June 24, 2019

Erin McDonnell
Oregon Department of Environmental Quality
700 NE Multnomah Street, Suite 600
Portland, OR 97232

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

Dear Erin:

This letter provides the Oregon Department of Environmental Quality (DEQ) with a response to comments received on the *Revised Feasibility Study and Source Control Evaluation – Willamette Cove Upland Facility* (Revised FS/SCE; Apex, 2019). The comments were provided to the Port of Portland (Port) in a letter from the DEQ dated May 21, 2019. Comments on the Revised FS/SCE from the U.S. Environmental Protection Agency (EPA) were provided concurrently in a letter dated April 16, 2019. Comments from Yakama Nation Fisheries (Yakama Nation), and the Tribes were provided in a letter dated April 10, 2019 and a memorandum dated April 10, 2019, respectively. DEQ, EPA, Yakama Nation, and the Tribes comments are repeated (in italics) followed by the Port response.

DEQ Comments

SOURCE CONTROL COMMENTS

1. Groundwater Source Control*. Groundwater data in the exceedance area are not presented or discussed in the Revised FS/SCE in any meaningful way [see comment for Appendix D below], nor are potential remedial options presented as requested by DEQ. At this time, there is insufficient information to support source control decision-making for this pathway. This deficiency has been identified by EPA, Tribal representatives, and DEQ.*

DEQ considers groundwater contamination to be uncontrolled and present a medium source control concern per the Portland Harbor Joint Source Control Strategy. Given this, we feel it is necessary for the Port to submit a separate Source Control Evaluation/Source Control Alternatives Analyses (SCE/SCAA) for groundwater, the results of which will be considered in preparation of the upland record of decision (ROD).

Response: A separate groundwater SCE/SCAA report will be prepared and submitted separately to DEQ.

Appendix D. *This section has been dramatically reduced from the 2017 version. The current version does not present sufficient information to support the conclusions presented. It is not possible to understand the groundwater investigations completed or the extent of impacts. The basic question of where groundwater exceeding cleanup levels or screening level values occurs is not presented in a way that can be confirmed. EPA's primary comment 5 on the 2017 FS noted the evaluation of contaminants of potential concern (COPCs) was not sufficient. This comment was not addressed and in fact, the revised report presents substantially less justification for not carrying contaminants of interest (COIs) forward as COPCs. The Port presents a response to EPA's primary comment in attachment A-9, "The explanation of COPC evaluation has been expanded to clarify the reasons for removing/retaining COPCs, including discussion on location. Figures showing screening level exceedances in groundwater are presented in Appendix D." These figures are limited to contaminants of concern (COCs) and are therefore of limited use in justifying why COPCs were not carried forward as COCs. The SCE for groundwater discharge to the river is not sufficient to support the conclusions regarding the COCs and extent that may pose an impact to the river.*
Action: Port/Metro have agreed to complete the requested SCE/SCAA for groundwater. Analysis should conform to the JSCS in both identifying the nature and extent of contamination, risk screening and identification of COCs, area and magnitude of exceedances, risk prioritization, and source control alternatives analysis. To the extent that contaminants presented in Table 17 of the Harbor ROD were not analyzed for, justification should be provided. We recommend that remedial alternatives be vetted by DEQ prior to submission of the source control evaluation document. Both in-water and upland remedial alternatives should be presented.

Response: A separate groundwater SCE/SCAA report will be prepared and submitted to DEQ. The report will conform to the JSCS guidance as requested in the Action item above. Remedial alternatives will be vetted with DEQ prior to submission of the source control evaluation document. Both in-water and upland remedial alternatives will be evaluated.

2. Riverbank Source Control. *Significant portions of the site riverbank (notably Central and East Parcel) contain contaminants that exceed relevant screening values and are either eroding or have the potential to erode. Riverbank soils represent an uncontrolled source. DEQ's analysis indicates the West Parcel riverbank to be a low source control concern (per the JSCS) based on extensive armoring, while conditions in the Central and East Parcel represent a medium to high source control concern.*

The report acknowledges that the riverbank area will be addressed by EPA but provides little discussion of the potential for upland soil in the vicinity of top of bank to represent a source control concern, both at present and following remedy implementation. To the extent that residual (uncapped) contamination is present in the upland following remediation, it will be necessary to confirm that concentrations are below Portland Harbor Superfund Site riverbank soil screening values presented in Table 17 of the 2017 Portland Harbor ROD or are otherwise not transportable to the river.
Action: In either the response-to-comments or source control addendum, discuss whether upland soil in the top-of-bank vicinity exceeding Portland Harbor cleanup levels (CULs for riverbank) has the potential to migrate to the river, both at present and following remedy implementation. For the latter, discuss whether residual contaminant concentrations are expected to be above CULs, and if so, whether a cap will be present to prevent potential migration.

Response: As discussed in response to Yakama Nation comments on Section 3.1, overland flow erosion is not occurring under current conditions except at one path area near the west end of the Central

Parcel. That path is in an area of observed bank erosion. Other areas of bank erosion are observed on the riverbank as discussed in Appendix D of the FS. Until implementation of a riverbank source control action, bank erosion could lead to slope failure and transport of material currently above top of bank to the river. In many areas, that material would contain contaminant concentrations above CULs. After source control actions on the riverbank are implemented to address erodible soil, migration of material from the upland to the river will not occur. Following remedy implementation, the majority of remaining soil will be contained in the consolidation cell beneath an engineered cap. Potential erosion of the capped area is discussed in response to DEQ Feasibility Study Comment #2. Residual soil outside the capped area will contain some COCs above riverbank CULs: arsenic, lead, mercury, and zinc at concentrations less than twice CULs; carcinogenic polycyclic aromatic hydrocarbons (cPAHs) at up to 40 times the CUL, total polychlorinated biphenyls (PCBs) at up to 11 times the CUL; and dioxins/furans at up to 3 times CULs. The topography after remediation will be similar to the current topography so erosion of those soils would not be expected. Additionally, these areas will have cover soils that over time will mix with the underlying soils, further reducing concentrations of COCs in surface soil.

3. Remedial Action Objectives (RAOs). *Source control should be included in identified RAOs as follows:*

- *Control of groundwater contaminant sources in the upland (West Parcel).*
- *Control of contaminated upland soil (inland of top of bank) that has the potential to migrate to the riverbank, beaches, or in-water.*

<u>Action:</u> Please confirm inclusion of these RAOs in the response-to-comments. These RAOs will be included in DEQ's forthcoming staff report.

Response: The Port acknowledges that the RAOs will include the source control objectives listed above.

FEASIBILITY STUDY COMMENTS

1. Amended Capping. *DEQ does not consider an amended (thin) cap to be viable alternative where hot-spot level contamination is left in place, based on uncertainty regarding protectiveness, long-term reliability, etc.*
<u>Action:</u> None necessary, although we do not expect amended capping to be a component of the DEQ-recommended remedy.

Response: See the response to EPA Comment #2 in the To-Be-Considered Comments on Part II. As stated in that response, a cover that includes additives is intended to reduce the bioavailability of the contaminants in the soil. The intent of amended cover options is to provide alternatives that would be less destructive of the existing native vegetation. Saving the native vegetation however, would leave concentrations in soil that would be higher than could be addressed only by mixing with the cover soil; hence the addition of supplements to reduce bioavailability. Unfortunately, there is little experience with the efficacy of this approach in the upland environment. As a result, consistent with DEQ's comment above, alternatives with an amended cover were not recommended for implementation[1] because of the uncertainty associated with the effectiveness of the amendment. The Port agrees with DEQ's position that thin cover layers are not appropriate where hot spot level contamination is present.

[1] We acknowledge some confusion on this issue. As correctly described in the FS report text, the recommended alternative (4c) does not include amendments in the cover soil. However, the cost estimate incorrectly included amendment purchase and mixing. This has been corrected in the revised cost estimates included in Attachment A to these response to comments.

As discussed in Section 11.3 of the FS, residual risks that will be manage by "thin" cover soils do not include hot spot concentrations. The Port acknowledges that if excavation in areas where native trees are saved does not achieve concentrations below hot spot levels, removal of the trees may be required so that excavation can continue.

2. Seismic/Erosion Considerations. *These need to be considered in the evaluation of remedial alternatives, notably in how a seismic event or flooding might compromise long-term reliability of a chosen remedy. The large (~20,000 yd^3) containment feature, a key element of the recommended remedial alternative, would need to be constructed to withstand at least moderate seismic disturbance and be located in a site area where it would not be disturbed by flooding or was designed to withstand flooding. Climate change and the potential for rising river levels need to be factored into flood analysis. A similar analysis is necessary for any (non-consolidation) cap or cover elements, in particular those in the top-of-bank area.*
Action: Please discuss in the response-to-comments and provide supporting documentation.

Response: The following discusses seismic and flooding erosion hazards as they relate to a potential consolidation area on the East Parcel (the issues are similar for the West Parcel except that elevations are higher, so the flood risk is lower). See response to DEQ Feasibility Study Comment #7 for a summary of the advantages/disadvantages of locating the consolidation cell in the East or West Parcels.

Seismic. The City of Portland Water Bureau conducted a seismic hazard study to evaluate the potential for liquefaction-induced ground settlement, lateral spreading, or landslide deformation resulting from a magnitude 9 Cascadia Subduction Zone earthquake. Results are summarized on a map at the City's website.[2] The data presented in the study are not sufficiently detailed for design purposes, so site-specific evaluation will be required during design. The data do present information that is useful in evaluating feasibility of consolidating soil on-site. Landward of the top of bank, the study results indicate that settlement and landslide movement would each be less than 6 inches. A soil-based engineered cap would be expected to perform adequately under those conditions. The study results for lateral spreading are summarized on Figure B-1 in Attachment B to these response to comments. The area proposed for the soil consolidation cell has predicted lateral spread of less than 1 foot to 10 feet. Based on these results, a soil-based engineered cap would require repair following the modeled earthquake. However, given that the consolidation cell would be located at least 50 feet from the top of bank and the lateral spreading would be less than 10 feet, the consolidated materials would not be released to the river as a result of a model-level earthquake.

Flooding. Figure B-2 in Attachment B to these response to comments shows a contour map of the East Parcel overlain with the 100-year and 500-year flood zones and the 1996 flood inundation area.[3] The 100-year floodplain elevation is 31.2 feet (all elevations NAVD88) and approximately corresponds to the top of bank on the East Parcel. The 500-year floodplain elevation is 35.2 feet and encompasses essentially all of the East Parcel. The bulk of the East Parcel is between elevation 33 to 34 feet, with some areas up to elevation 36 feet. Allowing for some settlement resulting from placement of the soil consolidation area, a 500-year flood could inundate the lower three feet of the capped consolidation

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[2] https://pdx.maps.arcgis.com/apps/webappviewer/index.html?id=22e4c106698b4087bd790005a2437531
[3] From City of Portland flood maps at
https://pdx.maps.arcgis.com/apps/Viewer/index.html?appid=f23b1f78bcd846e7b83769ad0638da0f

area. Because the East Parcel is located downstream of the Burlington Northern Sante Fe (BNSF) railroad embankment, the proposed consolidation area would be located in an area protected from direct river currents. Erosion forces would be expected to be similar to runoff resulting from a design rain storm. Well-established vegetation would be suitable to protect the engineered cell from erosion from both rainfall and a river flood event. Over the next 50 to 80 years, global warming models suggest that sea levels could rise by several feet. This would lead to similar increases in flood elevations. In that event, the consolidation cell could be subjected to flooding under a 100-year event, and a 500-year event could approach the top of the consolidation cell (assuming a cell on the order of 10 feet total height). However, given that the cell would still be within a protected area of the floodplain, surface vegetation would still be suitably protective under increased flooding resulting from predicted sea level rise conditions.

3. Estimated Soil Volumes and Cost Estimates.

- *There are a number of inconsistencies in the original FS/SCE cost tables relative to information relating to contaminated soil volume estimates, backfill and cap volumes, etc. Also, the derivation of various acreage values used for cost estimating (24, 23, 20, 11.5) was not clear.*
- *DEQ does not consider trucking, in general, to be a viable transport option given that routing options are through high-density residential/commercial development areas. The site was apparently used for loading/unloading via barge during McCormick & Baxter remediation work, including removal of hot spot material. It is DEQ's expectation that the site would be similarly used for upland remediation, and that limits would be applied during remedial design on vehicle traffic to and from the site during remediation.*
- *The cost estimate for recommended Alternative 4c is likely low. DEQ expects that consolidated soil (including ecological hot spot material) will require an engineered cell rather that simple cap, and a 3-foot cover to be protective of both human and ecological receptors. Monitoring and maintenance will be required in perpetuity for both the consolidation cell and any outlying "standard cap" areas under this alternative, and it is almost certain that ongoing, long-term maintenance will be necessarily associated with these features (cost estimate uses 15 years).*
- *Contingency costs (15%) for alternatives are low.*
- *The consolidation area will need to be engineered to withstand the "elements" such as flooding, storms, seismic consideration and additional reinforcement will be necessary. An enhanced consolidation area will increase project costs.*
- *It is assumed the non-dioxin hotspot will be reduced to 10% of the West Parcel after remedial design sampling is performed. The lesser volume (0.4-acre rather than 4.3 acres) is used for cost estimation purposes, including excavation volumes in Alternative 4c. Given that additional offsite transport/disposal substantially increase costs, a more conservative approach could be taken to reduce uncertainty.*
- *Both Alternative 3b and 4c incorporate extensive areas of excavation, which would require placement of topsoil of sufficient thickness to support vegetation and corresponding habitat. Alternative 3b specifies 1-foot across the site except 0.5-feet around native trees. Alternative 4c is similar in concept in terms importing topsoil material but as cap (or cover) at a minimum of 1 to 2 feet site-wide, excepting the consolidation area (0.5-foot topsoil plus 1.5-foot import fill) and native trees. Further explanation is necessary to account for the significantly reduced topsoil volume estimated in 4c than 3b.*

<u>Action:</u> Supplementary information on cost estimating was presented in an April 22, 2019 email to DEQ, including updated cost tables and assumptions used in soil volume estimates. We continue to have

questions about the accuracy of cost estimates, notably for recommended alternative 4c. Please discuss in response-to-comments, clarify assumptions in cost estimating, and revise cost estimates accordingly.

Response: Updated cost estimates for each of the alternatives and alternative comparison tables are provided in Attachment A to this response to comments. In general, the estimates provided in the April 22, 2019 email to DEQ have been checked/revised as needed to assure consistency and to address any revisions resulting from these responses to comments. Key specific changes include the following:

- Addition of costs for engineered cap on soil consolidation area;
- Revised contingency costs;
- Increased costs for pre-construction, clarifying that pre-design sampling is included;
- Increased costs for agency oversight; and
- Addressed inconsistencies in quantities.

4. Active versus Passive Park User. *Information presented in the document is confusing and some cases appears inconsistent. The exposure assumptions used for PRG development should be clearly articulated. It is DEQ's understanding that park user preliminary remediation goals (PRGs) are based on 2 days per week exposure for a duration of 26 years.*
Action: Please address in response-to-comments.

Response: We believe that the confusion over whether the remedy is protective of an active versus passive future park user arose from an attempt to discriminate between future plans for the Facility and the baseline assumptions used to generate the proposed cleanup levels or PRGs. Metro has indicated that the intended future uses of the Facility will be passive. In this context passive is defined as viewpoints, a bicycle path, and similar other uses. Plans do not call for active uses such as athletic fields or playgrounds. The term passive was used when discussing both future use of the Facility and development of PRGs during the risk assessment process. However, development of the PRGs for cleanup assumed active use of the Facility as described above. Specifically, the following assumptions were used to calculate PRGs for the basis of cleanup.

Ingestion/Exposure Rates	EPA Recommendations for Residential Exposure
Exposure Frequency	2 days per week
Exposure Duration	30 years (6 years as a child, 24 years as an adult)
Other Factors	EPA Recommended Values

5. Residual Eco Risk and Capping. *Under Alternative 4c, all soil exceeding human health PRGs would be removed. Two notes:*

- *As human health PRGs are based on conservative exposure assumptions, DEQ's preliminary conclusion is that that cleanup to Recreational Trespasser/Park User (RT/PU) values would be protective for both passive and active recreational uses. That said, site owner Metro has made it clear to DEQ in completing risk analysis work that they do not intend to allow active recreational uses on the property.*
- *Achieving human health PRGs through removal may result in contaminant concentrations that only modestly exceed ecological PRGs. Achieving the human health PRG of 15 ng/kg (2,3,7,8-TCDD TEQ), for example, would largely address ecological risk as well (6.1 ng/kg PRG for dioxin). For non-dioxin contaminants, exceedance ratios may be similarly low. For areas with low (residual) ecological ERs following removal, DEQ is willing to discuss placement of cover with no*

requirements for subsequent monitoring. In developing a decision protocol for cap/cover, we will consider the magnitude of exceedances and identity and number of contaminants; and whether hot spot-level contamination is present.

Action: Please acknowledge in response-to-comments.

Response: The approach described in the comment is consistent with the Port's understanding of the approach to be used in the recommended alternative.

6. Tree Retention. *DEQ is in favor of retaining native trees provided that contamination beneath them can be removed to reasonable levels and controls put in place that meet protectiveness and long-term reliability requirements. If this cannot be accomplished, trees will likely have to be removed.*
Action: Please acknowledge in response-to-comments.

Response: The Port acknowledges the approach described in the comment.

7. Soil Consolidation and Capping

- *More information on the potential "configuration" of a containment area (area, thickness with and without cover, sloping requirements, etc.,) is necessary to determine viability. Constraints such as City of Portland and DEQ Solid Waste permitting must also be considered. We understand that some of this will be covered in remedial design, but basic information is necessary in the FS to confirm that a containment feature is a viable remedial element.*
- *Rather than simple 2-foot clean cover, an engineered containment cell would be necessary given the volume of soil recommended for containment, and that elevated contamination (notably for ecological receptors) would be present. Factors to consider in design would include: seismic stability, resistance to erosion from natural and anthropogenic sources (flooding, high rainfall events, human activity, wildlife burrowing), and leaching potential. Downgradient monitoring of shallow groundwater would likely be necessary to confirm groundwater conditions are not altered.*
- *DEQ is expected to place limits on the amount of soil that can be addressed by consolidation and capping, and has a preference for off-site disposal of more highly-concentrated ecological risk material (e.g. surface soil from eastern portion of Central Parcel).*

Action: please address in response to comments.

Response: The following provides additional detail on the potential consolidation cell.

Location – East Parcel vs. West Parcel. Potential locations for the consolidation cell are the West or East Parcels. The Central Parcel is relatively narrow – after accounting for setbacks from the property line and top of bank, there is insufficient area to consolidate the needed volume of soil. The East Parcel has greater available area (after allowing for approximately 50-foot setbacks from property lines and the top of bank, the East Parcel has approximately 150,000 square feet available compared to the West Parcel at approximately 100,000 square feet). Both parcels are outside the 100-year floodplain. The West Parcel is above the 500-year floodplain, but the East Parcel is within the 500-year floodplain. In the event of an increase in flood levels associated with global warming induced sea level rise, the West Parcel could be subject to flooding during a 500-year event. In that case, the West Parcel would be directly subjected to river currents whereas the East Parcel would be in a protected area behind the BNSF embankment. In summary, the East Parcel provides greater area but would be subject to flooding during events greater than 100-year events. The West Parcel would be subject to flooding only during

greater than 500-year events. In the event of increased flooding from sea level rise, the East Parcel is better protected from river currents.

Consolidation Cell Configuration. In general, it was assumed that the consolidation cell would be rectangular with a flat top and uniformly sloped sides. Steeper side slopes would maximize the containment volume. For slope stability, a practical maximum steepness for side slopes would be approximately 3H:1V. Assuming side slopes of 3H:1V, the following summarizes the practical range of available capacity for contaminated soil consolidation on the East and West Parcels (the relative coverage is based on available area assuming 50-foot setbacks as discussed above). The Total Cell Height includes a three-foot clean soil cap.

Total Cell Height (ft)	Contaminated Soil Capacity (cy)			
	West Parcel		East Parcel	
	50% Coverage	100% Coverage	50% Coverage	100% Coverage
6	3,900	8,400	6,100	13,200
10	8,600	18,700	13,500	29,800
15	13,100	29,000	21,000	na

We developed an Excel tool to estimate containment volume based on input for cell dimensions, total cell height, cap thickness, and steepness of side slopes. If desired, this tool can be provided to DEQ to assist in evaluating cell configurations. During final design, the cell configuration would be adjusted to accommodate existing topography, final setbacks, and parcel shape – we expect that the final cell would not be precisely rectangular.

Substantive Requirements of Permits. Design of the consolidation cell would need to meet the substantive requirements of DEQ solid waste permitting, including land-use compatibility requirements of the City of Portland. Given the end use of the area as a natural area and potential future park activities, a soil consolidation cell could be designed consistent with solid waste rules (e.g., cap design standards) and land-use compatibility needs.

Engineered Cap. Many elements of the engineered cap are discussed in responses to other comments as follows:

- Engineered cap layers – Response to Comment #2 of EPA To Be Considered Comments on Part II
- Seismic and Flooding/Erosion – Response to DEQ Feasibility Study Comment #2

With respect to leaching, the COCs generally have low solubility and are not expected to migrate via leaching/groundwater. The groundwater source control evaluation (being submitted under separate cover) confirms this conclusion. The areas of groundwater exceeding source control screening levels do not correspond to the areas of soil requiring cleanup. Rather, groundwater impacts are associated with the deep fill in the former log pond. It is understood that groundwater monitoring may be a part of the remedy to verify compliance with groundwater source control requirements.

Preference for Off-Site Disposal of Higher Risk Material. It is understood that DEQ prefers off-site disposal of higher risk material. As proposed, the recommended alternative achieves this by disposing of hot spot materials (excluding the lower range of dioxin/furan ecological hot spots) off-site. Verification sampling will be conducted to verify removal of hot spot material. During construction, verification sample results and real-time removal volumes can be used to evaluate the practicability of additional material removal (e.g., if hot spot volumes are less than predicted and material with multiple COCs only slightly below hot spot levels is still present, additional removal may be practicable).

8. Confirmatory Sampling Following Removal. *To the extent that the site remedy incorporates removal of contaminated soil, either for off-site disposal or consolidation, DEQ expects that characterization of the "leave surface" will rely on exposure unit-based incremental sampling for a complete list of COCs unless otherwise approved by the Department. Depending on the receptor being protected, the size of sampling decision units may vary. In general, decision unit size for ecological receptors will default to 0.5 acres.*
Action: Please acknowledge in response-to-comments.

Response: The approach described in the comment is consistent with the Port's understanding of implementation of confirmatory sampling.

9. Cap Thickness Decision Matrix. *The goal of cleanup work in the site upland is to achieve acceptable PRGs over a depth of 3 feet, which is the surmised exposure depth for both ecological and human receptors (excluding construction worker). DEQ is working on developing a decision matrix for capping and/or cover placement based on: a) exceedance ratios for both individual contaminants and summer ERs; and b) the presence of hot-spot level contamination. In general, it is DEQ's expectation that hot spot contamination remaining on site will need both a demarcation layer and minimum of three feet of clean cover.*
Action: Please acknowledge in response to comments and consider in providing updated cost estimates.

Response: This is consistent with the Port's understanding of the approach to selecting the type and thickness of caps or cover soil.

ALTERNATIVE 4C COMMENTS

1. Potential Complexity of Cap/Cover. *Depending on the results of confirmatory sampling, a "mosaic" of cap elements might be necessary in the upland including: an engineered containment cell, thin and thicker caps, and cover, the majority of which would be subject to monitoring and maintenance in perpetuity. [Note that "caps" are assumed by DEQ to include physical isolation layers that would not be disturbed over time by burrowing animals or the like, while "covers" assume that mixing with underlying contaminated soil would occur]. DEQ's preference is for sufficient soil removal to eliminate the need for capping, and attendant long-term monitoring and maintenance, outside of the consolidation area. This would require removal of all soil exceeding human health PRGs outside of the consolidation cell as outlined under the recommended alternative (4c), and with residual soil concentrations either below or only modestly above ecological PRGs.*
Action: Please address in response-to-comments.

Response: The approach described in the comment is consistent with the Port's understanding of implementation of the recommended remedy. See specifically the response to the Yakama Nation

comment on "Future Use" and the response to EPA Comment #2 in the To-Be-Considered Comments on Part II. After soil consolidation, the remaining risk outside the consolidation area is expected to exceed risk levels only for ecological receptors and by factors of 3.5 or less. The only cap would be the consolidation area. Remaining areas would receive soil covers in the range of 1 to 2.5 feet in thickness. The cover areas would not require demarcation layers or long-term monitoring/maintenance.

2. Location of Consolidation and Cap Area. *Use of the East Parcel for consolidation may be less favorable given that site elevation including top of bank is lower, making it more subject to flooding. DEQ notes that historically, river stage has exceeded East Parcel top of bank multiple times associated with Willamette River flood events, most recently in 1996.*
Action. Please address in response-to-comments.

Response: See response to DEQ Feasibility Study Comments #2 and #7. Specifically, Figure B-2 in Attachment B to these response to comments shows neither the 100-year floodplain nor the 1996 flood inundation area overlap the proposed soil consolidation area (nor do they encroach on the upland portion of the West Parcel). Additionally, response to Comment #7 discusses the advantages and disadvantages of locating the consolidation area in the West and East Parcels.

3. Demarcation Layer. *Alternative 4c calls for capping of residual ecological contamination with a one- to two-foot cap, depending on residual risk levels/exceedance ratios for ecological receptors. Please note that capping normally requires installation of demarcation material below the clean cap, which may not be viable for thinner caps (1- or 2-foot thick). Vegetation rooting, burrowing, etc. would likely compromise the layer or preclude its use. Conversely, eliminating the demarcation layer is not likely to be approved given its importance in confirming long-term integrity of the cap as an undisturbed, physical isolation layer.*
Action: Please address in response-to-comments.

Response: See response to DEQ Comment #1 on "Alternative 4c Comments." As clarified in that and related responses, the residual ecological risk areas would receive a cover soil rather than a cap. This cover soil would be intended to mix with the underlying soil and no demarcation layer would be used.

4. Uncertainty, Depth of Contamination. *A core element of Alternative 4c is, following non-dioxin hot spot removal, excavation and on-site consolidation/capping of "remaining soil above human health risk levels…" A few comments:*

- *It is unclear to what extent there might be limitations on excavation to achieve human health PRGs under this alternative.*
- *DEQ continues to recommend pre-design sampling to support/refine assumptions about the depth of contamination exceeding, for example, human health PRGs. As noted in the Revised FS/SCE, fill is commonly deep, present to depths of up to 35 feet below ground surface (bgs). The human health PRG for dioxin (15 ng/kg TEQ) may be difficult to achieve.*

Action: Please discuss in detail how human health PRGs will be achieved under 4c. Is full removal contemplated (with no depth limitation), or only to, say, 3 feet bgs, if deeper contamination is encountered. Please identify if and when pre-design sampling is expected to occur.

Response: The intent under Alternative 4c is full removal of soil exceeding human health PRGs (with hot spot material disposed off-site and the remainder moved to the consolidation cell). Pre-design sampling is expected for the entire Facility. In the event that pre-design sampling identifies an area with

extensive soil above human health PRGs extending to depths greater than 2 feet, the practicality of consolidating that soil will be reassessed. It may be more appropriate to cap that material in-place (using the same type of engineered cap as would be used for the consolidation area) or to move the consolidation cell to that location. However, as discussed below, the current alternatives have substantial allowance for excavation of soil exceeding human health PRGs.

There are seven human health COCs for the Facility: four metals (antimony, arsenic, copper, and lead), cPAHs, PCBs, and dioxins/furans. Using the summary table below, the following discussion of these COCs demonstrates that dioxins/furans (entire Facility) and cPAHs (west end of Central Parcel) will control the depth of excavation.

COC Concentrations in Selected Samples

	Human Health PRG	DU-4	DU-5	DU-6	DU-7	Upland Samples
Antimony	24.3	2.89	1.3 - 1.5	<0.51	<0.52	NA
Arsenic	4.4	3.67	6.0 - 8.0	4.95	4.52	NA
Copper	11,000	65	196 - 293	404	102	NA
Lead	400	201	270 - 310	164	43	NA
cPAHs	0.55	0.3	0.36 - 0.43	1.1	0.45	NA
Total PCBs	0.74	--	--	--	--	ND - 0.733
Dioxins/Furans	1.5E-05	0.0001	0.000093 - 0.000168	0.00417	6.1E-05	NA

Concentrations in mg/kg

Upland samples defined as samples collected landward of the top of bank in the depth range of 0 to 10 feet.

NA = Not applicable

-- = Not analyzed

ND = Not detected

The summary results for COCs listed above suggest the following.

- Antimony, Copper, and Lead – The ISM results are a good indicator of potential results for verification sampling that would be completed post-remediation. The concentrations of antimony, copper, and lead are below the PRG, so these COCs are predicted to be acceptable regardless of the depth of excavation.
- Arsenic – The arsenic PRG is controlled by the background concentration. To compare to the ISM result, the mean default background concentration for the Portland Basin of 4.4 mg/kg was used for the PRG. The ISM results for arsenic range up to 8 mg/kg. In the event that cover soil would be imported to address the arsenic exceeding the PRG, the 95% UPL default background concentration of 8.8 mg/kg would be used to assess the suitability of imported soil for use as cover material. That is, soil with concentrations of arsenic up to 8.8 mg/kg could be used to cover the soil that contains 8 mg/kg or less arsenic. Therefore, from a verification sampling perspective, the concentration of arsenic is predicted to be acceptable regardless of the depth of excavation.

- cPAHs – The ISM results for benzo(a)pyrene toxicity equivalent (BaP Eq) are below the PRG except in DU-6 where the concentration exceeds the PRG by a factor of 2. Sample DU-6 was collected prior to the 2015 removal action that included cPAH hot spot removal in the area of DU-6. The concentrations of cPAHs in the hot spot area ranged from 0.45 to 22.8 mg/kg (samples Area-2-1 through Area-2-14a), and five of the 50 sub-samples for the DU-6 ISM sample were collected in the hot spot area. These results show that the hot spot area alone accounts for the ISM concentration detected in DU-6.[4] Therefore, within and near the cPAH hot spot in the western end of the Central Parcel, cPAHs may control the depth of excavation needed to remove soil exceeding human health PRGs.
- PCBs – The ISM samples were not analyzed for PCBs. However, for samples collected upland of the top of bank in soil to a depth of 10 feet or less, PCBs were either not detected, or when detected, the concentrations were less than the PRG.[5] Therefore, the concentration of PCBs is predicted to be acceptable for excavation depths of 10 feet or less.
- Dioxins/furans – Dioxin/furan ISM concentrations exceed the PRG in each exposure area. Therefore, the concentration of dioxins/furans may control the depth of excavation throughout the Facility.
- In summary, to address human receptors, dioxins/furans will control the depth of excavation throughout the facility except that cPAHs may control near the hot spot area at the west end of the Central Parcel.

