSS CL (0.085 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. CL = Portland Harbor Superfund Site Cleanup Level
3. MDL = Method Detection Limit
4. Sample locations shown are those from Upper Source Control Screening Boundary to Lower Source Control Screening Boundary.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

CL Exceedances - Mercury in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

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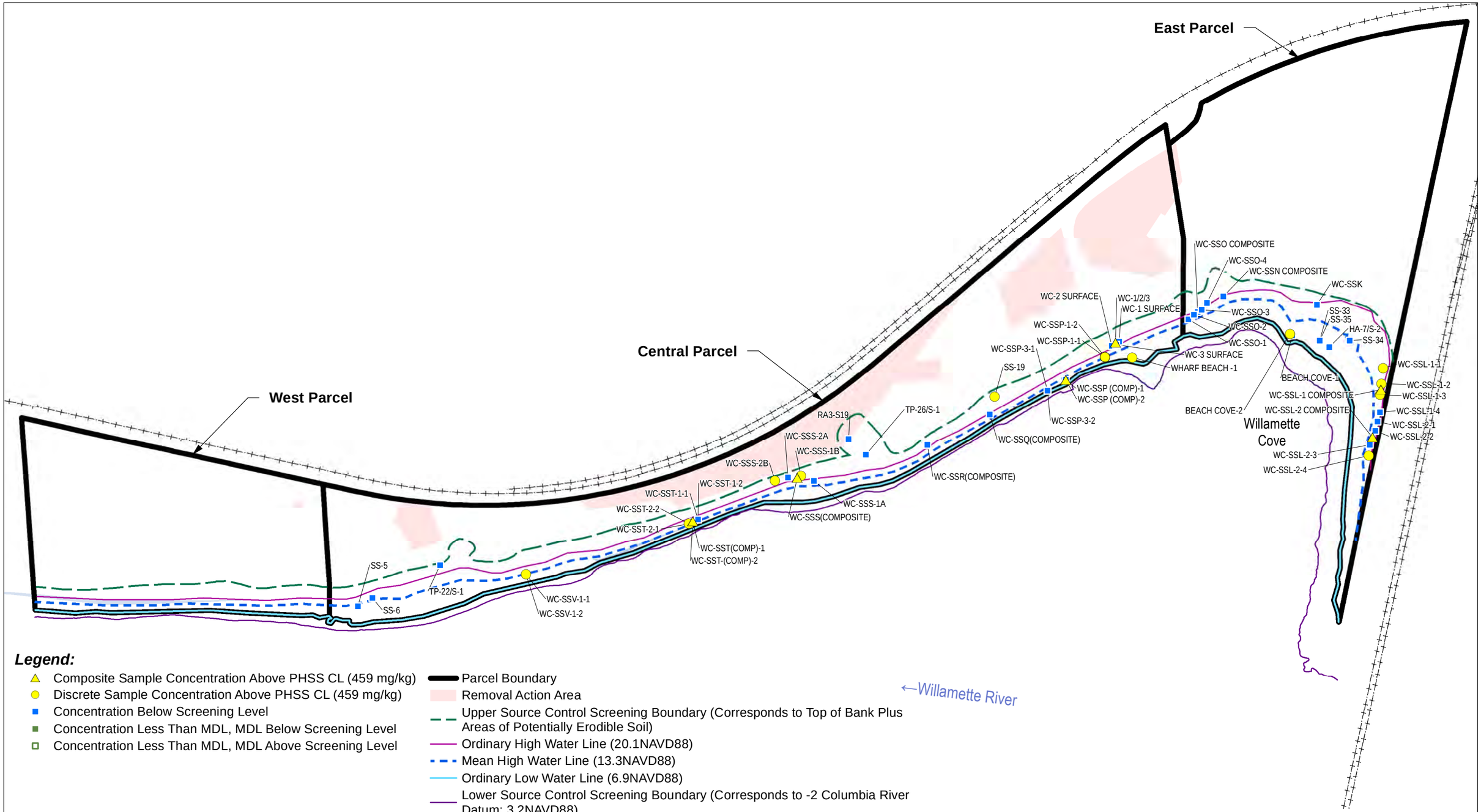
Project Number	1056-10	Figure
March 2019		D-11



Legend:

- Composite Sample Concentration Above PHSS CL (459 mg/kg)
- Discrete Sample Concentration Above PHSS CL (459 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. CL = Portland Harbor Superfund Site Cleanup Level
3. MDL = Method Detection Limit
4. Sample locations shown are those from Upper Source Control Screening Boundary to Lower Source Control Screening Boundary.

0 200 400

Approximate Scale in Feet

N

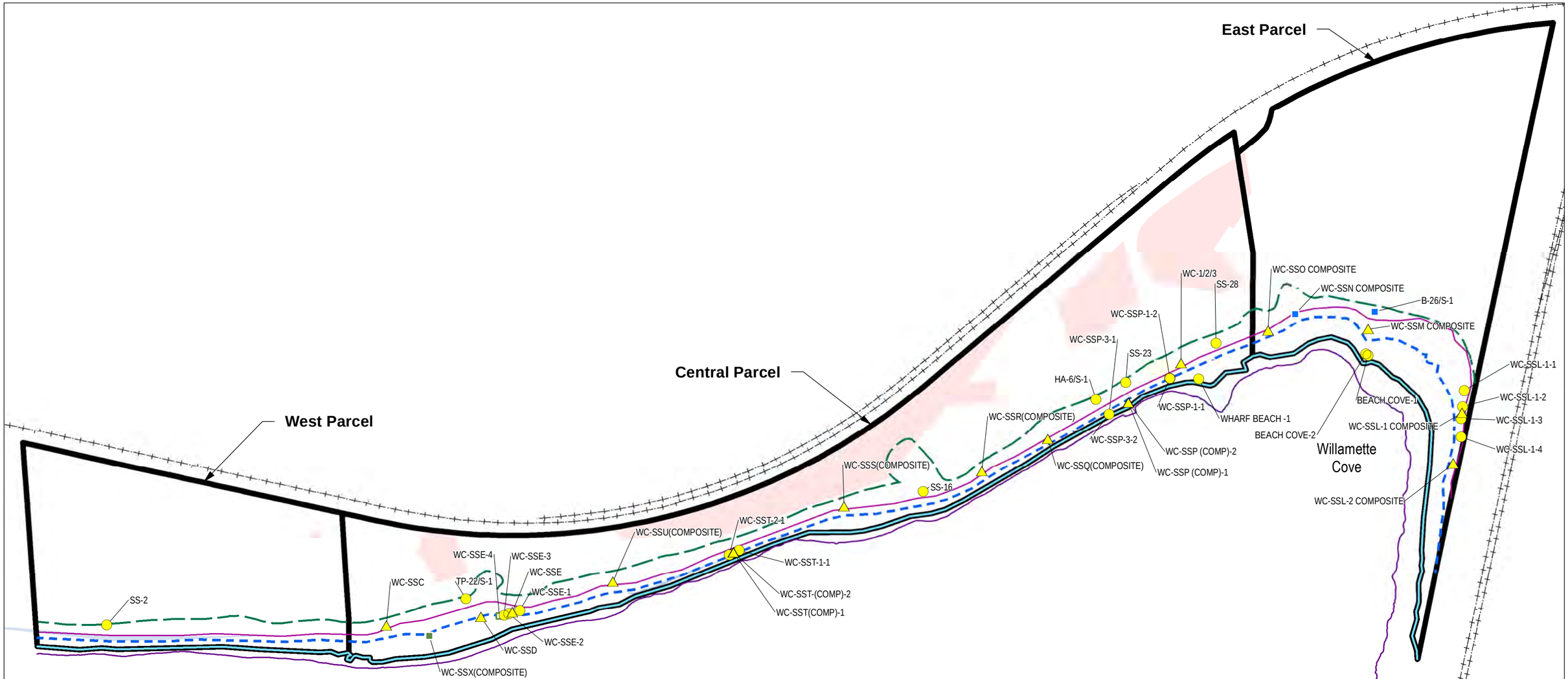
Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

CL Exceedances - Zinc in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-12



Legend:

- Composite Sample Concentration Above PHSS PTW Threshold (106 mg/kg)
- Discrete Sample Concentration Above PHSS PTW Threshold (106 mg/kg)
- Composite Sample Concentration Above PHSS CL (0.012 mg/kg)
- Discrete Sample Concentration Above PHSS CL (0.012 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level

- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. BaP Eq = Benzo(a)pyrene Equivalents Calculated for Cancer Toxicity
2. mg/kg = Milligrams Per Kilogram
3. CL = Portland Harbor Superfund Site Cleanup Level
4. PTW = Portland Harbor Superfund Site Principle Threat Waste
5. MDL = Method Detection Limit
6. Sample locations shown are those from Upper Source Control Screening Boundary to Lower Source Control Screening Boundary.

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

0 200 400
Approximate Scale in Feet

N

CL and PTW Exceedances - BaP Eq in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

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3015 SW First Avenue
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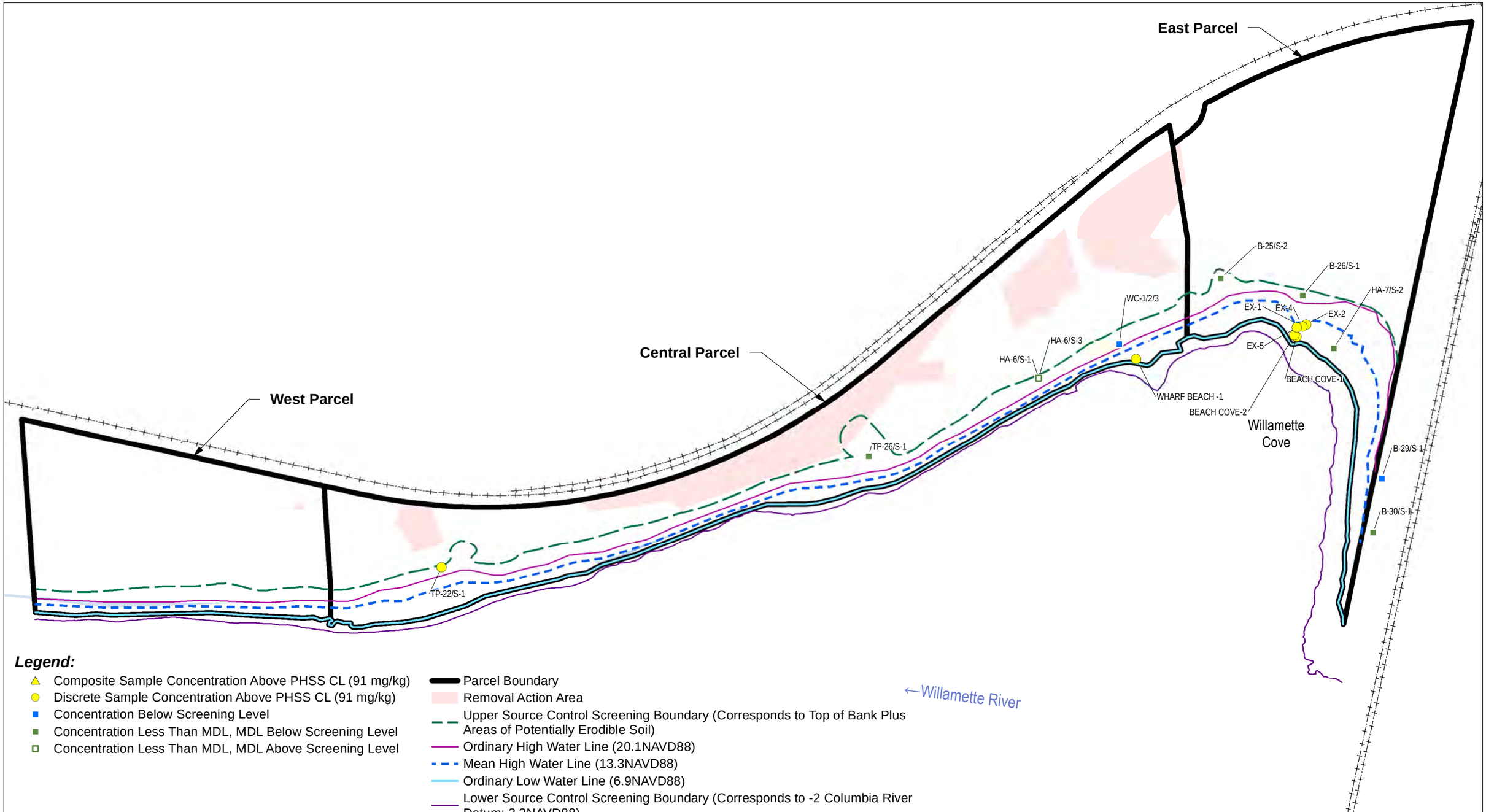
Project Number	1056-10	Figure
March 2019		D-13



Legend:

- Composite Sample Concentration Above PHSS CL (91 mg/kg)
- Discrete Sample Concentration Above PHSS CL (91 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. TPH = Total Petroleum Hydrocarbons
3. CL = Portland Harbor Superfund Site Cleanup Level
4. MDL = Method Detection Limit
5. Sample locations shown are those from Upper Source Control Screening Boundary to Lower Source Control Screening Boundary.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

