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Technical Memorandum

May 7, 2021

To: Brick Spangler and Joanna Florer, Port of Seattle

From: Dan Berlin, Delaney Peterson, Julia Fitts, and Stephen Strehl, Anchor QEA, LLC

Re: Terminal 25 Quality Assurance Project Plan Addendum 2: Subsurface Sediment Characterization

Introduction and Background

This Addendum 2 to the *Quality Assurance Project Plan: Soil and Subsurface Sediment Characterization* (QAPP; Anchor QEA and Windward 2019) provides the additional methods and procedures to support the second phase of in-water field investigations at the Port of Seattle Terminal 25 South (T-25S). The investigation is being conducted to support the delineation of the nature and extent of sediment contamination in support of the habitat restoration project, specifically in the area where dredging will occur to remove contaminated sediments. This dredging is intended to fulfill the requirements of the remediation that will be required within the footprint of the habitat restoration area under the forthcoming Proposed Plan and Record of Decision by the Environmental Protection Agency for the East Waterway Operable Unit of the Harbor Island Superfund Site.

Cleanup of the sediments within the habitat restoration footprint is a requirement by the Natural Resource Trustees. The entire T-25S habitat project includes restoration of intertidal and shallow subtidal habitat within and around the footprint of a former creosote-piling dock structure, in addition to fill removal from more than 5 acres of adjacent uplands, to create off-channel emergent marsh and riparian habitat. The project will be significant because it is located in a critical estuarine and marine transition area that is important to juvenile salmon. In addition, fine-grained intertidal habitat is rare in the East Waterway, and no emergent marsh or riparian resources are present.

The first phase of upland and in-water investigations occurred in 2019, with supplemental upland borings in 2020 (Anchor QEA 2020). Additional in-water investigation is needed to characterize the vertical extent of sediment with concentrations that exceed the East Waterway Remedial Action Levels (RALs) and to understand concentrations along the adjacent dredge slopes around the perimeter of the habitat footprint.

As part of the *East Waterway Existing Information Summary Report* (Anchor Environmental and Windward 2008), the deepest historical bed elevations were determined based on historical U.S. Army Corps of Engineers bathymetric surveys dating back to 1925. Sediment thickness was derived by comparing these deepest historical bed elevations to recent bathymetry data and calculating the

difference. The differences in elevations were used to estimate the thickness of accumulated sediment. Figure 1 presents the estimated thickness of accumulated sediment above the deepest historical bed elevations. Reliable bathymetry surveys were not always available adjacent to the edges of the waterway, so the thickness presented on Figure 1 was cropped to only show thickness in the area with the most reliable historical bathymetry survey data.

Figure 1 also presents the proposed supplemental subsurface sediment coring locations and historical sediment sampling locations. The deepest historical bed elevations and the physical and chemical results associated with sediment cores summarized in the *Data Report: Subsurface Sediment Sampling for Chemical Analyses* (Windward 2010) and Supplemental Remedial Investigation Report (SRI; Windward and Anchor QEA 2014) were used to inform target sampling depths for the proposed cores (Table 1).

The full extent of the habitat restoration project, shown in Figure 1, includes the eastern half of the East Waterway navigation channel. This footprint delineates the extent that the Port of Seattle anticipates removing sediments that contain concentrations above any of the East Waterway RALs, which is anticipated to fulfill the forthcoming requirements in the East Waterway Record of Decision. Previous sediment coring indicates that sediment concentrations determined the vertical extent of contamination, based on concentrations that are below East Waterway RALs, at four locations: EW10-SC-08 and EW10-SC-09 at approximately 9 feet below mudline in the northern portions of the habitat project footprint, EW10-SC06 at approximately 7 feet below mudline in the central portion, and EW10-SC05 at 2 feet below mudline in the south end. The supplemental sampling program is intended to further delineate the vertical extent of contamination in each core and also delineate the sediment concentrations along the south, west, and north sides of the dredge area where dredge slopes will transition to existing sediment elevations around the project perimeter.

Sample Collection and Analysis

Sample collection and analysis procedures will be in accordance with the QAPP (Anchor QEA and Windward 2019), as modified herein.

