LOCKHEED WEST SEATTLE SUPERFUND SITE

REMEDIAL INVESTIGATION DATA REPORT

Prepared for

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CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

This Data Report for the Lockheed West Site (Site) is submitted on behalf of Lockheed Martin Corporation (LMC) and presents data resulting from the sampling and analysis activities described in the Lockheed West Site Remedial Investigation/Feasibility Study (RI/FS) Work Plan.

This Data Report was prepared as required by Section II, Task 2 of the Statement of Work (SOW), Appendix A to the Administrative Settlement Agreement and Order on Consent (ASAOC) (U.S. Environmental Protection Agency [EPA] Docket No. CERCLA-10-2006-0321/Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]) for the Lockheed West Seattle Superfund Site. EPA approval of this Data Report will fulfill the requirements specified in Section II, Task 2 of the SOW.

1.1 BACKGROUND

The Site is located in the southwest corner of Elliott Bay, and consists of the areal extent of sediment contamination from the former shipyard facility also known as Lockheed Shipyard No. 2, which was located at 2330 Southwest Florida Street in West Seattle, Washington. The area of investigation for the Site includes both the property occupied by the former shipyard and the areas of Elliott Bay and the West Waterway immediately adjacent to the former shipyard property.

The Site is bordered by Elliott Bay on the north, Harbor Island West Waterway on the east, and Pacific Sound Resources (PSR) Superfund Site on the west (Figure 1-1). It includes approximately 7 acres of aquatic land now owned by the Port of Seattle (Port) (formerly owned by LMC) and approximately 20 acres owned by Washington Department of Natural Resources and historically leased to LMC.

Data presented in this report and subsequent data collected from the area of investigation will be used to delineate the nature and extent of contamination at the site, establish sediment remediation goals, and refine the conceptual site model to support evaluation of remedial alternatives. Remediation goals will be derived for sediment contaminants of concern (COCs) from site-specific baseline human health and ecological risk assessments that utilize data collected from the area of investigation, background sampling locations within Elliott Bay, and other potentially relevant information established by the nearby Lower Duwamish Waterway (LDW) Superfund Site.

The Remedial Investigation sampling was designed to collect necessary data to support the streamlined RI/FS in light of remedial plans. Specifically, the purpose of the investigation was to collect a comprehensive sediment quality data set to better delineate the nature and extent of sediment contamination resulting from historical releases at the Former Lockheed Shipyard No. 2 (Lockheed West) in support of developing risk-based cleanup goals and determining an appropriate remediation alternative for the Site. EPA authorized the sampling event described in the Work Plan. Specific objectives included the following:

- Collecting both the surface and subsurface sediment quality samples within the area of investigation;
- Collecting sediment quality data to identify and characterize the representative range finding for background locations in and about the Elliott Bay system in support of developing appropriate potential cleanup goals for the site; and
- Performing supplemental tests and analyses where appropriate to determine effectiveness of capping and dredging remedial alternatives.

The rationale for the sampling approach was based on the assessment of existing data and identification of data gaps (see Section 4.8 of the Work Plan). EPA's seven step Data Quality Objectives process was followed to develop all the data collection efforts (e.g., Guidance on Systematic Planning using the Data Quality Objectives Process (QA/G-4), EPA 240/B-06/001 Feb 2006), and provides the technical and decision-making basis for the collection of data.

1.2 PURPOSE AND ORGANIZATION OF THIS DOCUMENT

The purpose of this Data Report is to document the field data collection activities and results from the shoreline conditions survey in August 2006, discuss the sample collection for sediment characterization in January 2007, and summarize the sample data. The field data collection for the intertidal areas was conducted April 20, 2007, during low tide, and data associated with that field effort will be documented in a supplement to this report.

This Data Report summarizes the results of field sampling activities and identifies discrepancies with the sampling and analysis plan. This report consists of a sample identification matrix that relates sample identification numbers to sample locations, maps that show actual sample locations, and tables of chemical analysis data. These data were validated by a third-party validator in accordance with the Quality Assurance Project Plan (QAPP). Field notes, log sheets, photos, laboratory data reports, and data validation reports are included as appendices. This report does not attempt to interpret these data. Instead, the data will be evaluated as part of the RI/FS report.

This Data Report is organized into the following sections:

- Section 2 – Methods used to conduct the field investigations and laboratory methods of analysis.
- Section 3 – Discussion of the data quality and summary of sample results.
- Section 4 – Recommendations for additional sample analysis and data collection.
- Figures and tables are provided at the end of the Data Report text.
- Appendix A includes the shoreline conditions survey photos and shoreline habitat video.
- Appendix B includes photos documenting the sediment sample collection.
- Appendix C includes all field notes and log sheets documenting the sediment sampling.
- Appendix D includes the chain of custody forms used to transfer samples to the laboratory.
- Appendix E includes the data validation reports.
- Appendix F includes the chemistry laboratory data reports.
- Appendix G includes the project database of historical and 2007 sample results.

2. FIELD ACTIVITIES AND METHODS

Field activities discussed below were performed at the Lockheed West project site in August 2006 (shoreline survey), January 2007 (sediment sampling), and April 2007 (intertidal sampling and topographic survey). EPA authorized the implementation of the RI field work described in the Work Plan. The discussion of field work is divided into subsections based on the types of sampling/activities performed, including physical characterization of the site (topographic survey and shoreline condition survey), and sediment quality characterization including the core, surface, and intertidal sampling.

2.1 PHYSICAL CHARACTERIZATION

Physical characterization of the site included a bathymetry survey, topographic survey, and shoreline condition survey. The results of the bathymetry survey were included in the Work Plan (Tetra Tech 2007). The topographic survey results will be discussed in an addendum to the Data Report, and the Shoreline Condition Survey is discussed below.

2.1.1 Topographic Survey

The purpose of the topographic survey was to document the current upland elevations to tie in the current bathymetry survey. This survey will provide additional data that will be used during the FS and design. Pacific Geomatic Services, Inc. conducted a survey during low tide on April 20 and April 23, 2007. The survey area extended from the top of bank (at the Port of Seattle fence line) to the water's edge, approximately -2 mean lower low water (MLLW). Results of the survey will be included in the Data Report Addendum.

2.1.2 Shoreline Condition Survey

The condition of the shoreline at the Lockheed West Site was assessed during three site visits, including:

- On August 9, 2006, during a physical survey of the shoreline areas during a daytime low tide;
- On August 17, 2006, during a site visit with Port of Seattle staff to upland areas between Terminal 5 and the Lockheed West Site; and
- On April 20, 2007, during the sampling of the intertidal areas.

2.1.2.1 August 9, 2006 Shoreline Condition Survey

On August 9, 2006, a team of scientists and engineers from Tetra Tech visited the Lockheed West site to survey and document the current physical conditions along the shoreline. The survey team consisted of Gary Braun, Principal Scientist; Pamela Sargent, P.E., Principal Engineer; Jennifer Hawkins, Environmental Scientist; and John Herzog, Principal Scientist. Representatives from EPA (Lynda Priddy) and the Muckleshoot Tribe (Glen St. Amant) were also present during the survey.

The survey was performed during a daytime low tide to maximize the extent of the survey. The predicted tide was -2.6 feet MLLW at 11:26 am at the site. The survey area is depicted in Figure 2-1.