Vertical profile sampling for dioxins was conducted on the Central Parcel. The following table summarizes the results.

Dioxin/Furan TEQ concentration in ng/kg - Vertical Profile Sampling

Location:	Area 2	Area 3	Area 3	Area 3 (Debris Area)	Area 6
Sample:	Area-2-10	Area-3-3	DU-6-COMP-5-3	DU-6-COMP-5-6	Area-6-9
Depth (ft.)					
0 - 0.5	17	29	577	860,000	7.1
0.5 - 1.0	2.2	10	10	420,000	0.65
1.0 - 1.5	20	15	12	110,000	0.82
1.5 - 2.0	--	--	--	77,000	--
2.0 - 2.5	--	--	--	61,000	--
2.5 - 3.0	--	--	--	180,000	--

Human Health PRG is 15 ng/kg

Area designations correspond to 2015 Removal Action areas. All samples located on Central Parcel.

-- = Not analyzed

[4] Assume 45 sub-samples are non-detect for cPAHs and five sub-samples at the mid-point of the concentrations detected in the hot-spot area. The predicted concentration of the ISM sample would be (45*0 + 5*(0.45 + 22.8)/2)/50 = 1.2 mg/kg compared to the actual value of 1.1 mg/kg.

[5] Total of 20 samples. PCBs were detected in two samples. For the 18 non-detect samples, two had detection limits greater than the PRG. For the remaining 16 samples, the detection limits for individual Aroclors were less than the total PCBs PRG. Two soil samples, collected from depths of greater than 10 feet within the log pond fill, had total PCB concentrations greater than the park user PRG. Because those samples were collected from deeper fill material, they are not representative of the soil to which park user receptors would be potentially exposed.

These results indicate that, outside of the debris area, removal of 0.5 feet of soil should meet the human health PRG. Additional data are available from the confirmation sampling conducted during the removal action. Results for samples collected from depths of 0.5 feet or greater are summarized in the following table.

Dioxin/Furan TEQ concentration in ng/kg - Removal Area Base Sampling

Sample	Depth (ft.)	TEQ
RA3-B1	0.5	14
RA3-B2	0.5	160
RA3-B3	0.5	29
RA3-B4	0.5	14
RA3-B5	0.5	130
RA3-B6	0.5	55
RA3-B7	0.5	78
RA3-B8	0.5	7.6
RA3-B9	0.5	2.2
RA3-B10	0.5	110
RA3-B11	0.5	9.1
RA3-B12	0.5	1,200
RA3-B13	0.5	36
RA3-B14	0.5	18
RA3-B15	0.5	0.017
RA3-B16	1	5.3
RA3-D-B1	5	140
RA3-D-B2	5	19
RA3-D-S1	0.5-1	1.5
RA3-D-S2	0.5-1	0.63
RA3-D-S3	3.5-4	4.9
RA3-D-S4	3.5-4	16

The “B” samples were collected at the base of the excavation outside the debris area, and the “D” samples were collected from the sidewalls and base of the debris area excavation. These results suggest that in the areas of higher concentration dioxins/furans (i.e., where surface concentrations exceeded TEQ concentrations of 1,000 ng/kg prior to the 2015 removal action), excavation depths of greater than 0.5 feet are required to meet human health PRGs. Except for directly beneath the debris area, excavation to a depth of 1 foot achieved the human health PRG.

Outside of the debris area, these dioxin/furan results are consistent with surface deposition impacting a relatively thin surface layer. It was assumed that this model would apply throughout the Facility. One

area where that model may not apply is the former log pond fill on the West Parcel. Four samples within and near the log pond fill were analyzed for dioxins/furans (DP-2, DP-4, DP-5, and Saturated Fill Soil). The first three samples were composited over a depth range of 10 to 30 feet and had TEQ concentrations ranging from 2.0 to 9.5 ng/kg. The latter sample was composited over a depth of 40 to 45 feet and had a TEQ concentration of 45 ng/kg. These results suggest that the log pond fill soil to depths of at least 30 feet will not exceed human health PRGs for TEQ.

Vertical profile sampling for cPAHs was conducted in the hot spot area at the west end of the Central Parcel. The following table summarizes the results.

cPAH concentration in mg/kg - Vertical Profile Sampling

Depth (ft.)	Location:	Area 2	
	Sample:	Area-2-10	Area-2-14
0 - 0.5		0.77	3.5
0.5 - 1.0		0.18	0.25
1.0 - 1.5		0.32	0.15

Human Health PRG is 0.55 mg/kg
Area designation corresponds to 2015 Removal Action area on west end of the Central Parcel.

These results indicate that removal of 0.5 feet of soil should meet the human health PRG. Additional data are available from the confirmation sampling conducted during the removal action. Results for samples collected from depths of 0.5 feet or greater are summarized in the following table.

cPAH concentration in mg/kg - Removal Area Base Sampling

Sample	Depth (ft.)	TEQ
RA2-B1	0.5	3.5
RA2-B2	0.5	6.9
RA2-B3	1	3.2

These results suggest that in the areas of higher concentration cPAHs (i.e., where surface concentrations exceeded hot spot concentrations targeted for removal in the 2015 removal action), excavation depths of greater than 1 foot will be required to meet human health PRGs.

In summary, the vertical profile sampling supports that human health PRGs can be achieved with excavation of 0.5 feet of soil except in the following areas:

- West Parcel: None.
- Central Parcel, West End:
    - Areas where surface soil dioxin/furan concentrations were greater than 1,000 ng/kg prior to the 2015 removal action. Excavation to a depth of 1 foot achieved is anticipated to achieve the PRG in these areas (except in the debris area).[6]
    - The debris area. Excavation beyond the five feet conducted during the 2015 removal action will be needed to achieve PRGs in this area.[7]
    - In and near the PAH human health hot spot area at the west end of the Central Parcel, excavation to a depth of greater than 1 foot is anticipated to achieve human health PRGs.[8]
- Central Parcel, East End: None.
- East Parcel: None.

These results suggest that the following excavation depths will achieve human health PRGs:

- West Parcel: 0.5 feet
- Central Parcel, West End: 1 foot (in the debris area on the order of 1 foot of <u>additional</u> excavation beyond the 2015 removal action depth)
- Central Parcel, East End: 0.5 feet
- East Parcel: 0.5 feet

In comparison, the following was assumed for the excavation depths for estimated remediation costs in the FS:

- West Parcel: 1.5 feet
- Central Parcel, West End: 2 feet
- Central Parcel, East End: 0.5 feet
- East Parcel: 0.5 feet

5. Oversight Costs. *For the recommended remedy, DEQ oversight would include both remedy implementation and monitoring in perpetuity. The oversight cost presented for Alternative 4c ($54,500) are considered low.*

<u>Action:</u> Please consider in revising cost estimates.

Response: Revised cost estimates including updated oversight costs are included in Attachment A to these response to comments.

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[6] The upper 0.5 feet of that material was removed in the 2015 removal action.
[7] The upper 5 feet of that material was removed in the 2015 removal action. Additionally, the PRG only applies to material in the depth range of 0 to 3 feet.
[8] The upper 0.5 feet of that material was removed from a portion of that area in the 2015 removal action.

EPA Comments

Primary Comments on Part I:

1. The revised report should be updated to address EPA's November 14, 2017 comments. Specifically, the comments included in the category "Previous Comments on Part I" have not been adequately addressed in this revised report.

Response: See the responses to comments in the category "Previous Comments on Part I."

To be Considered Comments on Part I:

1. Analytical results for groundwater are not presented in a way that supports the report nor are the results easily understandable for the reader. Plume maps for groundwater and non-aqueous phase liquids (NAPL) should be included to present the results of investigations and current conditions. Additionally, the table of contents for Appendix D indicates there is a figure included for CUL exceedances for polycyclic aromatic hydrocarbons (PAHs) in groundwater, but that figure is missing from the report.

Response: A separate report has been prepared presenting the groundwater data, groundwater Source Control Evaluation, and groundwater Source Control Alternatives Analysis. That report includes figures showing groundwater sampling locations, observations of sheen or NAPL (no NAPL plumes are present), locations where COCs (including PAHs) were detected above CULs, and groundwater plumes of COCs. The report includes a searchable database of groundwater data as well as tables presenting groundwater data in a format that is easily understandable to the reader.

Matters of Style Comments on Part I:

1. Groundwater and riverbank analytical data that were included as Tables 3 through 15 in the previous report have been moved to Appendix D. In many cases these tables are listed as "Provided as Electronic File." Currently, a reviewer of the PDF document cannot view pertinent concentration levels for groundwater or river banks. Given the importance of analytical data on the discussion and conclusions of the SCE, tables detailing analytical data for groundwater and river banks should be provided in the PDF at a similar level of detail as Tables 3 through 15 in the previous report.

Response: See response to EPA To Be Considered comments on Part I. Groundwater data tables are provided in the separate groundwater Source Control Evaluation report. Riverbank soil data tables are included with this response to comments in Attachment C.

2. The presentation of figures in Appendix D does not support the information in the document, is confusing, and should be revised. The figures listed in the table of contents for Appendix D do not match the figures presented in Appendix D. At a minimum, the table of contents lists a figure for CUL exceedances for PAHs in groundwater that is not included. Meanwhile, numerous references to figures in the text of Appendix D do not appear to match either the table of contents or the figures included.

Response: For the riverbank figures (D-1 through D-30), there were three figures where the Table of Contents title differed slightly from the figure title (Figures D-13, D-16, and D-22). For reference, a corrected Table of Contents is included with this response to comments as Attachment D. For the

groundwater figures, the PAHs figure was inadvertently omitted, and the order of the figures differed from the Table of Contents. The groundwater figures have been updated and revised. The revised figures are included in the separate groundwater Source Control Evaluation report.

3. Table D-3 is titled "Riverbank Soil COC Summary" but includes a summary of both river bank soil and groundwater. Please correct the title to be accurate of the content.

Response: Corrected in the new groundwater Source Control Evaluation report.

4. A footnote in Section 4.2.1 of Appendix D indicates there is a CUL for total petroleum hydrocarbon (TPH) specific to the C10-C12 aliphatic range. Additionally, Section 4.2.2 of Appendix D discusses CUL exceedances for TPH-diesel. However, Table D-8 (groundwater) does not list a CUL for C10-C12 aliphatic range. Please include the CUL for the C10-C12 aliphatic range in Table D-8. The analyses of groundwater samples should provide the petroleum hydrocarbon fractions and meet the reporting limits for comparison to the CUL for the C10-C12 aliphatics.

Response: Evaluation of TPH in groundwater is included in the new groundwater Source Control Evaluation report. As stated in Appendix D, and included in the new source control report, the historical data were not evaluated for the specific TPH range corresponding to the TPH CUL. However, the historical data are screened against the TPH CUL. Because the historical data included a broader carbon range than the target range of the TPH CUL, the screening conducted is conservative.

Previous Comments on Part I:

1. The SCE is incomplete and needs to be revised to provide data that could 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 the distribution of constituents of interest (COIs) in groundwater, historical releases, the potential for river bank erosion, and the potential for groundwater discharge to the river.

Response: Since this comment was originally provided, the river bank SCE was expanded to provide clarification/consolidation of observations/discussion on potential riverbank erosion (as summarized by Figures D-1 through D-6 of the FS). Each of the various lines of evidence for riverbank erosion (bed shear, slope steepness, surface characteristics, observed erosion features) are summarized on Figure D-6 in the FS and discussed in the FS Appendix D text. Specific conclusions on where bank repairs/stabilization/removal need to occur are not included as we understand that river bank source control is being addressed as part of the in-water action.

With respect to groundwater, a new Source Control Evaluation report has been prepared that addresses, among other topics, distribution of COI, historical releases, and potential for discharge of groundwater to the river.

2. 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 revised 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 or 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.

Response: The 2007 sheen observation is one incident in a span of 30 years when sheen was observed in a very small area on the beach near the former wharf road. The assessment determined that it was most likely that the material did not originate from the upland. Regardless, there has been extensive sampling of groundwater (through grab sampling and monitoring wells along the river bank) over a period of 30 years. Occasional sheens were observed on soil or water samples (primarily grab samples), but NAPL has not been observed on groundwater at the upland site. Sheen and NAPL observations are discussed and addressed in the new groundwater Source Control Evaluation report.

3. A table of groundwater elevations should be included in the SCE so that the data can be used to verify the conclusions. Additionally, Table D-7 presents well construction details in a datum that is different than the datum used in the text of the report. It is recommended that elevations in the report be presented in a consistent datum.

Response: The new groundwater Source Control Evaluation report includes tables with well construction details and groundwater elevations using the same datum as the rest of the report.

4. 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 is unknown, the outfalls should be investigated to determine if they are discharging contaminated sediment and soil to the Willamette River.

Response: The "outfalls" have been thoroughly investigated on multiple occasions. Some have been determined to be debris and not outfalls at all. For the others, no discharge has been observed and all upland facilities to which the pipes could have been connected have been demolished. There are no outfalls discharging stormwater from the Facility.

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 all regulatory requirements for waste classification. COIs include PAHs, dioxins/furans, polychlorinated biphenyls, and other chemicals that could result in waste being characterized as hazardous for characteristics other than toxicity per the Resource Conservation and Recovery Act and/or Oregon Hazardous Substance Rules, and/or regulated under other regulatory programs such as those established under the Toxic Substances Control Act. The testing framework should be reviewed and revised to account for all waste characterization requirements.

Response: Section 2.11 is not intended to substitute for waste designation at the time of the remedial action. Rather, it is included to support that the cost estimate is based on the soil being non-hazardous. That said, toxicity is expected to be the primary differentiator because there is no process knowledge to identify wastes as listed wastes; the waste will be essentially soil so other characteristics (ignitability, corrosivity, or reactivity) are unlikely to control; and the lack of PCBs or building materials in upland soil rule out applicability of TSCA rules.

6. 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 feature may be important for the conceptual site model.

Response: The information known about the log pond is included in the new groundwater Source Control Evaluation report.

Primary Comments on Part II:

1. The feasibility study portion of the revised report should be updated to incorporate revisions to the SCE and the site model based on the "Part I" comments provided on Sections 1 through 5 of the revised report.

Response: The comments on Part I that could impact portions of the feasibility study are related to either the river bank or groundwater source control. The river bank is being addressed with the in-water work so is not addressed in the upland feasibility study. The new groundwater Source Control Alternatives Evaluation report includes a focused feasibility study for groundwater source control that considers the information in the comments on Part I.

2. The revised report should be updated to address the comments provided by EPA dated November 14, 2017. Specifically, the comments included in the category "Previous Comments on Part II" have not been adequately addressed in this revised report.

Response: See the responses to comments in the category "Previous Comments on Part II."

3. Groundwater is excluded from the feasibility study portion of the revised report. EPA expects that this revised report should indicate that groundwater migration to surface water is a complete pathway and remedial action objectives should be established to prevent migration of groundwater exceeding CULs into surface water and river sediments. Groundwater exceeding CULs should be presented as part of the remedial action area and extent in Section 7. Technologies screened, and remedial alternatives developed in Section 8 should include groundwater remedial components to address the groundwater migration pathway.

Response: The new groundwater Source Control Alternatives Evaluation report includes a focused feasibility study addressing remedial action objectives, remedial action area, technology screening, and evaluation of groundwater remediation alternatives.

To be Considered Comments on Part II:

1. For clarity, Section 7 should include a statement indicating that river banks will be addressed as part of in-water activity and therefore are not included in the remedial action area. A statement about the exclusion of river banks is included in an earlier section, but it would be helpful to include again in Section 7.

Response: Acknowledged.

2. The proposed caps, described in Section 9, must have specific rationale and objectives for their use. The descriptions include an amended cap that will potentially use activated carbon or organic matter to sequester organic chemicals of concern (COCs). The purpose of using amendments is unclear because the caps are meant to contain contaminated soil, whereas amended caps are conventionally used to reduce mobility and bioavailability of aqueous/dissolved contaminant concentrations due to groundwater/porewater advection through caps. Additionally, the text states that the caps will be effective because the COCs have low solubility and are immobile, but the text does not identify or address groundwater migration in the area. Clarify the purpose of using amended caps for the containment of contaminated soil and what type of COC migration is expected through the caps.

Response: We recognize that the single term "cap" is used throughout the document to represent a range of particular technologies. Use of this single term has caused confusion. To clarify the terms, "cap", "cover", and "amended cover" are defined as follows.

- Cap – An engineered barrier designed to prevent direct contact between human/ecological receptors and underlying soil. This barrier would have multiple layers that at a minimum would include a demarcation layer, a bioturbation barrier, and an erosion prevention layer. The erosion prevention layer could consist of topsoil with vegetation, gravel/rip rap, or pavement. Where gravel/rip rap or pavement are used for the erosion prevention layer, these features could also serve as the bioturbation barrier.
- Cover – A layer of soil with vegetation. In general, a cover would be used in areas that only slightly exceed cleanup levels. The cover is not intended to be an impenetrable layer. Rather it is expected that over time the cover material would mix with underlying soil, and the long-term result would be acceptable concentrations throughout the soil column. As such, a cover would not include a demarcation layer or a bioturbation barrier.
- Amended Cover – A cover that includes additives intended to reduce the bioavailability of the contaminants in the soil. The intent of amended cover options is to provide alternatives that would be less destructive of the existing native vegetation. Saving the native vegetation however, could leave concentrations in soil that would be higher than could be addressed only by mixing with the cover soil. Hence the inclusion of additives to reduce bioavailability. Unfortunately, there is little experience with the efficacy of this approach in the upland environment. As a result, alternatives with an amended cover were not recommended for implementation[9] because of the uncertainty associated with the effectiveness of the amendment.

Using the above definitions, the alternatives in the feasibility study are clarified as follows.

- Alternative 2a: Cap: This alternative primarily consists of a cap placed over the entire site.
- Alternative 2b: Amended Cover: This alternative includes the placement of an amended cover over the entire site.
- Alternative 3a: Standard Excavation with Off-Site Disposal: This alternative includes the complete removal of impacted soils from the site to a licensed landfill.

[9] We acknowledge some confusion on this issue. As correctly described in the FS report text, the recommended alternative (4c) does not include amendments in the cover soil. However, the cost estimate incorrectly included amendment purchase and mixing. This has been corrected in the revised cost estimates included in Attachment A to these response to comments.

- Alternative 3b: Alternative Excavation with Off-Site Disposal: This alternative includes removal of impacted soil from the site using revised excavation techniques to save designated native trees. Areas that are not excavated to cleanup levels (i.e., areas with trees to be saved) would get a cover.
- Alternative 3c: Standard Excavation with On-Site Consolidation: This alternative includes excavation of impacted soil and consolidating the soil on-site beneath a cap.
- Alternative 3d: Standard Excavation with Off-Site Disposal and On-Site Consolidation: This alternative includes excavation of impacted soil with higher concentrations of COCs (non-dioxin/furan hot spots) for off-site disposal and consolidating the remaining soil on-site beneath a cap.
- Alternative 4a: Focused Standard Excavation with Off-Site Disposal and Cap – This alternative includes excavation of impacted soil with higher concentrations of COCs (non-dioxin/furan hot spots) for off-site disposal and capping remaining areas of impacted soil.
- Alternative 4b: Focused Alternative Excavation with Off-Site Disposal and Amended Cover: This alternative includes excavation of impacted soil (using alternative excavation techniques) from non-dioxin/furan hot spot areas for off-site disposal. The remaining areas would get an amended cover.
- Alternative 4c: Focused Alternative Excavation with Off-Site Disposal, On-Site Consolidation/Cap, and Cover: This alternative includes excavation of impacted soil (using alternative excavation techniques) with higher concentrations of COCs (non-dioxin/furan hot spots) for off-site disposal; consolidation on-site of soil exceeding human health PRGs beneath a cap; and covering soil exceeding ecological PRGs.

3. Since rainfall, runoff, and wind erosion are expected at the site, describe erosion protection or other measures that may be required to ensure that the caps presented as part of the remedial alternatives are not damaged or reduced in thickness, and continue to function as intended.

Response: All final surfaces, whether caps, covers, or excavations, will be restored with native vegetation to prevent erosion from rainfall, runoff, or wind. Figure 21 in the FS presents the typical final cross-sections for the various alternatives. See response to DEQ Comment 2 on the Feasibility Study for additional discussion of protection from seismic events, river flooding, and climate change. See response to DEQ Comment 7 on the Feasibility Study for additional discussion of the design of the engineered caps for cap alternatives.

Previous Comments on Part II:

1. 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 revised report is consistent with Oregon Administrative Rule (OAR) 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 (EPA 1993). Several issues arise that cause EPA to question the efficacy of the recommended upland remedy.

Response: Since this comment was submitted, the scope and approach for the feasibility study has been revised. The riverbank is no longer included in the scope of the feasibility study. Therefore, the upland alternatives are being evaluated only against the DEQ OAR requirements.

2. 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 and/or the requirements of the JSCS. Section A.1.3 of the JSCS states that hot spots of contamination are principal threats, as defined in the National Contingency Plan (NCP), and must be treated wherever practicable (EPA and DEQ 2005). Further requirements and details are in the OAR 340-122-0085 and defined in OAR 340-122-115(32). To be consistent with the ROD, all areas with chemicals concentrations greater than the threshold values listed in Table 21 of the ROD, which comprise principal threat waste (PTW), should be addressed by active remediation, and considered equivalent to the requirements of provisions in OAR 34-122. Consistency and compatibility with the ROD criteria to delineate action areas has particular significance for PCBs and the dioxin/furan congeners in areas near the river bank.

Response: Since this comment was submitted, the scope and approach for the feasibility study has been revised. The riverbank is no longer included in the scope of the feasibility study. Therefore, the upland alternatives are being evaluated only against the DEQ OAR requirements.

3. Basic terminology, including but not limited to CERCLA engineering evaluation/cost analysis (EPA 1993), PTW, and not reliably contained PTW should be consistent with the JSCS (EPA and DEQ 2005) and ROD (EPA 2017).

Response: Since this comment was submitted, the scope and approach for the feasibility study has been revised. The riverbank is no longer included in the scope of the feasibility study. Therefore, the upland alternatives are being evaluated only against the DEQ OAR requirements.

YAKAMA NATIONS COMMENTS

Future Use. *The recommended alternative 4c does not adequately consider, incorporate, or provide a protective remedy for future anticipated uses of the property. Historical operations at the Willamette Cove facility have resulted in extensive contaminant impacts to soil (surface, subsurface, riverbank, beach), groundwater, and in-river sediments. Currently the site provides one of the rare opportunities within the Portland Harbor area to access the Willamette River and its beaches, and in its vacant and vegetated state provides both upland and aquatic habitat. As a result, it serves is an attractant for local Portland residents and fishers (despite signage), as well as habitat for wildlife and aquatic life. Future use and zoning of the site includes plans for a greenway with paths; ecological restoration to support aquatic, bird and native vegetation; potential mitigation work for credits; and possibly a public park or viewing areas. Future use of the site will not be industrial, and therefore only cleanup alternatives that are fully protective of human and ecological uses should be allowed to move forward. It is not appropriate to use the site as a repository for persistent, bioaccumulative contamination adjacent to the river. Instead of fully addressing contamination to allow for full use of the planned greenway, natural area, or park, the recommend alternative 4C heavily utilizes institutional controls (signs, fences, deed restrictions) to restrict human access. The vision and layout for the property end use is not entirely clear in this report. For example, it is not clear how much or what portions of the site are recommended to be*

restricted from human or ecological uses. Most recently, restricting access at Willamette Cove has not prevented trespassers and fishers from utilizing the site and access restrictions don't work for most ecological receptors. We suggest providing additional detail on the end-use vision(s) and conceptual design(s) so that they can be incorporated into the FS work, prior to selecting a remedy. This visioning and conceptual design work is also critical for considering how any remedial action on the riverbank and beaches might impact upland areas (and vice versa). In addition, we urge the responsible parties to engage and coordinate with the community on their vision for future use of this publically owned property prior to selecting a remedy. Lastly, we recommend incorporating habitat or mitigation needs into the FS evaluation process.

Response: We believe that this comment mischaracterizes the adequacy of the proposed remedial action. In summary, the major elements of the proposed remedy include the following:

- Soil exceeding hot spot concentrations for all chemicals of concern (COCs) except dioxins/furans would be excavated and disposed of in an off-site landfill.[10] During the removal action in 2015, soil with dioxins/furans greater than 0.001 mg/kg were removed from the site and disposed of in an off-site landfill. Following the hot spot removal proposed in the recommended alternative, there would be no human health hot spots remaining at the site. There would be small areas remaining with ecological (bird and mammal) hot spots resulting from dioxins/furans.
- After the hot spot removal, any soil remaining on the site with concentrations of COCs exceeding human health risk levels would be consolidated in one location and capped with an engineered cap to prevent direct contact by human or ecological receptors. The consolidation area would constitute less than 20 percent of the total site area. The remaining 80 percent of the site would then be suitable for recreational activity by human receptors with no additional restrictions. Contrary to the comment, the proposed remedy does not heavily utilize institutional controls. Only the consolidated cap area (less than 20 percent of the overall area) would use institutional controls for human health, and those would be only for the purpose of preventing disturbance of the cap. The cap, by preventing direct contact, would provide the primary risk control for that portion of the remedy.
- The remaining soil outside the consolidation area would have some areas of soil exceeding the ecological risk levels. Of the 14 ecological COCs, only one COC would exceed risk levels for each invertebrates and birds, two COCs would exceed for plants, and four COCs would exceed for mammals. The maximum exceedance of a risk level would be by a factor of 3.5. These remaining areas with soil concentrations above ecological risk levels would be covered with a layer of soil and revegetated to re-create natural habitat or allow park uses, consistent with the long-term end use of the property. This cover soil would not be a cap. Rather, in the short run, the soil would act as a barrier to direct contact by surface ecological receptors. Over time, the soil cover will mix with the underlying soil resulting in an overall acceptable concentration in the soil. The thickness of the cover soil will be determined based on verification sampling conducted during construction.

Groundwater. *Without source control, soil and groundwater pathways are determined to be complete pathways for contaminants to reach surface water and river sediments. However the recommended*

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[10] As written in the FS, this recommended alternative would use alternative excavation techniques to save mature native trees. This approach, however, could leave concentrations of chemicals in soil exceeding the target goals. The DEQ is evaluating this option and will ultimately decide if alternative or standard excavation techniques will be used.

alternative 4C addresses only surface soils. Further consideration should be given to groundwater contaminant source and transport to the river so that a more protective cleanup is selected.

Response: The FS report addresses only the upland soil area. The riverbanks, beaches, and sediments will be addressed in the in-water cleanup action. The riverbank observations and data were provided in Appendix D for use by the in-water design team to address riverbank source control. Additionally, a separate report has been prepared presenting the groundwater data, groundwater Source Control Evaluation, and groundwater Source Control Alternatives Analysis.

Riverbanks. *This FS evaluates primarily the upland areas and specifically excludes the river bank, which is anticipated to be incorporated into the in-river cleanup. However, the upland and in-river cleanups are not disconnected and this report needs to provide additional evaluation into what is needed for cleanup and future use goals in the transition area from upland to in-river sediments so that the upland and in-river remedies are compatible. In addition, future monitoring of the riverbank and beaches should be included to ensure that any possible releases are identified.*

Response: The Portland Harbor ROD identifies river bank remedies for river banks in two broad categories: 1) river banks that are erosive or that contain principal threat waste are addressed through active remedies such as capping, excavation, or a combination of these; and 2) non-erosive banks that do not contain principal threat waste are addressed by monitoring. Active upland remedies include excavation, capping, or a combination of these. Figures 8 and 9 of the FS show how each of the potential upland remedies would coordinate with each of the potential river bank remedies sufficiently for selecting a final remedy. The specific details connecting the upland and river bank work will be addressed in remedy design. Future monitoring requirements for the river banks and beaches will be specified as part of the in-water remedy.

Hotspots. *The recommended alternative 4C cuts corners to provide cost savings by excavating and disposing off-site all hotspots except dioxins/furans. This approach neither complies with the hotspot guidance nor does it provide long-term protective of the resources.*

Response: The recommended alternative does not "cut corners." It is a common misconception that the hot spot rule mandates removal of hot spots. Rather, the rule requires that a higher threshold of cost be considered when evaluating the efficacy of removal/treatment of hot spots. In fact, the vast majority of the hot spot soil will be removed from the site (through the 2015 removal action and the proposed hot spot removal in the final remedy), and the evaluation of the remedies was conducted in accordance with the hot spot rule.

Seismic criteria, climate change, flood rise potential are not mentioned in this report. Although they will be considered in more detail in the design stage, these should be considered at a high level in the FS as well.

Response: See response to DEQ Comment 2 on the Feasibility Study.

Consolidation and capping. *Dioxins/furans are highly toxic and bioaccumulative contaminants that will persist for hundreds to thousands of years. We do not agree with capping them on site, adjacent to the river. The text of this report does not indicate general design considerations that would prevent*

bioturbation for the long-term. The cost tables do include demarcation fabric, but it is unclear why, how, and where it will be used.

Response: As stated in the response to the preceding comment, the vast majority of dioxin/furan mass will be removed from the site. Only residual concentrations of dioxins/furans will be consolidated on-site. See response to DEQ Comment 7 on the Feasibility Study for additional discussion of the proposed engineered cap for the consolidation area.

2.9.2. *It was stated in this section that non-aqueous phase liquid (NAPL) was found near the McCormick and Baxter site, which was excavated to the river. The discussion implies that there may still be some NAPL off-shore. Is this possibility being explored by EPA?*

Response: The NAPL was discovered on the inner cove beach during initial work associated with the McCormick & Baxter cap in Willamette Cove. The extent of NAPL was delineated landward with test pits and excavated for off-site disposal. This information is provided in the source control evaluation information and will be considered by EPA in design of the in-water remedy.

2.9.3 *This section noted that petroleum sheen has been observed at times on the beach, but the source of that sheen was not well identified. The site investigations included some groundwater measurements which did not indicate a problem, but it is not clear that those investigations were either in the correct place or of sufficient density to find potential upland sources. This issue may be address more directly in the riverbank remedy, but the possible link to an upland source should be determined before the upland remedy is implemented.*

Response: See response to EPA Comment 2 in the category "Previous Comments on Part I."

3.1. *Overland runoff was not evaluated as a potential migration pathway from the site to the river, but it seems likely. It should be evaluated and discussed to determine (1) if it is a complete pathway and (2) whether the alternatives will address it.*

Response: Overland runoff is addressed in Section 3.2.1 of the FS. As stated in that section, there have been no overland flow erosion features observed on the river bank during any of the multiple river bank surveys (with the one exception described below). In addition, a site visit was conducted during a heavy rainfall event specifically to observe for overland flow to the riverbanks. Although ponding of precipitation occurred, the ponded water did not flow over the banks and eventually infiltrated. The one exception is the beach area toward the western end of the Central Parcel. Foot traffic has eroded a pathway to the beach in the area of observed bank erosion from river action. Very local runoff is captured by the pathway, but as stated, this is located in an area of erosion that will otherwise be addressed by the river bank source control.