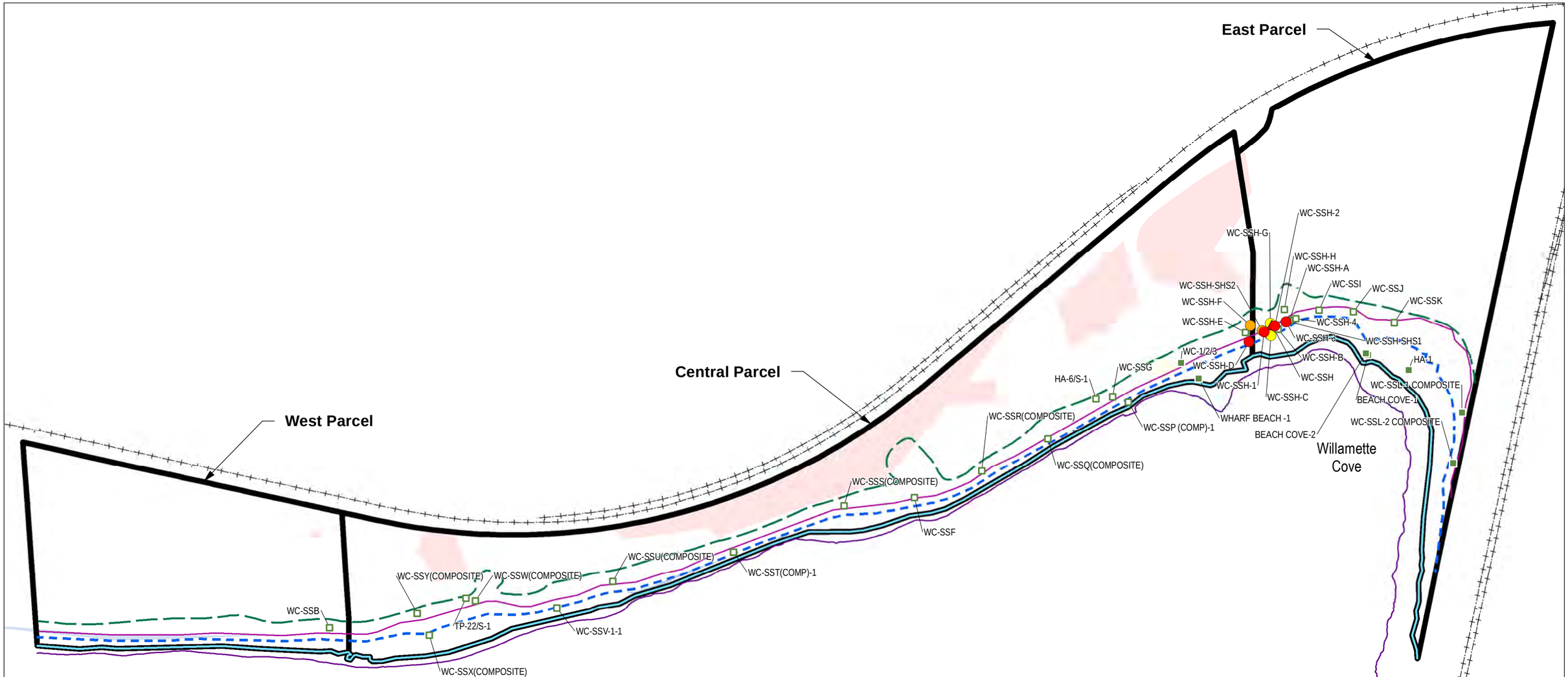
CL Exceedances - TPH-Diesel in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-14



Legend:

- Composite Sample Concentration Above PHSS PTW Threshold (0.2 mg/kg)
- Discrete Sample Concentration Above PHSS PTW Threshold (0.2 mg/kg)
- Composite Sample Concentration Above RAL (0.075 mg/kg)
- Discrete Sample Concentration Above RAL (0.075 mg/kg)
- Composite Sample Concentration Above PHSS CL (0.009 mg/kg)
- Discrete Sample Concentration Above PHSS CL (0.009 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. PCB = Polychlorinated Biphenyl
2. mg/kg = Milligrams Per Kilogram
3. CL = Portland Harbor Superfund Site Cleanup Level
4. RAL = Remedial Action Level
5. PTW = Portland Harbor Superfund Site Principle Threat Waste
6. MDL = Method Detection Limit
7. Sample locations shown are those from Upper Source Control Screening Boundary to Lower Source Control Screening Boundary.

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

0 200 400
Approximate Scale in Feet

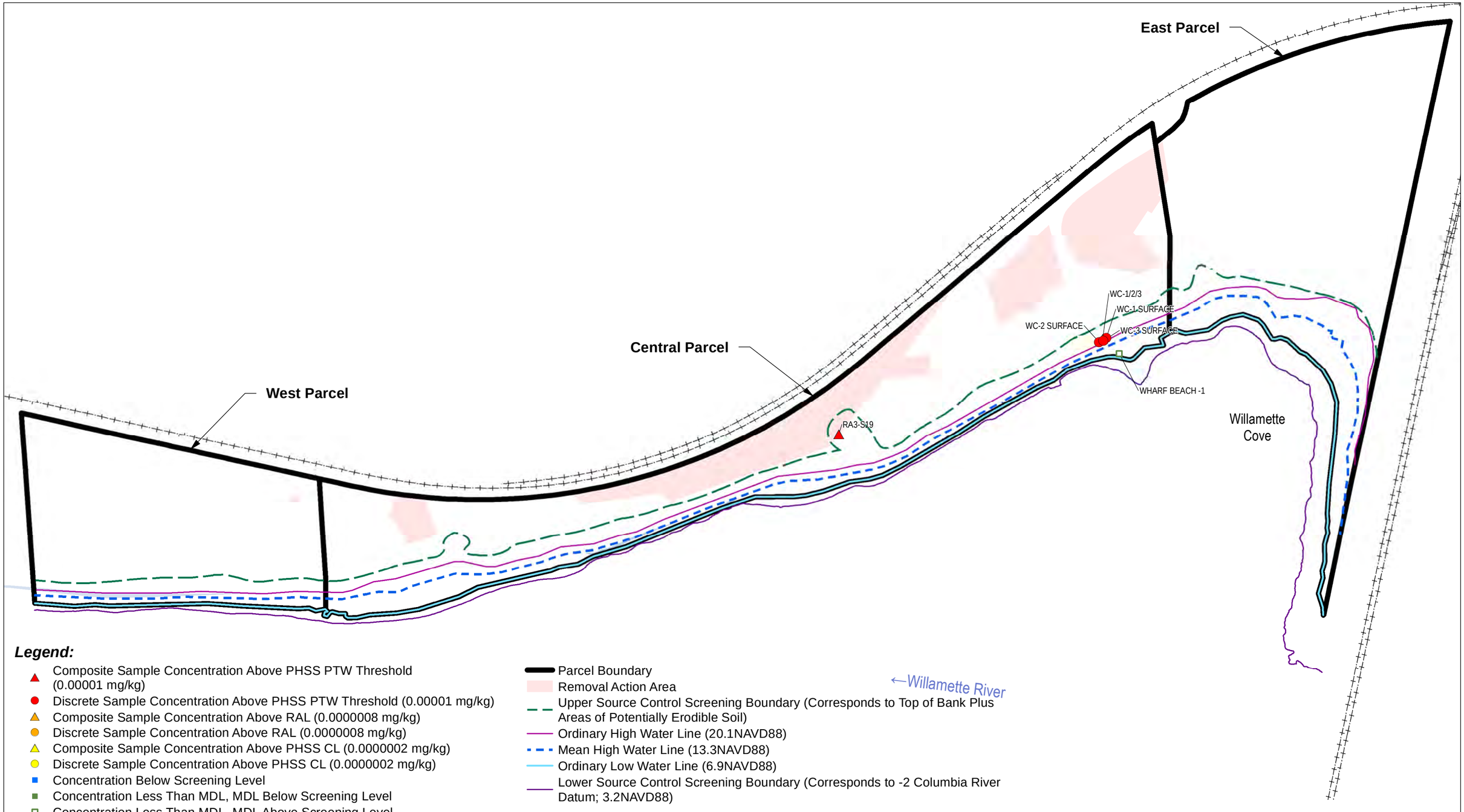
N

CL, RAL, and PTW Exceedances - Total PCBs in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-15



Legend:

- Composite Sample Concentration Above PHSS PTW Threshold (0.00001 mg/kg)
- Discrete Sample Concentration Above PHSS PTW Threshold (0.00001 mg/kg)
- Composite Sample Concentration Above RAL (0.0000008 mg/kg)
- Discrete Sample Concentration Above RAL (0.0000008 mg/kg)
- Composite Sample Concentration Above PHSS CL (0.0000002 mg/kg)
- Discrete Sample Concentration Above PHSS CL (0.0000002 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. CL = Portland Harbor Superfund Site Cleanup Level
3. RAL = Remedial Action Level
4. PTW = Portland Harbor Superfund Site Principle Threat Waste
5. MDL = Method Detection Limit
6. Sample locations shown are those from Upper Source Control Screening Boundary to Lower Source Control Screening Boundary.

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

0 200 400
Approximate Scale in Feet

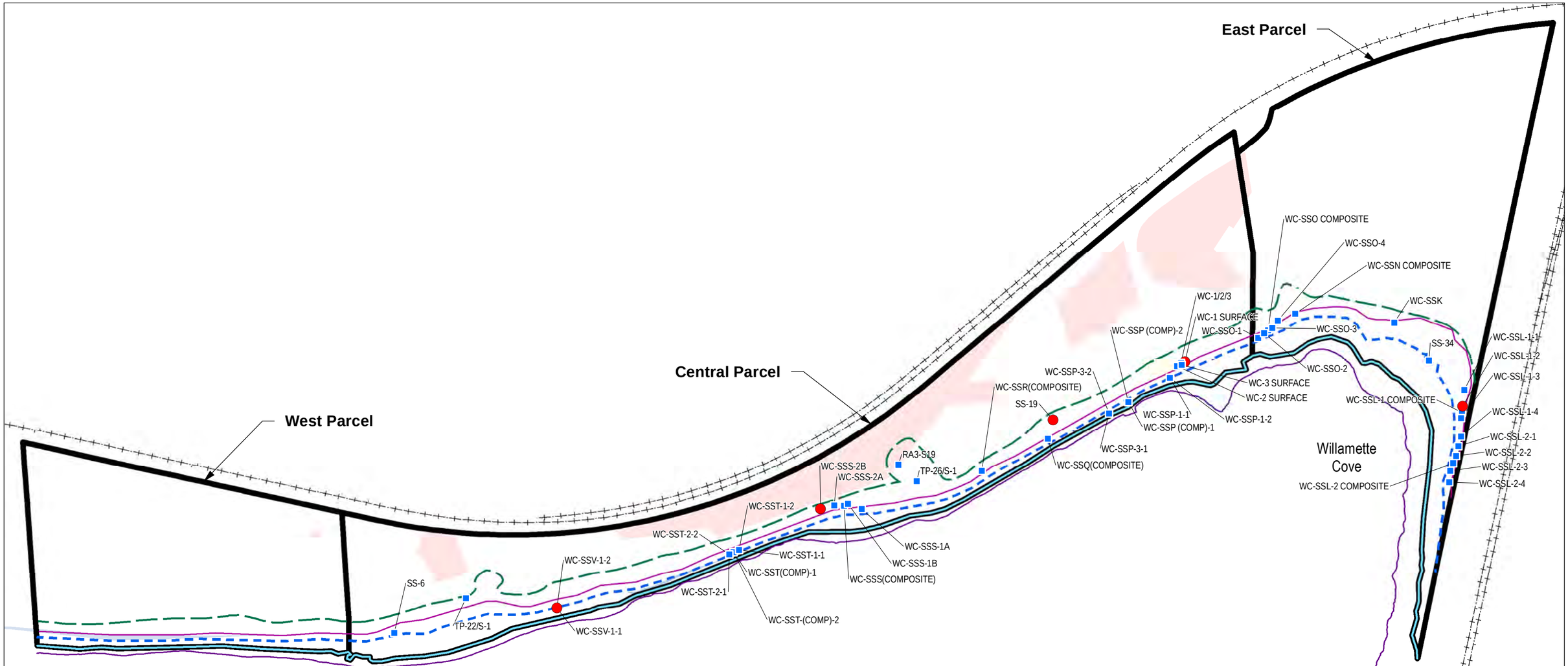
N

CL, RAL, and PTW Exceedances - 1,2,3,7,8-PeCDD in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-16



Legend:

- Composite Sample Concentration Above Plant PRG (18 mg/kg)
- Discrete Sample Concentration Above Plant PRG (18 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. PRG = Preliminary Remediation Goal
3. MDL = Method Detection Limit
4. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Ecological PRG Exceedances - Arsenic in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
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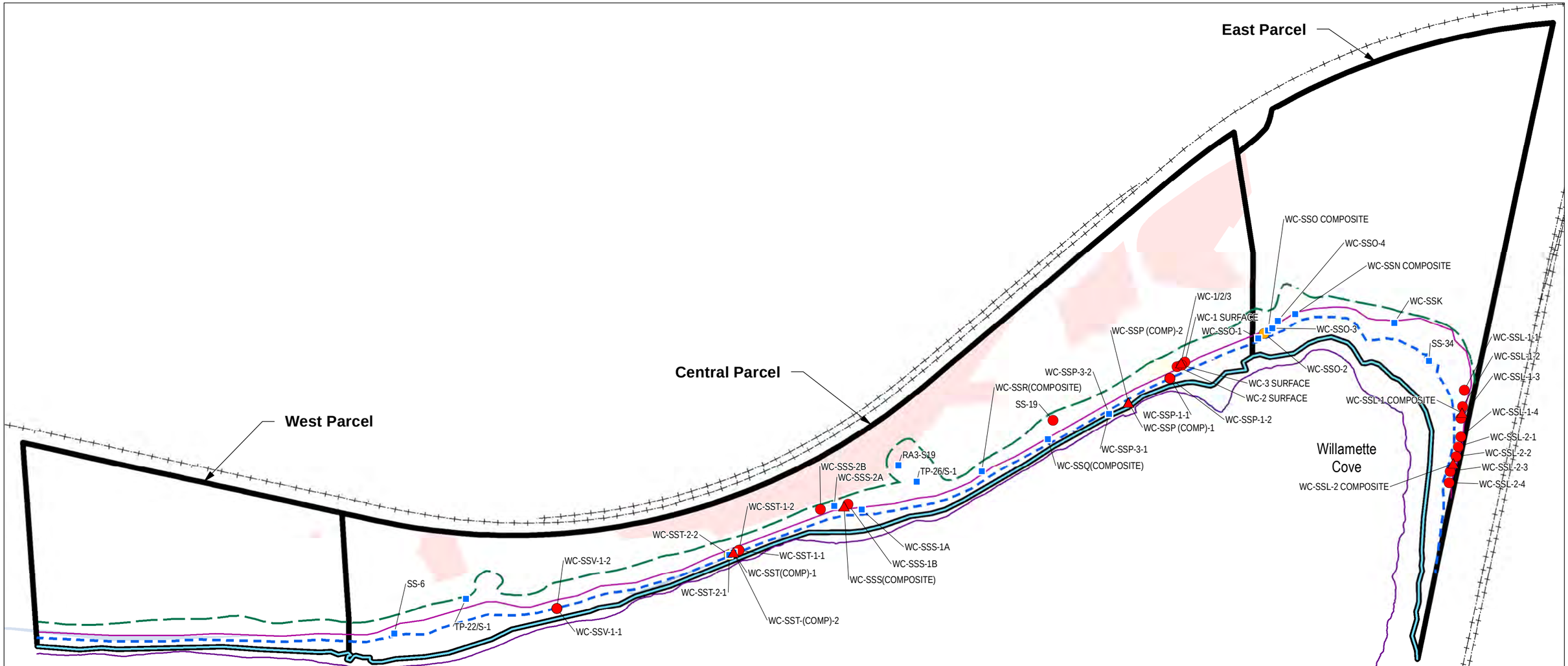
Project Number	1056-10	Figure
March 2019		D-17



Legend:

- Composite Sample Concentration Above Bird PRG (87.7 mg/kg)
- Discrete Sample Concentration Above Bird PRG (87.7 mg/kg)
- Composite Sample Concentration Above Invertebrate PRG (80 mg/kg)
- Discrete Sample Concentration Above Invertebrate PRG (80 mg/kg)
- Composite Sample Concentration Above Plant PRG (70 mg/kg)
- Discrete Sample Concentration Above Plant PRG (70 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. PRG = Preliminary Remediation Goal
3. MDL = Method Detection Limit
4. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

0 200 400

Approximate Scale in Feet

N

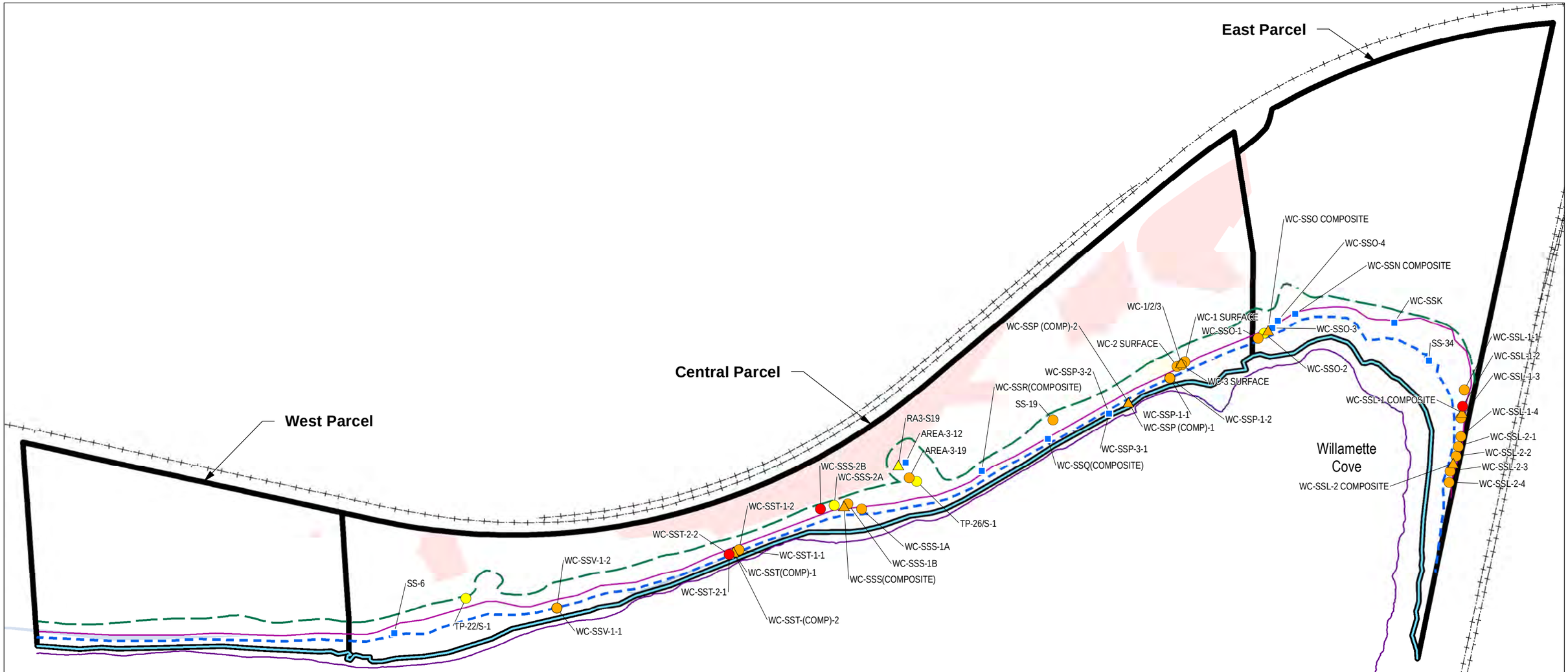
Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Ecological PRG Exceedances - Copper in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-18



Legend:

- Composite Sample Concentration Above Invertebrate PRG (1,700 mg/kg)
- Discrete Sample Concentration Above Invertebrate PRG (1,700 mg/kg)
- Composite Sample Concentration Above Plant PRG (120 mg/kg)
- Discrete Sample Concentration Above Plant PRG (120 mg/kg)
- Composite Sample Concentration Above Bird PRG (79 mg/kg)
- Discrete Sample Concentration Above Bird PRG (79 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. PRG = Preliminary Remediation Goal
3. MDL = Method Detection Limit
4. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

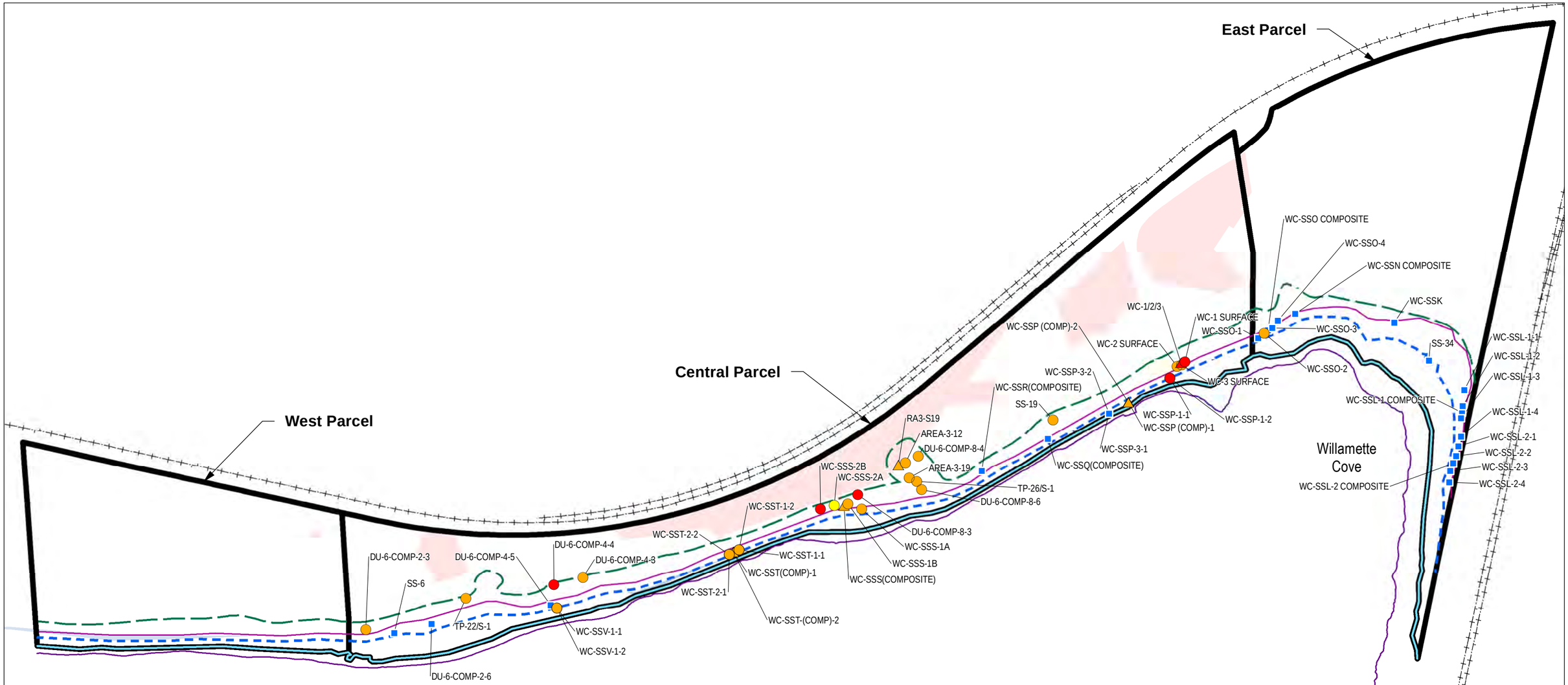
Ecological PRG Exceedances - Lead in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-19



Legend:

- Composite Sample Concentration Above Mammal PRG (3.53 mg/kg)
- Discrete Sample Concentration Above Mammal PRG (3.53 mg/kg)
- Composite Sample Concentration Above Plant PRG (0.3 mg/kg)
- Discrete Sample Concentration Above Plant PRG (0.3 mg/kg)
- Composite Sample Concentration Above Bird/Invertebrate PRG (0.23 mg/kg)
- Discrete Sample Concentration Above Bird/Invertebrate PRG (0.23 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

←Willamette River

Notes:

1. mg/kg = Milligrams Per Kilogram
2. PRG = Preliminary Remediation Goal
3. MDL = Method Detection Limit
4. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

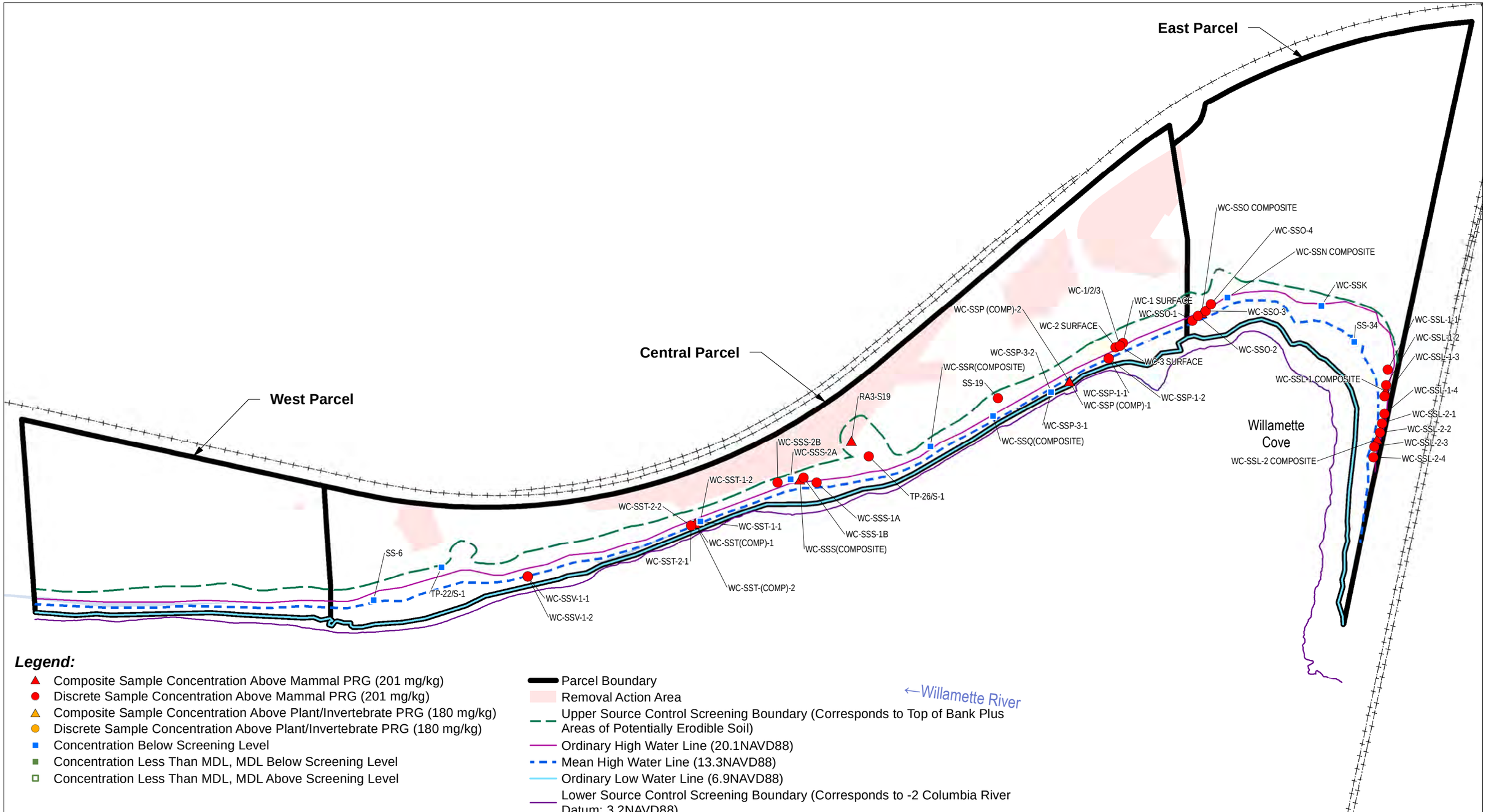
Ecological PRG Exceedances - Mercury in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-20