Field activities at the Site included the following:

- Documenting the weather and tidal conditions during the survey;
- Systematically photographing the shoreline areas with overlapping photos:
- Recording the condition of shoreline, including the nature and extent of shore protection and debris;
- Recording substrate types and sizes;
- Documenting the relative slope angles and slope conditions;
- Recording types, conditions, locations, and extent of shoreline and nearshore structures, including pilings and bulkheads (where present);
- Documenting presence/absence of biota;
- Documenting presence, size, material of construction, location and condition of outfalls (where present); and
- Documenting the presence, location, and extent of seeps along the shoreline.

Summary of Observations

The weather conditions were partly cloudy with periods of sun and light showers during this site visit.

Slopes along the shoreline ranged from very shallow to vertical. Substrates observed in the shoreline area included medium sand, shell hash, small- to medium- size cobbles, medium to large riprap, concrete keel blocks, cutoff and broken off wood pilings, and debris, including trash, wire rope, concrete and ductile iron piping, and portions of deteriorated wooden bulkheads. Biota observed included crabs, barnacles, algae, kelp, starfish, mussels, and clams. Seeps were observed in the area between the Florida Street Outfall and the Terminal 5 Pier, as well as between the concrete pier just north of the Florida Street outfall and the northeast corner of the shoreline. Several pipes, in addition to the Florida Street Outfall, were observed along the eastern and northern shorelines. No discharge was noted from any of the pipes. The majority of the shoreline north of the Florida Street outfall is bulkheaded. Bulkhead types include single wooden, double wooden, steel sheetpile, and concrete bulkheads (very small area). In general, the wooden bulkheads were observed to be in poor to very poor condition, and the concrete and steel sheetpile bulkheads were observed to be in good condition.

Representative photos showing shoreline condition and features are included in Appendix A.1 of this Data Report. Video documentation of the condition of the shoreline and shoreline habitat during the August 9, 2006, visit is included as Appendix A.2 on DVD. Copies of the field logs from this and the two subsequent visits are included in Appendix C of this report. The observations made during this and the two subsequent site visits were compiled and are presented in Figures 2-2 through 2-6.

2.1.2.2 August 17, 2006 Upland Site Visit

On August 17, 2006, Tetra Tech personnel visited the upland areas between the Port of Seattle's Terminal 5 and the Lockheed West Site to observe upland site conditions. The observations were made by Jennifer Hawkins, Environmental Scientist; Pamela Sargent, Principal Engineer; and Mary Diesel, Environmental Scientist. They visited the site between 12:30 pm and 1:30 pm Pacific Daylight Time (PDT) on August 17, 2006. The area visited is shown on Figure 2-1. During this period, a high tide of 9.7 feet MLLW was predicted for 2:20 pm PDT. This visit was made with representatives of the Port of Seattle (Kathy Bahnick and Roy Kuroiwa) and Warren Hansen, a consultant to the Port from Windward Environmental LLC.

The purpose of this site visit was to walk the portion of Terminal 5 adjacent to the Lockheed West sediment site with Port of Seattle personnel to address the following:

- Observe the stormwater system and discharges (outfalls) that potentially impact the Lockheed West sediment site;
- Take photographs of upland site features;
- Point out miscellaneous pipes observed during the low tide shoreline survey and obtain information regarding their status (active or inactive; if active, the source of water discharged via the piping);

- Obtain information regarding the planted area at the top of the bank on the northeast side of Terminal 5;
- Obtain recent groundwater sampling and boring log information from Terminal 5; and
- Obtain recent Puget Sound Dredged Disposal Analysis (PSDDA) and geotechnical sampling data from sediment sampling performed on behalf of the Port along the east side of Terminal 5.

Summary of Observations

The weather was overcast with little wind during this field visit.

The tide was high and the shoreline slope areas were generally submerged. Keel blocks were noted at the edge of the pavement parallel to the fence line between the fence line and the planted area on the north side of Terminal 5 and directly behind the sheet pile walls at the head of the shipway and along the northwest boundary of the shipway (Figures 2-7 and 2-8). The Terminal 5 perimeter fence is in excellent condition along the north terminal boundary. The planted area on the north side of Terminal 5 between the PSR Site and the West Waterway includes irrigation.

Discussions during the site visit between Port of Seattle and Tetra Tech personnel during this site visit are summarized below:

- The Florida Street outfall drains all of Terminal 5. There are no other active outfalls for Terminal 5. The Port provided a map of the existing Terminal 5 storm sewer system.
- Historic outfalls were plugged as part of previous remedial activities per drawing C-10 3/21/97 of the Site Drainage/Environmental Remediation Plan (Port of Seattle 1997). The status of miscellaneous piping observed during the shoreline survey was not verified during the site visit. A comparison of the piping found during the survey with the drawing provided by the Port will be completed as part of an upland source survey.
- Current groundwater monitoring program (Phase 1) includes water levels, but does not include chemical data. Phase 2 of the Port's monitoring program will include sampling for chemistry analysis.

2.1.2.3 April 20, 2007 Intertidal Sampling

On April 20, 2007, a field team from Tetra Tech mobilized to the Lockheed West site to collect intertidal sediment samples. The field team consisted of Gary Braun, Principal

Scientist; Pamela Sargent, P.E., Principal Engineer; and Jennifer Hawkins, Environmental Scientist.

The intertidal sampling field activities are discussed in Section 2.2.7 of this report.

The intertidal sampling was performed during a daytime low tide. The predicted tide at the Site was -2.7 feet MLLW at 1:49 pm, and the site visit occurred between 11:30 am and 2:30 pm**.** The wind was calm and the weather ranged from partly cloudy to partly sunny during the sampling efforts. The substrates, biota, debris, seep areas, and slope angles observed during this sampling event were consistent with those previously observed. No discharges were noted from any of the pipes observed along the shoreline. Copies of the field logs from this visit are included in Appendix C of this report. The observations made during this and the two previous site visits were compiled and are presented in Figures 2-2 through 2-6.

2.2 SEDIMENT SAMPLING PROCEDURES

A synopsis of the RI sediment field program is provided below. Samples are located beyond the property boundary to assess the potential extent of contamination from the former shipyard. Samples were not located beyond the adjacent PSR Superfund Site boundary (Figure 2-9) because remedial actions (sediment capping) have been recently completed in this area of the site.

The sampling effort includes collection and analysis of subtidal subsurface samples, subtidal surface samples, intertidal surface samples, and range finding for background subtidal surface sediment samples.

Sediment sampling and analysis was performed in accordance with the Sampling and Analysis Plan (SAP) and Statement of Work (SOW) for the purpose of identifying the nature and extent of chemical contamination in sediment at the Site. Sediment sampling was performed in the general vicinity of the Lockheed West property boundaries.

Sediment samples included surface (0 to 10 centimeter [cm]) grab samples and subsurface core samples. All sampling, handling, and analyses were performed in general accordance with EPA-recommended methodology and Puget Sound Estuary Program (PSEP) protocols as outlined in the standard operating procedures included in the SAP. Sediment sampling was performed at 42 subtidal locations throughout the Site as shown on Figure 2-9. Subsurface and co-located surface sediment sampling was performed at 35 locations, surface sediment sampling only was performed at 7 locations, and 9 discrete intertidal bank surface samples were collected along the shoreline. The core sample IDs and locations are included in Table 2-1. The surface sample IDs and locations are included in Table 2-2.