3.2.1. *The discussion also noted that various debris has been observed on the beaches and indicated that the presence and type of debris changes over time. Why? Doesn't this indicate the beaches and river bank are eroding or are unstable?*

Response: It is unclear to what this comment is referring. Debris is not discussed in Section 3.2.1. Debris observations on the beaches is discussed in Section 2.9.1. That section does not indicate that the debris presence and type changes with time. One sentence in Section 2.9.1 does state that "debris is

only occasionally present" and this may be a source of confusion. The intent of the statement was to indicate that debris is not present over the entire beach but rather at scattered locations.

5.1.1. *The FS makes an argument for the depth of contamination in the surface soils to be limited to the upper few feet, and proposes confirming that any removals are performed to clean soil. We recommend considering the advantages of instead doing more pre-design sampling in removal areas to guide the design. The site consists of many feet of fill and the heterogeneity and varied sources of fill always has the possibility of smaller locations of deeper contamination.*

Response: The statement regarding confirmation sampling is intended to make it clear that the depth of excavation will not rely on any pre-excavation sampling but will be verified during construction. Pre-design sampling is not precluded and in fact is expected. Costs for pre-design sampling are included in the cost estimates.

Figure 20. Alternative 4C. *This figure did not seem to accurately depict the site features, which makes it difficult to evaluate what areal extent of soil removal, consolidation, and capping is proposed.*

Response: It is not known to what site features the comment is referring. We do note that the line type used to define the hot spot excavation areas is not well defined. For reference, the hot spot excavation areas on Figure 20 correspond to the solid green areas shown on Figure 19.

THE TRIBES COMMENTS

1) Pending DEQ's final determination of the preferred remedy for the upland site, we recommend additional consideration of the erodibility with respect to the 100-year and 500-year floods. The issue of potential erosion above the top of the bank during floods is not directly addressed in the FS, and the figures do not clearly show elevations within the footprint of the proposed consolidation area. Figure 2 indicates elevations somewhere between 30 and 40 feet NAVD88 elevation, and the 100-year and 500-year flood elevations are reported as 31.2 and 35.2 feet, respectively. Based on this, it appears the consolidation area could perhaps be inundated by a 100-year flood and almost certainly by a 500-year flood. While the location is sheltered and unlikely to be exposed to strong erosive forces, inundation could compromise the remedy and should be considered in the remedial design. Elsewhere on the site, where capping is the proposed remedy, the potential for cap erosion during flood events should be analyzed and mitigation measures taken if necessary. Riprap or other measures may be considered to provide additional stabilization, provided the benefits outweigh any other potential detriments (e.g., habitat degradation) associated with their construction.

Response: See response to DEQ Comment 2 on the Feasibility Study.

2) The SCE identifies both river bank soils and groundwater as complete migration pathways to the Willamette River. However, the SCE notes that source control remedial action to address river bank soils and groundwater will be conducted concurrent with the Willamette Cove in-water work, rather than concurrent with upland work. While coordination of the river bank remedial action with the inwater work is appropriate, further characterization of the groundwater pathway and an evaluation of remedial technologies should be prioritized in order to control the potential groundwater-to-surface water migration of contaminants in parallel with remedial action for the upland portion of the site.

Response: A separate report has been prepared presenting a groundwater Source Control Evaluation and groundwater Source Control Alternatives Evaluation.

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

Sincerely,

Dwight Leisle
Environmental Project Manager

c: Dan Hafley, DEQ
David Lacey, DEQ
Jennifer Peterson, DEQ
Mike Poulsen, DEQ
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

Attachments

A Revised Remedial Alternative Cost Estimates - Tables 11-22 - 2019 Revised FS
B Seismic/Flooding Consideration Figures
C Riverbank Soil Summary Data Tables
D Revised Table of Contents – Appendix D - 2019 Revised FS

Attachment A

Revised Remedial Alternative Cost Estimates from Tables 11-22 - 2019 Revised FS

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
AREA							
Site Features - Above MHW							
Parcel Total	ft^2	210,023	214,418	212,364	339,848	976,654	These quantities were used for site clearing assuming the riverbank would be cleared during the same mobilization. Equals 22.4 ac.
Forested - All Species	ft^2	105,012	107,209	106,182	146,328	464,731	
Unforested	ft^2	105,012	107,209	106,182	146,328	464,731	
Site Features - Above TOB							
Parcel Total	ft^2	187,719	167,246	184,757	303,144	842,866	Total area of potential remediation. Equals 19.3 ac.
Forested - All Species	ft^2	93,859	83,623	92,379	127,976	397,837	Based on aerial photos, assummed half total area less concrete pad is forested.
Forested - Designated Native Species - Excavated in 2015	ft^2	0	6,067	6,300	0	12,367	Actual area as documented in Removal Action Report.
Forested - Designated Native Species not Excavated in 2015	ft^2	19,074	3,227	3,098	24,412	49,811	Total area mapped during Removal Action design (based on site reconnaissance and historical habitat assessment) less area excavated in Removal Action.
Forested - Designated Native Species - Remaining on Site Within Non-Dioxin Hot Spots	ft^2	1,907	1,194	753	0	3,854	For West Parcel, this was assumed to be 10% of forested area.
Unforested	ft^2	93,859	83,623	92,379	127,976	397,837	Half total area above TOB less the concrete pad area. Equals 8.6 ac
Concrete Pad	ft^2	0	0	0	47,193	47,193	Concrete pad located on West Parcel.
Soil Consolidation Area - Small	ft^2	0	0	0	115,726	115,726	As shown for Alternative 4c on Figure 20.
Soil Consolidation Area - Large	ft^2	0	0	38,762	161,418	200,181	As shown for Alternative 3c and 3d on Figures 16 and 17.
Concrete Pad Outside of Large Soil Consolidation Area	ft^2	0	0	0	5,663	5,663	Portion of concrete pad on West Parcel not covered by large consolidation area. See, for example Figure 16.
Concentrated Debris Area	ft^2	0	5,204	0	0	5,204	Area excavated to a depth 5 feet during 2015 soil removal action.

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
AREA							
Ecological Risk Areas							
Above PRGs	ft^2	187,719	162,042	184,757	255,952	790,470	Total Facility area above TOB minus the concrete area and concentrated debris area. See Figure 6.
Dioxin Hot Spots	ft^2	187,719	162,042	184,757	255,952	790,470	Total Facility area above TOB minus the concrete area and concentrated debris area. See Figure 6 showing ecological hot spots covering entire Facility.
Non-Dioxin Hot Spots	ft^2	187,719	55,749	36,951	0	280,419	Scaled from Figures 6 and 7.
Assumed Non-Dioxin Hot Spots After Remedial Design Sampling	ft^2	18,772	55,749	36,951	0	111,472	As the West Parcel is only slightly above the hot spot concentrations, it was assumed that remedial design would further delineate this area to 10% of parcel. These areas are shown on Figure 11.
Human Health Risk Areas							
Above PRGs	ft^2	187,719	162,042	184,757	255,952	790,470	Parcel area minus the concrete area and concentrated debris area. See Figure 7.
Dioxin Hot Spots	ft^2	0	0	0	0	0	Human health dioxin hot spots removed to property line and TOB during 2015 removal action.
Non-Dioxin Hot Spots	ft^2	0	796	0	0	796	Small area of cPAH hot spot remaining after 2015 removal action - see Figure 7.

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
CAP OR COVER THICKNESSES AND EXCAVATION DEPTHS							
Cap or Cover Thicknesses							
Cap Layers							
Gravel Transition Layer	ft	0.5	0.5	0.5	0.5		Total cap thickness is 3 feet, consisting of a 2-foot burrowing animal barrier overlain by 1 foot of topsoil.
Cobble Layer	ft	1.5	1.5	1.5	1.5		
Topsoil	ft	1.0	1.0	1.0	1.0		
Cover Soil							
Topsoil - Amended Cover	ft	1.0	1.0	1.0	1.0		
Topsoil - Site Restoration - Standard Excavation	ft	1.0	1.0	1.0	1.0		
Topsoil - Site Restoration - Alternative Excavation	ft	0.5	0.5	0.5	0.5		
Average Cover (Topsoil) Over Ecological Risk Areas	ft	1.5	1.5	1.5	1.5		The cover thickness will range from 0-2.5 ft
Excavation Within Area of Trees to be Saved							
Forested - Designated Native Species not Excavated in 2015	ft	0.5	0.5	0.5	0.5	--	This is the maximum depth that will be excavated around native trees.
Ecological Risk Areas							
Above PRGs	ft	2.0	3.0	1.0	1.0	--	
Dioxin Hot Spots	ft	1.0	1.0	1.0	1.0	--	
Non-Dioxin Hot Spots	ft	1.0	1.0	1.0	1.0	--	
Human Health Risk Areas							
Above PRGs	ft	1.5	2.0	0.5	0.5	--	See response to DEQ Comment #4 on Alternative 4c.
Dioxin Hot Spots	ft	0.5	0.5	0.5	0.5	--	
Non-Dioxin Hot Spots	ft	0.5	0.5	0.5	0.5	--	

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
ALTERNATIVE SPECIFIC QUANTITIES							
Alternative 2a - Standard Cap							
Site Clearing (Forested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Site Clearing (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Area to be Capped	ft^2	187,719	162,042	184,757	255,952	790,470	All soil above PRGs. This is the total area above TOB less the concrete pad area on West Parcel.
Cap Gravel Layer Thickness	ft	0.5	0.5	0.5	0.5		
Purchase/Deliver Gravel for Cap	cy	3,476	3,001	3,421	4,740	14,638	
	ton	6,605	5,701	6,501	9,006	**27,813**	
Cap Cobble Layer Thickness	ft	1.5	1.5	1.5	1.5		
Purchase/Deliver Cobble for Cap	cy	10,429	9,002	10,264	14,220	43,915	
	ton	19,815	17,104	19,502	27,017	**83,439**	
Cap Topsoil Layer Thickness	ft	1.0	1.0	1.0	1.0		
Purchase/Deliver Topsoil for Cap	cy	6,953	6,002	6,843	9,480	29,277	
	ton	11,124	9,603	10,949	15,168	**46,843**	
Place and Compact	**cy**	20,858	18,005	20,529	28,439	**87,830**	
Site Grading	**ac**	4.8	4.9	4.9	6.7	**21.3**	
Re-Vegetation - Cap Vegetation	**ac**	4.8	4.9	4.9	6.7	**21.3**	

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
ALTERNATIVE SPECIFIC QUANTITIES							
Alternative 2b - Amended Cover							
Site Clearing (Forested)	**ac**	2.0	2.2	2.2	2.8	**9.2**	Assumes total area above PRGs cleared except native tree stands.
Site Clearing (Unforested)	**ac**	2.8	2.5	2.5	3.9	**11.8**	Includes grass/shrub removal within native tree stands.
Area Amended Cover	ft^2	187,719	155,975	178,457	255,952	778,103	All soil above PRGs except designated tree areas excavated in 2015.
Topsoil Cover Thickness	ft	1.0	1.0	1.0	1.0		
Purchase/Deliver Topsoil for Cover	cy	6,953	5,777	6,610	9,480	28,819	
	ton	11,124	9,243	10,575	15,168	**46,110**	
Place and Compact	**cy**	6,953	5,777	6,610	9,480	**28,819**	
Site Grading	**ac**	4.4	4.7	4.7	6.2	**19.9**	
Re-Vegetation (Forested)	**ac**	2.0	2.2	2.2	2.8	**9.2**	
Re-Vegetation (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	Same as unforested clearing except no restoration in native trees stands that remain

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
ALTERNATIVE SPECIFIC QUANTITIES							
Alternative 3a - Standard Excavation with Off-Site Disposal							
Site Clearing (Forested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Site Clearing (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Area to be Excavated	ft^2	187,719	162,042	184,757	255,952	790,470	All soil above PRGs.
Excavation Depth	ft	2.0	3.0	1.0	1.0		
Soil Excavation and Load (Standard)	**cy**	13,905	18,005	6,843	9,480	**48,232**	
Transport Off-Site	cy	13,905	18,005	6,843	9,480	48,232	
	ton	23,639	30,608	11,633	16,115	**81,995**	
Topsoil Thickness	ft	1.0	1.0	1.0	1.0		
Purchase/Deliver Topsoil for Site Restoration	cy	6,953	6,002	6,843	9,480	29,277	
	ton	11,124	9,603	10,949	15,168	**46,843**	
Place and Compact	**cy**	6,953	6,002	6,843	9,480	**29,277**	
Site Grading	**ac**	4.8	4.9	4.9	6.7	**21.3**	
Re-Vegetation (Forested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Re-Vegetation (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
ALTERNATIVE SPECIFIC QUANTITIES							
Alternative 3b - Alternative Excavation with Off-Site Disposal							
Site Clearing (Forested)	**ac**	2.0	2.2	2.2	2.8	**9.2**	Assumes total area above PRGs cleared except native tree stands.
Site Clearing (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Area to be Excavated (Standard)	ft^2	168,645	152,748	175,359	231,540	728,292	All soil above PRGs except designated tree areas.
Standard Excavation Dept	ft	2.0	3.0	1.0	1.0		
Area to be Excavated (Alternative)	ft^2	19,074	3,227	3,098	24,412	49,811	Remaining designated tree areas on site.
Alternative Excavation Depth	ft	0.5	0.5	0.5	0.5		
Soil Excavation and Load (Standard)	**cy**	12,492	16,972	6,495	8,576	**44,535**	
Soil Excavation and Load (Alternative)	**cy**	353	60	57	452	**922**	
Transport Off-Site	cy	12,845	17,032	6,552	9,028	45,457	
	ton	21,837	28,954	11,139	15,347	**77,277**	
Topsoil Thickness - Standard Excavation Area	ft	1.0	1.0	1.0	1.0		
Topsoil Thickness - Alternative Excavation Area	ft	0.5	0.5	0.5	0.5		
Purchase/Deliver Topsoil for Site Restoration	cy	6,599	5,717	6,552	9,028	0	Includes both alternative excavation areas and standard excavation areas.
	ton	10,559	9,147	10,483	14,444	**44,634**	
Place and Compact	**cy**	6,599	5,717	6,552	9,028	**27,896**	
Site Grading	**ac**	4.4	4.7	4.7	6.2	**19.9**	
Re-Vegetation (Forested)	**ac**	2.0	2.2	2.2	2.8	**9.2**	
Re-Vegetation (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
ALTERNATIVE SPECIFIC QUANTITIES							
Alternative 3c - Standard Excavation with On-Site Consolidation							
Site Clearing (Forested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Site Clearing (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Area to be Excavated (Standard)	ft^2	187,719	162,042	145,995	136,063	631,819	Areas with soil above PRG minus the large soil consolidation area footprint.
Soil Excavation and Load (Standard)	**cy**	13,905	18,005	5,407	5,039	**42,356**	
Transport/Place On-Site	**cy**	13,905	18,005	5,407	5,039	**42,356**	
Area to be Capped	ft^2	0	0	38,762	161,418	200,181	
Cap Gravel Layer Thickness	ft	0.5	0.5	0.5	0.5		
Purchase/Deliver Gravel for Soil Consolidation	cy	0	0	718	2,989	3,707	
Area Cap	**ton**	0	0	1,364	5,680	**7,043**	
Cap Cobble Layer Thickness	ft	1.5	1.5	1.5	1.5		
Purchase/Deliver Cobbles for Soil Consolidation	cy	0	0	2,153	8,968	11,121	
Area Cap	**ton**	0	0	4,092	17,039	**21,130**	
Cap Topsoil Layer Thickness	ft	1.0	1.0	1.0	1.0		
Purchase/Deliver Topsoil for Soil Consolidation	cy	0	0	1,436	5,978	7,414	
Area Cap	**ton**	0	0	2,297	9,566	**11,863**	
Topsoil Layer Thickness - Restoration Area	ft	1.0	1.0	1.0	1.0		
Purchase/Deliver Topsoil for Site Restoration	cy	6,953	6,002	5,407	5,039	23,401	
Area	**ton**	11,124	9,603	8,652	8,063	**37,441**	
Place and Compact Cap Soils	**cy**	0	0	4,307	17,935	**22,242**	
Place and Compact Restoration Soil	**cy**	6,953	6,002	5,407	5,039	**23,401**	
Site Grading	**ac**	4.8	4.9	4.9	6.7	**21.3**	
Re-Vegetation (Forested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Re-Vegetation (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
ALTERNATIVE SPECIFIC QUANTITIES							
Alternative 3d - Standard Excavation with Off-Site Disposal and On-Site Consolidation							
Site Clearing (Forested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Site Clearing (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Area to be Excavated (Standard)	ft^2	187,719	162,042	145,995	136,063	631,819	Areas with soil above PRG minus the large soil consolidation area footprint.
Soil Excavation and Load (Standard)	**cy**	13,905	18,005	5,407	5,039	**42,356**	
Transport/Place On-Site	**cy**	13,210	15,940	4,039	5,039	**38,228**	
Transport Off-Site	cy	695	2,065	1,369	0	4,129	
	ton	1,182	3,510	2,327	0	**7,019**	
Area to be Capped	ft^2	0	0	38,762	161,418	200,181	
Cap Gravel Layer Thickness	ft	0.5	0.5	0.5	0.5		
Purchase/Deliver Gravel for Soil Consolidation	cy	0	0	718	2,989	3,707	
Area Cap	**ton**	0	0	1,364	5,680	**7,043**	
Cap Cobble Layer Thickness	ft	1.5	1.5	1.5	1.5		
Purchase/Deliver Cobbles for Soil Consolidation	cy	0	0	2,153	8,968	11,121	
Area Cap	**ton**	0	0	4,092	17,039	**21,130**	
Cap Topsoil Layer Thickness	ft	1.0	1.0	1.0	1.0		
Purchase/Deliver Topsoil for Soil Consolidation	cy	0	0	1,436	5,978	7,414	
Area Cap	**ton**	0	0	2,297	9,566	**11,863**	
Topsoil Layer Thickness - Restoration Area	ft	1.0	1.0	1.0	1.0		
Purchase/Deliver Topsoil for Site Restoration	cy	6,953	6,002	5,407	5,039	23,401	
Area	**ton**	11,124	9,603	8,652	8,063	**37,441**	
Place and Compact Cap Soils	**cy**	0	0	4,307	17,935	**22,242**	
Place and Compact Restoration Soil	**cy**	6,953	6,002	5,407	5,039	**23,401**	
Site Grading	**ac**	4.8	4.9	4.9	6.7	**21.3**	
Re-Vegetation (Forested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Re-Vegetation (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
ALTERNATIVE SPECIFIC QUANTITIES							
Alternative 4a - Focused Standard Excavation with Off-Site Disposal and Cap							
Site Clearing (Forested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Site Clearing (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Area to be Excavated (Standard)	ft^2	18,772	55,749	36,951	0	111,472	Non-Dioxin Hot Spots
Soil Excavation and Load (Standard)	**cy**	695	2,065	1,369	0	**4,129**	
Transport Off-Site	**ton**	1,182	3,510	2,327	0	**7,019**	
Area to be Capped (Standard)	ft^2	187,719	162,042	184,757	255,952	790,470	All soil above PRGs. This is the total area above TOB less the concrete pad area on West Parcel.
Cap Gravel Layer Thickness	ft	0.5	0.5	0.5	0.5		
Purchase/Deliver Gravel for Cap	cy	3,476	3,001	3,421	4,740	14,638	
	ton	6,605	5,701	6,501	9,006	**27,813**	
Cap Cobble Layer Thickness	ft	1.5	1.5	1.5	1.5		
Purchase/Deliver Cobble for Cap	cy	10,429	9,002	10,264	14,220	43,915	
	ton	19,815	17,104	19,502	27,017	**83,439**	
Cap Topsoil Layer Thickness	ft	1.0	1.0	1.0	1.0		
Purchase/Deliver Topsoil for Cap	cy	6,953	6,002	6,843	9,480	29,277	
	ton	11,124	9,603	10,949	15,168	**46,843**	
Place and Compact	**cy**	20,858	18,005	20,529	28,439	**87,830**	
Site Grading	**ac**	4.8	4.9	4.9	6.7	**21.3**	
Re-Vegetation (Forested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Re-Vegetation (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
ALTERNATIVE SPECIFIC QUANTITIES							
Alternative 4b - Focused Alternative Excavation with Off-Site Disposal and Amended Cover							
Site Clearing (Forested)	**ac**	2.0	2.2	2.2	2.8	**9.2**	Assumes total area above PRGs cleared except native tree stands.
Site Clearing (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Area to be Excavated (Standard)	ft^2	16,864	54,555	36,198	0	107,618	Non-dioxin hot spot areas less areas with designated native tree species.
Standard Excavation Dept	ft	1.0	1.0	1.0	1.0		
Area to be Excavated (Alternative)	ft^2	1,907	1,194	753	0	3,854	Non-dioxin hot spot areas with designated tree species.
Alternative Excavation Depth	ft	0.5	0.5	0.5	0.5		
Soil Excavation and Load (Standard)	**cy**	625	2,021	1,341	0	**3,986**	
Soil Excavation and Load (Alternative)	**cy**	35	22	14	0	**71**	
Transport Off-Site	**ton**	1,122	3,473	2,303	0	**6,897**	
Area to be Covered (Amended)	ft^2	187,719	155,975	178,457	255,952	778,103	All soil above PRGs except designated tree areas excavated in 2015.
Standard Cover Thickness	ft	1.0	1.0	1.0	1.0		
Cover Thickness - Alternative Excavation Area	ft	0.5	0.5	0.5	0.5		
Purchase/Deliver Topsoil for Cover	cy	6,917	5,755	6,596	9,480	28,747	
	ton	11,068	9,208	10,553	15,168	**45,996**	
Place and Compact	**cy**	6,917	5,755	6,596	9,480	**28,747**	
Site Grading	**ac**	4.4	4.7	4.7	6.2	**19.9**	
Re-Vegetation (Forested)	**ac**	2.0	2.2	2.2	2.8	**9.2**	
Re-Vegetation (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
ALTERNATIVE SPECIFIC QUANTITIES							
Alternative 4c - Focused Alternative Excavation with Off-Site Disposal, On-Site Consolidation and Cap, and Cover							
Site Clearing (Forested)	**ac**	2.0	2.2	2.2	2.8	**9.2**	Designated tree areas excavated in 2015 will not be cleared.
Site Clearing (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	
Area to be Excavated - Non-Dioxin Hot Spots (Standard)	ft^2	16,864	54,555	36,198	0	107,618	Non-dioxin hot spot areas without designated tree species.
Excavation Depth - Non-Dioxin Hot Spot (Standard)	ft	1.0	1.0	1.0	1.0		
Area to be Excavated - Non-Dioxin Hot Spots (Alternative)	ft^2	1,907	1,194	753	0	3,854	Non-dioxin hot spot areas with designated tree species.
Excavation Depth - Non-Dioxin Hot Spot (Alternative)	ft	0.5	0.5	0.5	0.5		
Area to be Excavated - Above HH PRGs (Standard)	ft^2	168,645	157,952	139,161	115,814	581,572	Areas with soil above HH PRGs except does not include: designated tree areas; non-dioxin hot spot areas that will be excavated to a depth greater than the HH PRG depth (non-dioxin hot spots in the Central East and East Parcels); and small consolidation area.
Excavation Depth - HH PRGs (Standard)	ft	1.5	2.0	0.5	0.5		
Area to be Excavated - Above HH PRGs (Alternative)	ft^2	17,166	2,033	2,345	24,412	45,957	Designated tree areas outside of non-dioxin hot spots.
Excavation Depth - HH PRGs (Alternative)	ft	0.5	0.5	0.5	0.5		
Soil Excavation and Load - Non-Dioxin Hot Spots (Standard)	cy	625	2,021	1,341	0	3,986	
Soil Excavation and Load - Non-Dioxin Hot Spots (Alternative)	cy	35	22	14	0	71	
Soil Excavation and Load - Above HH PRGs (Standard)	cy	8,745	9,680	1,236	2,145	21,805	
Soil Excavation and Load - Above HH PRGs (Alternative)	cy	318	38	43	452	851	
Soil Excavation and Load (Standard)	**cy**	9,369	11,700	2,577	2,145	**25,791**	
Soil Excavation and Load (Alternative)	**cy**	353	60	57	452	**922**	
Transport/Place On-Site	**cy**	9,062	9,717	1,280	2,597	**22,656**	
Transport Off-Site	**ton**	1,122	3,473	2,303	0	**6,897**	
Area Above Eco PRGs to be Covered	ft^2	187,719	155,975	0	0	343,694	
Cover Thickness (Average)	ft	1.5	1.5	1.5	1.5		
Area to be restored	ft^2	0	1,977	139,161	115,814	256,952	

Please see notes at end of table.

Backup Calculations - Cost Tables
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Site Quantities	Units	Parcel				Total	Notes
		West	Central		East		
			West End	East End			
ALTERNATIVE SPECIFIC QUANTITIES							
Alternative 4c - Focused Alternative Excavation with Off-Site Disposal, On-Site Consolidation and Cap, and Cover							
Topsoil restoration thickness	ft	1.0	1.0	1.0	1.0		
Area to be Capped	ft^2	0	0	0	115,726	115,726	
Cap Gravel Layer Thickness	ft	0.5	0.5	0.5	0.5		
Purchase/Deliver Gravel for Soil Consolidation	cy	0	0	0	2,143	2,143	
Area Cap	**ton**	0	0	0	4,072	**4,072**	
Cap Cobble Layer Thickness	ft	1.5	1.5	1.5	1.5		
Purchase/Deliver Cobbles for Soil Consolidation	cy	0	0	0	6,429	6,429	
Area Cap	**ton**	0	0	0	12,215	**12,215**	
Cap Topsoil Layer Thickness	ft	1.0	1.0	1.0	1.0		
Purchase/Deliver Topsoil for Soil Consolidation	cy	0	0	0	4,286	4,286	
Area Cap	**ton**	0	0	0	6,858	**6,858**	
Purchase/Deliver Topsoil for Cover/Restoration	cy	10,429	8,739	5,154	4,289	28,611	
	ton	16,686	13,982	8,247	6,863	**45,777**	
Place and Compact Cap Soils	**cy**	0	0	0	12,858	**12,858**	
Place and Compact Restoration Soil	**cy**	10,429	8,739	5,154	4,289	**28,611**	
Site Grading	**ac**	4.4	4.7	4.7	6.2	**19.9**	
Re-Vegetation (Forested)	**ac**	2.0	2.2	2.2	2.8	**9.2**	
Re-Vegetation (Unforested)	**ac**	2.4	2.5	2.4	3.4	**10.7**	

Notes:

1. All quantities are from top of bank landward unless otherwise noted .
2. BGS = below ground surface
3. ft2 = feet squared
4. ft = feet
5. cy = cubic yards
6. ac = acres
7. Bold quantities are those listed in cost tables for each alternative. Additional information was provided to support calculations and is not bolded.