Sediment Core Collection and Processing

In-water sediment cores will be collected at the locations shown in Figure 1. Proposed coring locations are spaced along transects approximately 100 feet apart. Many coring locations are within the project boundary, and are intended to define the vertical extent of contamination to support development of the dredge plan. Some coring locations are located on the edges of the project boundary, either slightly outside (e.g., west and north) of the project boundary or along the Spokane Street Fishing Pier. These locations are intended to define the vertical extent of contamination, but also to understand dredge cut slope concentrations where dredging may not remove all contamination, either because the dredge area transitions to existing mudlines where future cleanup

will occur (west and north sides) or because dredging may be limited adjacent to structures (on the south side). After the first round of testing, dredge elevations will be estimated for the area within the project footprint, and additional sampling intervals may be tested within each perimeter core to assess dredge slope concentrations.

The target core locations were developed using existing core information from the SRI (Windward and Anchor QEA 2014), which documented concentrations below East Waterway RALs and native elevations. Sediment cores will be collected from 20 locations using a vessel-mounted vibracorer equipped with 17-foot core tubes in order to collect cores to a target depth of 16 feet. Sediment core collection and processing will be performed consistent with the QAPP (Anchor QEA and Windward 2019).

Sediment sample processing will follow procedures described in Section 4.2.2.2 of the QAPP. The profile of the accepted sediment core for each location will be visually logged for major and minor constituents (i.e., regions in the core where sediment characteristics noticeably change). A portable photoionization detector will be used to determine the potential presence of volatile organic compounds in the core. Photographs of each core and each sample interval will be taken before sampling. The core will be logged by a field geologist or geotechnician and recorded on the sediment core processing log (presented in Appendix B of the QAPP [Anchor QEA and Windward 2019]). Data recorded on the sediment boring logs will follow procedures described in Section 4.2.2.3 of the QAPP.

Sediment Sample Analyses

Target analytical intervals, analyses, and the rationale for analytical design are summarized in Table 1. Three depth intervals from each location will be submitted for the full suite of Sediment Management Standards analyses and dioxin/furans listed in Table 4 of the QAPP (Anchor QEA and Windward 2019). These three intervals were selected based on nearby core information and the historical bed elevation presented in Figure 1. Remaining 1-foot sample intervals will be stored in frozen archive for potential tiered analyses pending review of the first and subsequent rounds of data. Additional 1-foot intervals may be tested to refine the depth of contamination below, if some constituents remain above RALs, or above, if no RALs are exceeded. Once the lowest depth is determined where RALs are achieved in perimeter cores (Table 1), the probable slope elevation will be calculated and shallower depth intervals will be tested for that core.

References

Anchor Environmental and Windward (Anchor Environmental, LLC and Windward Environmental, LLC), 2008. *Existing Information Summary Report*. East Waterway Supplemental RI/FS. Prepared for U.S. Environmental Protection Agency. March 2008.

Anchor QEA (Anchor QEA, LLC), 2020. *Draft Data Report: Soil and Subsurface Sediment Characterization*. Port of Seattle T-25 South Design Characterization. Prepared for U.S. Environmental Protection Agency. December 2020.

Anchor QEA and Windward, 2019. *Quality Assurance Project Plan: Soil and Subsurface Sediment Characterization*. Port of Seattle T-25 South Design Characterization. Prepared for U.S. Environmental Protection Agency. January 2019.

Windward, 2010. *Data Report: Subsurface Sediment Sampling for Chemical Analyses*. East Waterway Supplemental RI/FS. Prepared for U.S. Environmental Protection Agency. November 2010.

Windward and Anchor QEA, 2014. *East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final Supplemental Remedial Investigation Report*. Prepared for U.S. Environmental Protection Agency. January 2014.