2.2.1 Horizontal and Vertical Location Control

Navigation to each proposed subtidal sediment sampling location was accomplished using a Trimble Ag 132 DGPS and a computer running HYPACK® hydrographic survey software. Actual locations where samples were collected were recorded at the time of collection. Horizontal positioning was recorded in State Plane Washington North, North American Datum (NAD) 1983 coordinate system to the nearest 0.1 foot. Sample locations are listed in Tables 2-1 and 2-2.

Vertical control parameters measured at all core sampling locations included depth to sediment and water surface elevation. The depth to sediment was measured with a fathometer at the time of each sampling event. The time of core collection was noted, and water surface elevations were obtained from National Oceanic and Atmospheric Administration (NOAA) tides online web site (URL http://tidesonline.nos.noaa.gov/geographic.html) for the appropriate time of core collection. The observed tide readings were available within a few hours to obtain corrected mudline elevations.

After the core collection, the elevation of the mudline for each core was calculated by subtracting the water depth from the observed tide reading, based on MLLW datum for Elliott Bay.

Navigation to each proposed intertidal sediment sampling location was accomplished using a hand-held Trimble® GEO-XT GPS unit. Actual locations where samples were collected were recorded at the time of collection using Integrated WAAS correction in the field. Horizontal positioning was recorded in State Plane Washington North, NAD 83.

2.2.2 Core Sample Collection

Subsurface sampling was performed using a P3 equivalent vibracore system. The coring system was operated from the R/V *Brendan D II*. Forty-five successful cores were collected at 35 locations January 10 to 23, 2007. Subsurface sediment sampling was conducted in accordance with the SAP (Tetra Tech 2007). Equipment decontamination procedures and sample handling procedures detailed in the SAP were followed closely to prevent cross-contamination of the samples and quality assurance/quality control (QA/QC) samples were collected to evaluate the effectiveness of these QC measures.

The objectives of the subsurface sampling are presented in the SAP. Most subsurface cores were advanced beyond the deepest extent of PRG exceedances indicated by the existing data. The goal was to reach native material, expected to be an approximate elevation of -45 feet MLLW, which is the historical dredging depth; however, native material was only encountered in several cores. Cores were penetrated to a maximum of 20 feet in length. The length of the core was determined by the difference in mudline elevation and -53 MLLW, the estimated maximum depth potentially required for navigation. The primary objective was to determine the vertical extent of sediment contamination. Photos documenting the collection of cores are included in Appendix B.

Depth of penetration versus depth of recovery was closely monitored during the collection of the cores. During core collection, penetration and sediment retention were measured to the nearest tenth of a foot. The core tube was monitored during extraction to evaluate if sediment was lost. After the core was extracted, the core catcher was inspected for rocks or other obstacles that may have plugged the core while penetrating. Caution was taken to prevent disturbance of the surface of the sediment when the core was laid at an angle during removal from the drive head. Cores were rejected if there was insufficient recovery, sediment was lost out of the bottom of the core tube during extraction, the core catcher was plugged, or there was doubt about their representativeness. The actual penetration depth and sample recovery were compared and documented on core log forms. A sample recovery of 75 percent or greater was considered acceptable and representative of an individual location.

Cores were considered acceptable if the recovery was greater than 75 percent on the first attempt. If multiple attempts were made and recovery was less than 75 percent, the location was moved and additional attempts were made. If a core with recovery greater than 75 percent was not obtained at the second location after multiple attempts, a core with less than 75 percent recovery but greater than 50 percent recovery was accepted.

2.2.3 Core Processing

As soon as possible after collection, the cores were transported from the boat to the processing area located on Port of Seattle Property, adjacent to the Jack Block Public Shoreline Access, where logging, sample processing, and sub-sampling were completed. Cores were kept on ice in the processing area until they were processed. Core sections collected for chemical sampling were extruded at the core processing station by cutting the polyethylene liner, and visually inspecting and photographing each section of core. Each subsurface core was logged generally using the Unified Soil Classification System. The core logging included the description of grain size, sediment consistency, and location of native sediments (if possible) to aid in the evaluation of dredging suitability. Photos were taken of each core segment and are included in Appendix B. The core logs are included in Appendix C.

Cores were measured on the processing table to calculate linear compaction. Compaction of the sediment that occurred during the coring process was assessed by calculating the percent sediment recovery for each core**.** The difference between the penetration depth and recovery depth was assumed to be compaction unless there was evidence of sediment loss. Evidence of sediment loss (besides observation of loss during extraction) included smears on the core liner where sediment had slipped down the core tube. Compaction was assumed to be linear for the entire core and was estimated by dividing the measured sediment recovery by the measured core penetration depth. The resulting percent recovery was applied to the measured features and intervals in each recovered core to account for compaction. Both the recovered/observed depth from mudline and expanded elevation of each sample increment are identified on the core logs in Appendix C.

Sample intervals were identified first based on sediment stratigraphy, and then by 1-foot intervals to correlate with elevations (MLLW). Therefore, a 20-foot-long core was divided up into 20 samples. Approximately three samples were analyzed from each core and the rest of the intervals were archived. Selection of samples to be submitted for chemical analyses was representative of the various subsurface sediment types observed based on the visual observations. A relatively uniform subsurface sediment stratigraphy was observed in most cores. As a result, the two to three sediment sample intervals collected at the top of each core were submitted to the laboratory for chemical analysis.

Samples in increments of 4 feet were also collected from selected cores in the area south of the property boundary along the West Waterway at Stations 1 through 5 and 27. These samples were archived and may be used to support a preliminary evaluation of dredged material disposal options.

Duplicate core samples from the potential dredge area were archived in 1-foot sample increments for the option to be analyzed for contaminant mobility testing. Pending review of sediment chemistry results, one to two sediment composite samples representative of the potential dredge prism may be created from the archived samples to support sediment contaminant mobility testing. Based on a review of sediment stratigraphy, sediment chemistry results, and dredging plan specifics, a volume-weighted sediment composite sample (e.g., equal volume of sediment for each depth interval that may require removal) will be created that is representative of sediments that may require removal from the subtidal area. Contaminant mobility testing performed on the sediment composite will include a Column Settling Test (CST) and a Dredging Elutriate Test (DRET) to provide an assessment of contaminant mobility during dredging and aquatic confinement and disposal (i.e., thick capping, capped aquatic disposal, or upland disposal).

2.2.4 Surface Sediment Sample Collection

Forty-two subtidal surface sediment samples, representative of the upper 10 cm of sediment, were collected around the Lockheed West Seattle Site on January 24 through 26, 2007. All surface sediment sampling was conducted as described in the SAP (Tetra Tech 2007). The project-specific sampling interval for surface sediments was 0 to 10 cm. Equipment decontamination procedures and sample handling procedures detailed in the SAP were followed closely to prevent cross-contamination of the samples. QA/QC samples were collected to evaluate the effectiveness of these QC measures.

As described in more detail in the SAP, the purpose of the surface samples was to determine surface sediment quality and establish the locations of potential chemical "hot spots."

Samples for chemical analysis were obtained with a modified, single 0.1 square meter van Veen grab sampler deployed from the R/V *Brendan DII*. The sampler was lowered to the bottom at a controlled rate of speed and then retried at a similar controlled rate of speed and placed in a stable position on the boat deck. The top covers were opened and the sample was checked for acceptability using PSEP criteria (e.g., relatively clear overlying water present and no significant winnowing or other disturbance). The overlying water was siphoned off the top of the van Veen grab, and a stainless steel spoon was used to remove the sediment sample. The sediment was placed into a stainless steel bowl, thoroughly homogenized, and portioned into sampling jars provided by the laboratory. These samples were placed into coolers and covered with ice to maintain the temperature at 4°C during transport to Columbia Analytical Services in Kelso, Washington, for chemical analysis.