Coversions and Densities		
Topsoil Density	1.6	ton/cy
In Situ Soil Density	1.7	ton/cy
Gravel/Cobble Fill Density	1.9	ton/cy
Cubic Feet per Cubic Yard	27	
Sqaure Feet per Acre	43,560	

Table 11
Cost Table – Alternative 2a: Standard Cap
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Alternative Component	Units	Unit Cost	Extension	Notes
Capital				
Pre-Construction				
Pre-Design Sampling, Surveying, Work Plan, Design, Permitting, Procurment/Contracting				
	15 %	$8,002,000	$1,200,300	Assume 15% of Dircect Construction Cost
		Pre-Construction Subtotal	**$1,200,000**	
Direct Construction				
Mobilization	10 %	$5,819,401	$581,940	Assume 10% of Direct Construction Cost; includes contractor work plans
Site Prep				
Utility Locating	8 hr	$70 /hr	$560	Unit rate from recent subcontract
Access Road Improvements	1,420 sy	$23.66 /sy	$33,597	4-inch overlay (Means) along N Edgewater Ave
Erosion Control	4,500 lf	$1.07 /foot	$4,815	Means
Construction Entrance	1 LS	$1,500 /each	$1,500	25 x 60 rock construction entrance (per City req's)
Erosion Control Maintenance	5 months	$632 /month	$3,158	10% of Erosion Control and Construction Entrance
Dust Control	90 day	$280 /day	$25,200	Water truck/driver (Means); purchase water from City (0.5 gal/sy/hr)
Survey Control	22.4 ac	$2,200 /ac	$49,326	Means
Site Clearing (forested)	10.7 ac	$9,700 /ac	$103,487	Means (cut and chip trees, close-cut stumps)
Site Clearing (unforested)	10.7 ac	$950 /ac	$10,135	Means (shrub/brush mowing)
Cap				
Demarcation Layer	87,830 sy	$2.05 /sy	$180,052	Means
Purchase/Deliver Gravel	27,813 ton	$22 /ton	$611,882	Means
Purchase/Deliver Cobbles	83,439 ton	$30 /ton	$2,503,155	Means
Purchase/Deliver Topsoil	46,843 ton	$23 /ton	$1,077,382	Means
Place and Compact	87,830 cy	$6.22 /cy	$546,303	Means
Cover/Topsoil				
Purchase/Deliver Topsoil	0 ton	$23 /ton	$0	Means
Purchase/Deliver Activated Carbon	0 lb	$1.00 /lb	$0	EPA, OSWER 9200.2-128FS, 2013; assume 1% by dry weight to supplement topsoil organics for 25% of area
Apply Amendment	0 lb	$0.25 /lb	$0	Professional judgment; could be direct application or blended
Place and Compact	0 cy	$6.22 /cy	$0	Means
Excavation				
Soil Excavation and Load (standard)	0 cy	$16 /cy	$0	Means
Soil Excavation and Load (alternative)	0 cy	$88 /cy	$0	Means - hand excavation around minor structures, normal soil
Chemical Analyses (TCLP metals)	0 each	$150 /each	$0	1 sample per 1000 tons; Unit rate from lab price list
Waste Profiling Data Package	0 hr	$125 /hr	$0	Soil data compilation and prepare waste profile forms
Transport Off-Site	0 ton	$10 /ton	$0	Means and professional judgement
Tranport/Place On-Site	0 cy	$8.73 /cy	$0	Means
Disposal	0 ton	$30 /ton	$0	Quote from Waste Management for Hillsboro Landfill
Confirmation Soil Sampling and Chemical Analyses	0 each	$440 /each	$0	Assume one sample per 100 lineal feet of perimeter and one sample per 5000 sf bottom; analyze for total metals (20% of samples for PAHs and 10% of samples for dioxins and PCBs); Unit rate from lab price list
Site Restoration				
Site Grading	21.3 ac	$2,150 /ac	$45,876	Means
Re-Vegetation (forested)	0.0 ac	$43,500 /ac	$0	Means; hydroseeding, trees @ 20' spacing, shrubs @ 6' spacing
Re-Vegetation (unforested)	21.3 ac	$20,000 /ac	$426,750	Means; hydroseeding, shrubs @ 6' spacing
Temporary Irrigation System	21.3 ac	$6,560 /ac	$139,974	Temporary Drip System for trees and shrubs; cost from similar project
First Year of Irrigation	9 months	$6,250 /month	$56,250	Water truck/driver (Means); purchase water from City
Construction Contingency	25 %	$6,401,341	$1,600,335	Percent of Direct Construction Cost (Incl. Mobe.); From EPA guidance use 25% for cap focused alternatives; 30% for mixed alternatives; and 35% for excavation focused alternatives; includes both scope and bid contingency
		Direct Construction Subtotal	**$8,002,000**	
Indirect Construction Costs				
Contractor OH/Bonding/Insurance, Soil Management Plan/Institutional Controls, Construction Management, Engineering, Agency Oversight, Completion Reporting				
	25 %	$8,002,000	$2,000,500	Assume 25 percent of Direct Construction Cost
		Indirect Construction Subtotal	**$2,001,000**	
		Capital Cost Subtotal	**$11,203,000**	
Long-Term Costs (Net Present Value)				Assume net discount rate of 5% for present-worth calculations.
Cap Annual Inspections	30 yr	$5,800 /yr	$89,160	Inspection and report.
Cap Maintenance	30 yr	$49,188 /yr	$1,029,514	Assume 1% of cap installation cost annually
Plant Inspection and Replacement/Control	5 yr	$21,337 /yr	$99,130	Assume 5% of plant installation cost annually
Indirect Long-Term Costs (Project Management, Agency Oversight, Reporting)	30 yr	$15,265 /yr	$319,502	Assume 20% of Long-Term Costs annually
Contingency	25 %	$1,537,306	$384,327	Percent of Long-Term Costs; percentage same as construction
		Long-Term Subtotal (Net Present Value)	**$1,922,000**	
Total		**Total**	**$13,125,000**	

Notes:

1. Means - 2017 RS Means Online Cost Estimating

Table 12
Cost Table – Alternative 2b: Amended Cover
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Alternative Component	Units	Unit Cost	Extension	Notes
Capital				
Pre-Construction				
Pre-Design Sampling, Surveying, Work Plan, Design, Permitting, Procurment/Contracting	15 %	$3,641,000	$546,150	Assume 15% of Dircect Construction Cost
		Pre-Construction Subtotal	**$546,000**	
Direct Construction				
Mobilization	10 %	$2,647,853	$264,785	Assume 10% of Direct Construction Cost; includes contractor work plans
Site Prep				
Utility Locating	8 hr	$70 /hr	$560	Unit rate from recent subcontract
Access Road Improvements	1,420 sy	$23.66 /sy	$33,597	4-inch overlay (Means) along N Edgewater Ave
Erosion Control	4,500 lf	$1.07 /foot	$4,815	Means
Construction Entrance	1 LS	$1,500 /each	$1,500	25 x 60 rock construction entrance (per City req's)
Erosion Control Maintenance	2 months	$632 /month	$1,263	10% of Erosion Control and Construction Entrance
Dust Control	30 day	$280 /day	$8,400	Water truck/driver (Means); purchase water from City (0.5 gal/sy/hr)
Survey Control	22.4 ac	$2,200 /ac	$49,326	Means
Site Clearing (forested)	9.2 ac	$9,700 /ac	$89,641	Means (cut and chip trees, close-cut stumps)
Site Clearing (unforested)	11.8 ac	$950 /ac	$11,222	Means (shrub/brush mowing)
Cap				
Demarcation Layer	0 sy	$2.05 /sy	$0	Means
Purchase/Deliver Gravel	0 ton	$22 /ton	$0	Means
Purchase/Deliver Cobbles	0 ton	$30 /ton	$0	Means
Purchase/Deliver Topsoil	0 ton	$23 /ton	$0	Means
Place and Compact	0 cy	$6.22 /cy	$0	Means
Cover/Topsoil				
Purchase/Deliver Topsoil	46,110 ton	$23 /ton	$1,060,526	Means
Purchase/Deliver Activated Carbon	230,549 lb	$1.00 /lb	$230,549	EPA, OSWER 9200.2-128FS, 2013; assume 1% by dry weight to supplement topsoil organics for 25% of area
Apply Amendment	230,549 lb	$0.25 /lb	$57,637	Professional judgment; could be direct application or blended
Place and Compact	28,819 cy	$6.22 /cy	$179,252	Means
Excavation				
Soil Excavation and Load (standard)	0 cy	$16 /cy	$0	Means
Soil Excavation and Load (alternative)	0 cy	$88 /cy	$0	Means - hand excavation around minor structures, normal soil
Chemical Analyses (TCLP metals)	0 each	$150 /each	$0	1 sample per 1000 tons; Unit rate from lab price list
Waste Profiling Data Package	0 hr	$125 /hr	$0	Soil data compilation and prepare waste profile forms
Transport Off-Site	0 ton	$10 /ton	$0	Means and professional judgement
Tranport/Place On-Site	0 cy	$8.73 /cy	$0	Means
Disposal	0 ton	$30 /ton	$0	Quote from Waste Management for Hillsboro Landfill
Confirmation Soil Sampling and Chemical Analyses	0 each	$440 /each	$0	Assume one sample per 100 lineal feet of perimeter and one sample per 5000 sf bottom; analyze for total metals (20% of samples for PAHs and 10% of samples for dioxins and PCBs); Unit rate from lab price list
Site Restoration				
Site Grading	21.3 ac	$2,150 /ac	$45,876	Means
Re-Vegetation (forested)	10.7 ac	$43,500 /ac	$464,090	Means; hydroseeding, trees @ 20' spacing, shrubs @ 6' spacing
Re-Vegetation (unforested)	10.7 ac	$20,000 /ac	$213,375	Means; hydroseeding, shrubs @ 6' spacing
Temporary Irrigation System	21.3 ac	$6,560 /ac	$139,974	Temporary Drip System for trees and shrubs; cost from similar project
First Year of Irrigation	9 months	$6,250 /month	$56,250	Water truck/driver (Means); purchase water from City
Construction Contingency	25 %	$2,912,638	$728,160	Percent of Direct Construction Cost (Incl. Mobe.); From EPA guidance use 25% for cap focused alternatives; 30% for mixed alternatives; and 35% for excavation focused alternatives; includes both scope and bid contingency
		Direct Construction Subtotal	**$3,641,000**	
Indirect Construction Costs				
Contractor OH/Bonding/Insurance, Soil Management Plan/Institutional Controls, Construction Management, Engineering, Agency Oversight, Completion Reporting	25 %	$3,641,000	$910,250	Assume 25 percent of Direct Construction Cost
		Indirect Construction Subtotal	**$910,000**	
		Capital Cost Subtotal	**$5,097,000**	
Long-Term Costs (Net Present Value)				Assume net discount rate of 5% for present-worth calculations.
Cap Annual Inspections	30 yr	$0 /yr	$0	Inspection and report.
Cap Maintenance	30 yr	$0 /yr	$0	Assume 1% of cap installation cost annually
Plant Inspection and Replacement/Control	5 yr	$33,873 /yr	$157,369	Assume 5% of plant installation cost annually
Indirect Long-Term Costs (Project Management, Agency Oversight, Reporting)	30 yr	$6,775 /yr	$141,795	Assume 20% of Long-Term Costs annually
Contingency	25 %	$299,165	$74,791	Percent of Long-Term Costs; percentage same as construction
		Long-Term Subtotal (Net Present Value)	**$374,000**	
Total		**Total**	**$5,471,000**	

Notes:

1. Means - 2017 RS Means Online Cost Estimating

Table 13
Cost Table – Alternative 3a: Standard Excavation with Off-Site Disposal
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Alternative Component	Units	Unit Cost	Extension	Notes
Capital				
Pre-Construction				
Pre-Design Sampling, Surveying, Work Plan, Design, Permitting, Procurment/Contracting				
	15 %	$7,866,000	$1,179,900	Assume 15% of Dircect Construction Cost
		Pre-Construction Subtotal	**$1,180,000**	
Direct Construction				
Mobilization	10 %	$5,296,980	$529,698	Assume 10% of Direct Construction Cost; includes contractor work plans
Site Prep				
Utility Locating	8 hr	$70 /hr	$560	Unit rate from recent subcontract
Access Road Improvements	1,420 sy	$23.66 /sy	$33,597	4-inch overlay (Means) along N Edgewater Ave
Erosion Control	4,500 lf	$1.07 /foot	$4,815	Means
Construction Entrance	1 LS	$1,500 /each	$1,500	25 x 60 rock construction entrance (per City req's)
Erosion Control Maintenance	3 months	$632 /month	$1,895	10% of Erosion Control and Construction Entrance
Dust Control	50 day	$280 /day	$14,000	Water truck/driver (Means); purchase water from City (0.5 gal/sy/hr)
Survey Control	22.4 ac	$2,200 /ac	$49,326	Means
Site Clearing (forested)	10.7 ac	$9,700 /ac	$103,487	Means (cut and chip trees, close-cut stumps)
Site Clearing (unforested)	10.7 ac	$950 /ac	$10,135	Means (shrub/brush mowing)
Cap				
Demarcation Layer	0 sy	$2.05 /sy	$0	Means
Purchase/Deliver Gravel	0 ton	$22 /ton	$0	Means
Purchase/Deliver Cobbles	0 ton	$30 /ton	$0	Means
Purchase/Deliver Topsoil	0 ton	$23 /ton	$0	Means
Place and Compact	0 cy	$6.22 /cy	$0	Means
Cover/Topsoil				
Purchase/Deliver Topsoil	0 ton	$23 /ton	$0	Means
Purchase/Deliver Activated Carbon	0 lb	$1.00 /lb	$0	EPA, OSWER 9200.2-128FS, 2013; assume 1% by dry weight to supplement topsoil organics for 25% of area
Apply Amendment	0 lb	$0.25 /lb	$0	Professional judgment; could be direct application or blended
Place and Compact	0 cy	$6.22 /cy	$0	Means
Excavation				
Soil Excavation and Load (standard)	48,232 cy	$16 /cy	$759,660	Means
Soil Excavation and Load (alternative)	0 cy	$88 /cy	$0	Means - hand excavation around minor structures, normal soil
Chemical Analyses (TCLP metals)	82 each	$150 /each	$12,300	1 sample per 1000 tons; Unit rate from lab price list
Waste Profiling Data Package	20 hr	$125 /hr	$2,500	Soil data compilation and prepare waste profile forms
Transport Off-Site	81,995 ton	$10 /ton	$819,950	Means and professional judgement
Tranport/Place On-Site	0 cy	$8.73 /cy	$0	Means
Disposal	81,995 ton	$30 /ton	$2,459,850	Quote from Waste Management for Hillsboro Landfill
Confirmation Soil Sampling and Chemical Analyses	236 each	$440 /each	$103,840	Assume one sample per 100 lineal feet of perimeter and one sample per 5000 sf bottom; analyze for total metals (20% of samples for PAHs and 10% of samples for dioxins and PCBs); Unit rate from lab price list
Site Restoration				
Site Grading	21.3 ac	$2,150 /ac	$45,876	Means
Re-Vegetation (forested)	10.7 ac	$43,500 /ac	$464,090	Means; hydroseeding, trees @ 20' spacing, shrubs @ 6' spacing
Re-Vegetation (unforested)	10.7 ac	$20,000 /ac	$213,375	Means; hydroseeding, shrubs @ 6' spacing
Temporary Irrigation System	21.3 ac	$6,560 /ac	$139,974	Temporary Drip System for trees and shrubs; cost from similar project
First Year of Irrigation	9 months	$6,250 /month	$56,250	Water truck/driver (Means); purchase water from City
Construction Contingency	35 %	$5,826,678	$2,039,337	Percent of Direct Construction Cost (Incl. Mobe.); From EPA guidance use 25% for cap focused alternatives; 30% for mixed alternatives; and 35% for excavation focused alternatives; includes both scope and bid contingency
		Direct Construction Subtotal	**$7,866,000**	
Indirect Construction Costs				
Contractor OH/Bonding/Insurance, Soil Management Plan/Institutional Controls, Construction Management, Engineering, Agency Oversight, Completion Reporting				
	25 %	$7,866,000	$1,966,500	Assume 25 percent of Direct Construction Cost
		Indirect Construction Subtotal	**$1,967,000**	
		Capital Cost Subtotal	**$11,013,000**	
Long-Term Costs (Net Present Value)				Assume net discount rate of 5% for present-worth calculations.
Cap Annual Inspections	30 yr	$0 /yr	$0	Inspection and report.
Cap Maintenance	30 yr	$0 /yr	$0	Assume 1% of cap installation cost annually
Plant Inspection and Replacement/Control	5 yr	$33,873 /yr	$157,369	Assume 5% of plant installation cost annually
Indirect Long-Term Costs (Project Management, Agency Oversight, Reporting)	5 yr	$6,775 /yr	$31,474	Assume 20% of Long-Term Costs annually
Contingency	35 %	$188,843	$66,095	Percent of Long-Term Costs; percentage same as construction
		Long-Term Subtotal (Net Present Value)	**$255,000**	
Total		**Total**	**$11,268,000**	

Notes:

1. Means - 2017 RS Means Online Cost Estimating

Table 14
Cost Table – Alternative 3b: Alternative Excavation with Off-Site Disposal
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Alternative Component	Units	Unit Cost	Extension	Notes
Capital				
Pre-Construction				
Pre-Design Sampling, Surveying, Work Plan, Design, Permitting, Procurment/Contracting				
	15 %	$7,486,000	$1,122,900	Assume 15% of Dircect Construction Cost
		Pre-Construction Subtotal	**$1,123,000**	
Direct Construction				
Mobilization	10 %	$5,040,899	$504,090	Assume 10% of Direct Construction Cost; includes contractor work plans
Site Prep				
Utility Locating	8 hr	$70 /hr	$560	Unit rate from recent subcontract
Access Road Improvements	1,420 sy	$23.66 /sy	$33,597	4-inch overlay (Means) along N Edgewater Ave
Erosion Control	4,500 lf	$1.07 /foot	$4,815	Means
Construction Entrance	1 LS	$1,500 /each	$1,500	25 x 60 rock construction entrance (per City req's)
Erosion Control Maintenance	3 months	$632 /month	$1,895	10% of Erosion Control and Construction Entrance
Dust Control	50 day	$280 /day	$14,000	Water truck/driver (Means); purchase water from City (0.5 gal/sy/hr)
Survey Control	22.4 ac	$2,200 /ac	$49,326	Means
Site Clearing (forested)	9.2 ac	$9,700 /ac	$89,641	Means (cut and chip trees, close-cut stumps)
Site Clearing (unforested)	10.7 ac	$950 /ac	$10,135	Means (shrub/brush mowing)
Cap				
Demarcation Layer	0 sy	$2.05 /sy	$0	Means
Purchase/Deliver Gravel	0 ton	$22 /ton	$0	Means
Purchase/Deliver Cobbles	0 ton	$30 /ton	$0	Means
Purchase/Deliver Topsoil	0 ton	$23 /ton	$0	Means
Place and Compact	0 cy	$6.22 /cy	$0	Means
Cover/Topsoil				
Purchase/Deliver Topsoil	0 ton	$23 /ton	$0	Means
Purchase/Deliver Activated Carbon	0 lb	$1.00 /lb	$0	EPA, OSWER 9200.2-128FS, 2013; assume 1% by dry weight to supplement topsoil organics for 25% of area
Apply Amendment	0 lb	$0.25 /lb	$0	Professional judgment; could be direct application or blended
Place and Compact	0 cy	$6.22 /cy	$0	Means
Excavation				
Soil Excavation and Load (standard)	44,535 cy	$16 /cy	$701,420	Means
Soil Excavation and Load (alternative)	922 cy	$88 /cy	$81,174	Means - hand excavation around minor structures, normal soil
Chemical Analyses (TCLP metals)	78 each	$150 /each	$11,700	1 sample per 1000 tons; Unit rate from lab price list
Waste Profiling Data Package	20 hr	$125 /hr	$2,500	Soil data compilation and prepare waste profile forms
Transport Off-Site	77,277 ton	$10 /ton	$772,769	Means and professional judgement
Tranport/Place On-Site	0 cy	$8.73 /cy	$0	Means
Disposal	77,277 ton	$30 /ton	$2,318,308	Quote from Waste Management for Hillsboro Landfill
Confirmation Soil Sampling and Chemical Analyses	233 each	$440 /each	$102,520	Assume one sample per 100 lineal feet of perimeter and one sample per 5000 sf bottom; analyze for total metals (20% of samples for PAHs and 10% of samples for dioxins and PCBs); Unit rate from lab price list
Site Restoration				
Site Grading	19.9 ac	$2,150 /ac	$42,807	Means
Re-Vegetation (forested)	9.2 ac	$43,500 /ac	$401,998	Means; hydroseeding, trees @ 20' spacing, shrubs @ 6' spacing
Re-Vegetation (unforested)	10.7 ac	$20,000 /ac	$213,375	Means; hydroseeding, shrubs @ 6' spacing
Temporary Irrigation System	19.9 ac	$6,560 /ac	$130,610	Temporary Drip System for trees and shrubs; cost from similar project
First Year of Irrigation	9 months	$6,250 /month	$56,250	Water truck/driver (Means); purchase water from City
Construction Contingency	35 %	$5,544,989	$1,940,746	Percent of Direct Construction Cost (Incl. Mobe.); From EPA guidance use 25% for cap focused alternatives; 30% for mixed alternatives; and 35% for excavation focused alternatives; includes both scope and bid contingency
		Direct Construction Subtotal	**$7,486,000**	
Indirect Construction Costs				
Contractor OH/Bonding/Insurance, Soil Management Plan/Institutional Controls, Construction Management, Engineering, Agency Oversight, Completion Reporting				
	25 %	$7,486,000	$1,871,500	Assume 25 percent of Direct Construction Cost
		Indirect Construction Subtotal	**$1,872,000**	
		Capital Cost Subtotal	**$10,481,000**	
Long-Term Costs (Net Present Value)				Assume net discount rate of 5% for present-worth calculations.
Cap Annual Inspections	30 yr	$0 /yr	$0	Inspection and report.
Cap Maintenance	30 yr	$0 /yr	$0	Assume 1% of cap installation cost annually
Plant Inspection and Replacement/Control	5 yr	$30,769 /yr	$142,946	Assume 5% of plant installation cost annually
Indirect Long-Term Costs (Project Management, Agency Oversight, Reporting)	5 yr	$6,154 /yr	$28,589	Assume 20% of Long-Term Costs annually
Contingency	35 %	$171,535	$60,037	Percent of Long-Term Costs; percentage same as construction
		Long-Term Subtotal (Net Present Value)	**$232,000**	
Total		**Total**	**$10,713,000**	

Notes:

1. Means - 2017 RS Means Online Cost Estimating

Table 15
Cost Table – Alternative 3c: Standadard Excavation with On-Site Consolidation
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Alternative Component	Units	Unit Cost	Extension	Notes
Capital				
Pre-Construction				
Pre-Design Sampling, Surveying, Work Plan, Design, Permitting, Procurment/Contracting	15 %	$6,748,000	$1,012,200	Assume 15% of Dircect Construction Cost
		Pre-Construction Subtotal	**$1,012,000**	
Direct Construction				
Mobilization	10 %	$4,543,778	$454,378	Assume 10% of Direct Construction Cost; includes contractor work plans
Site Prep				
Utility Locating	8 hr	$70 /hr	$560	Unit rate from recent subcontract
Access Road Improvements	1,420 sy	$23.66 /sy	$33,597	4-inch overlay (Means) along N Edgewater Ave
Erosion Control	4,500 lf	$1.07 /foot	$4,815	Means
Construction Entrance	1 LS	$1,500 /each	$1,500	25 x 60 rock construction entrance (per City req's)
Erosion Control Maintenance	5 months	$632 /month	$3,158	10% of Erosion Control and Construction Entrance
Dust Control	90 day	$280 /day	$25,200	Water truck/driver (Means); purchase water from City (0.5 gal/sy/hr)
Survey Control	22.4 ac	$2,200 /ac	$49,326	Means
Site Clearing (forested)	10.7 ac	$9,700 /ac	$103,487	Means (cut and chip trees, close-cut stumps)
Site Clearing (unforested)	10.7 ac	$950 /ac	$10,135	Means (shrub/brush mowing)
Cap				
Demarcation Layer	22,242 sy	$2.05 /sy	$45,597	Means
Purchase/Deliver Gravel	7,043 ton	$22 /ton	$154,955	Means
Purchase/Deliver Cobbles	21,130 ton	$30 /ton	$633,906	Means
Purchase/Deliver Topsoil	11,863 ton	$23 /ton	$272,839	Means
Place and Compact	22,242 cy	$6.22 /cy	$138,347	Means
Cover/Topsoil				
Purchase/Deliver Topsoil	37,441 ton	$23 /ton	$861,146	Means
Purchase/Deliver Activated Carbon	0 lb	$1.00 /lb	$0	EPA, OSWER 9200.2-128FS, 2013; assume 1% by dry weight to supplement topsoil organics for 25% of area
Apply Amendment	0 lb	$0.25 /lb	$0	Professional judgment; could be direct application or blended
Place and Compact	23,401 cy	$6.22 /cy	$145,552	Means
Excavation				
Soil Excavation and Load (standard)	42,356 cy	$16 /cy	$667,113	Means
Soil Excavation and Load (alternative)	0 cy	$88 /cy	$0	Means - hand excavation around minor structures, normal soil
Chemical Analyses (TCLP metals)	73 each	$150 /each	$10,950	1 sample per 1000 tons; Unit rate from lab price list
Waste Profiling Data Package	20 hr	$125 /hr	$2,500	Soil data compilation and prepare waste profile forms
Transport Off-Site	0 ton	$10 /ton	$0	Means and professional judgement
Tranport/Place On-Site	42,356 cy	$8.73 /cy	$369,771	Means
Disposal	0 ton	$30 /ton	$0	Quote from Waste Management for Hillsboro Landfill
Confirmation Soil Sampling and Chemical Analyses	204 each	$440 /each	$89,760	Assume one sample per 100 lineal feet of perimeter and one sample per 5000 sf bottom; analyze for total metals (20% of samples for PAHs and 10% of samples for dioxins and PCBs); Unit rate from lab price list
Site Restoration				
Site Grading	21.3 ac	$2,150 /ac	$45,876	Means
Re-Vegetation (forested)	10.7 ac	$43,500 /ac	$464,090	Means; hydroseeding, trees @ 20' spacing, shrubs @ 6' spacing
Re-Vegetation (unforested)	10.7 ac	$20,000 /ac	$213,375	Means; hydroseeding, shrubs @ 6' spacing
Temporary Irrigation System	21.3 ac	$6,560 /ac	$139,974	Temporary Drip System for trees and shrubs; cost from similar project
First Year of Irrigation	9 months	$6,250 /month	$56,250	Water truck/driver (Means); purchase water from City
Construction Contingency	35 %	$4,998,156	$1,749,355	Percent of Direct Construction Cost (Incl. Mobe.); From EPA guidance use 25% for cap focused alternatives; 30% for mixed alternatives; and 35% for excavation focused alternatives; includes both scope and bid contingency
		Direct Construction Subtotal	**$6,748,000**	
Indirect Construction Costs				
Contractor OH/Bonding/Insurance, Soil Management Plan/Institutional Controls, Construction Management, Engineering, Agency Oversight, Completion Reporting	25 %	$6,748,000	$1,687,000	Assume 25 percent of Direct Construction Cost
		Indirect Construction Subtotal	**$1,687,000**	
		Capital Cost Subtotal	**$9,447,000**	
Long-Term Costs (Net Present Value)				Assume net discount rate of 5% for present-worth calculations.
Cap Annual Inspections	30 yr	$4,800 /yr	$73,788	Inspection and report.
Cap Maintenance	30 yr	$12,456 /yr	$260,717	Assume 1% of cap installation cost annually
Plant Inspection and Replacement/Control	5 yr	$33,873 /yr	$157,369	Assume 5% of plant installation cost annually
Indirect Long-Term Costs (Project Management, Agency Oversight, Reporting)	30 yr	$10,226 /yr	$214,032	Assume 20% of Long-Term Costs annually
Contingency	35 %	$705,906	$247,067	Percent of Long-Term Costs; percentage same as construction
		Long-Term Subtotal (Net Present Value)	**$953,000**	
Total		**Total**	**$10,400,000**	

Notes:

1. Means - 2017 RS Means Online Cost Estimating

Table 16
Cost Table – Alternative 3d: Standard Excavation with Off-Site Disposal and On-Site Consolidation
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Alternative Component	Units	Unit Cost	Extension	Notes
Capital				
Pre-Construction				
Pre-Design Sampling, Surveying, Work Plan, Design, Permitting, Procurment/Contracting				
	15 %	$7,111,000	$1,066,650	Assume 15% of Dircect Construction Cost
		Pre-Construction Subtotal	**$1,067,000**	
Direct Construction				
Mobilization	10 %	$4,788,480	$478,848	Assume 10% of Direct Construction Cost; includes contractor work plans
Site Prep				
Utility Locating	8 hr	$70 /hr	$560	Unit rate from recent subcontract
Access Road Improvements	1,420 sy	$23.66 /sy	$33,597	4-inch overlay (Means) along N Edgewater Ave
Erosion Control	4,500 lf	$1.07 /foot	$4,815	Means
Construction Entrance	1 LS	$1,500 /each	$1,500	25 x 60 rock construction entrance (per City req's)
Erosion Control Maintenance	5 months	$632 /month	$3,158	10% of Erosion Control and Construction Entrance
Dust Control	90 day	$280 /day	$25,200	Water truck/driver (Means); purchase water from City (0.5 gal/sy/hr)
Survey Control	22.4 ac	$2,200 /ac	$49,326	Means
Site Clearing (forested)	10.7 ac	$9,700 /ac	$103,487	Means (cut and chip trees, close-cut stumps)
Site Clearing (unforested)	10.7 ac	$950 /ac	$10,135	Means (shrub/brush mowing)
Cap				
Demarcation Layer	22,242 sy	$2.05 /sy	$45,597	Means
Purchase/Deliver Gravel	7,043 ton	$22 /ton	$154,955	Means
Purchase/Deliver Cobbles	21,130 ton	$30 /ton	$633,906	Means
Purchase/Deliver Topsoil	11,863 ton	$23 /ton	$272,839	Means
Place and Compact	22,242 cy	$6.22 /cy	$138,347	Means
Cover/Topsoil				
Purchase/Deliver Topsoil	37,441 ton	$23 /ton	$861,146	Means
Purchase/Deliver Activated Carbon	0 lb	$1.00 /lb	$0	EPA, OSWER 9200.2-128FS, 2013; assume 1% by dry weight to supplement topsoil organics for 25% of area
Apply Amendment	0 lb	$0.25 /lb	$0	Professional judgment; could be direct application or blended
Place and Compact	23,401 cy	$6.22 /cy	$145,552	Means
Excavation				
Soil Excavation and Load (standard)	42,356 cy	$16 /cy	$667,113	Means
Soil Excavation and Load (alternative)	0 cy	$88 /cy	$0	Means - hand excavation around minor structures, normal soil
Chemical Analyses (TCLP metals)	73 each	$150 /each	$10,950	1 sample per 1000 tons; Unit rate from lab price list
Waste Profiling Data Package	20 hr	$125 /hr	$2,500	Soil data compilation and prepare waste profile forms
Transport Off-Site	7,019 ton	$10 /ton	$70,186	Means and professional judgement
Tranport/Place On-Site	38,228 cy	$8.73 /cy	$333,729	Means
Disposal	7,019 ton	$30 /ton	$210,558	Quote from Waste Management for Hillsboro Landfill
Confirmation Soil Sampling and Chemical Analyses	204 each	$440 /each	$89,760	Assume one sample per 100 lineal feet of perimeter and one sample per 5000 sf bottom; analyze for total metals (20% of samples for PAHs and 10% of samples for dioxins and PCBs); Unit rate from lab price list
Site Restoration				
Site Grading	21.3 ac	$2,150 /ac	$45,876	Means
Re-Vegetation (forested)	10.7 ac	$43,500 /ac	$464,090	Means; hydroseeding, trees @ 20' spacing, shrubs @ 6' spacing
Re-Vegetation (unforested)	10.7 ac	$20,000 /ac	$213,375	Means; hydroseeding, shrubs @ 6' spacing
Temporary Irrigation System	21.3 ac	$6,560 /ac	$139,974	Temporary Drip System for trees and shrubs; cost from similar project
First Year of Irrigation	9 months	$6,250 /month	$56,250	Water truck/driver (Means); purchase water from City
Construction Contingency	35 %	$5,267,328	$1,843,565	Percent of Direct Construction Cost (Incl. Mobe.); From EPA guidance use 25% for cap focused alternatives; 30% for mixed alternatives; and 35% for excavation focused alternatives; includes both scope and bid contingency
		Direct Construction Subtotal	**$7,111,000**	
Indirect Construction Costs				
Contractor OH/Bonding/Insurance, Soil Management Plan/Institutional Controls, Construction Management, Engineering, Agency Oversight, Completion Reporting				
	25 %	$7,111,000	$1,777,750	Assume 25 percent of Direct Construction Cost
		Indirect Construction Subtotal	**$1,778,000**	
		Capital Cost Subtotal	**$9,956,000**	
Long-Term Costs (Net Present Value)				Assume net discount rate of 5% for present-worth calculations.
Cap Annual Inspections	30 yr	$4,800 /yr	$73,788	Inspection and report.
Cap Maintenance	30 yr	$12,456 /yr	$260,717	Assume 1% of cap installation cost annually
Plant Inspection and Replacement/Control	5 yr	$33,873 /yr	$157,369	Assume 5% of plant installation cost annually
Indirect Long-Term Costs (Project Management, Agency Oversight, Reporting)	30 yr	$10,226 /yr	$214,032	Assume 20% of Long-Term Costs annually
Contingency	35 %	$705,906	$247,067	Percent of Long-Term Costs; percentage same as construction
		Long-Term Subtotal (Net Present Value)	**$953,000**	
Total		**Total**	**$10,909,000**	

Notes:

1. Means - 2017 RS Means Online Cost Estimating

Table 17
Cost Table – Alternative 4a: Focused Standard Excavation with Off-Site Disposal and Cap
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Alternative Component	Units	Unit Cost	Extension	Notes
Capital				
Pre-Construction				
Pre-Design Sampling, Surveying, Work Plan, Design, Permitting, Procurment/Contracting				
	15 %	$8,866,000	$1,329,900	Assume 15% of Dircect Construction Cost
		Pre-Construction Subtotal	**$1,330,000**	
Direct Construction				
Mobilization	10 %	$6,447,746	$644,775	Assume 10% of Direct Construction Cost; includes contractor work plans
Site Prep				
Utility Locating	8 hr	$70 /hr	$560	Unit rate from recent subcontract
Access Road Improvements	1,420 sy	$23.66 /sy	$33,597	4-inch overlay (Means) along N Edgewater Ave
Erosion Control	4,500 lf	$1.07 /foot	$4,815	Means
Construction Entrance	1 LS	$1,500 /each	$1,500	25 x 60 rock construction entrance (per City req's)
Erosion Control Maintenance	5 months	$632 /month	$3,158	10% of Erosion Control and Construction Entrance
Dust Control	90 day	$280 /day	$25,200	Water truck/driver (Means); purchase water from City (0.5 gal/sy/hr)
Survey Control	22.4 ac	$2,200 /ac	$49,326	Means
Site Clearing (forested)	10.7 ac	$9,700 /ac	$103,487	Means (cut and chip trees, close-cut stumps)
Site Clearing (unforested)	10.7 ac	$950 /ac	$10,135	Means (shrub/brush mowing)
Cap				
Demarcation Layer	87,830 sy	$2.05 /sy	$180,052	Means
Purchase/Deliver Gravel	27,813 ton	$22 /ton	$611,882	Means
Purchase/Deliver Cobbles	83,439 ton	$30 /ton	$2,503,155	Means
Purchase/Deliver Topsoil	46,843 ton	$23 /ton	$1,077,382	Means
Place and Compact	87,830 cy	$6.22 /cy	$546,303	Means
Cover/Topsoil				
Purchase/Deliver Topsoil	0 ton	$23 /ton	$0	Means
Purchase/Deliver Activated Carbon	0 lb	$1.00 /lb	$0	EPA, OSWER 9200.2-128FS, 2013; assume 1% by dry weight to supplement topsoil organics for 25% of area
Apply Amendment	0 lb	$0.25 /lb	$0	Professional judgment; could be direct application or blended
Place and Compact	0 cy	$6.22 /cy	$0	Means
Excavation				
Soil Excavation and Load (standard)	4,129 cy	$16 /cy	$65,025	Means
Soil Excavation and Load (alternative)	0 cy	$88 /cy	$0	Means - hand excavation around minor structures, normal soil
Chemical Analyses (TCLP metals)	8 each	$150 /each	$1,200	1 sample per 1000 tons; Unit rate from lab price list
Waste Profiling Data Package	20 hr	$125 /hr	$2,500	Soil data compilation and prepare waste profile forms
Transport Off-Site	7,019 ton	$10 /ton	$70,186	Means and professional judgement
Tranport/Place On-Site	0 cy	$8.73 /cy	$0	Means
Disposal	7,019 ton	$30 /ton	$210,558	Quote from Waste Management for Hillsboro Landfill
Confirmation Soil Sampling and Chemical Analyses	64 each	$440 /each	$28,160	Assume one sample per 100 lineal feet of perimeter and one sample per 5000 sf bottom; analyze for total metals (20% of samples for PAHs and 10% of samples for dioxins and PCBs); Unit rate from lab price list
Site Restoration				
Site Grading	21.3 ac	$2,150 /ac	$45,876	Means
Re-Vegetation (forested)	10.7 ac	$43,500 /ac	$464,090	Means; hydroseeding, trees @ 20' spacing, shrubs @ 6' spacing
Re-Vegetation (unforested)	10.7 ac	$20,000 /ac	$213,375	Means; hydroseeding, shrubs @ 6' spacing
Temporary Irrigation System	21.3 ac	$6,560 /ac	$139,974	Temporary Drip System for trees and shrubs; cost from similar project
First Year of Irrigation	9 months	$6,250 /month	$56,250	Water truck/driver (Means); purchase water from City
Construction Contingency	25 %	$7,092,520	$1,773,130	Percent of Direct Construction Cost (Incl. Mobe.); From EPA guidance use 25% for cap focused alternatives; 30% for mixed alternatives; and 35% for excavation focused alternatives; includes both scope and bid contingency
		Direct Construction Subtotal	**$8,866,000**	
Indirect Construction Costs				
Contractor OH/Bonding/Insurance, Soil Management Plan/Institutional Controls, Construction Management, Engineering, Agency Oversight, Completion Reporting				
	25 %	$8,866,000	$2,216,500	Assume 25 percent of Direct Construction Cost
		Indirect Construction Subtotal	**$2,217,000**	
		Capital Cost Subtotal	**$12,413,000**	
Long-Term Costs (Net Present Value)				Assume net discount rate of 5% for present-worth calculations.
Cap Annual Inspections	30 yr	$5,800 /yr	$89,160	Inspection and report.
Cap Maintenance	30 yr	$49,188 /yr	$1,029,514	Assume 1% of cap installation cost annually
Plant Inspection and Replacement/Control	5 yr	$33,873 /yr	$157,369	Assume 5% of plant installation cost annually
Indirect Long-Term Costs (Project Management, Agency Oversight, Reporting)	30 yr	$17,772 /yr	$371,977	Assume 20% of Long-Term Costs annually
Contingency	25 %	$1,648,021	$412,005	Percent of Long-Term Costs; percentage same as construction
		Long-Term Subtotal (Net Present Value)	**$2,060,000**	
Total		**Total**	**$14,473,000**	

Notes:

1. Means - 2017 RS Means Online Cost Estimating

Table 18
Cost Table – Alternative 4b: Focused Alternative Excavation with Off-Site Disposal and Amended Cover
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Alternative Component	Units	Unit Cost	Extension	Notes
Capital				
Pre-Construction				
Pre-Design Sampling, Surveying, Work Plan, Design, Permitting, Procurment/Contracting				
	15 %	$4,050,000	$607,500	Assume 15% of Dircect Construction Cost
		Pre-Construction Subtotal	**$608,000**	
Direct Construction				
Mobilization	10 %	$2,945,116	$294,512	Assume 10% of Direct Construction Cost; includes contractor work plans
Site Prep				
Utility Locating	8 hr	$70 /hr	$560	Unit rate from recent subcontract
Access Road Improvements	1,420 sy	$23.66 /sy	$33,597	4-inch overlay (Means) along N Edgewater Ave
Erosion Control	4,500 lf	$1.07 /foot	$4,815	Means
Construction Entrance	1 LS	$1,500 /each	$1,500	25 x 60 rock construction entrance (per City req's)
Erosion Control Maintenance	2 months	$632 /month	$1,263	10% of Erosion Control and Construction Entrance
Dust Control	30 day	$280 /day	$8,400	Water truck/driver (Means); purchase water from City (0.5 gal/sy/hr)
Survey Control	22.4 ac	$2,200 /ac	$49,326	Means
Site Clearing (forested)	9.2 ac	$9,700 /ac	$89,641	Means (cut and chip trees, close-cut stumps)
Site Clearing (unforested)	10.7 ac	$950 /ac	$10,135	Means (shrub/brush mowing)
Cap				
Demarcation Layer	0 sy	$2.05 /sy	$0	Means
Purchase/Deliver Gravel	0 ton	$22 /ton	$0	Means
Purchase/Deliver Cobbles	0 ton	$30 /ton	$0	Means
Purchase/Deliver Topsoil	0 ton	$23 /ton	$0	Means
Place and Compact	0 cy	$6.22 /cy	$0	Means
Cover/Topsoil				
Purchase/Deliver Topsoil	45,996 ton	$23 /ton	$1,057,899	Means
Purchase/Deliver Activated Carbon	229,978 lb	$1.00 /lb	$229,978	EPA, OSWER 9200.2-128FS, 2013; assume 1% by dry weight to supplement topsoil organics for 25% of area
Apply Amendment	229,978 lb	$0.25 /lb	$57,495	Professional judgment; could be direct application or blended
Place and Compact	28,747 cy	$6.22 /cy	$178,808	Means
Excavation				
Soil Excavation and Load (standard)	3,986 cy	$16 /cy	$62,777	Means
Soil Excavation and Load (alternative)	71 cy	$88 /cy	$6,281	Means - hand excavation around minor structures, normal soil
Chemical Analyses (TCLP metals)	7 each	$150 /each	$1,050	1 sample per 1000 tons; Unit rate from lab price list
Waste Profiling Data Package	20 hr	$125 /hr	$2,500	Soil data compilation and prepare waste profile forms
Transport Off-Site	6,897 ton	$10 /ton	$68,973	Means and professional judgement
Tranport/Place On-Site	0 cy	$8.73 /cy	$0	Means
Disposal	6,897 ton	$30 /ton	$206,918	Quote from Waste Management for Hillsboro Landfill
Confirmation Soil Sampling and Chemical Analyses	64 each	$440 /each	$28,160	Assume one sample per 100 lineal feet of perimeter and one sample per 5000 sf bottom; analyze for total metals (20% of samples for PAHs and 10% of samples for dioxins and PCBs); Unit rate from lab price list
Site Restoration				
Site Grading	19.9 ac	$2,150 /ac	$42,807	Means
Re-Vegetation (forested)	9.2 ac	$43,500 /ac	$401,998	Means; hydroseeding, trees @ 20' spacing, shrubs @ 6' spacing
Re-Vegetation (unforested)	10.7 ac	$20,000 /ac	$213,375	Means; hydroseeding, shrubs @ 6' spacing
Temporary Irrigation System	19.9 ac	$6,560 /ac	$130,610	Temporary Drip System for trees and shrubs; cost from similar project
First Year of Irrigation	9 months	$6,250 /month	$56,250	Water truck/driver (Means); purchase water from City
Construction Contingency	25 %	$3,239,627	$809,907	Percent of Direct Construction Cost (Incl. Mobe.); From EPA guidance use 25% for cap focused alternatives; 30% for mixed alternatives; and 35% for excavation focused alternatives; includes both scope and bid contingency
		Direct Construction Subtotal	**$4,050,000**	
Indirect Construction Costs				
Contractor OH/Bonding/Insurance, Soil Management Plan/Institutional Controls, Construction Management, Engineering, Agency Oversight, Completion Reporting				
	25 %	$4,050,000	$1,012,500	Assume 25 percent of Direct Construction Cost
		Indirect Construction Subtotal	**$1,013,000**	
		Capital Cost Subtotal	**$5,671,000**	
Long-Term Costs (Net Present Value)				Assume net discount rate of 5% for present-worth calculations.
Cap Annual Inspections	30 yr	$0 /yr	$0	Inspection and report.
Cap Maintenance	30 yr	$0 /yr	$0	Assume 1% of cap installation cost annually
Plant Inspection and Replacement/Control	5 yr	$30,769 /yr	$142,946	Assume 5% of plant installation cost annually
Indirect Long-Term Costs (Project Management, Agency Oversight, Reporting)	5 yr	$6,154 /yr	$28,589	Assume 20% of Long-Term Costs annually
Contingency	25 %	$171,535	$42,884	Percent of Long-Term Costs; percentage same as construction
		Long-Term Subtotal (Net Present Value)	**$214,000**	
Total		**Total**	**$5,885,000**	

Notes:

1. Means - 2017 RS Means Online Cost Estimating

Table 19
Cost Table – Alternative 4c: Focused Alternative Excavation with Off-Site Disaposal, On-Site Consolidation and Cap, and Cover
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Alternative Component	Units	Unit Cost	Extension	Notes
Capital				
Pre-Construction				
Pre-Design Sampling, Surveying, Work Plan, Design, Permitting, Procurment/Contracting				
	15 %	$5,822,000	$873,300	Assume 15% of Dircect Construction Cost
		Pre-Construction Subtotal	**$873,000**	
Direct Construction				
Mobilization	10 %	$4,070,995	$407,100	Assume 10% of Direct Construction Cost; includes contractor work plans
Site Prep				
Utility Locating	8 hr	$70 /hr	$560	Unit rate from recent subcontract
Access Road Improvements	1,420 sy	$23.66 /sy	$33,597	4-inch overlay (Means) along N Edgewater Ave
Erosion Control	4,500 lf	$1.07 /foot	$4,815	Means
Construction Entrance	1 LS	$1,500 /each	$1,500	25 x 60 rock construction entrance (per City req's)
Erosion Control Maintenance	4 months	$632 /month	$2,526	10% of Erosion Control and Construction Entrance
Dust Control	70 day	$280 /day	$19,600	Water truck/driver (Means); purchase water from City (0.5 gal/sy/hr)
Survey Control	22.4 ac	$2,200 /ac	$49,326	Means
Site Clearing (forested)	9.2 ac	$9,700 /ac	$89,641	Means (cut and chip trees, close-cut stumps)
Site Clearing (unforested)	10.7 ac	$950 /ac	$10,135	Means (shrub/brush mowing)
Cap				
Demarcation Layer	12,858 sy	$2.05 /sy	$26,360	Means
Purchase/Deliver Gravel	4,072 ton	$22 /ton	$89,580	Means
Purchase/Deliver Cobbles	12,215 ton	$30 /ton	$366,464	Means
Purchase/Deliver Topsoil	6,858 ton	$23 /ton	$157,730	Means
Place and Compact	12,858 cy	$6.22 /cy	$79,979	Means
Cover/Topsoil				
Purchase/Deliver Topsoil	45,777 ton	$23 /ton	$1,052,879	Means
Purchase/Deliver Activated Carbon	0 lb	$1.00 /lb	$0	EPA, OSWER 9200.2-128FS, 2013; assume 1% by dry weight to supplement topsoil organics for 25% of area
Apply Amendment	0 lb	$0.25 /lb	$0	Professional judgment; could be direct application or blended
Place and Compact	28,611 cy	$6.22 /cy	$177,960	Means
Excavation				
Soil Excavation and Load (standard)	25,791 cy	$16 /cy	$406,209	Means
Soil Excavation and Load (alternative)	922 cy	$88 /cy	$81,174	Means - hand excavation around minor structures, normal soil
Chemical Analyses (TCLP metals)	46 each	$150 /each	$6,900	1 sample per 1000 tons; Unit rate from lab price list
Waste Profiling Data Package	20 hr	$125 /hr	$2,500	Soil data compilation and prepare waste profile forms
Transport Off-Site	6,897 ton	$10 /ton	$68,973	Means and professional judgement
Tranport/Place On-Site	22,656 cy	$8.73 /cy	$197,789	Means
Disposal	6,897 ton	$30 /ton	$206,918	Quote from Waste Management for Hillsboro Landfill
Confirmation Soil Sampling and Chemical Analyses	211 each	$440 /each	$92,840	Assume one sample per 100 lineal feet of perimeter and one sample per 5000 sf bottom; analyze for total metals (20% of samples for PAHs and 10% of samples for dioxins and PCBs); Unit rate from lab price list
Site Restoration				
Site Grading	19.9 ac	$2,150 /ac	$42,807	Means
Re-Vegetation (forested)	9.2 ac	$43,500 /ac	$401,998	Means; hydroseeding, trees @ 20' spacing, shrubs @ 6' spacing
Re-Vegetation (unforested)	10.7 ac	$20,000 /ac	$213,375	Means; hydroseeding, shrubs @ 6' spacing
Temporary Irrigation System	19.9 ac	$6,560 /ac	$130,610	Temporary Drip System for trees and shrubs; cost from similar project
First Year of Irrigation	9 months	$6,250 /month	$56,250	Water truck/driver (Means); purchase water from City
Construction Contingency	30 %	$4,478,095	$1,343,428	Percent of Direct Construction Cost (Incl. Mobe.); From EPA guidance use 25% for cap focused alternatives; 30% for mixed alternatives; and 35% for excavation focused alternatives; includes both scope and bid contingency
		Direct Construction Subtotal	**$5,822,000**	
Indirect Construction Costs				
Contractor OH/Bonding/Insurance, Soil Management Plan/Institutional Controls, Construction Management, Engineering, Agency Oversight, Completion Reporting				
	25 %	$5,822,000	$1,455,500	Assume 25 percent of Direct Construction Cost
		Indirect Construction Subtotal	**$1,456,000**	
		Capital Cost Subtotal	**$8,151,000**	
Long-Term Costs (Net Present Value)				Assume net discount rate of 5% for present-worth calculations.
Cap Annual Inspections	30 yr	$3,800 /yr	$58,415	Inspection and report.
Cap Maintenance	30 yr	$7,201 /yr	$150,722	Assume 1% of cap installation cost annually
Plant Inspection and Replacement/Control	5 yr	$30,769 /yr	$142,946	Assume 5% of plant installation cost annually
Indirect Long-Term Costs (Project Management, Agency Oversight, Reporting)	30 yr	$8,354 /yr	$174,851	Assume 20% of Long-Term Costs annually
Contingency	30 %	$526,934	$158,080	Percent of Long-Term Costs; percentage same as construction
		Long-Term Subtotal (Net Present Value)	**$685,000**	
Total		**Total**	**$8,836,000**	

Notes:

1. Means - 2017 RS Means Online Cost Estimating

Table 21
Soil Alternative Evaluation Summary
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Alternative	Protectiveness	Effectiveness	Long-Term Reliability	Implementability	Implementation Risk	Reasonableness of Cost	Ability to Treat Hot Spots
	Unacceptable	**Rank: 10**	**Rank: 10**	**Rank: 1**	**Rank: 1**	**Rank: 1**	**Unacceptable**
Alternative 1: No Action	Protectiveness requirements are not met because contaminants are left in place at concentrations that exceed risk levels.	- No action taken - Risks are not reduced or managed - Residual risk unacceptable	- No long-term reliability	- Easiest to implement	- No implementation risks	This alternative has no cost. Total Cost: $0	This alternative does not treat or remove soil above hot spot or risk levels.
	Acceptable	**Rank: 8**	**Rank: 8**	**Rank: 7**	**Rank: 8**	**Rank: 9**	**Poor**
Alternative 2a: Standard Cap	Overall excellent protectiveness. Relies on long-term effectiveness and reliability through inspection, maintenance, and institutional controls.	- No removal - 2-Foot Cap in-place is effective - 6 months to construct	- All soil remains on-site - 2-foot cap - Cap maintenance - Engineering/institutional controls - Soil management plan	- Excavate and Place On-Site: 0 cy - Excavate and Dispose Off-Site: 0 cy - Import: 88,000 cy - Easy coordination with in-water	- Standard construction hazards - Removes native trees	Capital: $11,203,000 Long-Term (Present Worth): $1,922,000 Contingency: $1,985,000 Total: $13,125,000	Does not remove or treat hot spots.
	Acceptable	**Rank: 9**	**Rank: 9**	**Rank: 2**	**Rank: 2**	**Rank: 2**	**Poor**
Alternative 2b: Amended Cap	Protective. Relies on long-term effectiveness and reliability through inspection, maintenance, and institutional controls. Uncertainty in long-term reliability of cap.	- No soil removed - Soil capped in place - 1-Foot Cap with amendments has some uncertainty in effectiveness - Relies partially on access restrictions for human health; generally effective - 6 months to construct	- All soil remains on-site - 1-foot amended cap - Cap maintenance - Engineering/institutional controls - Soil management plan - Long-term effectiveness of cap uncertain	- Excavate and Place On-Site: 0 cy - Excavate and Dispose Off-Site: 0 cy - Import: 29,000 cy - Easy coordination with in-water	- Standard construction hazards - Saves native trees	Capital: $5,097,000 Long-Term (Present Worth): $374,000 Contingency: $803,000 Total: $5,471,000	Does not remove or treat hot spots.
	Acceptable	**Rank: 1**	**Rank: 1**	**Rank: 10**	**Rank: 10**	**Rank: 8**	**Excellent**
Alternative 3a: Standard Excavation and Off-Site Disposal	The excavation and off-site disposal of impacted soils is highly protective to human health and the environment. Overall protectiveness is better than capping alternatives because the performance of an off-site landfill is presumed to be more protective than on-site capping of materials.	- All soil removed off-site to landfill - 6 months to construct	- Off-site in controlled landfill	- Excavate and Place On-Site: 0 cy - Excavate and Dispose Off-Site: 49,000 cy - Import: 0 cy - Easy coordination with in-water	- Standard construction hazards - Removes native trees	Capital: $11,013,000 Long-Term (Present Worth): $255,000 Contingency: $2,105,000 Total: $11,268,000	This alternative removes hot spots within a reasonable time frame.
	Acceptable	**Rank: 2**	**Rank: 3**	**Rank: 9**	**Rank: 5**	**Rank: 6**	**Good**
Alternative 3b: Alternative Excavation and Off-Site Disposal	Same as Alternative 3a except that soil above risk levels may be left below the drip line of trees (up to 6% of total area)	- Most soil removed off-site to landfill - Some soil remains in tree drip line area (approx. 6% of total area) - 1-Foot cap of remaining soil is effective, but less so than thicker cap - 6 months to construct	- Most soil off-site in controlled landfill - Remaining soil has 1-foot cap - Cap maintenance - Engineering/institutional controls - Soil management plan	- Excavate and Place On-Site: 0 cy - Excavate and Dispose Off-Site: 45,000 cy - Import: 0 cy - Easy coordination with in-water	- Standard construction hazards - Saves native trees	Capital: $10,481,000 Long-Term (Present Worth): $232,000 Contingency: $2,001,000 Total: $10,713,000	Removes a large portion of hot spots.
	Acceptable	**Rank: 4**	**Rank: 4**	**Rank: 5**	**Rank: 6**	**Rank: 5**	**Fair**
Alternative 3c: Standard Excavation and On-Site Consolidation	Same as Alternative 3a except for the operation of the on-Site landfill is less reliable than that of a commercial landfill.	- No removal - Soil consolidated prior to capping - 2-Foot Cap is effective - 6 months to construct	- All soil on-site in smaller footprint than Alt. 2 - 2-foot cap - Cap maintenance - Engineering/institutional controls - Soil management plan	- Excavate and Place On-Site: 43,000 cy - Excavate and Dispose Off-Site: 0 cy - Import: 46,000 cy - Easy coordination with in-water	- Standard construction hazards - Removes native trees	Capital: $9,447,000 Long-Term (Present Worth): $953,000 Contingency: $1,996,000 Total: $10,400,000	Does not remove or treat hot spots. Hot spots consolidated on-site beneath cap.
	Acceptable	**Rank: 3**	**Rank: 2**	**Rank: 6**	**Rank: 7**	**Rank: 7**	**Moderate**
Alternative 3d: Standard Excavation with Off-Site Disposal and On-Site Consolidation	Same as Alternative 3c except the removal of non-dioxin/furan hot spots makes this more protective.	- Higher concentration soil removed - Remaining soil consolidated prior to capping - 2-Foot Cap is effective - 6 months to construct	- Same as Alternative 3c except higher concentration soil removed to off-site landfill	- Excavate and Place On-Site: 38,000 cy - Excavate and Dispose Off-Site: 4,000 cy - Import: 46,000 cy - Easy coordination with in-water	- Standard construction hazards - Removes native trees	Capital: $9,956,000 Long-Term (Present Worth): $953,000 Contingency: $2,091,000 Total: $10,909,000	This alternative removes non-dioxin/furan hot spots within a reasonable time frame. Dioxin/furan hot spots consolidated on-site beneath cap.
	Acceptable	**Rank: 6**	**Rank: 6**	**Rank: 8**	**Rank: 9**	**Rank: 10**	**Fair**
Alternative 4a: Focused Standard Excavation and Offsite Disposal with Cap	Same as Alternative 2a except removal of non-dioxin/furan hot spots makes this more protective.	- Higher concentration soil removed - Remaining soil capped in place - 2-Foot Cap is effective - 6 months to construct	- Same as Alternative 2a except higher concentration soil removed to off-site landfill	- Excavate and Place On-Site: 0 cy - Excavate and Dispose Off-Site: 4,000 cy - Import: 87,000 cy - Easy coordination with in-water	- Standard construction hazards - Removes native trees	Capital: $12,413,000 Long-Term (Present Worth): $2,060,000 Contingency: $2,185,000 Total: $14,473,000	This alternative removes non-dioxin/furan hot spots within a reasonable time frame. Dioxin/furan hot spots remain.
	Acceptable	**Rank: 7**	**Rank: 7**	**Rank: 3**	**Rank: 3**	**Rank: 3**	**Fair**
Alternative 4b: Focused Alternative Excavation with Offsite Disposal and Amended Cap	Same as Alternative 2b except the cap thickness is less, but the lesser thickness is off-set with the addition of the soil amendment.	- Most higher concentration soil removed - Remaining soil capped in place - 1-Foot Cap with amendments has some uncertainty in effectiveness - Relies partially on access restrictions for human health; generally effective - 6 months to construct	- Most higher concentration soil removed to off-site landfill - 1-foot amended cap - Cap maintenance - Engineering/institutional controls - Soil management plan	- Excavate and Place On-Site: 0 cy - Excavate and Dispose Off-Site: 4,000 cy - Import: 29,000 cy - Easy coordination with in-water	- Standard construction hazards - Saves native trees	Capital: $5,671,000 Long-Term (Present Worth): $214,000 Contingency: $853,000 Total: $5,885,000	This alternative removes non-dioxin/furan hot spots within a reasonable time frame. Dioxin/furan hot spots remain.
	Acceptable	**Rank: 4**	**Rank: 4**	**Rank: 4**	**Rank: 4**	**Rank: 4**	**Moderate**
Alternative 4c: Focused Alternative Excavation with Off-Site Disposal/On-Site Consolidation and Cap	Overall very good protectiveness. Most higher concentration soil removed. Human health soil and remaining hot spot soil consolidated and capped. Remaining area capped. Relies on long-term effectiveness and reliability through inspection, maintenance, and institutional controls.	- Most higher concentration soil removed - Remaining hot spot soil and soil above human health risk levels consolidated prior to 2-foot cap - Remaining soil with 1-Foot Cap is effective - Access restrictions for human health generally effective - 6 months to construct	- Higher concentration soil in controlled landfill - Soil above hot spot and human health risk levels consolidated and capped providing greater reliability than just capping - 1-foot cap on remaining lower risk soil - Cap maintenance - Engineering/institutional controls - Soil management plan	- Excavate and Place On-Site: 23,000 cy - Excavate and Dispose Off-Site: 4,000 cy - Import: 41,000 cy - Easy coordination with in-water	- Standard construction hazards - Saves native trees	Capital: $8,151,000 Long-Term (Present Worth): $685,000 Contingency: $1,502,000 Total: $8,836,000	This alternative removes non-dioxin/furan hot spots within a reasonable time frame. Dioxin/furan hot spots consolidated on-site beneath a cap.

