QUALITY ASSURANCE PROJECT PLAN

PORT OF SEATTLE TERMINAL 115 POST-DREDGE SUBSURFACE SEDIMENT CHARACTERIZATION

Prepared for

Port of Seattle

P.O. Box 1209

2711 Alaskan Way

Seattle, Washington 98111

Prepared by

Anchor QEA, LLC

1423 Third Avenue, Suite 300

Seattle, Washington 98101

June 2009

APPROVAL PAGE

Port of Seattle Terminal 115
Post-Dredge Subsurface Sediment Characterization

Contractor Project Manager	Date
Contractor QA Manager	Date
Port of Seattle Project Manager	Date
Laboratory Project Manager	Date
Laboratory Project Manager	Date

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
%R	percent recovery
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
COC	chain-of-custody
GPS	global positioning system
Corps	U.S. Army Corps of Engineers
DGPS	Differential Global Positioning System
DMMO	Dredge Material Management Office
DMMP	Dredge Material Management Program
DQO	data quality objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FC	Field Coordinator
GC/MS	gas chromatograph/mass spectrometer
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSP	Health and Safety Plan
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
MDL	Method detection limit
MLLW	mean lower low water
MTCA	Model Toxics Control Act
NAD	North American Datum
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PFD	personal flotation device

Port	Port of Seattle
PQL	practical quantitation limits
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	Quality Assurance Project Plan
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
RPD	relative percent difference
SC Manager	Sediment Characterization Manager
SDG	Sample Delivery Group
SOP	standard operating procedures
SRM	Standard Reference Materials
T-115	Terminal 115
TEQ	Toxic Equivalents Quotient

1 INTRODUCTION

The Port of Seattle (Port) proposes to conduct maintenance dredging to re-establish adequate depth to accommodate barge loading and unloading and to support new construction at the Berth 1 facilities at Terminal 115 (T-115), which includes the removal of existing wooden Pier B and fabrication of a new loading ramp (Ramp 1). T-115 is located at 6700 West Marginal Way Southwest in the City of Seattle, along the western shore of the Duwamish River (Figure 1). The proposed dredge depth is -16.5 feet mean lower low water (MLLW) with 2 feet of allowable overdepth to allow the placement of a minimum 1-foot-thick post-dredge clean sand layer to provide an interim clean surface. The site is located in the Joint Model Toxics Control Act (MTCA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Lower Duwamish Waterway (LDW) Superfund Site. The LDW Group (LDWG), which includes the Port, City of Seattle, King County, and the Boeing Company, have agreed to conduct a remedial investigation/feasibility study (RI/FS) for the entire LDW, which includes T-115.

As part of the U.S. Army Corps of Engineers (Corps) coordination with U.S. Environmental Protection Agency (EPA) and Washington State Department of Ecology (Ecology) on projects within the LDW, the Port has agreed to collect additional post-dredging cores of the new sediment surface that will be exposed after completion of dredging activities. This Quality Assurance Project Plan (QAPP) establishes the quality assurance (QA) objectives for collecting these additional cores. The methods and QA procedures described here will be followed by the Port of Seattle and its contractors during data collection activities for berth core sampling. This QAPP presents the study design including details on project organization, field data collection, laboratory analysis, data management, assessment and oversight, data reduction, validation, and reporting. The goal of this QAPP is to ensure that data of sufficiently high quality are generated to support the project data quality objectives (DQOs).

This QAPP was prepared in accordance with guidance for preparing QAPPs from EPA (EPA 2002). Analytical quality assurance/quality control (QA/QC) procedures were also developed based on the analytical protocols and quality assurance guidance of the Puget Sound Estuary Program (PSEP 1986, 1997a and b), EPA's *Test Methods for the Evaluation of Solid Waste:*

Physical/Chemical Methods, 3rd Edition (EPA 1986), and the U.S. EPA Contract Laboratory Program National Functional Guidelines for Data Review (EPA 1999).

This plan is organized into the following sections:

- Section 2 – Project Management
- Section 3 – Data Generation and Acquisition
- Section 4 – Assessment and Oversight
- Section 5 – Data Validation and Usability
- Section 6 – References

Appendix A contains a table listing historic sediment chemistry results for samples in the vicinity of T-115. Field collection forms and core processing forms are included as Appendix B. A Health and Safety Plan (HSP) designed for the protection of on-site personnel from physical, chemical, and other hazards posed during field sampling activities is included as Appendix C.

2 PROJECT MANAGEMENT

This section identifies key project personnel, describes the rationale for conducting the monitoring studies, identifies the studies to be performed and their respective schedules, outlines project DQOs and criteria, lists training and certification requirements for sampling personnel, and describes documentation and record keeping procedures. With the exception of the Port Project Manager, specific individuals are not identified, since this work is not under contract at this time.

2.1 Project Organization and Team Member Responsibilities

Functional responsibilities of the team members, as well as laboratory project managers, are described in the following paragraphs.

2.1.1 Project Management

The Sediment Characterization Manager (SC Manager) will report to the Port. The SC Manager will act as the direct line of communication between the contractor and the Port and is responsible for implementing activities described in this QAPP. The SC Manager will also be responsible for production of work plans, producing all project deliverables, and performing the administrative tasks needed to ensure timely and successful completion of these studies. The SC Manager will provide the overall programmatic guidance to support staff and will ensure that all documents, procedures, and project activities meet the objectives contained within this QAPP. The SC Manager will also be responsible for resolving project concerns or conflicts related to technical matters. The SC Manager will notify the Port of any long-term changes in core personnel.