Field sampling logs are included in Appendix C. Chain of custody forms are provided in Appendix D. Results of the chemical analyses are presented in Section 3 of this report.

2.2.5 Range-Finding Background Sediment Sample Collection

The Elliott Bay sediment background concentration range-finding study is focused on identifying a representative background range of concentrations for chemicals of potential concern (COPCs). The objectives for selection of sampling locations included the following considerations:

- Sample areas that are representative of the overall ambient sediment quality condition;

- Sample areas that do not have a potential to be biased by known or suspected contaminant sources;
- Sample at depth ranges comparable to those of Lockheed West Site (i.e., ~45 feet MLLW); and
- Sample sediments that are comparable to those of Lockheed West Site (e.g., %TOC, grain size).

Sediment sampling activities for the background concentration range-finding study were conducted on January 26, 2007. Surface (0 to 10 cm) sediments were sampled using a van Veen grab sampler deployed from the work vessel. Sampling procedures for these samples were the same as those discussed above for surface sediment samples. Locations for range-finding background samples are shown on Figure 2-10.

As described in the December 18, 2006, Technical Memorandum, rationale for the locations sampled included the following:

- Sampling Location 1 (TTB1-SS) is representative of northern Elliott Bay and is the same as the LDW background site 2. This site is situated near the Elliot Bay Marina and Terminals 90 and 91 at depths that are comparable to those of Lockheed West. This location is not in the immediate vicinity of known outfalls or industrial use areas that may provide point sources of contamination.
- Sampling Location 2 (TTB2-SS) is representative of northern Elliott Bay and is the same as the PSR Superfund Site background location “BK02.” This location is situated along a municipal park and is at depths that are comparable to those at Lockheed West. This location is not in the immediate vicinity of known outfalls or industrial use areas that may provide point sources of contamination. The location is not situated within an area to have been subject to anthropogenic disturbances. The nearest industrial use is the Port of Seattle bulk grain loading facility.
- Sampling Location 3 (TTB3-SS) is representative of the eastern portion of Elliott Bay. This location is situated along the central waterfront of downtown Seattle. This location is not in the immediate vicinity of known outfalls or industrial use areas that may provide point sources of contamination. The location is not situated within an area to have been subject to anthropogenic disturbances. Uses of areas near the sampling location are primarily commercial and maritime transportation.
- Sampling Location 4 (TTB4-SS) is representative of the southeastern portion of Elliott Bay. This location is situated along the large container dock south of the central waterfront of downtown Seattle. This location is not in the immediate vicinity of

known outfalls or industrial use areas that may provide point sources of contamination. The location is situated within an area that was last dredged in 1979. Uses of areas near the sampling location are primarily commercial and maritime transportation.

- Sampling Location 5 (TTB5-SS) is representative of the southern portion of Elliott Bay. This location is situated along the north shore of Harbor Island. The location is not in the immediate vicinity of known outfalls. The near shore and onshore areas located near the site are used for maritime commerce purposes such as tug boat storage and shipbuilding. The location is not situated within an area to have been subject to anthropogenic disturbances. Sediment cleanup has been completed at the shipyard facility to the west of the proposed sampling location.
- Sampling Location 6 (TTB6-SS) is representative of southwestern Elliott Bay. This location is situated along the west shore of Harbor Avenue. This location is not in the immediate vicinity of known outfalls or industrial use areas that may provide point sources of contamination. Uses of areas near the sampling location are primarily public access, municipal parks, and commercial businesses. The location is not situated within an area to have been subject to anthropogenic disturbances. Sediment cleanup has been completed at the PSR facility to the east of the proposed sampling location.
- Sampling Location 7 (TTB7-SS) is representative of western Elliott Bay. This location is situated along the west shore Harbor Avenue. This location is not in the immediate vicinity of known outfalls or industrial use areas that may provide point sources of contamination. Uses of areas near the sampling location are primarily public access, municipal parks, and commercial businesses. The location is not situated within an area to have been subject to anthropogenic disturbances.

2.2.6 Porewater Sample Collection

Porewater samples were collected from seven surface sediment locations located throughout the Lockheed West site on January 24 to 26, 2007. Porewater samples provide a direct measure of COCs in the surface sediments and will be used in cap design. Porewater samples were derived from surface sediment samples collected with a van Veen grab sampler using methods described above for surface sediments. The sediment was placed into 1-liter glass jars and sent to the lab for centrifuging to collect the porewater. The seven sample locations are identified on Figure 2-9.

2.2.7 Intertidal Sample Collection

Nine surface samples were collected in the intertidal zone on April 20, 2007. Samples were collected at low tide on foot using stainless steel bowls and spoons. The upper 10 cm of sediment was homogenized and placed into sample jars provided by the laboratory. Sample locations were documented using a hand-held Trimble® GEO-XT GPS. The nine sample locations are identified on Figure 2-9. An additional sample was collected from the sediment (mostly shell hash) at the opening of the Florida Street CSO and archived for potential future analyses. The rationale for each sample locations is included below.

Intertidal Sample Location and Rationale

Location	Sampling Location Description	Sampling Location Rationale
IT1	Sandy Area South of the Florida Street Outfall	Intertidal Seep Area with Sandy Substrate
IT2	Sandy Area South of the Florida Street Outfall	Intertidal Seep Area with Sandy Substrate
IT3	Small Sandy Area just North of Florida Street Outfall	Sandy Substrate adjacent to Florida Street Outfall
IT4	Central Portion of Eastern Shoreline	Intertidal Seep Area with Sandy Substrate
IT5	Head of the Eastern of the Two Existing Long Wooden Piers on the North End of the Site	Small Area with Substrate of Shell Hash and Sand
IT6	Head of the Pier just East of the Shipway – Northwest portion of the Site	Area with Sediment under the Head of the Pier just East of the Shipway
IT7	East Side of Central Portion of Shipway – Northwest portion of Site	Sediment Deposited on Shipway – East Side of Shipway
IT8	West Side of Central Portion of Shipway – Northwest portion of Site	Sediment Deposited on Shipway – West Side of Shipway
IT9	Northwest corner of Site	Sediment under/adjacent to Pier at Northwest corner of Site and adjacent to PSR Site

2.2.8 QA/QC Sampling Activities

The objective of the QA/QC sampling was to ensure that acceptable sampling practices were followed during field activities. Split samples were collected to determine the variability in chemical concentrations between samples of the same sediment. Equipment rinsate blanks were taken to document the effectiveness of decontamination procedures.

Split samples were derived from regular samples by filling a second, separate set of sample containers using the same homogenized material collected for the regular sample. Six split samples were collected during the field program. All split samples were analyzed for the same constituents as the regular samples. A total of 155 regular samples was analyzed. The split samples were analyzed at a rate of 5 percent of the regular samples; the minimum target rate specified in the SAP.

Equipment rinsate blanks were collected by first decontaminating sampling equipment per the protocol in the SAP and then rinsing the equipment with distilled water. Three field equipment rinsate blanks were collected: one for core sampling equipment, one for subtidal surface sampling equipment, and one for intertidal surface sampling equipment. The rinse water was collected in clean containers provided by the laboratory. QA/QC samples were handled and transported in the same manner as the regular samples.