Table 22
Comparative Evaluation of Alternatives
Willamette Cove Upland Facility Feasibility Study
Portland, Oregon

Release Area Alternative	Protective	Balancing Factors																																																		Score	Rank
		Effectiveness										Long-Term Reliability										Implementability										Implementation Risk										Reasonableness of Cost											
		1	2a	2b	3a	3b	3c	3d	4a	4b	4c	1	2a	2b	3a	3b	3c	3d	4a	4b	4c	1	2a	2b	3a	3b	3c	3d	4a	4b	4c	1	2a	2b	3a	3b	3c	3d	4a	4b	4c	1	2a	2b	3a	3b	3c	3d	4a	4b	4c		
1 No Action	No		-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-		+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	--	NA
2a Standard Cap	Yes	+		+	-	-	-	-	-	-	-	+		+	-	-	-	-	-	-	-	-		-	+	+	-	-	+	-	-	-		+	+	-	-	-	-	-	-	-		-	-	-	-	-	+	-	-	-25	9
2b Amended Cap	Yes	+	-		-	-	-	-	-	-	-	+	-		-	-	-	-	-	-	-	-	+		+	+	+	+	+	+	+	-	+		+	+	+	+	+	+	+	-	+		+	+	+	+	+	+	+	+	7	3
3a Standard Excavation with Off-Site Disposal	Yes	+	+	+		+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	-	-	-		-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	+	-		-	-	-	+	-	-	-5	7
3b Alternative Excavation with Off-Site Disposal	Yes	+	+	+	-		+	+	+	+	+	+	+	+	-		+	-	+	+	+	-	-	-	+		-	-	-	-	-	-	+	-	+		+	+	+	-	-	-	+	-	+		-	+	+	-	-	5	4
3c Standard Excavation with On-Site Consolidation	Yes	+	+	+	-	-		-	+	+	0	+	+	+	-	-		-	+	+	0	-	+	-	+	+		+	+	-	-	-	+	-	+	-		+	+	-	-	-	+	-	+	+		+	+	-	-	5	4
3d Standard Excavation with Off-Site Disposal and On-Site Consolidation	Yes	+	+	+	-	-	+		+	+	+	+	+	+	-	+	+		+	+	+	-	+	-	+	+	-		+	-	-	-	+	-	+	-	-		+	-	-	-	+	-	+	-	-		+	-	-	5	4
4a Focused Standard Excavation with Off-Site Disposal and Standard Cap	Yes	+	+	+	-	-	-	-		+	-	+	+	+	-	-	-	-		+	-	-	-	-	+	+	-	-		-	-	-	-	-	+	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-	-23	8
4b Focused Alternative Excavation with Off-Site Disposal and Amended Cap	Yes	+	+	+	-	-	-	-	-		-	+	+	+	-	-	-	-	-		-	-	+	-	+	+	+	+	+		+	-	+	-	+	+	+	+	+		+	-	+	-	+	+	+	+	+		+	9	2
4c Focused Alternative Excavation with Off-Site Disposal/On-Site Consolidation and Cap	Yes	+	+	+	-	-	0	-	+	+		+	+	+	-	-	0	-	+	+		-	+	-	+	+	+	+	+	-		-	+	-	+	+	+	+	+	-		-	+	-	+	+	+	+	+	-	0	13	1

Notes:

+ = The alternative is favored over the compared alternative (score=1)

0 = The alternative is equal with the compared alternative (score=0)

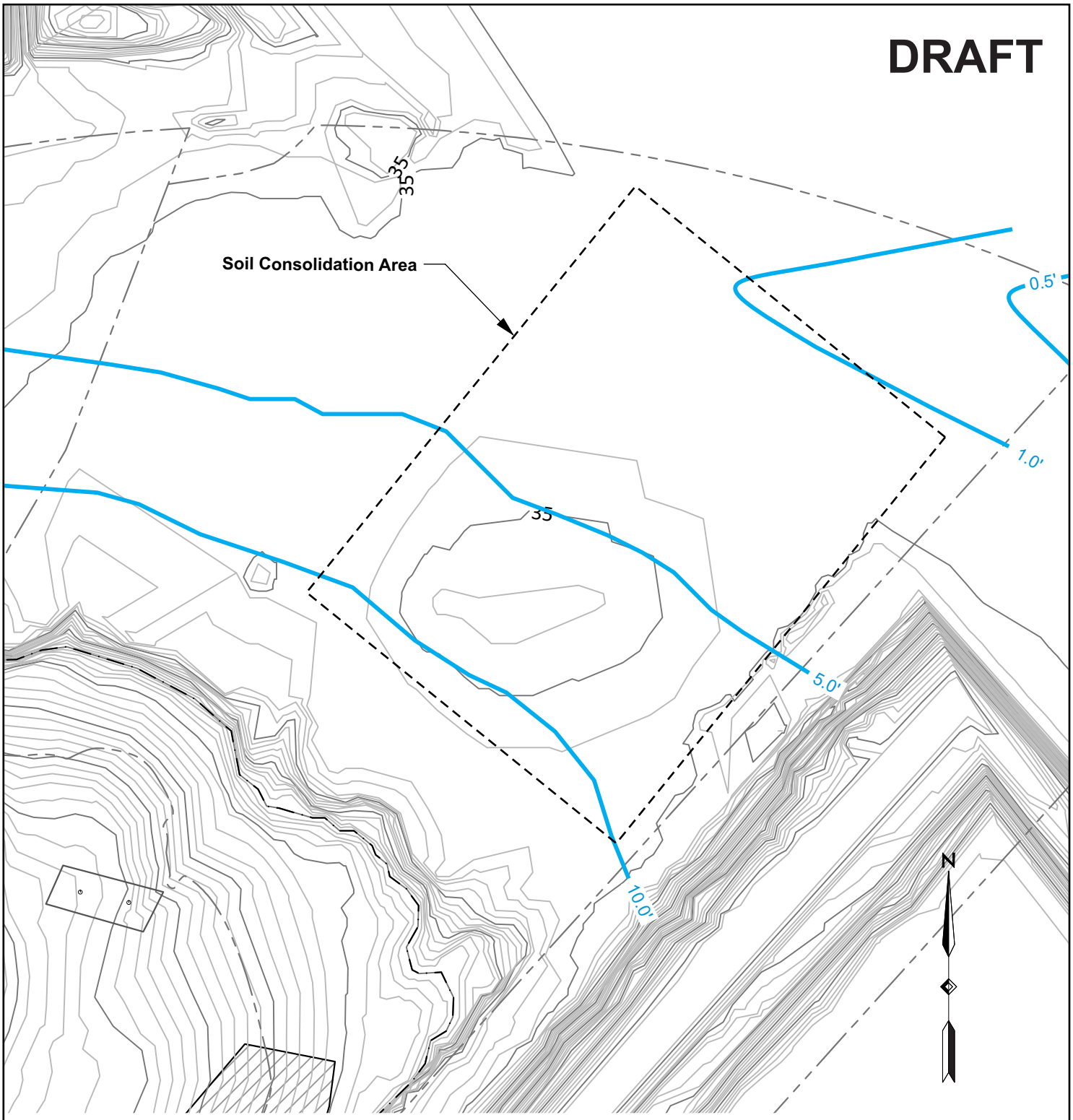
- = The alternative is less favorable than the compared alternative (score=-1)

na = Not protective, therefore not ranked

Alternative	Compared Against:									
Alternative 1		2a	2b	3a	3b	3c	3d	4a	4b	4c
Alternative 2a	1		2b	3a	3b	3c	3d	4a	4b	4c
Alternative 2b	1	2a		3a	3b	3c	3d	4a	4b	4c
Alternative 3a	1	2a	2b		3b	3c	3d	4a	4b	4c
Alternative 3b	1	2a	2b	3a		3c	3d	4a	4b	4c
Alternative 3c	1	2a	2b	3a	3b		3d	4a	4b	4c
Alternative 3d	1	2a	2b	3a	3b	3c		4a	4b	4c
Alternative 4a	1	2a	2b	3a	3b	3c	3d		4b	4c
Alternative 4b	1	2a	2b	3a	3b	3c	3d	4a		4c
Alternative 4c	1	2a	2b	3a	3b	3c	3d	4a	4b	

Attachment B

Seismic/Flooding Consideration Figures



Legend:

1.0' Predicted Lateral Spread

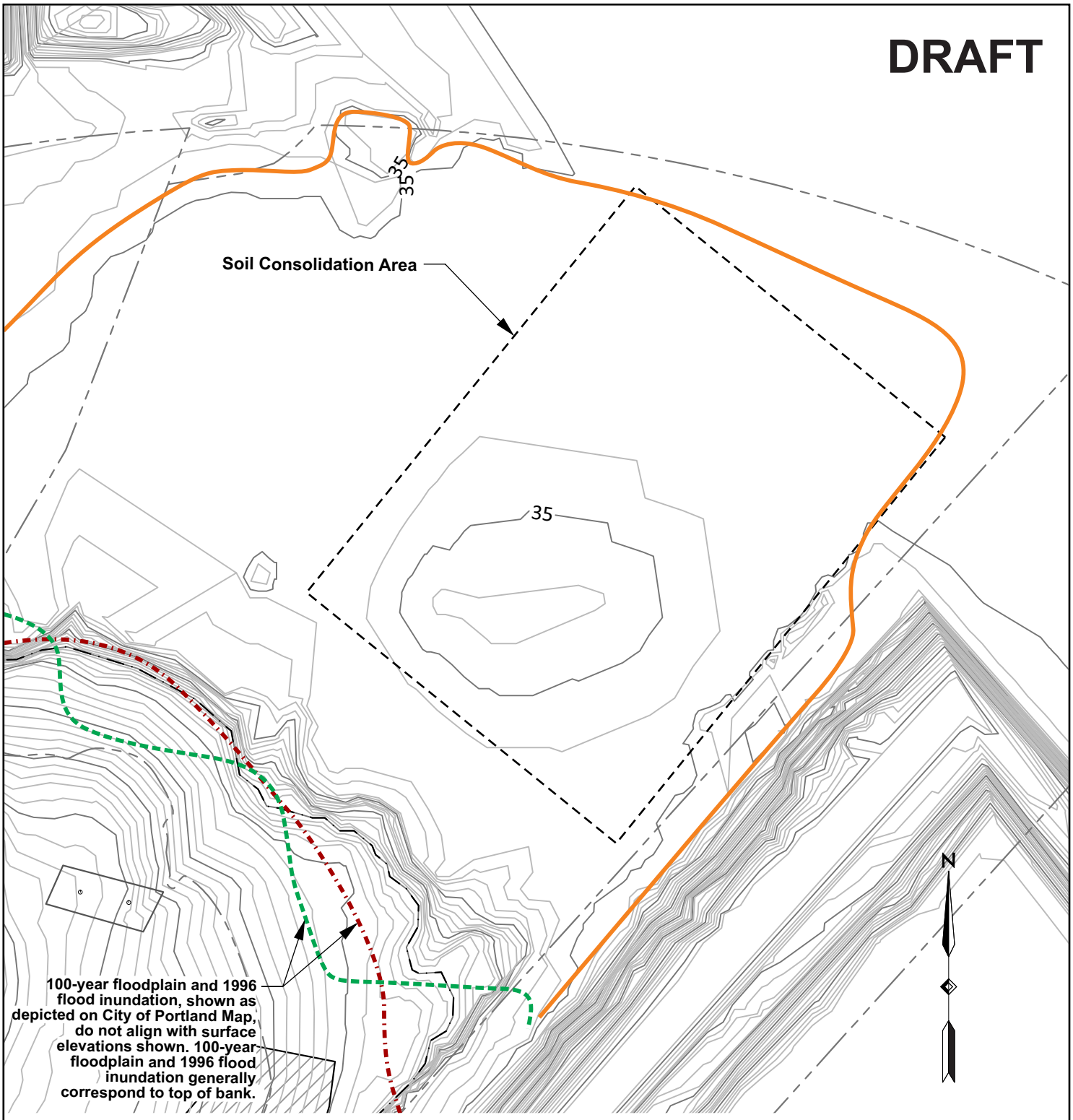
0 100 200
Approximate Scale in Feet

Notes:
1. Vertical Datum: NAVD88
2. Soil Consolidation Area from Feasibility Study Figure 20.
3. Lateral spreading contours from City of Portland Water Bureau seismic hazard study. Results at https://pdx.maps.arcgis.com/apps/webappviewer/index.html?id=22e4c106698b4087bd790005a2437531

Seismic Hazard

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
	June 2019		B-1



Legend:

500-Year Floodplain

100-Year Floodplain

1996 Flood Inundation

0 100 200

Approximate Scale in Feet

Notes:
1. Vertical Datum: NAVD88
2. Soil Consolidation Area from Feasibility Study Figure 20.
3. Floodplain information from City of Portland flood maps at https://pdx.maps.arcgis.com/apps/Viewer/index.html?appid=f23b1f78bcd846e7b83769ad0638da0f

Flood Hazard

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
	June 2019		B-2

Attachment C

Riverbank Soil Summary Data Tables

Table C-1
Riverbank Soil Analytical Results - PCBs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268	Total PCBs
			Minimum	Maximum	Concentration in mg/kg									
Screening Levels		Cleanup Level			--	--	--	--	--	--	--	--	--	0.009
		JSCS Screening Level Value			0.53	--	--	--	1.5	0.3	0.2	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--	--	--	0.075
		Principal Threat Waste			--	--	--	--	--	--	--	--	--	0.2
West Parcel														
WC-SSB	12/21/2005	Discrete	0	0.5	0.049 U	0.0985 U	0.049 U	0.049 U	0.049 U	0.049 U	0.049 U	--	--	0.0985 UJT
Central Parcel														
HA-6/S-1	5/18/2001	Discrete	0	0.5	0.067 U	0.134 U	0.067 U	0.067 U	0.067 U	0.134 U	0.134 U	--	--	0.134 UJT
TP-22/S-1	4/17/2001	Discrete	0	0.5	0.067 U	0.134 U	0.067 U	0.067 U	0.067 U	0.067 U	0.067 U	--	--	0.134 UJT
WC-1/2/3	10/1/2010	Composite	0.25	1	0.0054 U	0.0027 U	0.0037 U	0.005 U	0.0047 U	0.0029 U	0.0058 U	0.0034 U	0.0016 U	0.0058 UJT
WC-SSF	12/21/2005	Composite	0	0.5	0.0391 U	0.0787 U	0.0391 U	0.0391 U	0.0391 U	0.0391 U	0.0391 U	--	--	0.0787 UJT
WC-SSG	12/21/2005	Composite	0	0.5	0.0581 U	0.117 U	0.0581 U	0.0581 U	0.0581 U	0.0581 U	0.0581 U	--	--	0.117 UJT
WC-SSH-D	12/27/2007	Discrete	0	0.5	0.01 U	0.02 U	0.01 U	0.01 U	0.01 U	0.01 U	0.21	0.01 U	0.01 U	***0.3 JT***
WC-SSH-E	12/27/2007	Discrete	0	0.5	0.01 U	0.02 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.02 UJT
WC-SSH-F	12/27/2007	Discrete	0	0.5	0.01 U	0.02 U	0.015 U	0.031 U	0.01 U	0.01 U	0.13	0.01 U	0.01 U	***0.2 JT***
WC-SSP (Comp)-1	10/4/2010	Composite	0	0.5	0.0044 U	0.0088 U	0.0088 U	0.0066 U	0.0066 U	0.0055 U	0.0099 U	0.0044 U	0.0044 U	0.0099 UJT
WC-SSQ(Composite)	10/1/2010	Composite	0	0.5	0.0042 U	0.0084 U	0.0084 U	0.0063 U	0.0063 U	0.0052 U	0.0094 U	0.0042 U	0.0042 U	0.0094 UJT
WC-SSR(Composite)	10/1/2010	Composite	0	0.5	0.0043 U	0.0086 U	0.0086 U	0.0065 U	0.0065 U	0.0054 U	0.0097 U	0.0043 U	0.0043 U	0.0097 UJT
WC-SSS(Composite)	10/1/2010	Composite	0	0.5	0.0043 U	0.0086 U	0.0086 U	0.0064 U	0.0064 U	0.0054 U	0.0097 U	0.0043 U	0.0043 U	0.0097 UJT
WC-SST(Comp)-1	10/4/2010	Composite	0	0.5	0.0047 U	0.0094 U	0.0094 U	0.007 U	0.007 U	0.0058 U	0.0105 U	0.0047 U	0.0047 U	0.0105 UJT
WC-SSU(Composite)	10/1/2010	Composite	0	0.5	0.0043 U	0.0086 U	0.0086 U	0.0064 U	0.0064 U	0.0054 U	0.0096 U	0.0043 U	0.0043 U	0.0096 UJT
WC-SSV-1-1	10/4/2010	Discrete	0	0.5	0.0049 U	0.0097 U	0.0097 U	0.0073 U	0.0073 U	0.0061 U	0.0109 U	0.0049 U	0.0049 U	0.0109 UJT
WC-SSW(Composite)	10/4/2010	Composite	0	0.5	0.0043 U	0.0085 U	0.0085 U	0.0064 U	0.0064 U	0.0053 U	0.0096 U	0.0043 U	0.0043 U	0.0096 UJT
WC-SSX(Composite)	10/4/2010	Composite	0	0.5	0.004 U	0.0081 U	0.0081 U	0.0061 U	0.0061 U	0.005 U	0.0091 U	0.004 U	0.004 U	0.0091 UJT
WC-SSY(Composite)	10/4/2010	Composite	0	0.5	0.0055 U	0.011 U	0.011 U	0.0082 U	0.0082 U	0.0068 U	0.0123 U	0.0055 U	0.0055 U	0.0123 UJT
Wharf Beach -1	9/27/2010	Discrete	1	1.5	0.0057 U	0.0113 U	0.0113 U	0.0085 U	0.0085 U	0.0071 U	0.0127 U	0.0057 U	0.0057 U	0.0127 UJT

Please see notes at end of table.

Table C-1
Riverbank Soil Analytical Results - PCBs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs) Minimum	Depth (ft bgs) Maximum	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268	Total PCBs
					Concentration in mg/kg									
Screening Levels		**Cleanup Level**			--	--	--	--	--	--	--	--	--	0.009
		JSCS Screening Level Value			0.53	--	--	--	1.5	0.3	0.2	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--	--	--	0.075
		Principal Threat Waste			--	--	--	--	--	--	--	--	--	0.2
East Parcel														
Beach Cove-1	9/27/2010	Discrete	12	18	0.0892 U	0.178 U	0.178 U	0.134 U	0.134 U	0.112 U	0.201 U	0.0892 U	0.0892 U	0.201 UJT
Beach Cove-2	9/27/2010	Discrete	12	18	0.111 U	0.222 U	0.222 U	0.167 U	0.167 U	0.139 U	0.25 U	0.111 U	0.111 U	0.25 UJT
HA-1	12/12/1988	Composite	0	6	--	1 U	1 U	1 U	0.9 U	0.8 U	0.7 U	--	--	1 UJA
WC-SSH	12/21/2005	Composite	0	0.5	0.0787 U	0.158 U	0.0787 U	0.0787 U	0.0787 U	0.0787 U	0.748	--	--	***1.30 JT***
WC-SSH-1	12/21/2005	Discrete	0	0.5	0.193 UJ	0.388 UJ	0.193 UJ	0.193 UJ	0.193 UJ	0.193 UJ	1.2 J	--	--	***2.6 JT***
WC-SSH-2	12/21/2005	Discrete	0	0.5	0.0393 UJ	0.0792 UJ	0.0393 UJ	0.0393 UJ	0.0393 UJ	0.0393 UJ	0.261 J	--	--	***0.537 JT***
WC-SSH-3	12/21/2005	Discrete	0	0.5	0.403 UJ	0.811 UJ	0.403 UJ	0.403 UJ	0.403 UJ	0.403 UJ	1.85 J	--	--	***4.68 JT***
WC-SSH-4	12/21/2005	Discrete	0	0.5	0.0374 UJ	0.0752 UJ	0.0374 UJ	0.0374 UJ	0.0374 UJ	0.0374 UJ	0.0374 UJ	--	--	0.0752 UJT
WC-SSH-A	12/27/2007	Discrete	0	0.5	0.01 U	0.02 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.02 UJT
WC-SSH-B	12/27/2007	Discrete	0	0.5	0.01 U	0.02 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.02 UJT
WC-SSH-C	12/27/2007	Discrete	0	0.5	0.01 U	0.02 U	0.01 U	0.01 U	0.01 U	0.017	0.029	0.01 U	0.01 U	**0.1 JT**
WC-SSH-G	12/27/2007	Discrete	0	0.5	0.01 U	0.02 U	0.01 U	0.01 U	0.01 U	0.012 U	0.022	0.01 U	0.01 U	**0.1 JT**
WC-SSH-H	12/27/2007	Discrete	0	0.5	0.01 U	0.02 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.02 UJT
WC-SSH-SHS1	4/21/2008	Discrete	2.5	3	0.01 U	0.02 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.02 UJT
WC-SSH-SHS2	4/21/2008	Discrete	2.5	3	0.0099 U	0.02 U	0.0099 U	0.0099 U	0.0099 U	0.028 P	0.075	0.0099 U	0.0099 U	**0.2 JT**
WC-SSI	12/21/2005	Composite	0	0.5	0.0391 U	0.0787 U	0.0391 U	0.0391 U	0.0391 U	0.0391 U	0.0391 U	--	--	0.0787 UJT
WC-SSJ	12/21/2005	Composite	0	0.5	0.0391 U	0.0787 U	0.0391 U	0.0391 U	0.0391 U	0.0391 U	0.0391 U	--	--	0.0787 UJT
WC-SSK	12/21/2005	Composite	0	0.5	0.0419 U	0.0843 U	0.0419 U	0.0419 U	0.0419 U	0.0419 U	0.0419 U	--	--	0.0843 UJT
WC-SSL-1 Composite	9/28/2010	Composite	0	0.5	0.0058 U	0.0029 U	0.0041 U	0.0054 U	0.0052 U	0.0031 U	0.0063 U	0.0037 U	0.0017 U	0.0063 UJT
WC-SSL-2 Composite	9/30/2010	Composite	0	0.5	0.0059 U	0.0029 U	0.0041 U	0.0054 U	0.0052 U	0.0031 U	0.0063 U	0.0037 U	0.0017 U	0.0063 UJT

Please see notes at end of table.

Table C-1
Riverbank Soil Analytical Results - PCBs
Willamette Cove
Portland, Oregon

Notes:

1. PCBs = Polychlorinated Biphenyls.
2. Total PCBs calculated according to Appendix A of the Portland Harbor RI/FS for LWG RA Total PCB Aroclors (Calculated U=1/2)
3. ft bgs = feet below ground surface
4. mg/kg = milligrams per kilogram
5. Cleanup Levels from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
6. 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.
7. Remedial Action Level from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
8. Prinicipal Threat Waste from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
9. A = Summed value based on limited number of analytes.
10. J = Estimated value after QA review.
11. P = GC or HPLC confirmation criteria exceeded
12. T = Total value calculated or selected from >1 reported value.
13. U = Non-detected value.
14. 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.
15. Shaded values exceed CUL or JSCS SLV
16. **Bold values exceed RAL**
17. ***Underlined italicized values exceed PTW threshold***

Table C-2
Riverbank Soil Analytical Results - Dioxin/Furans
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Dixoin/Furan TEQ	1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-HxCDF	1,2,3,7,8,9-HxCDD
			Minimum	Maximum	Concentration in mg/kg								
Screening Levels		Cleanup Level			--	--	--	--	--	4.00E-07	--	--	--
		JSCS Screening Level Value			--	6.90E-04	6.90E-04	6.90E-04	--	--	--	2.70E-06	--
		Remedial Action Level			--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	4.00E-05	--	--	--
Central Parcel													
DU-2	8/8/2012	ISM	0	0.5	4.55E-04 JT	2.55E-03 E	4.49E-04	7.38E-05	4.39E-05	***2.55E-04***	2.82E-04	2.80E-04	1.23E-04
DU-3	8/13/2012	ISM	0	0.5	1.53E-04 JT	1.53E-03 E	2.35E-04	2.12E-05	2.03E-05	***5.13E-05***	1.18E-04	8.19E-05	6.42E-05
RA3-S19	10/28/2015	Composite	0	0.5	5.50E-05 JT	2.71E-04	5.91E-05	1.35E-06	6.43E-06	2.23E-06	1.25E-04	1.91E-06	9.63E-05
WC-1 Surface	10/1/2010	Discrete	0.25	0.75	3.10E-04 JT	2.00E-03	4.30E-04	5.20E-05	4.20E-05 J	***2.20E-04***	1.50E-04	4.60E-06 P U	9.00E-05
WC-1/2/3	10/1/2010	Composite	0.25	1	7.85E-05 JT	3.10E-03	2.50E-04	1.60E-05	1.50E-05	2.20E-05	1.50E-04	1.30E-05	2.90E-05
WC-2 Surface	10/1/2010	Discrete	0.25	0.75	8.99E-05 JT	1.20E-03	2.10E-04	1.90E-05 J	2.50E-05 J	***4.30E-05 J***	1.10E-04	2.20E-06 P U	6.50E-05
WC-3 Surface	10/1/2010	Discrete	0.25	0.75	2.60E-03 JT	2.40E-03	2.30E-03	3.40E-04	1.50E-04	***1.40E-03***	6.80E-04	5.00E-07 P U	4.30E-04
Wharf Beach -1	9/27/2010	Discrete	1	1.5	2.03E-06 JT	2.50E-06 J	2.50E-06 J	5.80E-07 U	5.50E-07 U	1.40E-06 J	5.10E-07 J	2.20E-06 J	4.90E-07 U

Please see notes at end of table.

Table C-2
Riverbank Soil Analytical Results - Dioxin/Furans
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		1,2,3,7,8,9-HxCDF	1,2,3,7,8-PeCDD	1,2,3,7,8-PeCDF	2,3,4,6,7,8-HxCDF	2,3,4,7,8-PeCDF	2,3,7,8-TCDD	2,3,7,8-TCDF	OCDD	OCDF
			Minimum	Maximum	Concentration in mg/kg								
Screening Levels		Cleanup Level			--	2.00E-07	--	--	3.00E-07	2.00E-07	4.07E-07	--	--
		JSCS Screening Level Value			2.70E-06	--	2.60E-06	2.70E-06	--	--	--	2.30E-02	2.30E-02
		Remedial Action Level			--	8.00E-07	--	--	2.00E-04	6.00E-07	--	--	--
		Principal Threat Waste			--	1.00E-05	--	--	2.00E-04	1.00E-05	6.00E-04	--	--
Central Parcel													
DU-2	8/8/2012	ISM	0	0.5	8.35E-07 U	***8.48E-05***	4.56E-05	6.52E-04	***1.59E-03 E***	**6.45E-06**	3.73E-05	1.88E-02 E	3.10E-04
DU-3	8/13/2012	ISM	0	0.5	4.94E-07 U	***2.15E-05***	1.56E-05	2.14E-04	***5.10E-04***	2.58E-06	1.62E-05	1.00E-02 E	3.66E-04
RA3-S19	10/28/2015	Composite	0	0.5	7.64E-07	***2.47E-05***	9.89E-07	2.86E-06	9.65E-07	2.99E-06	1.01E-06	6.05E-04	3.16E-05
WC-1 Surface	10/1/2010	Discrete	0.25	0.75	1.20E-04	***3.50E-05 J***	5.70E-06 P U	3.10E-04	***1.50E-03***	**1.90E-06 U**	5.30E-06 P U	1.30E-02	6.30E-04
WC-1/2/3	10/1/2010	Composite	0.25	1	1.40E-05	**8.50E-06**	5.80E-06	1.30E-05	8.30E-06	**1.00E-06 J**	5.00E-06	2.70E-02	4.90E-04
WC-2 Surface	10/1/2010	Discrete	0.25	0.75	2.00E-05 J	***1.80E-05 J***	2.80E-06 P U	5.80E-05	**1.80E-04**	**4.50E-06 J**	3.80E-06 P U	7.50E-03	2.40E-04
WC-3 Surface	10/1/2010	Discrete	0.25	0.75	1.00E-03	***2.40E-04***	9.58E-07 P U	3.20E-03	***1.60E-02***	***2.40E-05***	1.60E-06 P U	1.00E-02	4.60E-04
Wharf Beach -1	9/27/2010	Discrete	1	1.5	9.60E-07 J	5.40E-07 U	6.10E-07 U	3.10E-06 J	4.20E-07 U	4.00E-07 U	5.00E-07 J	8.50E-06 J	2.90E-06 J

Please see notes at end of table.

Table C-2
Riverbank Soil Analytical Results - Dioxin/Furans
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Total HcCDF	Total HpCDD	Total HpCDF	Total HxCDD	Total HxCDF	Total PeCDD	Total PeCDF	Total TCDD	Total TCDF
			Minimum	Maximum	Concentration in mg/kg								
Screening Levels		Cleanup Level			--	--	--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	--	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--	--	--
Central Parcel													
DU-2	8/8/2012	ISM	0	0.5	8.92E-03 P	4.62E-03	1.14E-03	2.30E-03	--	--	2.20E-02 P	2.44E-04	4.98E-03 P
DU-3	8/13/2012	ISM	0	0.5	2.97E-03 P	2.74E-03	6.89E-04	8.31E-04	--	--	6.80E-03 P	7.35E-05	1.49E-03 P
RA3-S19	10/28/2015	Composite	0	0.5	--	5.65E-04	1.05E-04	8.38E-04	4.62E-05	1.43E-04	2.93E-05	3.09E-05	1.60E-05
WC-1 Surface	10/1/2010	Discrete	0.25	0.75	8.50E-03	3.90E-03	1.30E-03	1.30E-03	--	--	1.60E-02	1.60E-04	3.50E-03
WC-1/2/3	10/1/2010	Composite	0.25	1	5.70E-04	6.00E-03	8.00E-04	6.00E-04	--	--	1.40E-04	3.50E-05	7.90E-05
WC-2 Surface	10/1/2010	Discrete	0.25	0.75	1.40E-03	2.60E-03	5.00E-04	9.20E-04	--	--	2.20E-03	8.40E-05	6.10E-04
WC-3 Surface	10/1/2010	Discrete	0.25	0.75	9.30E-02 E	5.00E-03	6.30E-03	7.30E-03	--	--	1.50E-01 E	8.90E-04	1.60E-02 E
Wharf Beach -1	9/27/2010	Discrete	1	1.5	--	4.90E-06	4.60E-06 J	4.50E-06 J	2.00E-05	5.40E-07 U	3.40E-05	4.00E-07 U	1.20E-05

Please see notes at end of table.

Table C-2
Riverbank Soil Analytical Results - Dioxin/Furans
Willamette Cove
Portland, Oregon

Notes:

1. Dioxin/Furan TEQ = 2,3,7,8-Tetrachlorodibenzodioxin Toxic Equivalent
2. Dioxin/Furan TEQ calculated according to Appendix A of the Portland Harbor RI/FS for LWG RA Dioxin/Furan TEQ 2005 (Calculated U=1/2)
3. ft bgs = feet below ground surface
4. mg/kg = milligrams per kilogram
5. ISM = Incremental Sampling Methodology
6. Cleanup Levels from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
7. 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 availabl
8. Remedial Action Level from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
9. Prinicipal Threat Waste from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
10. E = above the high calibration limit
11. J = Estimated value after QA review.
12. P = GC or HPLC confirmation criteria exceeded
13. T = Total value calculated or selected from >1 reported value.
14. U = Non-detected value.
15. 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.
16. Shaded values exceed CUL or JSCS SLV
17. **Bold values exceed RAL**
18. ***Underlined italicized values exceed PTW threshold***

Table C-3
Riverbank Soil Analytical Results - Metals
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium
			Minimum	Maximum	Concentration in mg/kg									
Screening Levels		Cleanup Level			--	3	--	0.51	--	359	196	0.085	--	--
		JSCS Screening Level Value			64	--	--	--	111	--	--	--	48.6	5
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--	--	--	--
Central Parcel														
Area-3-12	4/10/2014	Discrete	0	0.5	--	--	--	--	--	--	48.6	0.955	--	--
Area-3-19	4/10/2014	Discrete	0	0.5	--	--	--	--	--	--	198	0.703	--	--
DU-6-COMP-2-3	4/8/2014	Discrete	0	0.5	--	--	--	--	--	--	--	0.534 J2	--	--
DU-6-COMP-2-6	4/8/2014	Discrete	0	0.5	--	--	--	--	--	--	--	0.0796 J2	--	--
DU-6-COMP-4-1	4/8/2014	Discrete	0	0.5	--	--	--	--	--	--	--	3.88 J2	--	--
DU-6-COMP-4-3	4/8/2014	Discrete	0	0.5	--	--	--	--	--	--	--	1.82 J2	--	--
DU-6-COMP-4-4	4/8/2014	Discrete	0	0.5	--	--	--	--	--	--	--	4.22 J2	--	--
DU-6-COMP-4-5	4/8/2014	Discrete	0	0.5	--	--	--	--	--	--	--	0.113 J2	--	--
DU-6-COMP-8-3	4/8/2014	Discrete	0	0.5	--	--	--	--	--	--	--	5.34 J2	--	--
DU-6-COMP-8-4	4/8/2014	Discrete	0	0.5	--	--	--	--	--	--	--	1.42 J2	--	--
DU-6-COMP-8-6	4/8/2014	Discrete	0	0.5	--	--	--	--	--	--	--	1.98 J2	--	--
RA3-S19	10/28/2015	Composite	0	0.5	1.23 U	4.47	0.246	0.553	11.4	57.4	112	1.95	14.3	2.46 U
SS-19	1/17/2002	Discrete	0	0.5	--	40.3	--	--	68.6 J	744	468 J	0.747	121 J	--
SS-5	1/17/2002	Discrete	0	0.5	--	3.36	--	0.5 U	47.5 J	48.3	25.3 J	1.04	40.1 J	--
SS-6	1/17/2002	Discrete	0	0.5	--	2.34	--	0.431 U	13.2 J	16.6	7.14 J	0.214	17.2 J	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	0.5 UJ	3.9	0.5 U	0.5 U	21.3 J	42.9 J	116 J	0.663 J	71.3 J	0.5 U
TP-26/S-1	4/17/2001	Discrete	0	0.5	0.5 UJ	3.88	0.5 U	0.573	20.8	40	114 J	0.754	24.6	0.5 UJ
WC-1 Surface	10/1/2010	Discrete	0.25	0.75	6.9	24.8	0.31	0.37	62.1	262	889	8.1	54.5	0.2 J
WC-1/2/3	10/1/2010	Composite	0.25	1	4.9	8.6	0.19	1.7	42.3	251	693	5.5	28.4	0.75
WC-2 Surface	10/1/2010	Discrete	0.25	0.75	7.2	11.9	0.38	0.49	48.8	188	770	1.7	43.1	0.21 J
WC-3 Surface	10/1/2010	Discrete	0.25	0.75	2.5	7.3	0.28	0.88	31.7	195	727	1.4	49.1	0.13 J
WC-SSP (Comp)-1	10/4/2010	Composite	0	0.5	0.21 J	4.8	0.31	0.75	15.9	2860	262	3.5	16.4	0.87
WC-SSP (Comp)-2	10/4/2010	Composite	0	0.5	0.23 U	5.2	0.3	0.018 U	13.7	1030	175	1.9	17.3	0.11 U
WC-SSP-1-1	10/4/2010	Discrete	0	0.5	0.81	7.9	0.3	0.017 U	13.4	5440	436	9.8	19.2	0.1 U
WC-SSP-1-2	10/4/2010	Discrete	0	0.5	3	10.1	0.32	0.97	18.7	2420	386	3.4	20.4	1.5
WC-SSP-3-1	10/4/2010	Discrete	0	0.5	0.25 U	2.9	0.28	0.02 U	14.2	28.2	15.7	0.15	18	0.12 U
WC-SSP-3-2	10/4/2010	Discrete	0	0.5	0.22 U	5.6	0.41	0.057 J	18.1	27.2	23.8	0.077 J	20.8	1.7
WC-SSQ(Composite)	10/1/2010	Composite	0	0.5	0.18 U	3.3	0.3	0.15	13.7	27.2	13.8	0.11	14.2	1
WC-SSR(Composite)	10/1/2010	Composite	0	0.5	0.21 U	4.4	0.36	0.065 J	19.8	22.2	18.3	0.033 J	19.6	1
WC-SSS(Composite)	10/1/2010	Composite	0	0.5	3.1	12.1	0.34	0.76	25.5	116	733	2.4	28.4	0.89
WC-SSS-1a	10/1/2010	Discrete	0	0.5	0.42 J	4.3	0.27	0.43	12.6	57.7	203	2.7	22.2	0.11 U
WC-SSS-1b	10/1/2010	Discrete	0	0.5	8.4	15.9	0.28	0.19	20.2	140	388	2.9	25.5	0.1 U
WC-SSS-2a	10/1/2010	Discrete	0	0.5	1.1	3.9	0.3	0.088	14.4	33.6	111	0.24	21.8	0.11 U
WC-SSS-2b	10/1/2010	Discrete	0	0.5	2.5	21.3	0.25	0.83	35.7	417	4040	4.8	39.9	0.096 J
WC-SST(Comp)-1	10/4/2010	Composite	0	0.5	0.26 J	5.6	0.5	0.18	29.5	89.9	119	1.1	26.3	1.5
WC-SST-(Comp)-2	10/4/2010	Composite	0	0.5	0.39 J	4.7	0.34	0.49	16.3	58.6	1430	1.3	69.5	0.13 U
WC-SST-1-1	10/4/2010	Discrete	0	0.5	0.44 J	3.3	0.28	0.075 J	13.4	98.7	186	0.62	23.2	0.12 U
WC-SST-1-2	10/4/2010	Discrete	0	0.5	0.31 J	5.4	0.47	0.38	25.2	71.4	84.7	0.76	24.7	1.7
WC-SST-2-1	10/4/2010	Discrete	0	0.5	0.29 U	5	0.55	0.024 U	26.7	75.2	52.2	1.2	28.6	0.14 U
WC-SST-2-2	10/4/2010	Discrete	0	0.5	0.27 J	5.7	0.41	0.87	17.2	36.7	1800	0.66	57.5	1.5

Please see notes at end of table.