Legend:

- Composite Sample Concentration Above Mammal PRG (201 mg/kg)
- Discrete Sample Concentration Above Mammal PRG (201 mg/kg)
- Composite Sample Concentration Above Plant/Invertebrate PRG (180 mg/kg)
- Discrete Sample Concentration Above Plant/Invertebrate PRG (180 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level

- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. PRG = Preliminary Remediation Goal
3. MDL = Method Detection Limit
4. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

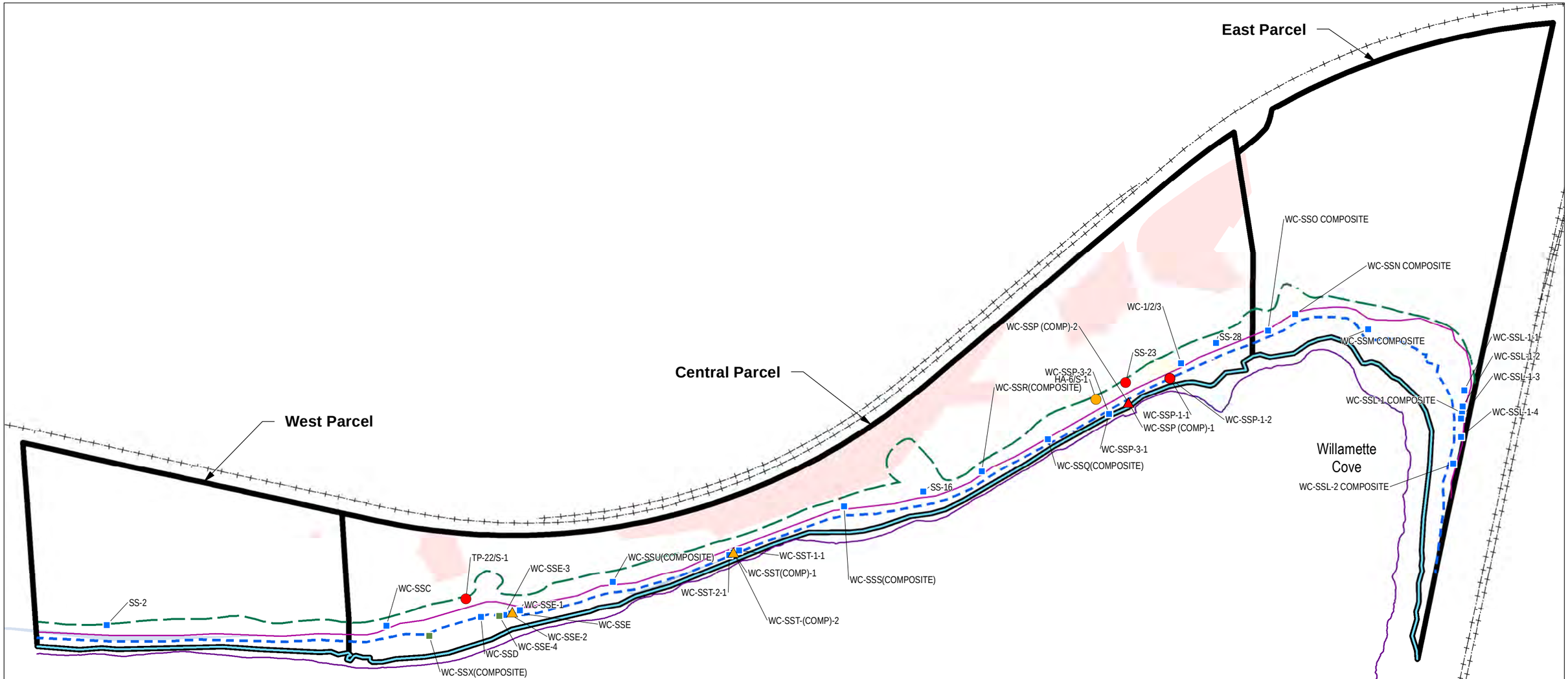
Ecological PRG Exceedances - Zinc in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-21



Legend:

- Composite Sample Concentration Above Invertebrate PRG (18 mg/kg)
- Discrete Sample Concentration Above Invertebrate PRG (18 mg/kg)
- Composite Sample Concentration Above Mammal PRG (5.6 mg/kg)
- Discrete Sample Concentration Above Mammal PRG (5.6 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level

- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

←Willamette River

Notes:

1. HPAH = High-molecular-weight Polycyclic Aromatic Hydrocarbons
2. mg/kg = Milligrams Per Kilogram
3. PRG = Preliminary Remediation Goal
4. MDL = Method Detection Limit
5. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

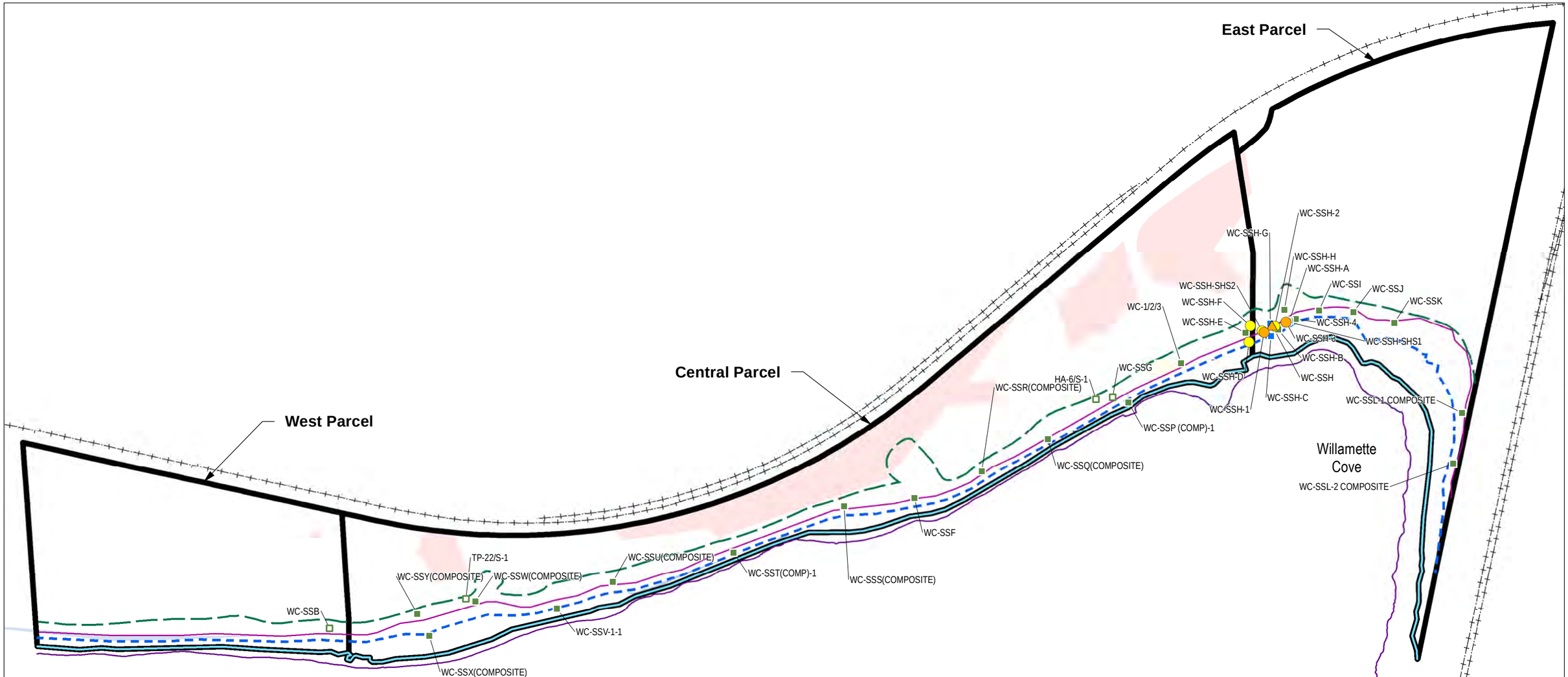
Ecological PRG Exceedances - HPAH in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-22



Legend:

- Composite Sample Concentration Above Plant PRG (40 mg/kg)
- Discrete Sample Concentration Above Plant PRG (40 mg/kg)
- Composite Sample Concentration Above Bird PRG (0.73 mg/kg)
- Discrete Sample Concentration Above Bird PRG (0.73 mg/kg)
- Composite Sample Concentration Above Mammal PRG (0.098 mg/kg)
- Discrete Sample Concentration Above Mammal PRG (0.098 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. PCB = Polychlorinated Biphenyl
2. mg/kg = Milligrams Per Kilogram
3. PRG = Preliminary Remediation Goal
4. MDL = Method Detection Limit
5. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

0 200 400
Approximate Scale in Feet

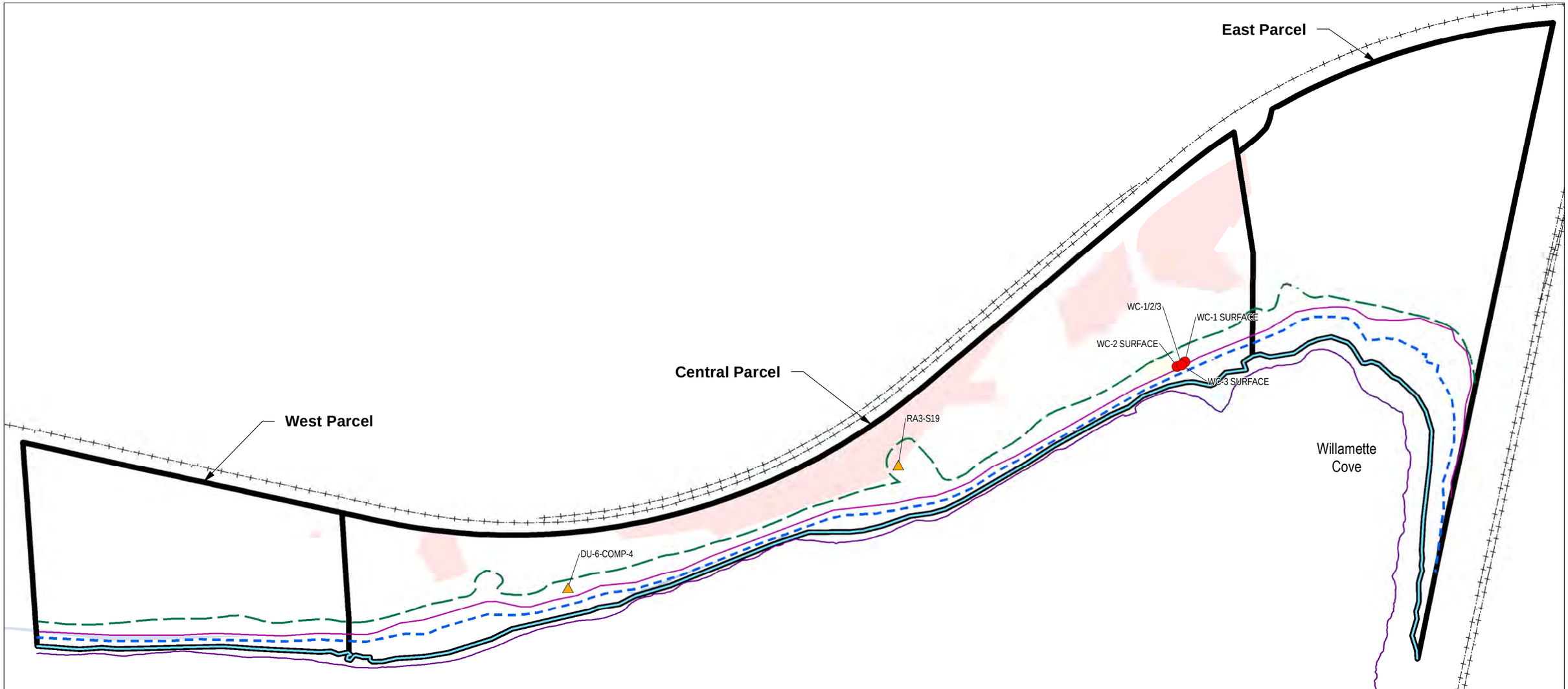
N

Ecological PRG Exceedances - Total PCBs in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-23