2.2.9 Surface Water Sample Collection

Surface water samples will be collected from representative locations as supply water for the column settling and elutriate tests, if and when they are performed. The analysis of contaminant mobility samples will follow the evaluation of the data from the initial sampling. The water will be collected below the water surface but above the bottom using a peristaltic pump with weighted Teflon-lined tubing. Details of water sample collection will be included in an Addendum to the Data Report.

2.2.10 Sample Identification

Samples are listed in Table 2-1 and 2-2. The samples were coded by sample type.

Core samples designated for chemistry analysis were identified as TT##-CS-X.

Where	TT	=	Tetra Tech
	##	=	location
	CS	=	chemistry sample
	X	=	increment letter, starting with A for the surface, ascending down the core in approximately 1-foot increments up to letter T

Archived samples from cores include contaminant mobility sample increments that are stored for potential compositing as well as 4-foot sample increments (“PSDDA” samples) representing the potential dredge area for the Port of Seattle project expansion. The “PSDDA” samples are identified as TT##-PD-X.

Contaminant mobility sample increments were identified as TT##-CM-X.

Surface samples were identified as TT##-SS.

Range finding background samples were identified as TTB#-SS.

Porewater samples were identified as TT##-SS-Pore.

Intertidal samples were identified as TT-IT-##.

Rinsate blanks were identified RB-CS-1, RB-SS-2, and RB-IT-3 to distinguish the rinsate blank pertaining to a core chemistry sample collection, the surface sample collection, and the intertidal sample collection.

2.2.11 Deviations from the Work Plan

Several sample locations were moved in the field after multiple attempts were made at the proposed locations due to either the inability to penetrate the sediment or insufficient recovery of the core or surface sample. Insufficient penetration or poor recovery was a result of sediment matrix or bathymetry. Sediment that is too hard is difficult to penetrate and sediment that is too soft is difficult to recover.

- Bathymetry was an issue at location 4, where the water was too shallow to penetrate a 20-foot core, so the location was moved away from the shore into water of sufficient depth to deploy the equipment.
- There were several windy days, and holding onto a location in strong wind was difficult, so by the time the core hit the mudline, the vessel might have been blown off the proposed location by 20 to 40 feet.
- Intertidal sample location IT-09 was moved from the NW corner of the Site (adjacent to the dock and PSR Site) to the shipway sandy area. The original proposed location for IT-09 was located on cap material from the PSR Site.
- Cores were attempted at the proposed locations. They were then moved, if necessary, to collect an acceptable core. Once all the cores were collected and processed, the surface samples were attempted at the proposed locations. Most surface samples were acceptable at the proposed locations. Therefore, some surface samples may be located near the proposed locations and not co-located with the core samples. Both surface and core sample locations are shown on Figure 2-9.

Several range-finding background locations were adjusted from the proposed locations. The following list describes each change.

- Location 1 (TTB1-SS) is located south of the Port of Seattle Terminal 91. This sample was collected south of the proposed location to be in water depth of approximately -37 feet MLLW, within the range of Lockheed West sample depths.
- Location 2 (TTB2-SS) was moved south along the shoreline to achieve adequate penetration.

- Location 3 (TTB3-SS) was moved closer to shore to obtain an appropriate elevation. The sample elevation obtained was approximately -56 feet MLLW.
- Location 4 (TTB4-SS) was located in front of Terminal 30. This location was collected as close as possible to the terminal face, but water depths comparable to the target depths were not located. The sample was collected from a water depth of -132 feet MLLW.

2.3 LABORATORY ANALYSIS

This section includes an overview of laboratory methods used.

2.3.1 Sediment Chemistry Methods

Sediment samples and porewater were analyzed for chemicals of interest (COIs) by the methods listed below. The required detection limits were intended to be consistent with risk-based low-level detection limits of the Lower Duwamish project. Sample increments were archived for the potential analysis of PCB congeners and dioxin/furans.

COIs for the Site Characterization

Parameters	Analysis	Sediment Target Detection Limit[a]
Grain Size	PSEP 1986/ASTM-D422	0.1 % retained
Total Organic Carbon	SW846 9060/EPA 415.1	500 mg/kg
TBT	Krone et al. 1989	1-5 µg/kg
Metals	SW846 6010B/6020	0.03 – 1 mg/kg
Mercury	SW846 7471A	0.003 µg/kg
PCB Aroclors[b]	SW846 8082	0.98 µg/kg
Pesticides	SW846 8081A	0.024- 30 µg/kg
Semivolatiles	SW846 8270D	0.006 – 0.1 mg/kg
PAHs	SW846 8270-low level	0.001 – 0.05 µg/kg
Archived		
PCB Congeners[c]	SW846 1668A	0.35 – 0.95 ng/kg
Dioxin/Furans[c]	Method 1613	0.059 – 0.518 ng/kg

(a) Detection limits will vary and are dependent on total solids content. Samples with high moisture contents or matrix interference may have detection limits higher than those listed.
(b) PCB Aroclors analyzed included 1016, 1221, 1232, 1242, 1248, 1254, and 1260 plus 1262 and 1268. Detected Aroclors were summed to find total PCBs.
(c) Sediment was archived for potential analysis of PCB Congeners and Dioxin/Furans.

EPA test methods are found in SW-846 Test methods for the evaluation of solid waste physical/chemical methods.

2.3.2 Geotechnical Test Methods

A suite of physical tests are used to evaluate dredging and capping methods, dredge material transport and placement, dredge material behavior in the disposal site, potential short-term impacts at the dredge and disposal sites, and capacity of existing sediments to provide foundation support for capping material.

The following tests were completed for selected samples collected in the cores:

Geotechnical Parameters and Methods

Grain Size	PSEP 1986
Atterburg Limits	ASTM D 4318-95
Specific Gravity	ASTM D 854-92

PSEP = Puget Sound Estuary Program
ASTM = American Society for Testing and Materials

2.3.3 Contaminant Mobility Methods

Sample increments representative of the material to be dredged are currently archived. If necessary, selected samples will be composited into one or two samples to be analyzed for column settling and elutriate testing. At this time, samples have not been evaluated to create the composite. The tests and methods that will be used for the composite samples are listed below. Discussion of the composite will be addressed in an addendum to the Data Report.

Contaminant Mobility Tests and Methods

- Column Settling Test — EPA/USACE 1998
- Dredge Elutriate Test — DiGiano et al. 1995

2.3.4 Deviations from Approved Plans

Methods followed the approved plans except for the following:

- The laboratory analyzed TOC by three different methods: EPA SW846-9060, ASTMD4129-98M**,** and PSEP (Plumb 1981). The difference in the methods is the laboratory QC samples (duplicate versus triplicate) and does not change the results of each sample.
- Not all detection limits were met for all parameters. Reporting limits depend on the total solids of the sample as well as any dilutions that need to occur due to matrix interference. There were matrix interferences with semivolatile organic compounds (SVOCs) and pesticide compounds requiring dilutions. Several pesticides and SVOCs in samples were not able to report non-detects as low as the project required reporting limits even when the sample was not diluted. The laboratory analyzed

hexachlorobenzene and hexachlorobutadiene using pesticide method 8081 in an attempt to meet the project required detection limits.