Table C-3
Riverbank Soil Analytical Results - Metals
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium
			Minimum	Maximum	Concentration in mg/kg									
Screening Levels		Cleanup Level			--	3	--	0.51	--	359	196	0.085	--	--
		JSCS Screening Level Value			64	--	--	--	111	--	--	--	48.6	5
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--	--	--	--
WC-SSV-1-1	10/4/2010	Discrete	0	0.5	29.9	7.5	0.45	1.9	25.4	3360	677	0.6	39.3	1.8
WC-SSV-1-2	10/4/2010	Discrete	0	0.5	11.3	30.9	0.36	0.028 U	36.5	693	833	1.4	144	1.2
Wharf Beach -1	9/27/2010	Discrete	1	1.5	0.57 J	39	0.45	1	33.4	1400	8660	113	25.3	0.82
East Parcel														
Beach Cove-1	9/27/2010	Discrete	12	18	154	14.8	0.27 J	0.3	14.5	72.9	1160	0.085	15.1	0.6 J
Beach Cove-2	9/27/2010	Discrete	12	18	0.96 J	2.5	0.18 J	0.8	11.7	36.2	59.4	0.24	12.4	0.29 J
HA-7/S-2	5/17/2001	Discrete	0.5	1	7.48 J	3.63	0.296	0.05 U	21.9	99.2	70	0.1 U	33.9	0.209
SS-33	1/18/2002	Discrete	0	0.5	0.522 J	1.55	--	--	15.6 J	30.3 J	35.7	0.1 U	16.1 J	--
SS-34	1/18/2002	Discrete	0	0.5	0.889 J	2.47	--	--	13.4 J	49.5 J	36.7	0.1 U	16.1 J	--
SS-35	1/18/2002	Discrete	0	0.5	2.42 J	1.99	--	--	10 J	32.7 J	48.5	0.1 U	19.2 J	--
WC-SSK	12/21/2005	Composite	0	0.5	0.652 U	3.03	0.652 U	0.652 U	13.5	42.2	41.2	0.0703 U	20.3	0.652 U
WC-SSL-1 Composite	9/28/2010	Composite	0	0.5	13.3	12.1	0.28	1.7	61.8	746	610	0.073 J	54.7	0.71
WC-SSL-1-1	9/28/2010	Discrete	0	0.5	24.8	10.3	0.43	0.02 U	33.4	143	631	0.14	45.4	0.14 J
WC-SSL-1-2	9/28/2010	Discrete	0	0.5	192	36.2	0.26	0.019 U	145	47500	3090	0.051 J	306	0.54
WC-SSL-1-3	9/28/2010	Discrete	0	0.5	12.5	10.7	0.33	0.019 U	39.9	233	381	0.066 J	53.6	0.23 J
WC-SSL-1-4	9/28/2010	Discrete	0	0.5	140	11.5	0.59	0.023 U	35.1	153	915	0.022 J	45.3	0.14 U
WC-SSL-2 Composite	9/30/2010	Composite	0	0.5	23.3	15.1	0.31	1.3	48.5	13500	1150	0.085 J	73	1.1
WC-SSL-2-1	9/30/2010	Discrete	0	0.5	21.5	9.8	0.43	0.019 U	38.7	207	147	0.14	47.9	0.11 J
WC-SSL-2-2	9/30/2010	Discrete	0	0.5	4.8	5.8	0.38	0.018 U	32.9	194	145	0.07 J	35	0.29 J
WC-SSL-2-3	9/30/2010	Discrete	0	0.5	7	9.7	0.48	0.018 U	62	276	169	0.074 J	47	0.11 U
WC-SSL-2-4	9/30/2010	Discrete	0	0.5	38.5	10.2	0.37	0.017 U	26.3	204	362	0.059 J	41.3	0.23 J
WC-SSN Composite	9/30/2010	Composite	0	0.5	0.23 U	3.3	0.29	0.12	16.4	17.5	11.6	0.019 J	19.9	0.9
WC-SSO Composite	9/30/2010	Composite	0	0.5	1.3	6.1	0.37	1	21.9	51.9	126	0.21	28.1	1.3
WC-SSO-1	9/30/2010	Discrete	0	0.5	0.78	4.8	0.34	0.48	17.2	37.1	193	0.21	25.6	0.13 U
WC-SSO-2	9/30/2010	Discrete	0	0.5	0.36 J	5.5	0.39	0.5	14.4	87.5	111	1.1	19.7	0.12 U
WC-SSO-3	9/30/2010	Discrete	0	0.5	1	5.2	0.31	0.75	14.8	37.4	66.8	0.059 J	27.7	0.15 J
WC-SSO-4	9/30/2010	Discrete	0	0.5	0.88	3.7	0.35	0.45	22.4	28.3	76	0.058 J	27.4	0.12 U

Please see notes at end of table.

Table C-3
Riverbank Soil Analytical Results - Metals
Willamette Cove
Portland, Oregon

Notes:

1. ft bgs = feet below ground surface
2. mg/kg = milligrams per kilogram
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. U = Non-detected value.
8. J = Estimated value after QA review.
9. J2 = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. The precision goal of 30% was exceeded for this analyte by the results of the lab duplicate.
10. 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.
11. Shaded values exceed CUL or JSCS SLV

Table C-4
Riverbank Soil Analytical Results - PAHs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		BaP Eq	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(a) anthracene	Benzo(a)pyrene	Chrysene	Dibenzo(a,h) anthracene	Indeno(1,2,3-cd)pyrene	Benzo(g,h,i) perylene	Fluoranthene
			Minimum	Maximum	Concentration in mg/kg									
Screening Levels		Cleanup Level			0.012	--	--	--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	13	1.05	1.45	1.29	1.3	0.1	0.3	2.23
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			106	--	--	--	--	--	--	--	--	--
West Parcel														
SS-2	1/17/2002	Discrete	0	0.5	0.16 JT	0.1	0.0868	0.0737	0.102	0.0893	0.0266	0.082	0.105	0.105
Central Parcel														
HA-6/S-1	5/18/2001	Discrete	0	0.5	0.924 JT	0.672	0.465	0.402	0.568	0.689	0.195 U	0.484	0.633	0.932
SS-16	1/17/2002	Discrete	0	0.5	0.207 JT	0.161	0.0984	0.0856	0.129	0.144	0.0396	0.131	0.184	0.177
SS-23	1/17/2002	Discrete	0	0.5	5.50 JT	3.61	2.71	2.89	3.38	4.68	1.09	3.49	4.74	5.07
SS-28	1/17/2002	Discrete	0	0.5	0.600 JT	0.454	0.402	0.273	0.414	0.421	0.0838	0.246	0.279	0.363
TP-22/S-1	4/17/2001	Discrete	0	0.5	63.6 JT	27.5	24.2	23.6	46.3	39.1	9.13	27.9	44.3	30.3
WC-1/2/3	10/1/2010	Composite	0.25	1	0.188 JT	0.155	0.0946	0.0821	0.121	0.116	0.0346	0.0786	0.0908	0.152
WC-SSC	12/21/2005	Composite	0	0.5	0.308 JT	0.151	0.139	0.104	0.234	0.146	0.0328	0.137	0.193	0.141
WC-SSD	12/21/2005	Composite	0	0.5	0.337 JT	0.17	0.168	0.141	0.265	0.200	0.0285	0.106	0.137	0.124
WC-SSE	12/21/2005	Composite	0	0.5	0.650 JT	0.307	0.337	0.663	0.494	0.971	0.0442	0.102	0.133	1.15
WC-SSE-1	12/21/2005	Discrete	0	0.5	0.054 JT	0.0357 J	0.0293 J	0.0209 J	0.0315 J	0.032 J	0.0151 UJ	0.0156 J	0.0187 J	0.0321 J
WC-SSE-2	12/21/2005	Discrete	0	0.5	0.0979 JT	0.0556 J	0.0491 J	0.0449 J	0.0686 J	0.0636 J	0.0161 UJ	0.026 J	0.0337 J	0.0489 J
WC-SSE-3	12/21/2005	Discrete	0	0.5	0.0549 JT	0.0266 J	0.0254 J	0.0309 J	0.0325 J	0.0296 J	0.0149 UJ	0.0149 UJ	0.0149 UJ	0.0427 J
WC-SSE-4	12/21/2005	Discrete	0	0.5	0.0356 UJT	0.0154 UJ	0.0154 UJ	0.0154 UJ	0.0154 UJ	0.0154 UJ	0.0154 UJ	0.0154 UJ	0.0154 UJ	0.0154 UJ
WC-SSP (Comp)-1	10/4/2010	Composite	0	0.5	5.40 JT	3.14	3.39	1.58	4.06	1.81	0.621	2.10	2.62	1.96
WC-SSP (Comp)-2	10/4/2010	Composite	0	0.5	9.30 JT	5.74	5.83	2.50	6.89	3.37	1.28	2.41	2.48	4.47
WC-SSP-1-1	10/4/2010	Discrete	0	0.5	15.0 JT	9.33	10.5	3.79	11.2	5.32	2.02	3.96	4.26	3.93
WC-SSP-1-2	10/4/2010	Discrete	0	0.5	17.8 JT	9.64	10.0	5.41	12.9	7.59	2.81	5.23	5.52	8.34
WC-SSP-3-1	10/4/2010	Discrete	0	0.5	0.0156 JT	0.0078 J	0.0096 J	0.0076 J	0.0112 J	0.0091 J	0.0021 J	0.0065 J	0.0099 J	0.0111 J
WC-SSP-3-2	10/4/2010	Discrete	0	0.5	0.0080 JT	0.0045 J	0.0043 J	0.0046 J	0.0059 J	0.0041 J	0.00081 J	0.0035 J	0.0065 J	0.0073
WC-SSQ(Composite)	10/1/2010	Composite	0	0.5	0.135 JT	0.0703	0.0653	0.105	0.0981	0.0897	0.0155	0.0331	0.0356	0.163
WC-SSR(Composite)	10/1/2010	Composite	0	0.5	0.028 JT	0.0176	0.0137	0.0138	0.0201	0.0164	0.0033 J	0.0106	0.0131	0.0183
WC-SSS(Composite)	10/1/2010	Composite	0	0.5	0.20 JT	0.176	0.108	0.093	0.137	0.143	0.0235	0.0695	0.0797	0.164
WC-SST(Comp)-1	10/4/2010	Composite	0	0.5	1.44 JT	0.719	0.642	1.03	1.03	0.926	0.186	0.401	0.434	1.22
WC-SST-(Comp)-2	10/4/2010	Composite	0	0.5	0.158 JT	0.0877	0.0713	0.053	0.106	0.0706	0.0301	0.0742	0.0969	0.0688
WC-SST-1-1	10/4/2010	Discrete	0	0.5	0.23 JT	0.0984	0.139	0.139	0.164	0.154	0.0326	0.079	0.0977	0.305
WC-SST-2-1	10/4/2010	Discrete	0	0.5	0.201 JT	0.109	0.103	0.0931	0.144	0.118	0.0268	0.0858	0.111	0.185
WC-SSU(Composite)	10/1/2010	Composite	0	0.5	0.03 JT	0.0208	0.0172	0.0138	0.0211	0.0185	0.0053 J	0.0125	0.0145	0.0213
WC-SSX(Composite)	10/4/2010	Composite	0	0.5	0.01 UJT	0.00076 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Wharf Beach -1	9/27/2010	Discrete	1	1.5	0.12 JT	0.123 J	0.11 J	0.103	0.0777	0.146	0.0128	0.0296	0.0295	0.315

Please see notes at end of table.

Table C-4
Riverbank Soil Analytical Results - PAHs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Pyrene	Benzo(b+k) fluoranthene	2-Methyl naphthalene	Acenaphthene	Acenaph thylene	Anthracene	Fluorene	Naphthalene	Phenanthrene	1-Methyl naphthalene
			Minimum	Maximum	Concentration in mg/kg									
Screening Levels		Cleanup Level			--	--	--	--	--	--	--	--	--	--
		JSCS Screening Level Value			1.52	--	0.2	0.3	0.2	0.845	0.536	0.561	1.17	--
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--	140	--	--
West Parcel														
SS-2	1/17/2002	Discrete	0	0.5	0.105	0.2 JT	--	0.0134 U	0.0134 U	0.0134 U	0.0134 U	0.0134 U	0.0473	--
Central Parcel														
HA-6/S-1	5/18/2001	Discrete	0	0.5	0.896	1.14 JT	0.66 U	0.195 U	0.195 U	0.195 U	0.195 U	0.195 U	0.436	--
SS-16	1/17/2002	Discrete	0	0.5	0.171	0.259 JT	--	0.0134 U	0.0185	0.0193	0.0134 U	0.0217	0.0761	--
SS-23	1/17/2002	Discrete	0	0.5	5.41	6.32 JT	--	0.0268 U	0.867	0.761	0.536 U	0.386	3.38	--
SS-28	1/17/2002	Discrete	0	0.5	0.522	0.856 JT	--	0.0268 U	0.0515	0.0402	0.0268 U	0.0268 U	0.147	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	52.1	51.7 JT	3.13	8.38 U	12.2	8.65	8.38 U	8.38 U	21.8	--
WC-1/2/3	10/1/2010	Composite	0.25	1	0.139	0.250 JT	0.035	0.0075	0.0194	0.0273	0.0095	0.0752	0.104	0.0153
WC-SSC	12/21/2005	Composite	0	0.5	0.196	0.290 JT	--	0.0166 U	0.0552	0.0167	0.0166 U	0.0209	0.0538	--
WC-SSD	12/21/2005	Composite	0	0.5	0.223	0.34 JT	--	0.0166 U	0.0507	0.0166 U	0.0166 U	0.0266	0.0325	--
WC-SSE	12/21/2005	Composite	0	0.5	1.97	0.644 JT	--	0.0153 U	0.0646	0.0893	0.0482	0.0387	1.80	--
WC-SSE-1	12/21/2005	Discrete	0	0.5	0.0393 J	0.0650 JT	--	0.0151 UJ	0.0151 UJ	0.0151 UJ	0.0151 UJ	0.0151 UJ	0.0151 UJ	--
WC-SSE-2	12/21/2005	Discrete	0	0.5	0.076 J	0.105 JT	--	0.0161 UJ	0.0161 UJ	0.0161 UJ	0.0161 UJ	0.0161 UJ	0.0208 J	--
WC-SSE-3	12/21/2005	Discrete	0	0.5	0.0435 J	0.0520 JT	--	0.0149 UJ	0.0149 UJ	0.0149 UJ	0.0149 UJ	0.0149 UJ	0.0149 UJ	--
WC-SSE-4	12/21/2005	Discrete	0	0.5	0.0154 UJ	0.0308 UJT	--	0.0154 UJ	0.0154 UJ	0.0154 UJ	0.0154 UJ	0.0154 UJ	0.0154 UJ	--
WC-SSP (Comp)-1	10/4/2010	Composite	0	0.5	1.88	6.53 JT	0.0695	0.0211	0.699	0.371	0.0479	0.214	0.56	0.0307
WC-SSP (Comp)-2	10/4/2010	Composite	0	0.5	4.29	11.6 JT	0.0583	0.0415	1.08	1.29	0.174	0.167	2.33	0.0332
WC-SSP-1-1	10/4/2010	Discrete	0	0.5	4.49	19.8 JT	0.132	0.0258	1.18	0.826	0.177	0.468	0.712	0.0601
WC-SSP-1-2	10/4/2010	Discrete	0	0.5	7.27	19.6 JT	0.175	0.11	2.97	2.42	0.37	0.506	4.03	0.0838 J
WC-SSP-3-1	10/4/2010	Discrete	0	0.5	0.0142	0.017 JT	0.0038 U	0.0032 U	0.0017 J	0.0023 J	0.0037 U	0.0037 U	0.0064 U	0.0018 U
WC-SSP-3-2	10/4/2010	Discrete	0	0.5	0.0082	0.0088 JT	0.002 U	0.0017 U	0.0012 J	0.0017 J	0.0019 U	0.0019 U	0.0039 J	0.00095 U
WC-SSQ(Composite)	10/1/2010	Composite	0	0.5	0.162	0.136 JT	0.0025 J	0.0016 U	0.0068	0.0176	0.0025 J	0.004 J	0.028	0.0009 U
WC-SSR(Composite)	10/1/2010	Composite	0	0.5	0.0219	0.0313 JT	0.0019 U	0.0016 U	0.0017 J	0.0023 J	0.0019 U	0.002 J	0.0068 J	0.00093 U
WC-SSS(Composite)	10/1/2010	Composite	0	0.5	0.179	0.284 JT	0.022	0.0067 J	0.0189	0.0216	0.0065 J	0.0357	0.0869	0.0105
WC-SST(Comp)-1	10/4/2010	Composite	0	0.5	1.27	1.36 JT	0.019	0.0221	0.104	0.183	0.031	0.0352	0.392	0.0124
WC-SST-(Comp)-2	10/4/2010	Composite	0	0.5	0.0772	0.159 JT	0.0074 J	0.0035 U	0.0083 J	0.0095 J	0.004 U	0.0177	0.0373	0.0044 J
WC-SST-1-1	10/4/2010	Discrete	0	0.5	0.348	0.237 JT	0.0032 J	0.0021 J	0.02	0.0342	0.0052 J	0.0088	0.114	0.0016 J
WC-SST-2-1	10/4/2010	Discrete	0	0.5	0.209	0.212 JT	0.0184	0.0115 J	0.0311	0.0509	0.0153 J	0.0403	0.121	0.0089 J
WC-SSU(Composite)	10/1/2010	Composite	0	0.5	0.0231	0.0380 JT	0.0019 J	0.0016 U	0.0014 J	0.0029 J	0.0019 U	0.0035 J	0.0118	0.0015 J
WC-SSX(Composite)	10/4/2010	Composite	0	0.5	0.005 U	0.006 UJT	0.005 U	0.005 U	0.00088 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Wharf Beach -1	9/27/2010	Discrete	1	1.5	0.256	0.23 JT	0.0793	0.013	0.0507	0.0344	0.0300	0.203	0.187	0.0395

Please see notes at end of table.

Table C-4
Riverbank Soil Analytical Results - PAHs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Total HPAH	Total LPAH	Total PAHs
			Minimum	Maximum	Concentration in mg/kg		
Screening Levels		Cleanup Level			--	--	23
		JSCS Screening Level Value			--	--	--
		Remedial Action Level			--	--	13
		Principal Threat Waste			--	--	--
West Parcel							
SS-2	1/17/2002	Discrete	0	0.5	0.9 JT	0.114 JTA	1 JTA
Central Parcel							
HA-6/S-1	5/18/2001	Discrete	0	0.5	5.94 JT	1.4 JT	8.0 JT
SS-16	1/17/2002	Discrete	0	0.5	1.32 JT	0.162 JTA	1.48 JTA
SS-23	1/17/2002	Discrete	0	0.5	37.1 JT	5.96 JTA	**43.0 JTA**
SS-28	1/17/2002	Discrete	0	0.5	3.46 JT	0.319 JTA	3.78 JTA
TP-22/S-1	4/17/2001	Discrete	0	0.5	324 JT	67.8 JT	**395 JT**
WC-1/2/3	10/1/2010	Composite	0.25	1	1.06 JT	0.24 JT	1.3 JT
WC-SSC	12/21/2005	Composite	0	0.5	1.47 JT	0.180 JTA	1.65 JTA
WC-SSD	12/21/2005	Composite	0	0.5	1.6 JT	0.160 JTA	1.7 JTA
WC-SSE	12/21/2005	Composite	0	0.5	6.17 JT	2.06 JTA	8.23 JTA
WC-SSE-1	12/21/2005	Discrete	0	0.5	0.270 JT	0.0906 UJTA	0.361 JTA
WC-SSE-2	12/21/2005	Discrete	0	0.5	0.48 JT	0.101 JTA	0.58 JTA
WC-SSE-3	12/21/2005	Discrete	0	0.5	0.276 JT	0.0894 UJTA	0.365 JTA
WC-SSE-4	12/21/2005	Discrete	0	0.5	0.154 UJT	0.0924 UJTA	0.246 UJTA
WC-SSP (Comp)-1	10/4/2010	Composite	0	0.5	23.2 JT	1.91 JT	**25.1 JT**
WC-SSP (Comp)-2	10/4/2010	Composite	0	0.5	39.3 JT	5.08 JT	**44.4 JT**
WC-SSP-1-1	10/4/2010	Discrete	0	0.5	58.8 JT	3.39 JT	**62.3 JT**
WC-SSP-1-2	10/4/2010	Discrete	0	0.5	74.7 JT	10 JT	**85 JT**
WC-SSP-3-1	10/4/2010	Discrete	0	0.5	0.089 JT	0.021 JT	0.11 JT
WC-SSP-3-2	10/4/2010	Discrete	0	0.5	0.050 JT	0.012 JT	0.064 JT
WC-SSQ(Composite)	10/1/2010	Composite	0	0.5	0.838 JT	0.06 JT	0.9 JT
WC-SSR(Composite)	10/1/2010	Composite	0	0.5	0.15 JT	0.02 JT	0.2 JT
WC-SSS(Composite)	10/1/2010	Composite	0	0.5	1.17 JT	0.18 JT	1.37 JT
WC-SST(Comp)-1	10/4/2010	Composite	0	0.5	7.86 JT	0.77 JT	8.6 JT
WC-SST-(Comp)-2	10/4/2010	Composite	0	0.5	0.736 JT	0.08 JT	0.8 JT
WC-SST-1-1	10/4/2010	Discrete	0	0.5	1.56 JT	0.2 JT	2 JT
WC-SST-2-1	10/4/2010	Discrete	0	0.5	1.18 JT	0.270 JT	1.47 JT
WC-SSU(Composite)	10/1/2010	Composite	0	0.5	0.17 JT	0.023 JT	0.19 JT
WC-SSX(Composite)	10/4/2010	Composite	0	0.5	0.05 UJT	0.03 UJT	0.08 UJT
Wharf Beach -1	9/27/2010	Discrete	1	1.5	1.20 JT	0.518 JT	1.80 JT

Please see notes at end of table.

Table C-4
Riverbank Soil Analytical Results - PAHs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		BaP Eq	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(a) anthracene	Benzo(a)pyrene	Chrysene	Dibenzo(a,h) anthracene	Indeno(1,2,3-cd)pyrene	Benzo(g,h,i) perylene	Fluoranthene
			Minimum	Maximum	Concentration in mg/kg									
Screening Levels		Cleanup Level			0.012	--	--	--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	13	1.05	1.45	1.29	1.3	0.1	0.3	2.23
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			106	--	--	--	--	--	--	--	--	--
East Parcel														
B-26/S-1	5/11/2001	Discrete	0	2	0.0313 JT	0.0134 U	0.0134 U	0.0163	0.0134 U	0.0162	0.0134 U	0.0134 U	0.0134 U	0.0292
Beach Cove-1	9/27/2010	Discrete	12	18	1.58 JT	1.76 J	1.56 J	2.82	0.849	6.22	0.233 J	0.169	0.38	1.26
Beach Cove-2	9/27/2010	Discrete	12	18	0.47 JT	0.51 J	0.488 J	0.401	0.222	1.28	0.136 J	0.138	0.161 J	0.249
WC-SSL-1 Composite	9/28/2010	Composite	0	0.5	0.729 JT	0.675	0.332	0.336	0.512	0.449	0.0856	0.269	0.343	0.507
WC-SSL-1-1	9/28/2010	Discrete	0	0.5	0.885 JT	0.782	0.555	0.568	0.589	0.803	0.127	0.278	0.335	0.745
WC-SSL-1-2	9/28/2010	Discrete	0	0.5	0.107 JT	0.0732	0.0574	0.0691	0.0734	0.0868	0.0147	0.039	0.0564	0.0916
WC-SSL-1-3	9/28/2010	Discrete	0	0.5	0.419 JT	0.237	0.221	0.218	0.311	0.295	0.043	0.174	0.286	0.342
WC-SSL-1-4	9/28/2010	Discrete	0	0.5	0.28 JT	0.194	0.144	0.145	0.182	0.22	0.0507	0.12	0.178	0.152
WC-SSL-2 Composite	9/30/2010	Composite	0	0.5	0.36 JT	0.243	0.173	0.19	0.272	0.243	0.0354	0.101	0.105	0.258
WC-SSM Composite	9/30/2010	Composite	0	0.5	0.02 JT	0.0142	0.011	0.0159	0.0164	0.0151	0.003 J	0.0066 J	0.0074	0.0255
WC-SSN Composite	9/30/2010	Composite	0	0.5	0.0073 JT	0.0052 J	0.0031 J	0.0032 J	0.0052 J	0.0047 J	0.00091 J	0.0035 J	0.0056 J	0.0046 J
WC-SSO Composite	9/30/2010	Composite	0	0.5	0.087 JT	0.0546	0.0421	0.0384	0.0619	0.056	0.0121	0.0348	0.0441	0.0846

Please see notes at end of table.

Table C-4
Riverbank Soil Analytical Results - PAHs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Pyrene	Benzo(b+k) fluoranthene	2-Methyl naphthalene	Acenaphthene	Acenaph thylene	Anthracene	Fluorene	Naphthalene	Phenanthrene	1-Methyl naphthalene
			Minimum	Maximum	Concentration in mg/kg									
Screening Levels		Cleanup Level			--	--	--	--	--	--	--	--	--	--
		JSCS Screening Level Value			1.52	--	0.2	0.3	0.2	0.845	0.536	0.561	1.17	--
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--	140	--	--
East Parcel														
B-26/S-1	5/11/2001	Discrete	0	2	0.0261	0.0268 JT	--	0.0134 U	0.0134 U	0.0134 U	0.0134 U	0.0134 U	0.0134 U	--
Beach Cove-1	9/27/2010	Discrete	12	18	3.37	3.32 JT	0.0709	0.118	0.0731	0.519 J	0.577	0.13	2.71	0.108
Beach Cove-2	9/27/2010	Discrete	12	18	0.532	0.998 JT	0.018 J	0.0145 J	0.0169 J	0.0102 U	0.0119 J	0.063	0.126 J	0.0118 J
WC-SSL-1 Composite	9/28/2010	Composite	0	0.5	0.549	1.007 JT	0.146	0.0292	0.138	0.171	0.0391	0.277	0.313	0.0671
WC-SSL-1-1	9/28/2010	Discrete	0	0.5	0.798	1.337 JT	0.259	0.0648	0.289	0.328	0.0808	0.506	0.47	0.0927
WC-SSL-1-2	9/28/2010	Discrete	0	0.5	0.116	0.1306 JT	0.0654	0.0116	0.0361	0.0406	0.0137	0.0996	0.106	0.0239
WC-SSL-1-3	9/28/2010	Discrete	0	0.5	0.437	0.458 JT	0.0407	0.0095	0.0813	0.0567	0.0209	0.0902	0.165	0.0145
WC-SSL-1-4	9/28/2010	Discrete	0	0.5	0.205	0.338 JT	0.0368	0.0127	0.108	0.107	0.0228	0.064	0.117	0.0151
WC-SSL-2 Composite	9/30/2010	Composite	0	0.5	0.353	0.416 JT	0.193	0.0127	0.154	0.0791	0.0149	0.211	0.188	0.0644
WC-SSM Composite	9/30/2010	Composite	0	0.5	0.0255	0.0252 JT	0.0019 U	0.0016 U	0.002 J	0.004 J	0.0019 U	0.003 J	0.0094	0.00092 U
WC-SSN Composite	9/30/2010	Composite	0	0.5	0.0054 J	0.0083 JT	0.0019 U	0.0016 U	0.0011 J	0.0009 J	0.0019 U	0.0031 J	0.0033 U	0.00093 U
WC-SSO Composite	9/30/2010	Composite	0	0.5	0.0948	0.0967 JT	0.0263	0.0042 J	0.0166	0.0099	0.0059 J	0.0839	0.0624	0.0108

Please see notes at end of table.