Legend:

- Composite Sample Concentration Above Bird PRG (0.000089 mg/kg)
- Discrete Sample Concentration Above Bird PRG (0.000089 mg/kg)
- Composite Sample Concentration Above Mammal PRG (0.0000061 mg/kg)
- Discrete Sample Concentration Above Mammal PRG (0.0000061 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level

- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

←Willamette River

Notes:

1. mg/kg = Milligrams Per Kilogram
2. PRG = Preliminary Remediation Goal
3. MDL = Method Detection Limit
4. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

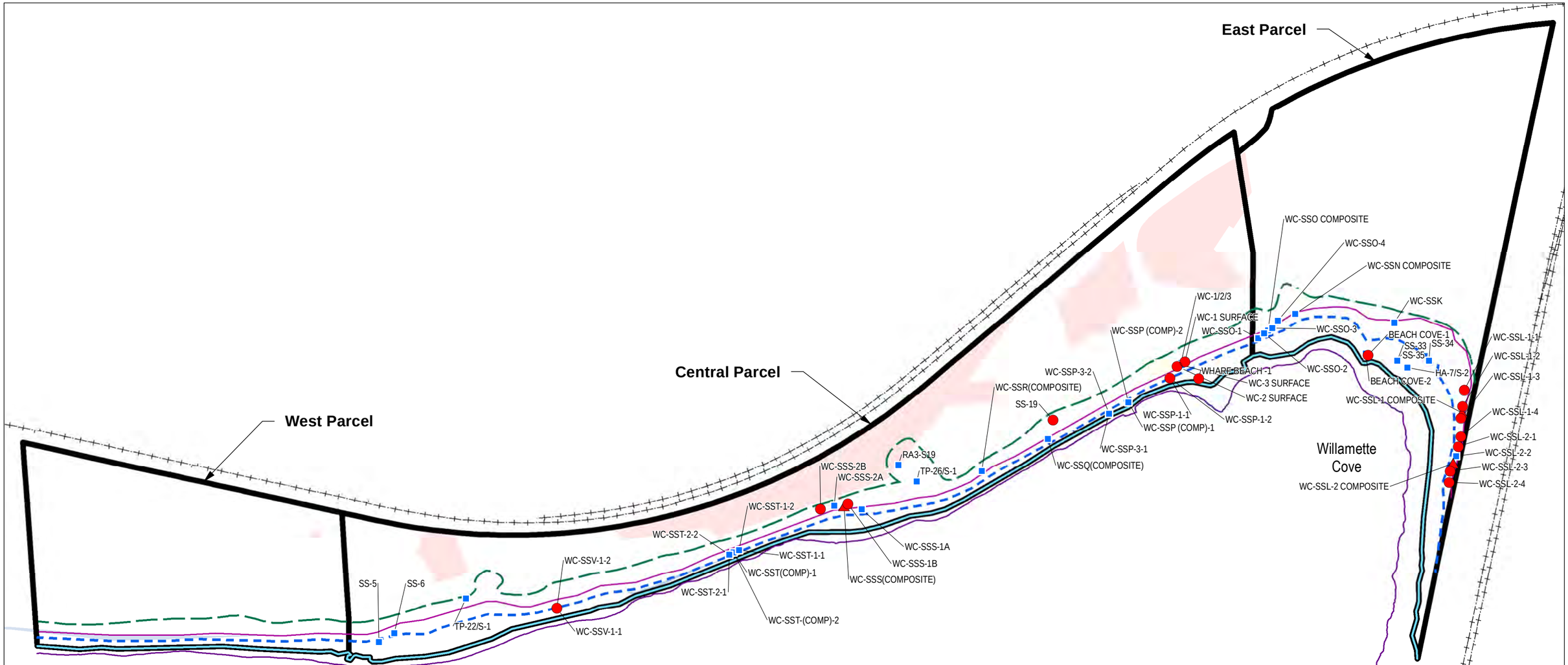
Ecological PRG Exceedances - Dioxin TEQ in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-24



Legend:

- Composite Sample Concentration Above RT/PU PRG (8.8 mg/kg)
- Discrete Sample Concentration Above RT/PU PRG (8.8 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. PRG = Preliminary Remediation Goal
3. RT/PU = Recreational Trespasser/Park User
4. MDL = Method Detection Limit
5. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

0 200 400
Approximate Scale in Feet

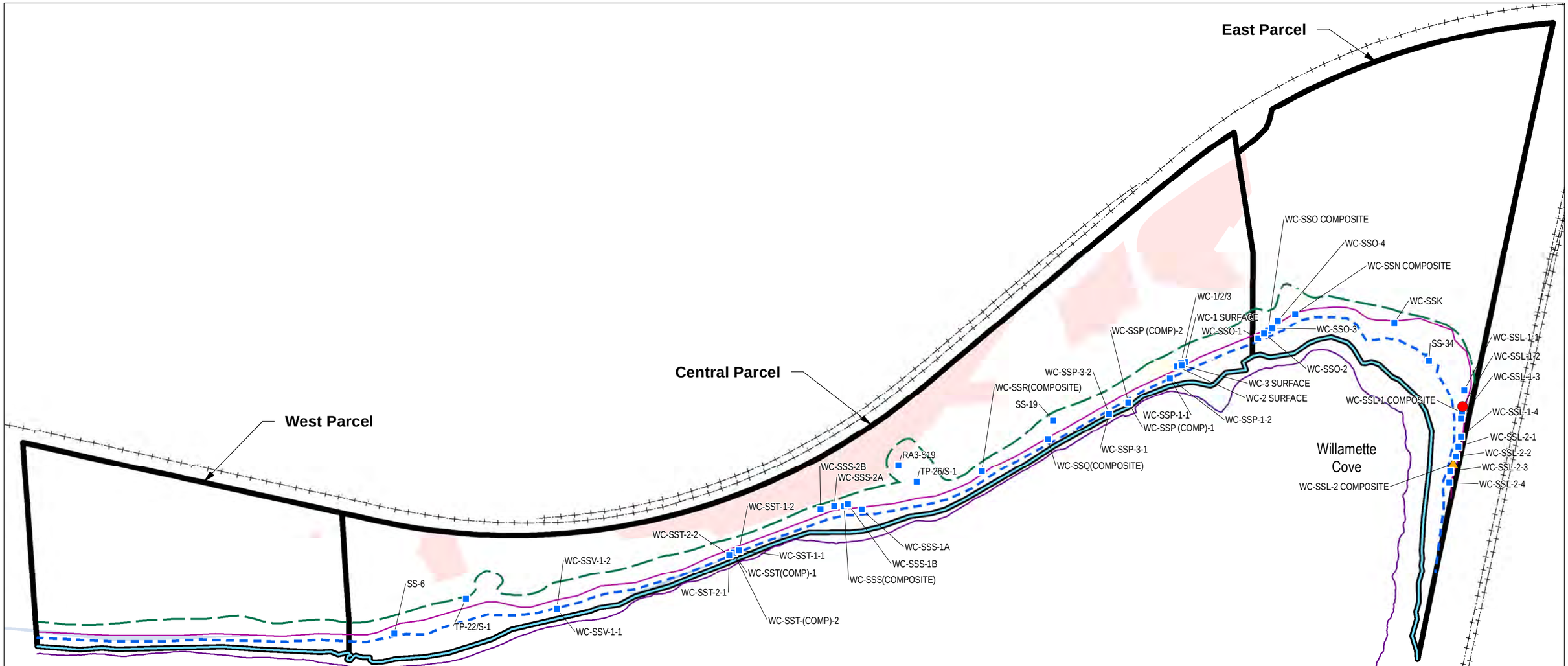
N

Human Health PRG Exceedances - Arsenic in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-25



Legend:

- Composite Sample Concentration Above CW PRG (14,000 mg/kg)
- Discrete Sample Concentration Above CW PRG (14,000 mg/kg)
- Composite Sample Concentration Above RT/PU PRG (11,000 mg/kg)
- Discrete Sample Concentration Above RT/PU PRG (11,000 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. PRG = Preliminary Remediation Goal
3. RT/PU = Recreational Trespasser/Park User
4. CW = Construction Worker
5. MDL = Method Detection Limit
6. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

0 200 400

Approximate Scale in Feet

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

Human Health PRG Exceedances - Copper in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

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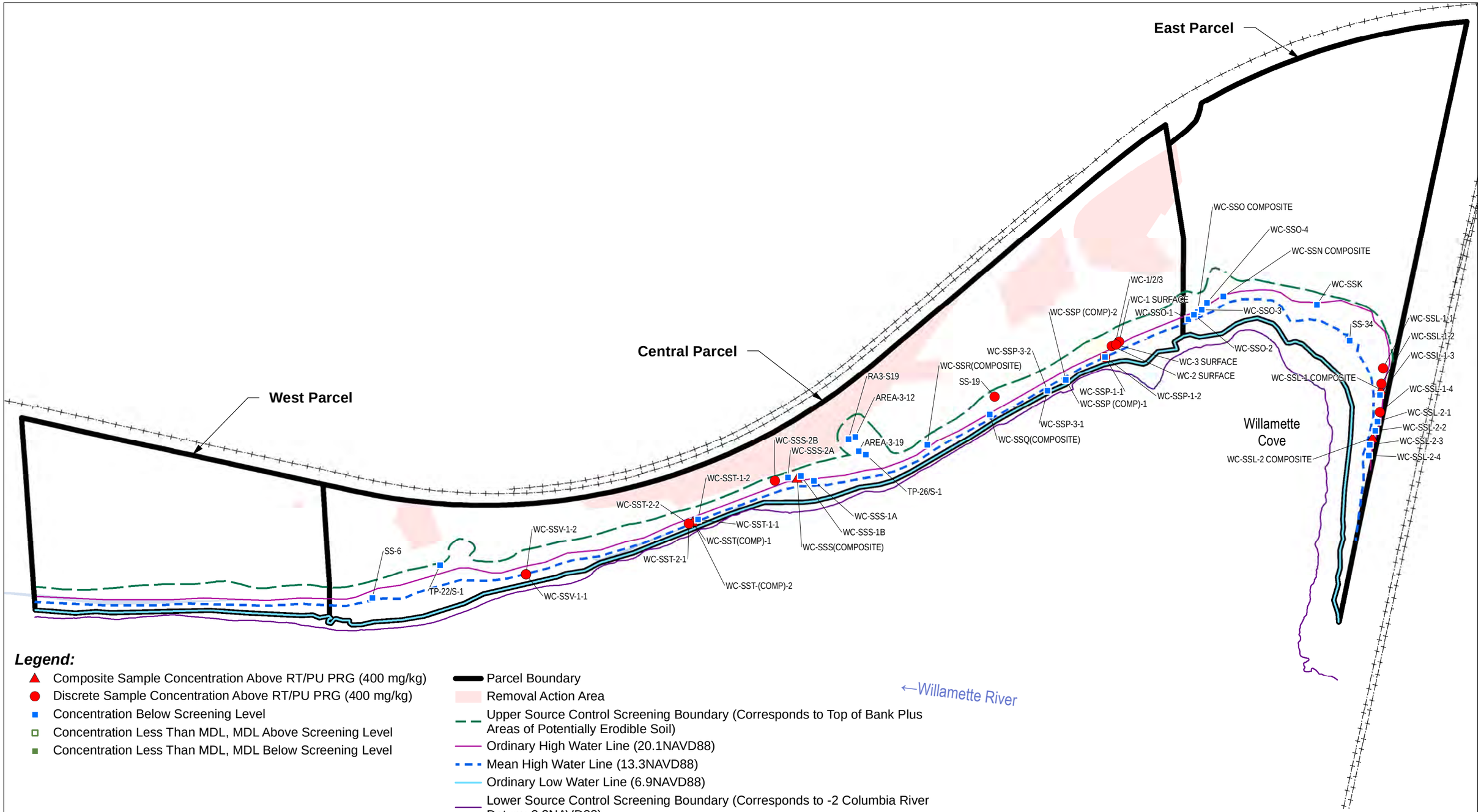
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-26



Legend:

- ▲ Composite Sample Concentration Above RT/PU PRG (400 mg/kg)
- ● Discrete Sample Concentration Above RT/PU PRG (400 mg/kg)
- ■ Concentration Below Screening Level
- □ Concentration Less Than MDL, MDL Above Screening Level
- ■ Concentration Less Than MDL, MDL Below Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. PRG = Preliminary Remediation Goal
3. RT/PU = Recreational Trespasser/Park User
4. MDL = Method Detection Limit
5. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