Table

Table 1
Phase 2 In-Water Sampling Design

Station	Easting	Northing	Existing Elevation (ft MLLW)	Deepest Historical Bed Elevation (ft MLLW)	Approximate Sediment Thickness (max, ft)	Sample Interval (ft)	Sample Interval[a, b] (ft below mudline)	Sample Analyses[c]	Notes
SC-10	1267404	212881	-34.4	-40.9	6.5	1	6-7	Full SMS & D/F	Perimeter slope location. EW10-SC08 nearby (<SCO at 9.4') and at similar elevation. Target sampling depth based on historical bed elevation.
						1	7-8	Full SMS & D/F	
						1	8-9	Full SMS & D/F	
SC-11	1267520	212918	-37.5	-42.4	4.9	1	5-6	Full SMS & D/F	Perimeter slope location. EW10-SC08 nearby (<SCO at 9.4') and at similar elevation. Target sampling depth based on historical bed elevation.
						1	6-7	Full SMS & D/F	
						1	7-8	Full SMS & D/F	
SC-12	1267626	212910	-35.1	-40.8	5.7	1	6-7	Full SMS & D/F	Perimeter slope location (toe of slope). EW10-SC08 nearby (<SCO at 9.4') and at similar elevation. Target sampling depth based on historical bed elevation.
						1	7-8	Full SMS & D/F	
						1	8-9	Full SMS & D/F	
SC-13	1267706	212909	-35.9	NA	NA	1	8-9	Full SMS & D/F	Perimeter slope location. EW10-SC09 nearby (<SCO at 9.2') and at similar elevation. Target sampling depth based on EW10-SC-09 starting at 8 feet below mudline.
						1	9-10	Full SMS & D/F	
						1	10-11	Full SMS & D/F	
SC-14	1267597	212834	-31.0	-39.0	8.0	1	8-9	Full SMS & D/F	Located along edge of the former dock, where dredging likely previously occurred (adjacent to the toe of former dredge slope). SC08 nearby (>CSL at 10') and at similar elevation. Target sampling depth based on historical bed elevation.
						1	9-10	Full SMS & D/F	
						1	10-11	Full SMS & D/F	
SC-15	1267371	212769	-36.6	-41.5	4.9	1	5-6	Full SMS & D/F	Perimeter slope location. No historical cores nearby. Target sampling depth based on historical bed elevation.
						1	6-7	Full SMS & D/F	
						1	7-8	Full SMS & D/F	
SC-16	1267479	212746	-38.1	-45.0	6.9	1	7-8	Full SMS & D/F	No historical cores nearby. Target sampling depth based on historical bed elevation.
						1	8-9	Full SMS & D/F	
						1	9-10	Full SMS & D/F	
SC-17	1267560	212726	-32.3	-37.6	5.3	1	5-6	Full SMS & D/F	Located along edge of the former dock, where dredging likely previously occurred (adjacent to the toe of former dredge slope). SC-07 nearby (>CSL at 7'). Target sampling depth based on historical bed elevation and SC-07 starting at 5 feet.
						1	6-7	Full SMS & D/F	
						1	7-8	Full SMS & D/F	
SC-18	1267343	212671	-32.3	-37.3	5.0	1	5-6	Full SMS & D/F	Perimeter slope location. No historical cores nearby. Target sampling depth based on historical bed elevation.
						1	6-7	Full SMS & D/F	
						1	7-8	Full SMS & D/F	
SC-19	1267441	212642	-31.9	-38.3	6.4	1	6-7	Full SMS & D/F	No historical cores nearby. Target sampling depth based on historical bed elevation.
						1	7-8	Full SMS & D/F	
						1	8-9	Full SMS & D/F	
SC-20	1267533	212623	-25.4	NA	NA	1	6-7	Full SMS & D/F	Located along edge of the former dock, where dredging likely previously occurred (adjacent to the toe of former dredge slope). Closest historical core is SC-07 to the north (>CSL at 7'). Target sampling depth based on SC-07 starting at 6 feet.
						1	7-8	Full SMS & D/F	
						1	8-9	Full SMS & D/F	
SC-21	1267313	212555	-31.3	-36.8	5.5	1	5-6	Full SMS & D/F	Perimeter slope location. EW-167 nearby, which was a shorter core (>CSL at 3.5'). Target sampling depth based on historical bed elevation.
						1	6-7	Full SMS & D/F	
						1	7-8	Full SMS & D/F	
SC-22	1267505	212518	-15.4	NA	NA	1	4-5	Full SMS & D/F	Located along edge of the former dock, where dredging likely previously occurred (adjacent to the toe of former dredge slope). SC-06 nearby (>CSL at 3.3'). Target sampling based on SC-06 starting at 4 feet. Intended to identify vertical extent that was unbounded in SC-06.
						1	5-6	Full SMS & D/F	
						1	6-7	Full SMS & D/F	
SC-23	1267273	212436	-25.3	-28.9	3.6	1	4-5	Full SMS & D/F	Perimeter slope location. No historical cores nearby. Target sampling depth based on historical bed elevation.
						1	5-6	Full SMS & D/F	
						1	6-7	Full SMS & D/F	
SC-24	1267365	212421	-15.7	NA	NA	1	3-4	Full SMS & D/F	SC-05 nearby (>SCO at 2'). Target sampling based on SC-05 starting at 3 feet.
						1	4-5	Full SMS & D/F	
						1	5-6	Full SMS & D/F	