- The Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260 were planned to be analyzed as the standard suite in SMS and LDWW, however Aroclors 1262 and 1268 were detected in some sediment samples and were therefore reported and included in the sum.

3. SAMPLE RESULTS

This section discusses the results of the chemical and physical analyses for surface and subsurface samples collected at Lockheed West during the January 2007 sampling event. The results for the intertidal sampling event conducted in April 2007, as well as additional chemical analyses from the January event, will be presented in an Addendum to this report.

Many of the subsurface samples were collected and then archived in accordance with the SAP. This was done to prevent additional field mobilizations and to accelerate the schedule. Samples that were collected and have not been analyzed (are still archived) are identified with an "A" in Table 2-1.

3.1 DATA QUALITY EVALUATION

Seven data packages, corresponding to individual sample delivery groups, were generated by Columbia Analytical Services, Inc., located in Kelso, Washington. The data packages were validated by Laboratory Data Consultants, Inc. (LDC), an independent validation firm. The validation is summarized by LDC in two data validation reports. Based on review of sediment and pore water data, the overall data quality objectives specified in the Quality Assurance Project Plan (QAPP) (Tetra Tech 2007) were met. The data validation reports are provided in Appendix E and are summarized below.

3.1.1 Validation Levels and Criteria

Two levels of validation were performed for this project. "Level 3" validation was performed on approximately 80 percent of the data. "Level 3" validation consists of an evaluation of the following items, as summarized in the data packages: holding time, calibration, blank, surrogate spike, matrix spike/matrix spike duplicate, laboratory control sample, and some method-specific requirements. "Level 4" validation was performed on approximately 20 percent of the data. "Level 4" validation is a more comprehensive effort and includes an evaluation of those items included in a "Level 3 validation" plus a review of the raw data to confirm compounds are properly identified and data are correctly calculated and transcribed.

Data validation was performed using the guidance as described in EPA's *National Functional Guidelines for Inorganic Data Review* (EPA 2004) and *National Functional Guidelines for Organic Data Review* (EPA 1999). Data were validated in accordance with criteria specified in the EPA validation guidance, analytical methods, and QAPP. Validated data are qualified in cases when the criteria were not met or as deemed appropriate, based on the professional judgment of the validator.

3.1.2 Qualified Data

The majority of analytical data are within control limits. However, due to the size and nature of the project and relatively large number of data points, there were several cases when control limits are not met. Data qualifiers are applied when control limits are not met.

Qualified data are listed in Appendix E. The majority of quality control issues are related to the following issues: calibration outliers, blank contaminants, laboratory control sample outliers, and differences between results obtained on two gas chromatograph columns. Some of the reported results may represent approximate concentrations due to these issues and are qualified as estimated (J/UJ). Some results are qualified as not detected (U) due to the likelihood of trace contamination, as demonstrated in analytical blanks. Some results are rejected (R) due to recovery of less than 10 percent in the laboratory control sample analysis. Results that were rejected included the following:

- One semivolatile compound (aniline) for a rinsate blank (RB-CS-1),
- Three semivolatile compounds (aniline, 4-chloroaniline, and 3,3'-dichlorobenzidine) for a rinsate blank (RB-SS-2),
- One semivolatile compound (benzoic acid) for 36 sediment samples,
- Five pesticides (oxychlordane, cis-nonachlor, trans-non-achlor, mirex, and hexachlorbutadiene) for six pore water samples (TT03-SS-PORE, TT09-SS-PORE, TT13-SS-PORE, TT15-SS-PORE, TT25-SS-PORE, and TT42-SS-PORE).
- Detected pesticide results were flagged JN, tentatively identified at estimated concentrations since PCB standards were not analyzed during pesticide analysis as a check for interferences caused by PCB peaks. Non-detect pesticide results are flagged UJ as estimated detection limits.

Control limit exceedances are typically encountered for data sets of this size and nature. The number of exceedances for this project is considered to be within the expected range, and associated data have been appropriately addressed as indicated above. Overall, project objectives were met and the laboratory analyses are considered usable for the intended purpose, with the exception of results that were rejected (R).

3.1.3 Other Comments

Other comments about the data quality include:

- The mercury result for one sample (TT42-SS) was very high relative to other samples from the site and was not consistent with a duplicate and matrix spike analysis performed for this sample. This result of 52.3 milligrams per kilogram (mg/kg) was qualified as estimated (J) by the independent validator and was attributed to a heterogeneous distribution of mercury. (The corresponding duplicate result was 0.879 mg/kg.) The laboratory reanalyzed the sample; the mercury result from the reanalysis (0.998 mg/kg) was similar to other project samples and consistent with the reanalyzed duplicate (0.911 mg/kg) and matrix spike. No qualifiers were applied by the validator to the reanalysis result. As the result from the reanalysis was consistent with other site samples and associated duplicate and matrix spike analysis, the reanalysis result is judged to be more representative.
- The independent validators commented that the reporting limit for benzoic acid in sediment samples (at 96 micrograms per kilogram [µg/kg]) is greater than the project required reporting limit specified in the QAPP (at 67 µg/kg). No samples were qualified. Detection limits will be considered during the risk assessment. As there are no screening criteria identified, no further action is taken at this time to obtain a lower detection limit.
- For the field duplicate sets precision is generally acceptable. However, the variance for TOC in one set is greater than expected. The TOC results for TT19-CS-B and field duplicate TT91-CS-B are 4.59 and 0.98 percent, respectively, which yield a relative percent difference of 130 percent. The reason for the discrepancy is unknown. The data is not qualified as a result of field duplicate discrepancies and is considered useable.

3.1.4 Data Reduction

3.1.4.1 Mulitple Results

There were several samples in which multiple results for a target analyte were reported by the laboratory. This situation occurred when analysis of a target analyte (e.g., hexachlorobenzene and hexachlorobutadiene) was performed by two analytical methods (8081A and 8270C) to meet a detection limit, or when a sample was reanalyzed due to QC sample results not within acceptance criteria. In these cases, the laboratory reported both the original analysis and reanalysis. After LDC applied data qualifiers, Tetra Tech selected the result that was more appropriate and assigned one valid result per target analyte per sample. Following are the guiding principles that were applied when selecting the result that would be used when multiple results were reported:

1. When multiple results indicated the analyte was not detected, the lowest reporting limit for a not detected analyte was selected.
2. When one result was rejected (R) during validation, the remaining result was selected.
3. When one result indicated a detection and the other result was not detected, the detected value was selected.
4. For TT42-SS, multiple results for mercury were reported. The result with the higher detected value was associated with QC samples that were not within acceptance criteria. Additionally, the result with the higher detected value appears to be an anomaly when compared to mercury results in the reanalysis, QC duplicates, and for other site samples. Therefore, the value from the reanalysis for mercury was selected for this sample.
5. For all other samples besides TT42-SS, when multiple results indicated a detection, the highest value for a detected analyte was selected.

3.1.4.2 Calculating Totals

Total PCBs, Total DDT, Total HPAH, Total LPAH, Total Benzofluoranthenes, Total PAH, and Total Chlordanes were calculated using Sediment Management Standards Chapter 173-204 WAC.

Total PCBs were calculated using only detected values for nine Aroclor mixtures. For individual samples in which none of the Aroclor mixtures are detected, total PCBs were given a value equal to the highest reporting limit of the Aroclors and assigned a “U” qualifier indicating the lack of detected concentrations.