0 200 400
Approximate Scale in Feet

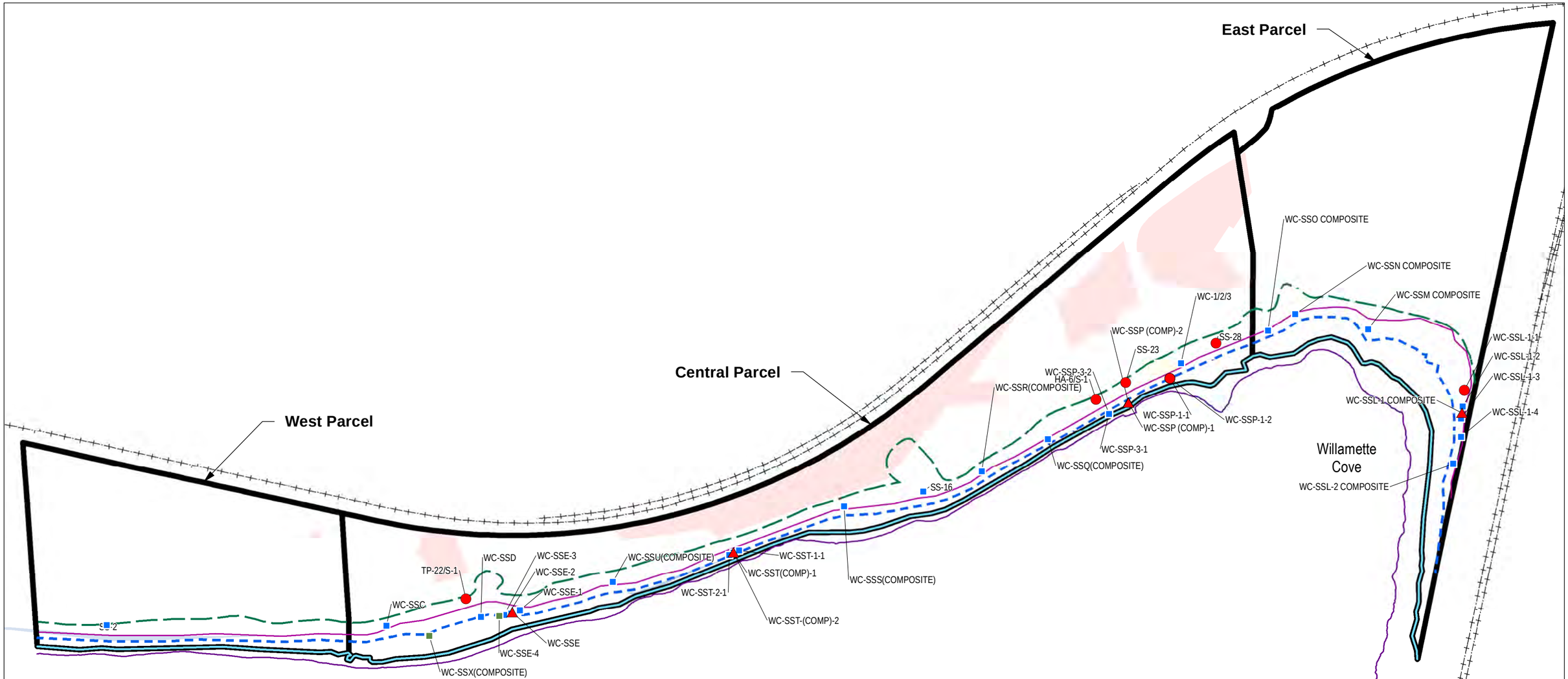
N

Human Health PRG Exceedances - Lead in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-27



Legend:

- Composite Sample Concentration Above RT/PU PRG (0.55 mg/kg)
- Discrete Sample Concentration Above RT/PU PRG (0.55 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. BaP Eq = Benzo(a)pyrene Equivalents Calculated for Cancer Toxicity
2. mg/kg = Milligrams Per Kilogram
3. PRG = Preliminary Remediation Goal
4. RT/PU = Recreational Trespasser/Park User
5. MDL = Method Detection Limit
6. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

0 200 400
Approximate Scale in Feet

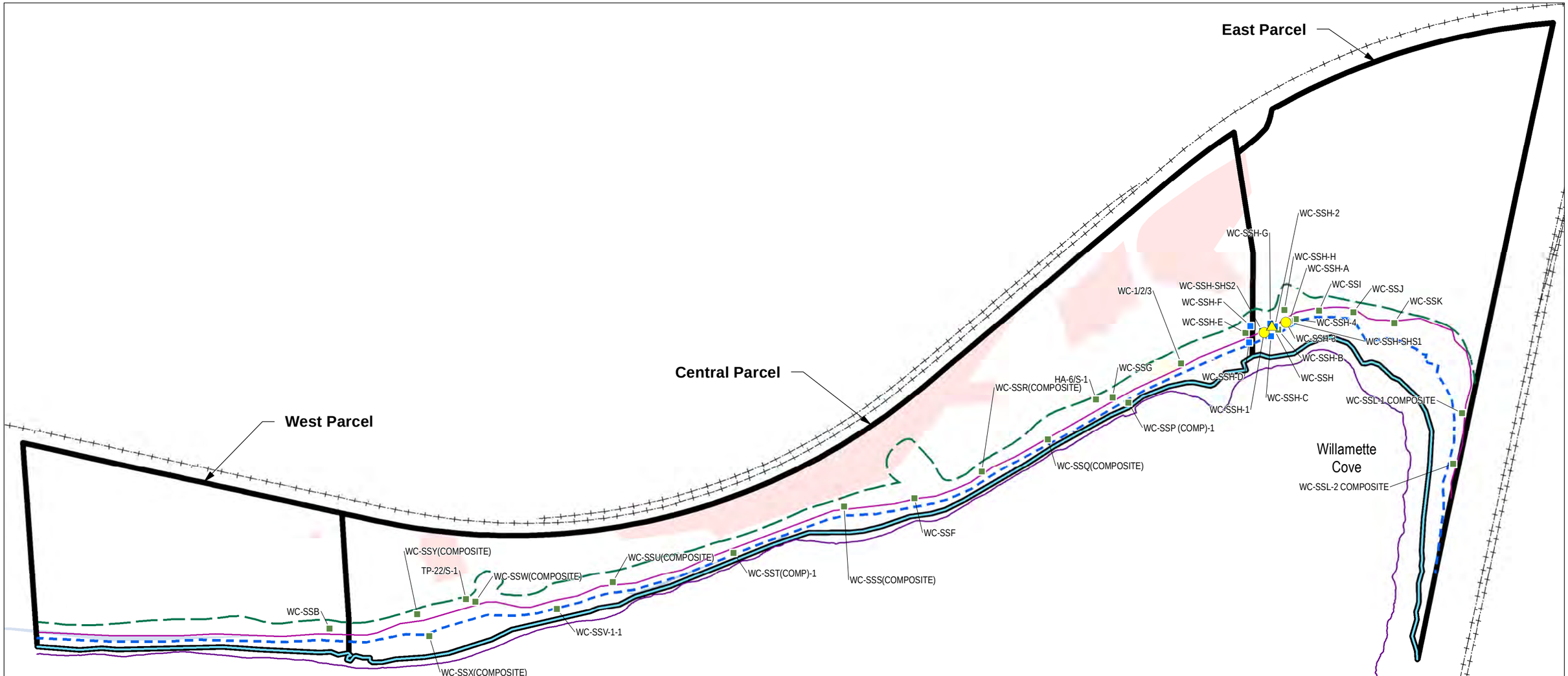
N

Human Health PRG Exceedances - BaP Eq in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-28



Legend:

- Composite Sample Concentration Above TT PRG (14 mg/kg)
- Discrete Sample Concentration Above TT PRG (14 mg/kg)
- Composite Sample Concentration Above CW PRG (4.9 mg/kg)
- Discrete Sample Concentration Above CW PRG (4.9 mg/kg)
- Composite Sample Concentration Above RT/PU PRG (0.74 mg/kg)
- Discrete Sample Concentration Above RT/PU PRG (0.74 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. PCB = Polychlorinated Biphenyl
2. mg/kg = Milligrams Per Kilogram
3. PRG = Preliminary Remediation Goal
4. RT/PU = Recreational Trespasser/Park User
5. TT = Transient Trespasser
6. CW = Construction Worker
7. MDL = Method Detection Limit
8. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

0 200 400
Approximate Scale in Feet

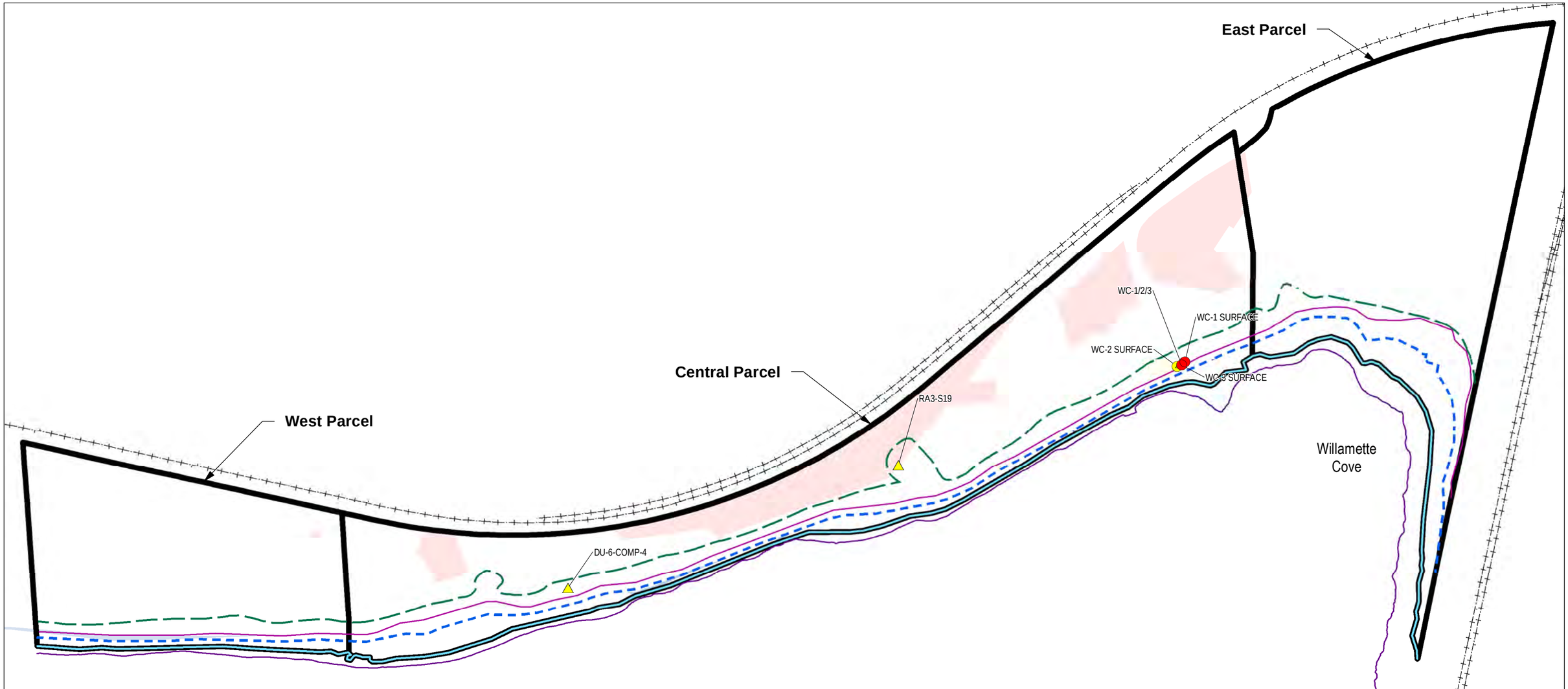
N

Human Health PRG Exceedances - Total PCBs in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-29



Legend:

- Composite Sample Concentration Above TT PRG (0.00032 mg/kg)
- Discrete Sample Concentration Above TT PRG (0.00032 mg/kg)
- Composite Sample Concentration Above CW PRG (0.00017 mg/kg)
- Discrete Sample Concentration Above CW PRG (0.00017 mg/kg)
- Composite Sample Concentration Above RT/PU PRG (0.000015 mg/kg)
- Discrete Sample Concentration Above RT/PU PRG (0.000015 mg/kg)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. mg/kg = Milligrams Per Kilogram
2. PRG = Preliminary Remediation Goal
3. RT/PU = Recreational Trespasser/Park User
4. TT = Transient Trespasser
5. CW = Construction Worker
6. MDL = Method Detection Limit
7. Sample locations shown are those between Upper Source Control Screening Boundary and Mean High Water.