Table 1
Phase 2 In-Water Sampling Design

Station	Easting	Northing	Existing Elevation (ft MLLW)	Deepest Historical Bed Elevation (ft MLLW)	Approximate Sediment Thickness (max, ft)	Sample Interval (ft)	Sample Interval[a, b] (ft below mudline)	Sample Analyses[c]	Notes
SC-25	1267250	212346	-21.3	NA	NA	1	3-4	Full SMS & D/F	Perimeter slope location. No historical cores nearby. Target sampling depth based on review of historical bathymetry condition maps.
						1	4-5	Full SMS & D/F	
						1	5-6	Full SMS & D/F	
SC-26	1267338	212327	-9.8	NA	NA	1	1-2	Full SMS & D/F	No historical cores nearby. Target sampling depth based on review of historical bathymetry condition maps.
						1	2-3	Full SMS & D/F	
						1	3-4	Full SMS & D/F	
SC-27	1267397	212315	1.9	NA	NA	1	1-2	Full SMS & D/F	No historical cores nearby. Target sampling depth based on review of historical bathymetry condition maps.
						1	2-3	Full SMS & D/F	
						1	3-4	Full SMS & D/F	
SC-28	1267321	212231	-3.4	NA	NA	1	2-3	Full SMS & D/F	Adjacent to Spokane Street Fishing Pier, where dredging may be restricted. No historical cores nearby. Target sampling depth based on review of historical bathymetry condition maps.
						1	3-4	Full SMS & D/F	
						1	4-5	Full SMS & D/F	
SC-29	1267380	212229	-0.5	NA	NA	1	2-3	Full SMS & D/F	Adjacent to Spokane Street Fishing Pier, where dredging may be restricted. No historical cores nearby. Target sampling depth based on review of historical bathymetry condition maps.
						1	3-4	Full SMS & D/F	
						1	4-5	Full SMS & D/F	

Notes:

Coordinates are in NAD83 WA State Plane North, U.S. Feet.

a. Samples will be collected in 1-foot intervals over the entire length of each core. Intervals may be adjusted due to anthropogenic debris encountered during sampling. Sample intervals not triggered for analysis will be archived.

b. Discrete samples will be collected within lithological layers with visual indicators of contamination (sheen), odors, or elevated PID readings relative to ambient conditions.

c. The full suite of analytes are listed in Table 4 of the QAPP (Anchor QEA and Windward 2019). Samples will be analyzed for Marine SMS parameters, total solids, total organic carbon, and D/F.