Table C-4
Riverbank Soil Analytical Results - PAHs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Total HPAH	Total LPAH	Total PAHs
			Minimum	Maximum	Concentration in mg/kg		
Screening Levels		Cleanup Level			--	--	23
		JSCS Screening Level Value			--	--	--
		Remedial Action Level			--	--	13
		Principal Threat Waste			--	--	--
East Parcel							
B-26/S-1	5/11/2001	Discrete	0	2	0.168 JT	0.0804 UJTA	0.249 JTA
Beach Cove-1	9/27/2010	Discrete	12	18	18.6 JT	4.13 JT	**22.8 JT**
Beach Cove-2	9/27/2010	Discrete	12	18	4.12 JT	0.243 JT	4.38 JT
WC-SSL-1 Composite	9/28/2010	Composite	0	0.5	4.06 JT	0.97 JT	5.2 JT
WC-SSL-1-1	9/28/2010	Discrete	0	0.5	5.58 JT	1.74 JT	7.58 JT
WC-SSL-1-2	9/28/2010	Discrete	0	0.5	0.68 JT	0.308 JT	1.1 JT
WC-SSL-1-3	9/28/2010	Discrete	0	0.5	2.56 JT	0.424 JT	3.03 JT
WC-SSL-1-4	9/28/2010	Discrete	0	0.5	1.59 JT	0.432 JT	2.06 JT
WC-SSL-2 Composite	9/30/2010	Composite	0	0.5	2.0 JT	0.660 JT	2.8 JT
WC-SSM Composite	9/30/2010	Composite	0	0.5	0.141 JT	0.0219 JT	0.164 JT
WC-SSN Composite	9/30/2010	Composite	0	0.5	0.0414 JT	0.0119 JT	0.0552 JT
WC-SSO Composite	9/30/2010	Composite	0	0.5	0.523 JT	0.183 JT	0.733 JT

Please see notes at end of table.

Table C-4
Riverbank Soil Analytical Results - PAHs
Willamette Cove
Portland, Oregon

Notes:

1. BaP Eq = Benzo(a)pyrene Equivalent
2. HPAH = High Molecular Weight PAHs
3. LPAH = Low Molecular Weight PAHs
4. PAHs = Polycyclic Aromatic Hydrocarbons
5. BaP Eq calculated according to Appendix of the Portland Harbor RI/FS for LWG RA Total cPAH TEQ (EPA1993) (Calculated U=1/2)
6. Benzo(b+k)fluoranthene calculated according to Appendix of the Portland Harbor RI/FS for LWG RA Total Benzo(x)fluoranthenes (Calculated U=1/2)
7. Total LPAHs calculated according to Appendix of the Portland Harbor RI/FS for LWG RA Total 7 of 17 LPAH (Calculated U=1/2)
8. Total HPAHs calculated according to Appendix of the Portland Harbor RI/FS for LWG RA Total 10 of 17 HPAH (Calculated U=1/2)
9. Total PAHs calculated according to Appendix of the Portland Harbor RI/FS for LWG RA Total 17 PAH (Calculated U=1/2)
10. ft bgs = feet below ground surface
11. mg/kg = milligrams per kilogram
12. Cleanup Levels from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
13. 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.
14. Remedial Action Level from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
15. Prinicipal Threat Waste from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
16. A = Summed value based on limited number of analytes.
17. J = Estimated value after QA review.
18. T = Total value calculated or selected from >1 reported value.
19. U = Non-detected value.
20. 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.
21. Shaded values exceed CUL or JSCS SLV
22. Bold values exceed RAL

Table C-5
Riverbank Soil Analytical Results - Pesticides
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		4,4'-DDD	4,4'-DDE	4,4'-DDT	Total 4,4-DDx	Aldrin	alpha-Endosulfan	beta-Endosulfan	beta-Hexachlo
			Minimum	Maximum	Concentration in mg/kg							
Screening Levels		Cleanup Level			0.114	0.226	0.246	0.0061	0.002	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	--	--	--
		Remedial Action Level			--	--	--	0.16	--	--	--	--
		Principal Threat Waste			--	--	--	7.05	--	--	--	--
East Parcel												
B-26/S-1	5/11/2001	Discrete	0	2	0.0067 U	0.0067 U	0.0067 U	0.01005 UJT	0.0067 U	0.0067 U	0.0067 U	0.0067 U

Sample ID	Date	Sample Type	Depth (ft bgs)		Chlordane (technical)	cis-Chlordane	delta-Hexachlo	Dieldrin	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone
			Minimum	Maximum	Concentration in mg/kg							
Screening Levels		Cleanup Level			0.0014	--	--	0.00007	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	0.207	--	--
		Remedial Action Level			--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--	--
East Parcel												
B-26/S-1	5/11/2001	Discrete	0	2	0.15 U	0.0067 U	0.0067 U	0.0067 U	0.0067 U	0.0067 U	0.0067 U	0.0067 U

Sample ID	Date	Sample Type	Depth (ft bgs)		gamma-Chlordane	gamma-Hexachlo	Heptachlor	Heptachlor epoxide	Methoxychlor	Toxaphene
			Minimum	Maximum	Concentration in mg/kg					
Screening Levels		Cleanup Level			--	0.005	--	--	--	--
		JSCS Screening Level Value			--	--	0.01	0.016	--	--
		Remedial Action Level			--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--
East Parcel										
B-26/S-1	5/11/2001	Discrete	0	2	0.0067 U	0.0067 U	0.0067 U	0.0067 U	0.0067 U	0.2 U

Please see notes at end of table.

Table C-5
Riverbank Soil Analytical Results - Pesticides
Willamette Cove
Portland, Oregon

Notes:

1. DDD = Dichlorodiphenyldichloroethane
2. DDE = Dichlorodiphenyldichloroethylene
3. DDT = Dichlorodiphenyltrichloroethane
4. Total 4,4-DDx calculated according to Appendix of the Portland Harbor RI/FS for LWG RA Sum 4,4 DDT, DDE, DDD (Calculated U=1/2)
5. ft bgs = feet below ground surface
6. mg/kg = milligrams per kilogram
7. Cleanup Levels from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
8. 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.
9. Remedial Action Level from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
10. Prinicipal Threat Waste from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
11. J = Estimated value after QA review.
12. T = Total value calculated or selected from >1 reported value.
13. U = Non-detected value.
14. 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.

Table C-6
Riverbank Soil Analytical Results - Petroleum
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Diesel Range Hydrocarbons	Gasoline Range Hydrocarbons	Motor oil	Oil Range Hydrocarbons	Total Organic Halides
			Minimum	Maximum	Concentration in mg/kg				
Screening Levels		Cleanup Level			91	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--
		Remedial Action Level			--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--
West Parcel									
HA-5/S-1	4/18/2001	Discrete	0	0.5	--	25 U	--	50 U	--
Central Parcel									
HA-6/S-1	5/18/2001	Discrete	0	0.5	68.5	--	--	250	--
HA-6/S-3	5/18/2001	Discrete	1	2	125 U	--	--	300	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	2,390	--	--	5,960	--
TP-26/S-1	4/17/2001	Discrete	0	0.5	25 U	--	--	50 U	--
WC-1/2/3	10/1/2010	Composite	0.25	1	72.1	20.5 U	738	--	--
Wharf Beach -1	9/27/2010	Discrete	1	1.5	397	1.4 J	--	199	--
East Parcel									
B-25/S-2	5/7/2001	Discrete	2	4	25 U	--	--	50 U	--
B-26/S-1	5/11/2001	Discrete	0	2	25 U	--	--	50 U	--
B-29/S-1	5/17/2001	Discrete	0	4	27.9	--	--	158	--
B-30/S-1	5/17/2001	Discrete	0	4	25 U	--	--	94	--
Beach Cove-1	9/27/2010	Discrete	12	18	18,500	--	--	49,400	--
Beach Cove-2	9/27/2010	Discrete	12	18	14,900	--	--	46,700	--
EX-1	10/28/2004	Discrete	2	2	89.4	--	--	299	--
EX-2	10/28/2004	Discrete	2	2	576	--	--	2,040	--
EX-4	10/28/2004	Discrete	4	4	4,500	--	--	8,390	--
EX-5	10/28/2004	Discrete	2	2	5,220	--	--	11,300	--
HA-1	12/12/1988	Composite	0	6	--	--	--	200 U	1
HA-7/S-2	5/17/2001	Discrete	0.5	1	25 U	--	--	50 U	--

Please see notes at end of table.

Table C-6
Riverbank Soil Analytical Results - Petroleum
Willamette Cove
Portland, Oregon

Notes:

1. ft bgs = feet below ground surface
2. mg/kg = milligrams per kilogram
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. U = Non-detected value.
8. 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.
9. Shaded values exceed CUL or JSCS SLV

Table C-7
Riverbank Soil Analytical Results - Phenols
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		2,3,4,5-Tetra chlorophenol	2,6-Dichlorophenol	2-Methyl-4,6-dinitrophenol	Cresol	Dinoseb	Tetrachloro phenol
			Minimum	Maximum	Concentration in mg/kg					
Screening Levels		Cleanup Level			--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	--
		Remedial Action Level			--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--
Central Parcel										
HA-6/S-1	5/18/2001	Discrete	0	0.5	--	--	--	--	--	--
RA3-S19	10/28/2015	Composite	0	0.5	--	--	--	--	--	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	--	--	--	--	--	--

Please see notes at end of table.

Table C-7
Riverbank Soil Analytical Results - Phenols
Willamette Cove
Portland, Oregon

Notes:

1. ft bgs = feet below ground surface
2. mg/kg = milligrams per kilogram
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. 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.

Table C-8
Riverbank Soil Analytical Results - SVOCs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		1,2-Dinitro benzene	1,3-Dinitro benzene	1,4-Dinitro benzene	2,3,4,6-Tetra chlorophenol	2,3,5,6-Tetra chlorophenol	2,4,5-Tri chlorophenol	2,4,6-Tri chlorophenol
			Minimum	Maximum	Concentration in mg/kg						
Screening Levels		Cleanup Level			--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--
Central Parcel											
HA-6/S-1	5/18/2001	Discrete	0	0.5	--	--	--	--	--	0.66 U	0.66 U
TP-22/S-1	4/17/2001	Discrete	0	0.5	--	--	--	--	--	1.65 U	1.65 U
TP-26/S-2	4/17/2001	Discrete	1.5	2	--	--	--	--	--	--	--
Wharf Beach -1	9/27/2010	Discrete	1	1.5	--	--	--	--	--	--	--
East Parcel											
Beach Cove-1	9/27/2010	Discrete	12	18	--	--	--	--	--	--	--
Beach Cove-2	9/27/2010	Discrete	12	18	--	--	--	--	--	--	--

Sample ID	Date	Sample Type	Depth (ft bgs)		2-Methyl phenol	2-Nitroaniline	2-Nitrophenol	3- and 4-Methylphenol	3,3'-Dichloro benzidine	3-Nitroaniline	4-Bromophenyl phenyl ether
			Minimum	Maximum	Concentration in mg/kg						
Screening Levels		Cleanup Level			--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--
Central Parcel											
HA-6/S-1	5/18/2001	Discrete	0	0.5	0.66 U	0.66 U	0.66 U	0.66 U	2 U	2 U	0.66 U
TP-22/S-1	4/17/2001	Discrete	0	0.5	1.65 U	1.65 U	1.65 U	1.65 U	5 U	5 U	1.65 U
TP-26/S-2	4/17/2001	Discrete	1.5	2	--	--	--	--	--	--	--
Wharf Beach -1	9/27/2010	Discrete	1	1.5	--	--	--	--	--	--	--
East Parcel											
Beach Cove-1	9/27/2010	Discrete	12	18	--	--	--	--	--	--	--
Beach Cove-2	9/27/2010	Discrete	12	18	--	--	--	--	--	--	--

Please see notes at end of table.

Table C-8
Riverbank Soil Analytical Results - SVOCs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		2,4-Dichloro phenol	2,4-Dimethyl phenol	2,4-Dinitro phenol	2,4-Dinitro toluene	2,6-Dinitro toluene	2-Chloro naphthalene	2-Chlorophenol
			Minimum	Maximum	Concentration in mg/kg						
Screening Levels		Cleanup Level			--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--
Central Parcel											
HA-6/S-1	5/18/2001	Discrete	0	0.5	0.66 U	2 U	4 U	1 U	1 U	0.66 U	0.66 U
TP-22/S-1	4/17/2001	Discrete	0	0.5	1.65 U	5 U	10 U	2.5 U	2.5 U	1.65 U	1.65 U
TP-26/S-2	4/17/2001	Discrete	1.5	2	--	--	--	--	--	--	--
Wharf Beach -1	9/27/2010	Discrete	1	1.5	--	--	--	--	--	--	--
East Parcel											
Beach Cove-1	9/27/2010	Discrete	12	18	--	--	--	--	--	--	--
Beach Cove-2	9/27/2010	Discrete	12	18	--	--	--	--	--	--	--

Sample ID	Date	Sample Type	Depth (ft bgs)		4-Chloro-3-methylphenol	4-Chloroaniline	4-Chlorophenyl phenyl ether	4-Methyl-2-pentanone	4-Nitroaniline	4-Nitrophenol	alpha-Hexachloro cyclohexane
			Minimum	Maximum	Concentration in mg/kg						
Screening Levels		Cleanup Level			--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--
Central Parcel											
HA-6/S-1	5/18/2001	Discrete	0	0.5	0.66 U	4 U	0.66 U	--	0.66 U	2 U	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	1.65 U	10 U	1.65 U	--	1.65 U	5 U	--
TP-26/S-2	4/17/2001	Discrete	1.5	2	--	--	--	--	--	--	--
Wharf Beach -1	9/27/2010	Discrete	1	1.5	--	--	--	0.00043 U	--	--	--
East Parcel											
Beach Cove-1	9/27/2010	Discrete	12	18	--	--	--	0.0011 U	--	--	--
Beach Cove-2	9/27/2010	Discrete	12	18	--	--	--	0.0023 U	--	--	--

Please see notes at end of table.

Table C-8
Riverbank Soil Analytical Results - SVOCs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Benzoic acid	Benzyl alcohol	Bis(2-Chloro ethoxy)methane	Bis(2-Chloro ethyl)ether	Bis(2-Chloro isopropyl)ether	Bis(2-Ethyl hexyl) adipate	Bis(2-ethyl hexyl)phthalate
			Minimum	Maximum	Concentration in mg/kg						
Screening Levels		Cleanup Level			--	--	--	--	--	--	0.135
		JSCS Screening Level Value			--	--	--	--	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--
Central Parcel											
HA-6/S-1	5/18/2001	Discrete	0	0.5	2 U	0.66 U	0.66 U	0.66 U	0.66 U	--	4 U
TP-22/S-1	4/17/2001	Discrete	0	0.5	5 U	1.65 U	1.65 U	1.65 U	1.65 U	--	10 U
TP-26/S-2	4/17/2001	Discrete	1.5	2	--	--	--	--	--	--	--
Wharf Beach -1	9/27/2010	Discrete	1	1.5	--	--	--	--	--	--	--
East Parcel											
Beach Cove-1	9/27/2010	Discrete	12	18	--	--	--	--	--	--	--
Beach Cove-2	9/27/2010	Discrete	12	18	--	--	--	--	--	--	--

Sample ID	Date	Sample Type	Depth (ft bgs)		Di-n-octyl phthalate	Hexachloro benzene	Hexachlorocyclo pentadiene	Hexachloro ethane	Isophorone	Nitrobenzene	N-Nitroso dimethylamine
			Minimum	Maximum	Concentration in mg/kg						
Screening Levels		Cleanup Level			--	--	--	--	--	--	--
		JSCS Screening Level Value			--	0.019	0.4	--	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--
Central Parcel											
HA-6/S-1	5/18/2001	Discrete	0	0.5	0.66 U	0.66 U	2 U	2 U	0.66 U	0.66 U	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	3.3 U	1.65 U	5 U	5 U	1.65 U	1.65 U	--
TP-26/S-2	4/17/2001	Discrete	1.5	2	--	--	--	--	--	--	--
Wharf Beach -1	9/27/2010	Discrete	1	1.5	--	--	--	--	--	--	--
East Parcel											
Beach Cove-1	9/27/2010	Discrete	12	18	--	--	--	--	--	--	--
Beach Cove-2	9/27/2010	Discrete	12	18	--	--	--	--	--	--	--

Please see notes at end of table.

Table C-8
Riverbank Soil Analytical Results - SVOCs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Butyl benzyl phthalate	Carbazole	Dibenzofuran	Dibutyl phthalate	Diethyl phthalate	Dimethyl phthalate
			Minimum	Maximum	Concentration in mg/kg					
Screening Levels		Cleanup Level			--	--	--	--	--	--
		JSCS Screening Level Value			--	1.6	--	--	0.6	--
		Remedial Action Level			--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--
Central Parcel										
HA-6/S-1	5/18/2001	Discrete	0	0.5	0.66 U	--	0.66 U	2 U	0.66 U	0.66 U
TP-22/S-1	4/17/2001	Discrete	0	0.5	1.65 U	--	1.65 U	5 U	1.65 U	1.65 U
TP-26/S-2	4/17/2001	Discrete	1.5	2	--	--	--	--	--	--
Wharf Beach -1	9/27/2010	Discrete	1	1.5	--	--	--	--	--	--
East Parcel										
Beach Cove-1	9/27/2010	Discrete	12	18	--	--	--	--	--	--
Beach Cove-2	9/27/2010	Discrete	12	18	--	--	--	--	--	--

Sample ID	Date	Sample Type	Depth (ft bgs)		N-Nitroso-di-n-propylamine	N-Nitroso diphenylamine	N-Nitroso dipropylamine	Pentachloro phenol	Phenol	Pyridine
			Minimum	Maximum	Concentration in mg/kg					
Screening Levels		Cleanup Level			--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	0.25	0.05	--
		Remedial Action Level			--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--
Central Parcel										
HA-6/S-1	5/18/2001	Discrete	0	0.5	--	0.66 U	0.66 U	2 U	0.66 U	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	--	1.65 U	1.65 U	5 U	1.65 U	--
TP-26/S-2	4/17/2001	Discrete	1.5	2	--	--	--	--	--	--
Wharf Beach -1	9/27/2010	Discrete	1	1.5	--	--	--	--	--	--
East Parcel										
Beach Cove-1	9/27/2010	Discrete	12	18	--	--	--	--	--	--
Beach Cove-2	9/27/2010	Discrete	12	18	--	--	--	--	--	--

Please see notes at end of table.

Table C-8
Riverbank Soil Analytical Results - SVOCs
Willamette Cove
Portland, Oregon

Notes:

1. SVOCs = Semi-volatile Organic Compounds
2. ft bgs = feet below ground surface
3. mg/kg = milligrams per kilogram
4. U = Non-detected value.
5. J = Estimated value after QA review.
6. Cleanup Levels from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
7. 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.
8. Remedial Action Level from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
9. Prinicipal Threat Waste from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
10. 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.
11. Shaded values exceed CUL or JSCS SLV

Table C-9
Riverbank Soil Analytical Results - VOCs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		1,1,1,2-Tetra chloroethane	1,1,1-Tri chloroethane	1,1,2,2-Tetra chloroethane	1,1,2-Tri chloroethane	1,1-Dichloro ethane	1,1-Dichloro ethene	1,1-Dichloro propene	1,2,3-Trichloro benzene	1,2,3-Trichloro	1,2,4-Trichloro	1,2,4-Trimethyl	1,2-Dibromo-3-chloropropane	1,2-Dibromo ethane
			Minimum	Maximum	Concentration in mg/kg												
Screening Levels		Cleanup Level			--	--	--	--	--	--	--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	--	--	--	--	9.2	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--	--	--	--	--	--	--
Central Parcel																	
HA-6/S-1	5/18/2001	Discrete	0	0.5	--	--	--	--	--	--	--	--	--	0.66 U	--	--	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	--	--	--	--	--	--	--	--	--	1.65 U	--	--	--
TP-26/S-2	4/17/2001	Discrete	1.5	2	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	--
Wharf Beach -1	9/27/2010	Discrete	1	1.5	0.00021 U	0.00026 U	0.00039 U	0.00039 U	0.00034 U	0.00053 U	0.00049 U	0.00039 U	0.00048 U	0.00038 J BU	0.00098 J BU	0.00055 U	0.0003 U
East Parcel																	
Beach Cove-1	9/27/2010	Discrete	12	18	0.00052 U	0.00065 U	0.00099 U	0.00099 U	0.00084 U	0.0013 U	0.0012 U	0.00099 U	0.0012 U	0.00086 U	0.0477	0.0014 U	0.00079 U
Beach Cove-2	9/27/2010	Discrete	12	18	0.0011 U	0.0014 U	0.0021 U	0.0021 U	0.0018 U	0.0028 U	0.0026 U	0.005 J	0.0025 U	0.0041 J	0.0144 J	0.0029 U	0.0016 U
HA-1	12/12/1988	Composite	0	6	--	--	--	--	--	--	--	--	--	--	--	--	--

Sample ID	Date	Sample Type	Depth (ft bgs)		1,2-Dichloro benzene	1,2-Dichloro ethane	1,2-Dichloro propane	1,3,5-Trimethyl	1,3-Dichloro benzene	1,3-Dichloro propane	1,4-Dichloro benzene	1-Methyl-4-isopropylbenzen	2,2-Dichloro propane	2-Butanone	2-Chloro toluene	2-Hexanone	4-Chloro toluene
			Minimum	Maximum	Concentration in mg/kg												
Screening Levels		Cleanup Level			--	--	--	--	--	--	--	--	--	--	--	--	--
		JSCS Screening Level Value			1.7	--	--	--	0.3	--	0.3	--	--	--	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--	--	--	--	--	--	--
Central Parcel																	
HA-6/S-1	5/18/2001	Discrete	0	0.5	2 U	--	--	--	2 U	--	2 U	--	--	--	--	--	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	5 U	--	--	--	5 U	--	5 U	--	--	--	--	--	--
TP-26/S-2	4/17/2001	Discrete	1.5	2	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	0.1 U	--	0.1 U	--	0.1 U
Wharf Beach -1	9/27/2010	Discrete	1	1.5	0.00035 U	0.00031 U	0.00026 U	0.00045 U	0.00027 U	0.00039 U	0.00034 U	--	0.00026 U	0.0021 U	0.00045 U	0.00051 U	0.00038 U
East Parcel																	
Beach Cove-1	9/27/2010	Discrete	12	18	0.00075 U	0.00088 U	0.00064 U	0.0189	0.00068 U	0.00099 U	0.0037 J	--	0.00066 U	0.198	0.0011 U	0.0013 U	0.00094 U
Beach Cove-2	9/27/2010	Discrete	12	18	0.0016 U	0.0019 J	0.0013 U	0.0045 J	0.0019 J	0.0021 U	0.0031 J	--	0.0014 U	0.0301 J	0.0023 U	0.0027 U	0.002 U
HA-1	12/12/1988	Composite	0	6	--	--	--	--	--	--	--	--	--	--	--	--	--

Please see notes at end of table.

Table C-9
Riverbank Soil Analytical Results - VOCs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		4-Isopropy ltoluene	Acetone	Anthracene	Benzene	Bromo benzene	Bromochloro methane	Bromodichloro methane	Bromoform	Bromom ethane	Carbon disulfide	Carbon tetrachloride	Chlorobenzene	Chloroethane
			Minimum	Maximum	Concentration in mg/kg												
Screening Levels		Cleanup Level			--	--	--	--	--	--	--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	0.845	--	--	--	--	--	--	--	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--	--	--	--	--	0.32	--
Central Parcel																	
HA-6/S-1	5/18/2001	Discrete	0	0.5	--	--	0.195 U	--	--	--	--	--	--	--	--	--	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	--	--	8.65	--	--	--	--	--	--	--	--	--	--
TP-26/S-2	4/17/2001	Discrete	1.5	2	--	1 U	--	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	1 U	0.1 U	0.1 U	0.1 U
Wharf Beach -1	9/27/2010	Discrete	1	1.5	0.00055 U	0.0054 J	0.0344	0.00021 U	0.00033 U	0.00031 U	0.00017 U	0.00033 U	0.00045 U	0.0004 U	0.00026 U	0.00026 U	0.00041 U
East Parcel																	
Beach Cove-1	9/27/2010	Discrete	12	18	0.01 J	1.18	0.519 J	0.00057 J	0.00083 U	0.00078 U	0.00042 U	0.00082 U	0.0011 U	0.0074 J	0.00064 U	0.00065 U	0.001 U
Beach Cove-2	9/27/2010	Discrete	12	18	0.0029 U	0.21	0.0102 U	0.0011 U	0.0017 U	0.0016 U	0.00087 U	0.0017 U	0.0024 U	0.0028 J	0.0013 U	0.0014 U	0.0021 U
HA-1	12/12/1988	Composite	0	6	--	--	--	--	--	--	--	--	--	--	--	--	--

Sample ID	Date	Sample Type	Depth (ft bgs)		Chloroform	Chloro methane	cis-1,2-Di chloroethene	cis-1,3-Dichloro propene	Dibromochloro methane	Dibromo methane	Dichlorodi fluoromethane	Ethylbenzene	Ethylene dibromide	Hexachloro butadiene	Isopropyl benzene	m,p-Xylene	Methyl iso butyl ketone
			Minimum	Maximum	Concentration in mg/kg												
Screening Levels		Cleanup Level			--	--	--	--	--	--	--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	--	--	--	--	0.6	--	--	--
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--	--	--	--	--	--	--
Central Parcel																	
HA-6/S-1	5/18/2001	Discrete	0	0.5	--	--	--	--	--	--	--	--	--	2 U	--	--	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	--	--	--	--	--	--	--	--	--	5 U	--	--	--
TP-26/S-2	4/17/2001	Discrete	1.5	2	0.1 U	0.5 U	0.1 U	0.1 U	0.1 U	--	0.5 U	0.1 U	0.1 U	0.2 U	0.2 U	0.2 U	0.5 U
Wharf Beach -1	9/27/2010	Discrete	1	1.5	0.00028 U	0.00029 U	0.0003 U	0.00019 U	0.00014 U	0.0003 U	0.00059 U	0.00054 U	--	0.00042 U	0.00049 U	0.0017 J BU	--
East Parcel																	
Beach Cove-1	9/27/2010	Discrete	12	18	0.00069 U	0.00073 U	0.00074 U	0.00046 U	0.00036 U	0.00074 U	0.0015 U	0.0098 J	--	0.0011 U	0.0012 U	0.0203 J	--
Beach Cove-2	9/27/2010	Discrete	12	18	0.0014 U	0.0015 U	0.0015 U	0.00097 U	0.00075 U	0.0015 U	0.0031 U	0.0035 J	--	0.0022 U	0.0026 U	0.0121 J	--
HA-1	12/12/1988	Composite	0	6	--	--	--	--	--	--	--	--	--	--	--	--	--

Please see notes at end of table.

Table C-9
Riverbank Soil Analytical Results - VOCs
Willamette Cove
Portland, Oregon

Sample ID	Date	Sample Type	Depth (ft bgs)		Methyl n-butyl ketone	Methyl tert-butyl ether	Methylene bromide	Methylene chloride	Methylethyl ketone	Naphthalene	n-Butyl benzene	n-Propylbenzene	o-Xylene	Sec-butyl benzene	Styrene	tert-Butyl benzene	Tetrachloro ethene
			Minimum	Maximum	Concentration in mg/kg												
Screening Levels		Cleanup Level			--	--	--	--	--	--	--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	--	0.561	--	--	--	--	--	--	0.5
		Remedial Action Level			--	--	--	--	--	--	--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	140	--	--	--	--	--	--	--
Central Parcel																	
HA-6/S-1	5/18/2001	Discrete	0	0.5	2 U	--	--	--	--	0.195 U	--	--	--	--	--	--	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	5 U	--	--	--	--	8.38 U	--	--	--	--	--	--	--
TP-26/S-2	4/17/2001	Discrete	1.5	2	1 U	0.1 U	0.1 U	0.5 U	1 U	0.2 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Wharf Beach -1	9/27/2010	Discrete	1	1.5	--	0.00035 U	--	0.0037 U	--	0.203	0.00065 U	0.0005 U	0.00046 U	0.00059 U	0.00061 J	0.00049 U	0.00054 U
East Parcel																	
Beach Cove-1	9/27/2010	Discrete	12	18	--	0.00089 U	--	0.0094 U	--	0.13	0.0016 U	0.0108	0.0087 J	0.0044 J	0.001 J	0.0012 U	0.0014 U
Beach Cove-2	9/27/2010	Discrete	12	18	--	0.0019 U	--	0.0196 U	--	0.063	0.0035 J	0.0037 J	0.0036 J	0.0031 U	0.0021 U	0.0026 U	0.0028 U
HA-1	12/12/1988	Composite	0	6	--	--	--	--	--	--	--	--	--	--	--	--	--

Sample ID	Date	Sample Type	Depth (ft bgs)		Toluene	Total Xylenes	trans-1,2-Dichloroethene	trans-1,3-Di chloropropene	Trichloro ethene	Trichlorofluoro methane	Vinyl chloride
			Minimum	Maximum	Concentration in mg/kg						
Screening Levels		Cleanup Level			--	--	--	--	--	--	--
		JSCS Screening Level Value			--	--	--	--	2.1	--	--
		Remedial Action Level			--	--	--	--	--	--	--
		Principal Threat Waste			--	--	--	--	--	--	--
Central Parcel											
HA-6/S-1	5/18/2001	Discrete	0	0.5	--	--	--	--	--	--	--
TP-22/S-1	4/17/2001	Discrete	0	0.5	--	--	--	--	--	--	--
TP-26/S-2	4/17/2001	Discrete	1.5	2	0.1 U	0.2 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Wharf Beach -1	9/27/2010	Discrete	1	1.5	0.00053 J	0.0017 J BU	0.00042 U	0.0003 U	0.0003 U	0.00032 U	0.0004 U
East Parcel											
Beach Cove-1	9/27/2010	Discrete	12	18	0.0094 J	0.029 J	0.0011 U	0.00075 U	0.00075 U	0.00081 U	0.00099 U
Beach Cove-2	9/27/2010	Discrete	12	18	0.003 J	0.0156 J	0.0022 U	0.0016 U	0.0016 U	0.0017 U	0.0021 U
HA-1	12/12/1988	Composite	0	6	--	--	--	--	--	--	--

Please see notes at end of table.

Table C-9
Riverbank Soil Analytical Results - VOCs
Willamette Cove
Portland, Oregon

Notes:

1. VOCs = Volatile Organic Compounds
2. ft bgs = feet below ground surface
3. mg/kg = milligrams per kilogram
4. U = Non-detected value.
5. J = Estimated value after QA review.
6. B = analyte was detected in the associated method blank. Result may be biased high
7. Cleanup Levels from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
8. 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.
9. Remedial Action Level from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
10. Prinicipal Threat Waste from Record of Decision, Portland Harbor Superfund Site, EPA, January 2017.
11. 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.

Attachment D

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Attachments

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