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

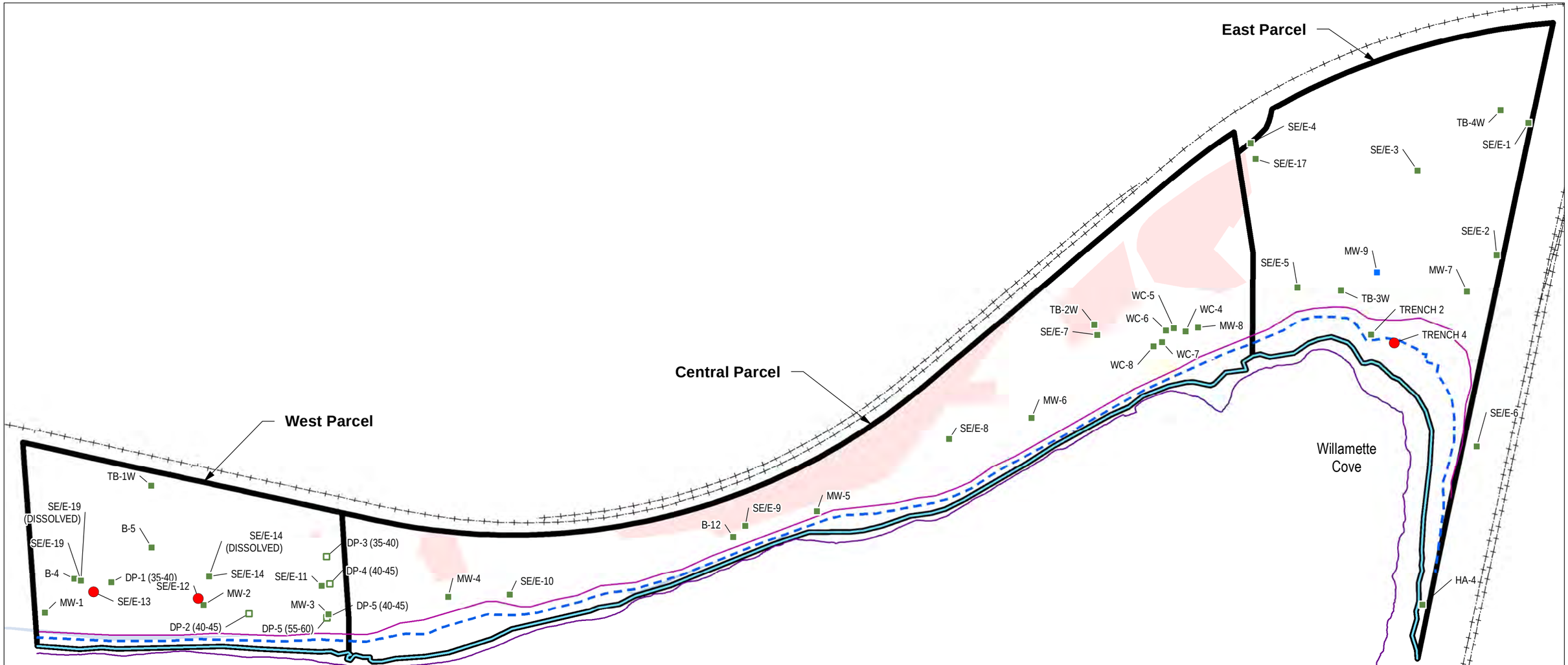
Human Health PRG Exceedances - Dioxin TEQ in Riverbank Soil

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-30



Legend:

- Monitoring Well Groundwater Concentration Above CL (0.014 µg/L)
- Grab Groundwater Concentration Above CL (0.014 µg/L)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. PCB = Polychlorinated Biphenyl
2. µg/L = Micrograms Per Liter
3. MDL = Method Detection Limit
4. CL = Portland Harbor Superfund Site Cleanup Level

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

0 200 400
Approximate Scale in Feet

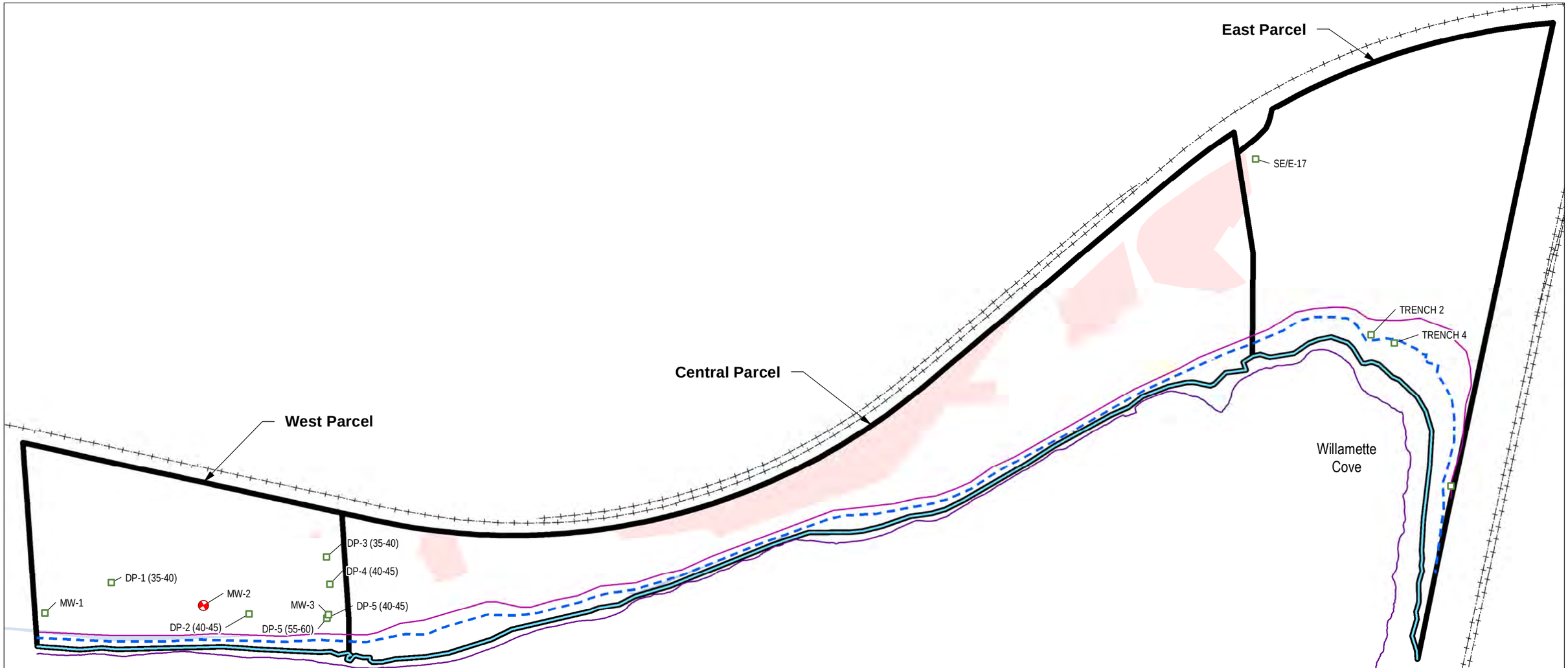
N

CL Exceedances - Total PCBs in Groundwater

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-31



Legend:

- Monitoring Well Groundwater Concentration Above CL (0.000031 µg/L)
- Grab Groundwater Concentration Above CL (0.000031 µg/L)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. µg/L = Micrograms Per Liter
2. MDL = Method Detection Limit
3. CL = Portland Harbor Superfund Site Cleanup Level

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

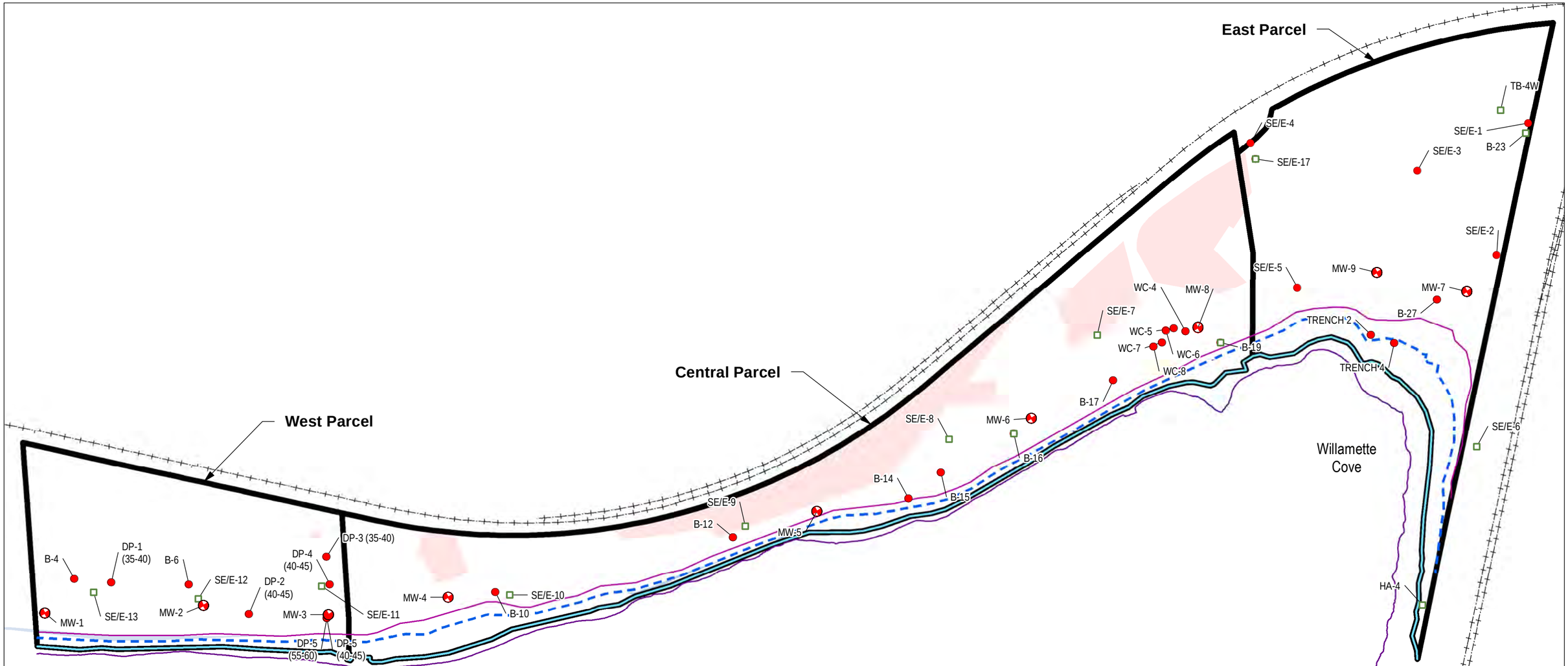
CL Exceedances - 4,4'-DDD in Groundwater

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-32



Legend:

- Monitoring Well Groundwater Concentration Above CL (0.018 µg/L)
- Grab Groundwater Concentration Above CL (0.018 µg/L)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. µg/L = Micrograms Per Liter
2. MDL = Method Detection Limit
3. CL = Portland Harbor Superfund Site Cleanup Level

0 200 400

Approximate Scale in Feet

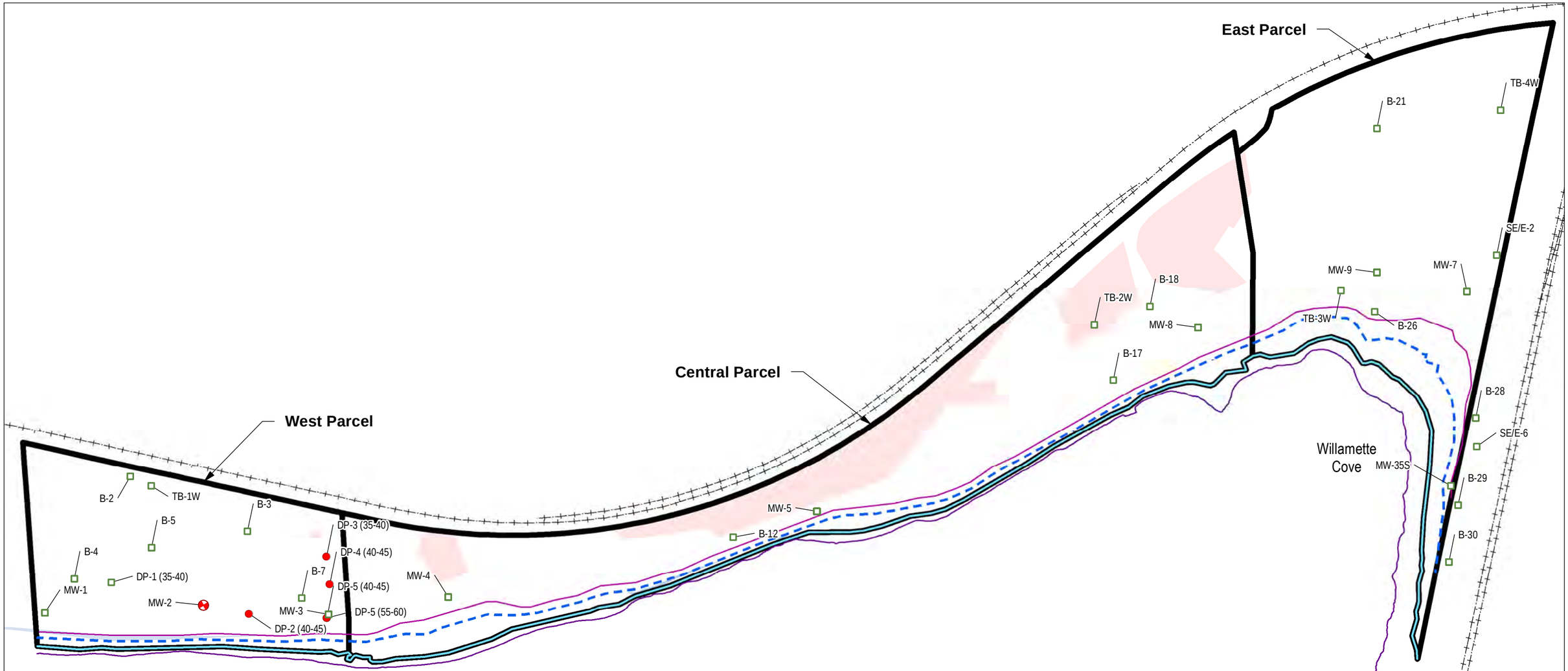
Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

CL Exceedances - Arsenic in Groundwater

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-33



Legend:

- Monitoring Well Groundwater Concentration Above CL (0.03 µg/L)
- Grab Groundwater Concentration Above CL (0.03 µg/L)
- Concentration Below Screening Level
- Concentration Less Than MDL, MDL Above Screening Level
- Concentration Less Than MDL, MDL Below Screening Level
- Parcel Boundary
- Removal Action Area
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Lower Source Control Screening Boundary (Corresponds to -2 Columbia River Datum; 3.2NAVD88)

Notes:

1. µg/L = Micrograms Per Liter
2. MDL = Method Detection Limit
3. CL = Portland Harbor Superfund Site Cleanup Level

0 200 400

Approximate Scale in Feet

N

Basemap prepared using spatial data from Metro (2010-2017), Apex, Formation Environmental, and Hart Crowser.
Coordinate System: NAD83 HARN StatePlane Oregon North FIPS 3601 (Intl Feet).