Total LPAHs are the sum of detected concentrations for naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. Total HPAHs are the sum of detected concentrations for fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Total benzofluoranthenes are the sum of the b (i.e., benzo(b)fluoranthene), j, and k isomers. Because the j isomer is rarely quantitated, this sum was calculated with only the b and k isomers. For samples in which all individual compounds within any of the three groups described above are undetected, the single highest reporting limit for that sample represents the sum.

Total DDTs were calculated using only detected values for the six DDT isomers: 2,4'-DDD, 4,4'-DDD, 2,4'-DDE, 4,4'-DDE, 4,4'-DDT, and 4,4'-DDT. For individual samples in which none of the isomers are detected, total DDTs are given a value equal to the highest reporting limit of the six isomers and assigned a "U" qualifier, indicating the lack of detected concentrations.

Total chlordane was calculated using only detected values for the following compounds: alpha-chlordane, gamma-chlordane, oxychlordane, cisnonachlor, and trans-nonachlor. For individual samples in which none of these compounds is detected, total chlordane was given a value equal to the highest reporting limit of the five compounds listed above and assigned a "U"qualifier, indicating the lack of detected concentrations.

3.2 SEDIMENT CHEMISTRY RESULTS

Discussions of the sample results are separated into the type of sample. The chemistry laboratory data reports are included in Appendix F. The Lockheed West Site database for all data is included as a Microsoft Access Database as Appendix G.

3.2.1 Core

A total of 45 cores were collected at 35 sample locations (Table 2-1). Core lengths ranged from 5 to 20 feet in length. A total of 104 core samples were analyzed and a total of 390 core samples were archived.

Most of the material in the cores consisted of dark grey sand or silty sand, and most locations included a silt layer at the mudline. One exception was location 35, which contained clay throughout the core. Several cores in the former dry dock area contained material that resembled sand blast grit. The locations with cores containing this material were 6, 7, 8, 9, 15, and 17.

Results from the chemistry analysis of core samples are included in Table 3-1. Based on review of the initial results, a second round of analysis was conducted on 29 additional archived subsurface samples. These data results will be included in the Addendum to this Data Report.

3.2.2 Surface

A total of 42 subtidal surface samples were analyzed. Surface samples primarily consisted of a dark gray silty sand. Results of the chemistry analysis of subtidal surface samples are included in Table 3-2.

3.2.3 Porewater

A total of seven porewater samples were analyzed. One porewater sample bottle was broken at the laboratory and therefore the remaining sample could only be analyzed for metals and SVOCs. Results for chemistry analysis of porewater samples are included in Table 3-3.

3.2.4 Range-Finding Background

A total of seven range-finding background surface sediment samples were analyzed. A tech memo discussing the preliminary range-finding background sample results was submitted to EPA in April 2007. Final sample results are included in Table 3-4.

Sampling and analysis results will be used to determine if the samples collected are representative of the background sediment quality condition and are not directly affected by anthropogenic or natural processes.

The data will be used by EPA to determine the next steps that will be required to establish Elliott Bay background sediment quality concentrations for the COPCs. Concurrent with this study, EPA is working to identify background sediment concentrations for the nearby LDW Superfund Site. Once established, the background sediment concentrations for both Elliott Bay and the LDW will be considered for use at the Lockheed West Site given the potential influence on sediment quality due to direct discharge of the river on the Site.

3.2.5 Intertidal

Discussion of the intertidal sample results will be included in an Addendum to the Data Report.

3.2.6 Geotechnical Results

Selected core samples were analyzed for specific gravity and Atterburg limits. Specific gravity was analyzed in 12 cores located within the potential dredge prism. Samples were selected to represent each lithological layer within the core. Atterburg limits were selected on samples containing a high percent fines content. Results are included in Table 3-5.

3.2.7 Contaminant Mobility

Discussion of the contaminant mobility sample results will be included in an Addendum to the Data Report.

4. RECOMMENDATIONS FOR ADDITIONAL SAMPLING

Based on a review of the initial subsurface data results, a second round of samples were analyzed to characterize deeper sediment in the cores if elevated concentrations were found in the lowest analyzed sample. A total of 29 samples are listed in Table 4-1 as the "Round 2" group of samples. Data from these samples will be included in the Addendum to the Data Report.

Based on review of the collected data and pending the results of the Round 2 samples, it is possible that one to two contaminant mobility composite samples will be analyzed to support evaluation of potential removal actions. No other additional data needs have been identified at this time.

5. REFERENCES

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FIGURES

TABLES

Table 4-1. Round 2 Samples and Rationale

Sample ID	Lab ID	Rationale:	Interval above	Round 2 sample Elevation	Bottom of core/ last archived increment	SQS Max EF	Bckg Max EF
TT04-CS-K	K0700566-027	Interval above contained Efs > 1 for Mercury.(TOC 1.5 %)	TT04-CS-J at -33	-34.00	-42	5.6	9.7
TT04-CS-M	K0700564-026	Additional increment possibly necessary to find EFs <1. Interval J was at contact with stratigraphy change. Further down in the core may be cleaner.		-36	-42		
TT05-CS-E	K0700375-027	Interval above contained Bckgd Efs > 1 for SVOCs (TOC 0.46%). Note: The cut line is at -22. The core was moved offshore in the field and a longer core should have been collected.	TT05-CS-C at -9	-11	-13	8	1.6
TT05-CS-G	K0700375-029	Additional increment possibly necessary to find Efs <1 since there was no sharp change in core stratigraphy		-13	-13		
TT06-CS-E	K0700498-028	Interval above contained Efs > 1 for metals/Pest/PCB/SVOC (TOC-1.1%)	TT06-CS-C at -46	-48	-55	23.6	15.6
TT06-CS-G	K0700498-030	Additional increment possibly necessary to find Efs <1 since there was no sharp change in core stratigraphy		-50	-55		
TT06-CS-I	K0700498-032	Additional increment possibly necessary to find Efs <1 since there was no sharp change in core stratigraphy		-52	-55		
TT07-CS-F	K0700503-023	Interval above contained Efs > 1 for metals/PCB, SVOC(PAH) (TOC-0.67%). Note: Core is located in an area likely to be filled.	TT07-CS-D at -9	-11	-13	27.1	45
TT07-CS-H	K0700503-025	Additional increment in lower stratigraphy layer with visual petroleum contamination. Note: Interval H contained visual and odor petroleum contamination		-13	-13		
TT08-CS-K	K0700503-003	Interval above Bckgd Efs >1 for metals/pest/PCB, PAH (TOC-0.48%). Note: Most of core contains petroleum odor - may not be clean.	TT08-CS-I at -49	-51	-53	24.9	115
TT08-CS-M	K0700502-007	Additional increment without petroleum odor may be clean. Interval M did not contain petroleum odor.		-53	-53		
TT09-CS-G	K0700502-011	Interval above contained Efs >1 for metals/PCB/PAH (TOC-0.6%). Note: Interval G does not contain sand blast grit as Interval E contained.	TT09-CS-E at -45	-47	-55	127	61
TT09-CS-I	K0700502-012	Additional increment in lower stratigraphy layer without visual contamination		-49	-55		
TT09-CS-K	K0700503-009	Additional increment in same stratigraphy layer without visual contamination possibly necessary to obtain clean layer		-51	-55		
TT09-CS-L	K0700503-010	Additional increment in same stratigraphy layer without visual contamination possibly necessary to obtain clean layer. Note: Interval L is above Interval M with HCB DL > SQS.		-52	-55		
TT10-CS-E	K0700693-018	Interval above contained Bckgd Efs >1 for Vanadium (TOC 2.2%)	TT10-CS-D at -35	-36	-51	0.2	1.1
TT30-CS-B	K0700503-026	Interval above contained Efs > 1 for Hg, PCB, SVOC (TOC 0.7%)	TT30-CS-A at -53	-54	-55	7.7	14.7