CSL: Cleanup Screening Level

D/F: polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans

ft: feet

MLLW: mean lower low water

NA: not available

NAD83: North American Datum of 1983

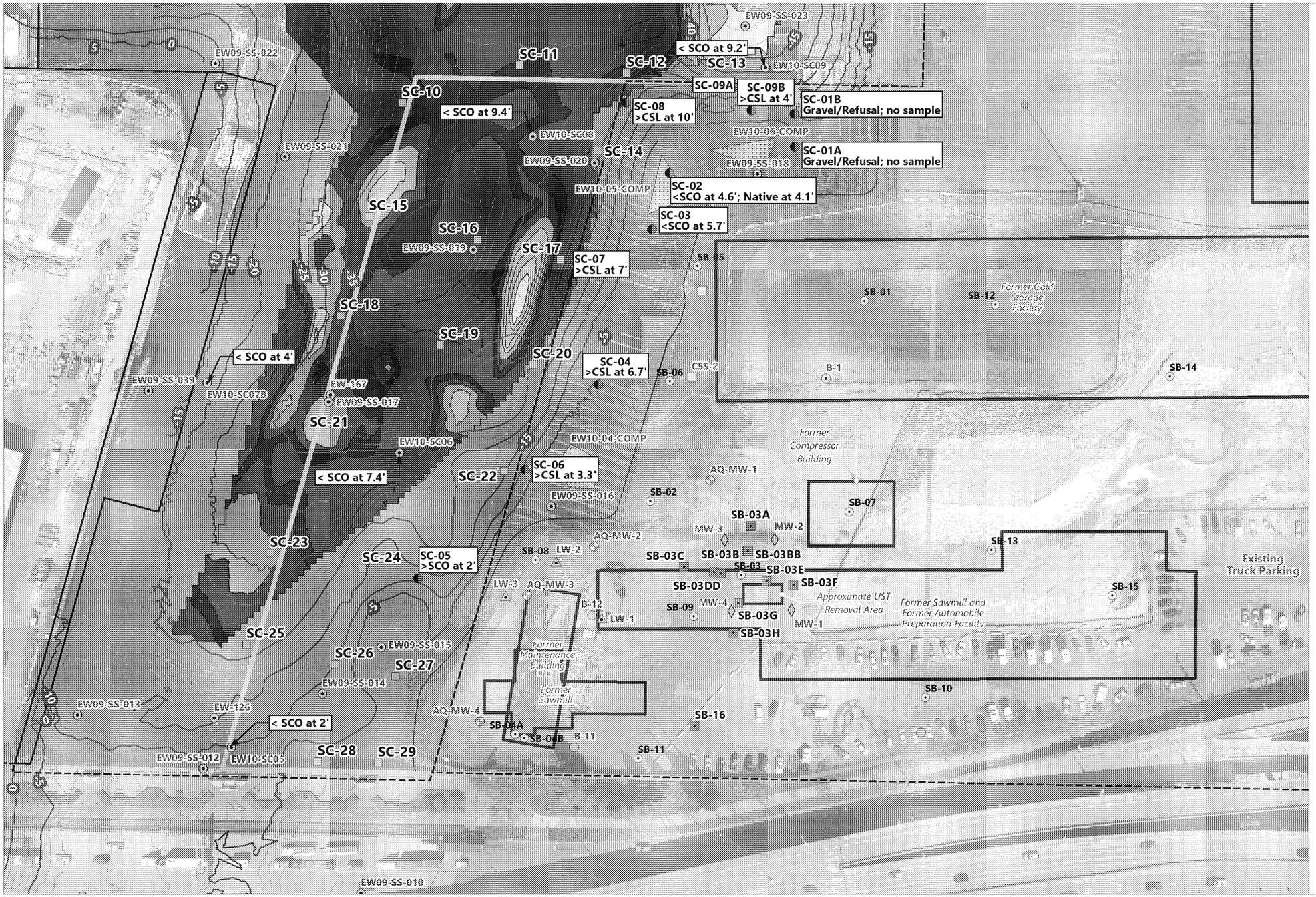
PID: photoionization detector

QAPP: Quality Assurance Project Plan: Soil and Subsurface Sediment Characterization

SCO: Sediment Cleanup Objective

SMS: Sediment Management Standards

Figure



LEGEND:

- Proposed Sediment Coring Location
- 2019 Upland Soil Boring Location
- 2019 Sediment Coring Locations
- 2020 Supplemental Boring Locations

Historical Borings

- Soil Boring (Blymyer, 1989)
- Soil Boring and Monitoring Well (Landau, 1990)
- Soil Boring and Monitoring Well (Sweet-Edwards/Emcon, 1990)
- Geotech Boring (Shannon and Wilson, 2008)

SRI Data (Windward and Anchor QEA 2014)[1]

- SRI Core Locations
- SRI Intertidal Surface Sediment Sampling Areas
- Approximate OHWM
- 5-foot Contour
- 1-foot Contour
- Project Boundary
- Approximate Key Historical Building Footprint
- Tax Parcel

Sediment Thickness, Feet

Color	Range Beg.	Range End
	20.00	10.00
	10.00	6.00
	6.00	5.00
	5.00	4.00
	4.00	3.00
	3.00	2.00
	2.00	1.00
	1.00	0.00
	0.00	Higher than 0.0

NOTES:
1. Sediment thickness taken from the deepest historic bed elevation analysis presented in Figure 4-5 of the Existing Information Summary Report (Anchor and Windward 2008).

SCO: Sediment Cleanup Objective

0 100
Feet

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Figure 1

Proposed Supplemental Coring Locations with Sediment Thickness Above Deepest Historical Water Depths

Terminal 25 Quality Assurance Project Plan Addendum 2: Subsurface Sediment Characterization
Port of Seattle T-25 South Design Characterization