CL Exceedances - Pentachlorophenol in Groundwater

Revised Feasibility Study and Source Control Evaluation
Willamette Cove Upland Facility
Portland, Oregon

APEX

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1056-10	Figure
March 2019		D-34

Attachment D-1

Photograph Log

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 1	
Photo Date: 8/10/17	
Orientation: Northeast	
Description: West Parcel armor and vegetation cover.	

Photo No: 2	
Photo Date: 8/10/17	
Orientation: Northeast	
Description: West Parcel armor and vegetation cover.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 3	
Photo Date: 9/4/2012	
Orientation: East	
Description: Sandy beach and rip rap at western end of the Central Parcel. Historical wood pilings to south toward water.	

Photo No: 4	
Photo Date: 8/10/2107	
Orientation: Northeast	
Description: Bare soil at western end of the Central Parcel.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 5

Photo Date: 8/10/2017

Orientation: North-Northeast

Description:

Erosion at western end of the Central Parcel.

Photo No: 6

Photo Date: 8/10/2017

Orientation: Northeast

Description:

Erosion at western end of the Central Parcel.

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 7	
Photo Date: 8/10/2017	
Orientation: North-Northeast	
Description: Erosion at western end of the Central Parcel.	

Photo No: 8	
Photo Date: 7/21/2017	
Orientation: Northeast	
Description: Erosion at western end of the Central Parcel.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 9	
Photo Date: 9/4/2012	
Orientation: Northwest	
Description: Colluvium (sand and silt) at base of erosional scarp (right).	

Photo No: 10	
Photo Date: 9/4/2012	
Orientation: South	
Description: Loose sand and silt in riprap cover.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 11	
Photo Date: 9/4/2012	
Orientation: East	
Description: Complete riprap cover above wooden bulkhead, dense vegetation upslope, above OHWL.	

Photo No: 12	
Photo Date: 9/4/2012	
Orientation: North	
Description: Scarp covered in vegetation, above OHWL, with riprap cover below.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 13	
Photo Date: 9/4/2012	
Orientation: North	
Description: Small scarp with varying amounts of riprap armoring, and vegetative cover.	

Photo No: 14	
Photo Date: 9/5/2012	
Orientation: West	
Description: Rafted debris and large concrete debris around wood pilings in the Central Parcel.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 15	
Photo Date: 9/5/2012	
Orientation: West	
Description: Sand patches in riprap cover.	

Photo No: 16	
Photo Date: 9/5/2012	
Orientation: North	
Description: Scarp face above OHWL, showing riprap below and vegetation above.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 17	
Photo Date: 9/5/2012	
Orientation: East	
Description: Complete riprap cover below OHWL, and dense vegetation above OHWL. Central Parcel.	

Photo No: 18	
Photo Date: 9/6/2012	
Orientation: North	
Description: Scarp face with riprap inclusions and vegetation above and approximately at OHWL. West end of East Parcel.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 19

Photo Date: 9/6/2012

Orientation: Northwest

Description:

Scarp face, partial riprap and debris coverage on slope, and dense vegetation above scarp face can be seen. East Parcel.

Photo No: 20

Photo Date: 9/6/2012

Orientation: North

Description:

Bank on north end of cove area, covered in concrete debris.

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 21	
Photo Date: 9/6/2012	
Orientation: Northeast	
Description: Bare soil in the middle of the East Parcel.	

Photo No: 22	
Photo Date: 9/6/2012	
Orientation: Northeast	
Description: Bank on north end of cove area, covered in concrete debris.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 23	
Photo Date: 9/6/2012	
Orientation: Southwest	
Description: Edge of beach area and start of articulated block armored cap extending south toward the rail bridge.	

Photo No: 24	
Photo Date: 9/6/2012	
Orientation: Southeast	
Description: Concrete structure at base of Burlington Northern Railroad embankment; beginning of scarp on east end of cove starts under the structure left of center of photograph.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 25	
Photo Date: 9/6/2012	
Orientation: South	
Description: Articulated block armoring to right, dense vegetation to left of photograph; scarp is within the vegetated area on bank.	

Photo No: 26	
Photo Date: 9/6/2012	
Orientation: South	
Description: Complete armoring in foreground, large riprap blocks at base of slope, and vegetated scarp at back of photograph.	

APPENDIX D, ATTACHMENT 1
PHOTOGRAPH LOG

Project Name: Willamette Cove Revised FS/SCE
Project Number: 1056-10

Client: Port of Portland
Location: Portland, Oregon

Photo No: 27	
Photo Date: 9/6/2012	
Orientation: Northeast	
Description: Articulated block armored cap extending north with large riprap bank armoring seen to the right. Note the absence of sand placed on articulated block.	

Attachment D-2

Willamette River Stage Evaluation

1.0 River Stage Evaluation

This attachment describes the development of the river stage frequency distribution. Table 2-1 presents the river stage frequency data and Figure 2-1 is a histogram showing the relative frequency of river stage.

Willamette river stage elevation data were obtained for the period of October 1, 1988 through January 3, 2019 from the USGS water science data center (http://or.water.usgs.gov/). The data were obtained for the USGS gauge 14211720 located at the Morrison Bridge in Portland, Oregon. Approximately 5% of the potential data set (24,000 out of 500,000 data points) was not available due to gauge maintenance, repairs, and/or technical difficulties. To obtain the most accurate time estimates per river stage, data collected over an hour apart were removed. This eliminated approximately 0.02% of the potential data set. In general, the data set consists of river elevation data measurements that were collected twice an hour for the duration of the study period. Data that lapsed an hour between recordings were weighted 2x a 30-minute sampling interval. This accounted for approximately 0.05% of the potential data set. For the purpose of the analysis, it was assumed that the missing and removed data were randomly distributed. The data are collected in City of Portland Datum and were converted from gauge datum to feet above mean sea level (MSL) in North American Vertical Datum of 1988 (NAVD88) by adding 2.10 feet. To account for the downward slope in the Willamette River between the Morrison Bridge and the Facility, a slope correction factor was developed. The correction factor was calculated based on average slope of the Willamette River[1]. To correct for the slope of the Willamette River, 0.57 feet was subtracted from each data point.

Over the monitoring period, river stage ranged from a low of 3.89 feet NAVD88 in September 2003 to a high of 32.19 feet NAVD88 in February 1996. Over the course of the 31-year period, the average river stage was 10.07-feet NAVD88, and the median river stage was 9.45-feet NAVD88. The data shows a right-skewed normal distribution. The lowest river stages generally occur between July and early November, with the highest river stages generally occurring January through June. All river stages above 28 feet NAVD88 (constituting of approximately 0.04% of the analyzed data) occurred in February 1996 during the Willamette Valley Flood of 1996.

[1] *Water-Discharge Determinations for the Tidal Reach of the Willamette River From Ross Island Bridge to Mile 10.3, Portland, Oregon, Geological Survey Water Supply Paper.* Dempster, George R. and Lutz, Gale A., 1968.

Table D2-1
Willamette River Stage Frequency, 1988 - 2019 (NAVD88)
Willamette Cove
Portland, Oregon

River Stage (feet above MSL)	Frequency	Percent of time at the given river stage	Cumulative
5	2,965	0.60%	0.60%
6	17,617	3.57%	4.17%
7	46,330	9.38%	13.54%
8	69,259	14.02%	27.56%
9	77,263	15.64%	43.20%
10	71,910	14.56%	57.76%
11	57,855	11.71%	69.47%
12	42,191	8.54%	78.01%
13	31,186	6.31%	84.32%
14	23,198	4.70%	89.02%
15	16,505	3.34%	92.36%
16	10,688	2.16%	94.52%
17	6,965	1.41%	95.93%
18	6,086	1.23%	97.17%
19	5,218	1.06%	98.22%
20	2,634	0.53%	98.76%
21	2,451	0.50%	99.25%
22	2,328	0.47%	99.72%
23	727	0.15%	99.87%
24	162	0.03%	99.90%
25	65	0.01%	99.92%
26	70	0.01%	99.93%
27	74	0.01%	99.95%
28	88	0.02%	99.96%
29	26	0.01%	99.97%
30	30	0.01%	99.97%
31	35	0.01%	99.98%
32	78	0.02%	99.998%
33	12	0.002%	100.00%
Totals	494,016	100.00%	100.00%

Notes:

1. River stage in feel above mean sea level (MSL), NAVD88 datum.
2. Each point represents one river stage measurment collected in a 30-minute period.

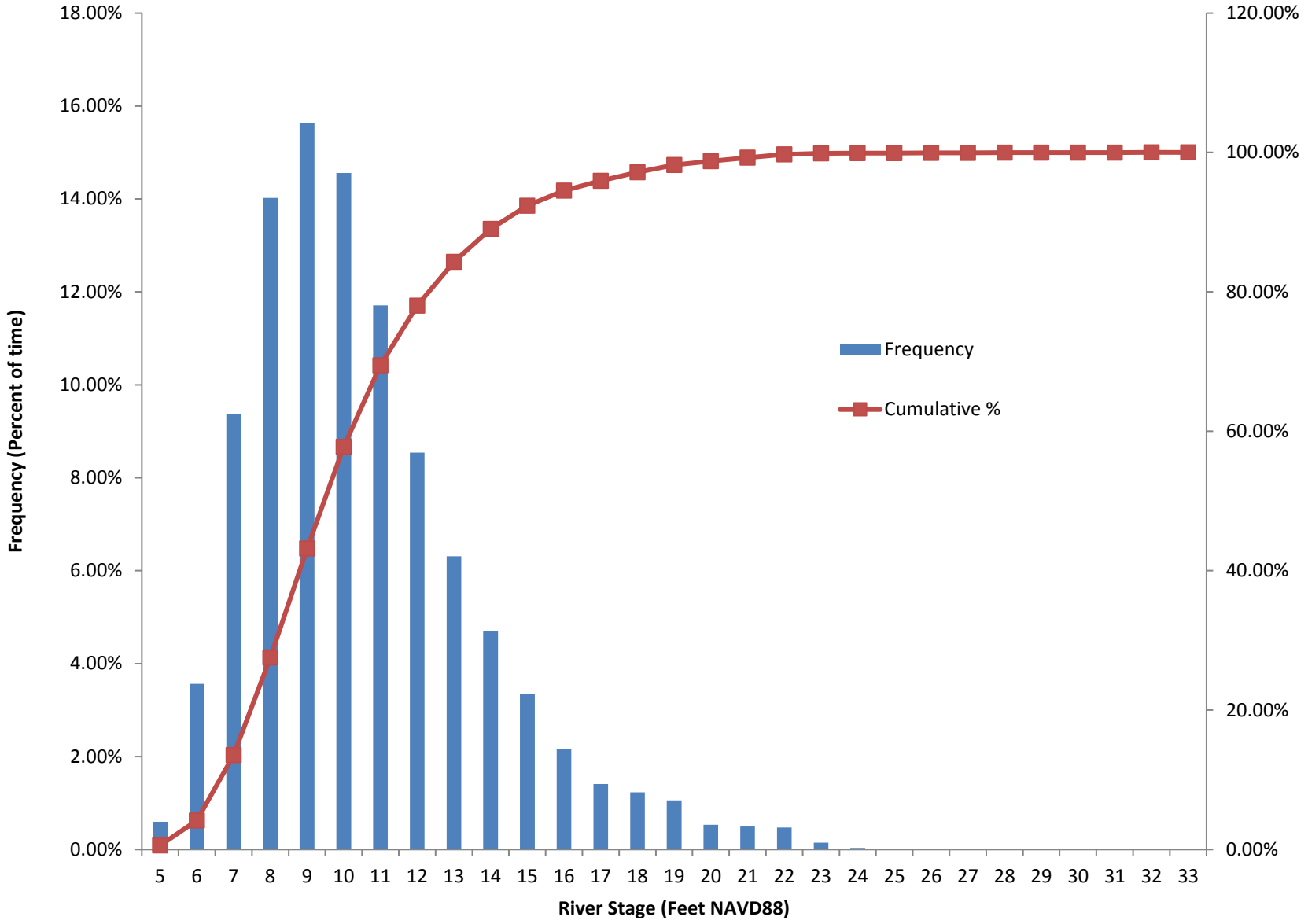

18.00%
16.00%
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
Frequency (Percent of time)
120.00%
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
Frequency
Cumulative %
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
River Stage (Feet NAVD88)

Figure D2-1