Table 4-1. Round 2 Samples and Rationale

Sample ID	Lab ID	Rationale:	Interval above	Round 2 sample Elevation	Bottom of core/ last archived increment	SQS Max EF	Bckg Max EF
TT31-CS-B	K0700498-026	Interval above contained Efs > 1 for metals, PCBs, SVOC (TOC 0.8%)	TT31-CS-A at -53	-54	-55	14	20
TT11-CS-E	K0700566-015	Interval above contained Bckgd Efs >1 for Vanadium (TOC 1.6%)	TT11-CS-D at -48	-49	-53	0.5	1.005
TT12-CS-E	K0700501-023	Interval above contained Bckgd Efs >1 for Analine. HCB DL > with SQS (TOC 0.53%)	TT12-CS-D at -46	-47	-53	1.4	1.1
TT15-CS-H	K0700501-028	Interval above contained Efs >1 for metals, PCBs, PAH (TOC 0.65%)	TT15-CS-G at -53	-54	-54	2.8	65
TT17-CS-F	K0700378-003	Interval above contained Efs > 1 for metals, PCBs, PAH (TOC - 1.4)	TT17-CS-D at -46	-48	-52	17	55.5
TT17-CS-H	K0700378-005	Additional increment in lower stratigraphy layer possibly necessary to obtain clean layer		-50	-52		
TT17-CS-J	K0700378-007	Additional increment in same stratigraphy layer possibly necessary to obtain clean layer		-52	-52		
TT18-CS-E	K0700503-013	Interval above contained Bckgd Efs >1 for Antimony (TOC 0.09%)	TT18-CS-D at -38	-39	-46	7.6	2.7
TT14-CS-L	K0700375-014	Interval above contained Bckgd Efs >1 for PCB-1262. SQS DL issues (TOC 1.9%)	TT14-CS-J at -35	-37	-38	4	19
TT19-CS-D	K0700503-032	Interval above contained Efs >1 for PCBs (TOC 1.2%)	TT19-CS-C at -36	-37	-44	1.4	16
TT19-CS-E	K0700503-033	Additional increment in same stratigraphy layer possibly necessary to obtain clean layer		-38	-44		
TT26-CS-I	K0700378-020	Interval above contained Efs >1 for metals, PCBs (SQS), / pest, SVOC (B). (TOC 1.3%)	TT26-CS-G at -37	-39	-42	4.4	47

Notes:
SQS EF = the maximum exceedance factor of the sample concentration compared to Sediment Management Standards Sediment Quality Standard
Bkgrd EF = the maximum exceedance factor of the sample concentration compared to the maximum background concentration

APPENDIX A

SHORELINE CONDITIONS SURVEY

APPENDIX A.1

PHOTOS (ON CD DISK 1)

Appendix A.1
Lockheed West Shoreline Survey Photograph Log

Description	Date Taken	Photograph Number
Shoreline of SE Portion of Site – Looking South Towards the Terminal 5 Pier	8/9/2007	004
Shoreline of SE Portion of Site – Looking North Towards the Florida Street Outfall	8/9/2007	007
Southeast Portion of the Site – Manhole on Shoreline for the Florida Street Outfall	8/9/2007	010
Looking South at the Florida Street Outfall	8/9/2007	011
Looking NW – Concrete Pier and Timber Bulkhead just North of the Florida Street Outfall	8/9/2007	012
Looking NW – Double Timber Bulkhead just North of the Concrete Pier	8/9/2007	013
Looking North – Eastern Shoreline of the Site North of the Concrete Pier	8/9/2007	014
Looking North – Northern Portion of the Eastern Shoreline	8/9/2007	019
Looking West – Close-up of Double Bulkhead and Debris Along the Central Portion of the Eastern Shoreline	8/9/2007	020
Looking Northwest – 12” Diameter Ductile Iron Pipe at Northern End of Eastern Shoreline	8/9/2007	021
Looking Northwest – Keel Blocks on Upper Slope at Northern End of Easter Shoreline	8/9/2007	024
Looking South – East Portion of Concrete and Timber Pile Remnant of Former Pier on Eastern Portion of Northern Shoreline	8/9/2007	028
Looking South – West Portion of Concrete and Timber Pile Remnant of Former Pier on Eastern Portion of Northern Shoreline	8/9/2007	029
Looking West – Steel Sheetpile Bulkhead and Easternmost Remaining Pier on Northern Shoreline with Debris, Riprap, Keel Blocks on Shoreline	8/9/2007	031
Looking South – Close-Up of Steel Sheetpile Bulkhead with Pipe Penetrating High Up on the Bulkhead just East of Easternmost Remaining Pier	8/9/2007	032
Looking West – All Three Remaining Piers on the Northern Shoreline with Rip Rap, Keel Blocks, Piping, Metal Debris and Piling on the Shoreline	8/9/2007	037
Looking West – Along the Upper Portion of the Shoreline Just West of the Easternmost Pier on the Northern Shoreline	8/9/2007	041
Looking South – Undermined Portion of Upper Shoreline in Area Just West of the Easternmost Pier on the Northern Shoreline	8/9/2007	042
Looking West – Steel Sheetpile Bulkhead and Piping to Center of the Three Remaining Piers with Piping, Keel Blocks and Rip Rap Present on the Slope	8/9/2007	047
Looking West – Upper Shoreline Area Between the Central and Western of the Remaining Piers with Rip Rap, Cutoff Timber Piles, Concrete and Metal Debris Present of the Slope and the Steel Structure in the Water Adjacent to the Western Pier.	8/9/2007	049
Looking Northeast – Shell Hash Under Central Remaining Pier on Northern Shoreline	8/9/2007	055
Looking South – Upper Portion of the Shipway at the Northwest Corner of the Site	8/9/2007	072

APPENDIX A.2

VIDEO (ON DVD DISK 2)

This video is the Shoreline Habitat Survey Video conducted at Lockheed West Seattle Site on August 9, 2006. The video is in two files (format *.VRO). They can be viewed using Windows Media Player or InterVideo Win DVD. In the event that these players are not available, this DVD contains Windows Media Player to view the survey video. Windows Media Player can be installed on the computer by clicking here.

APPENDIX B

REPRESENTATIVE SEDIMENT SAMPLING PHOTOGRAPHS
(all photos available on CD Disk 1)

APPENDIX C

FIELD LOGS

APPENDIX C.1

FIELD LOG BOOKS (ON CD DISK 1)

APPENDIX C.2

CORE LOGS

APPENDIX C.3

SURFACE SAMPLE LOGS

APPENDIX D

CHAIN OF CUSTODY FORMS (ON CD DISK 1)

APPENDIX E

DATA VALIDATION REPORTS (ON CD DISK 1)

APPENDIX F

CHEMISTRY LABORATORY DATA REPORTS
(ON CD DISKS 3 – 8)

APPENDIX G

PROJECT DATABASE (ON CD DISK 1)