2.1.2 Field Coordination

The Field Coordinator (FC) is responsible for technical and QA/QC oversight. The FC will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to the designated laboratories for chemical and physical analyses.

2.1.3 Quality Assurance/Quality Control (QA/QC)

The QA/QC manager will provide QA oversight for both the field sampling and laboratory programs, ensuring that samples are collected and documented appropriately, coordinating with the analytical laboratories, ensuring data quality, overseeing data validation, and supervising project QA coordination. Independent third-party data review and validation will be performed.

2.1.4 Laboratory Project Management

The Laboratory Manager will oversee all laboratory operations associated with the receipt of the sediment samples, Dredged Material Management Program (DMMP) chemical/physical analyses, and laboratory report preparation for this project. The Laboratory Manager will review all laboratory reports and prepare case narratives, describing any anomalies and exceptions that occurred during analysis.

2.1.5 Data Validation Manager

The Data Validation (DV) Manager and will oversee all validation efforts on the final data packages. The DV Manager will be responsible for reviewing this Plan, along with U.S. Environmental Protection Agency (EPA) *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods,* 3rd Edition (EPA 1986), *EPA Contract Laboratory Program National Functional Guidelines for Data Review* (EPA 1999, 2004) and *EPA Region 9 Superfund Data Evaluation/Validation Guidance R9QA/006.1* (EPA 2001), to ensure all data verification and data validation criteria are met.

The analytical testing laboratories will be responsible for the following:

- Perform the methods outlined in this QAPP, including those methods referenced for each analytical procedure
- Follow documentation, custody, and sample logbook procedures
- Implement QA/QC procedures required by PSEP (1986, 1997a, and b) or other guidelines
- Meet all reporting and QA/QC requirements
- Deliver electronic data files as specified in this QAPP
- Meet turnaround times for deliverables as described in this QAPP

- Allow EPA and the QA/QC contractor to perform laboratory and data audits

2.1.6 Data Management

The Data Manager will compile field observations and analytical data into a database, review the data for completeness and consistency, append the database with qualifiers assigned by the data validator, and ensure that the data obtained is in a format suitable for inclusion in the Ecology EIM database.

The Data Manager is also responsible for providing the analytical data to the Port in a format that is compatible with the Port's Analytical Chemistry electronic data deliverable specification. Sample locations will be provided in the Washington State North American Datum (NAD) 83 coordinate system and delivered to the Port in Microsoft Excel. The Port's contact for data transmittals is Seaport Data Manager Hillary Ritenburg at (206) 728-3161.

2.2 Problem Definition/Background

The Port proposes to conduct maintenance dredging to re-establish adequate depth to accommodate barge loading and unloading and to support new construction at the Berth 1 facilities at T-115, which includes the removal of existing wooden Pier B and fabrication of a new loading ramp (Ramp 1). T-115 is located at 6700 West Marginal Way Southwest in the City of Seattle, along the western shore of the Duwamish River (Figure 1). The proposed dredge depth is -16.5 feet MLLW with 2 feet of allowable overdepth to allow the placement of a minimum 1 foot thick post-dredge clean sand layer to provide an interim clean surface. The site is located in the joint MTCA/CERCLA LDW Superfund Site. The LDWG, which includes the Port, City of Seattle, King County, and the Boeing Company, have agreed to conduct a remedial RI/FS for the entire LDW, which includes T-115.

T-115 includes approximately 70 acres of upland yard space, a 1,200-lineal-foot main pier, and a 400-lineal-foot finger pier (where Berth 1 is located). T-115 supports marine uses such as receipt and shipment of bulk cargo using deep-draft vessels; barge cargo operation; repair and maintenance of cargo shipping containers; cargo warehouse activities; warehouse and storage of metal and wood construction materials; and vessel outfitting, maintenance, and repair. Several stormwater outfalls are present near the site (shown in Figure 2). SWD1 on Figure 2 represents a City of Seattle 72-inch storm drain. SWD2 and SWD3 are approximately 30-inch stormwater outfalls that primarily drain the Northland Services and Northwest Container Services properties.

2.2.1 Subsurface Sediment Core Sampling and Analysis

As part of the Corps coordination with EPA and Ecology on projects within the LDW, EPA has directed the Port to collect four subsurface sediment core samples from within the dredge prism following completion of dredge activities. This sampling plan includes the analysis of polycyclic aromatic hydrocarbons (PAHs), semivolatile organic chemicals (SVOCs) and polychlorinated biphenyls (PCBs), and dioxin/furan congeners.

Previous studies have characterized sediment quality in the vicinity of T-115 including surface grab samples collected for the Boeing Site Characterization in 1997 and locations sampled as part of the LDWG river-wide RI in February 2006. The available sediment data from the LDWG investigation include two sediment cores located in the southern portion of the site (shown in Figure 2). Table A-1 in Appendix A presents a complete set of sediment characterization data results for sediments in the vicinity of the proposed dredge location shown in Figure 3.

Sediment characterization was conducted in 2008 to determine whether the proposed dredge sediment was suitable for disposal at the Elliott Bay open-water disposal site or requires upland landfill disposal. Sediment sampling was accomplished by collecting and processing sediment cores. Testing and evaluation of cores from within the dredge prism were conducted in accordance with DMMP guidelines. Sampling and processing were carried out in accordance with the Sampling and Analysis Plan (SAP; Anchor 2008a), and sediment chemistry results are presented in the Port of Seattle Terminal 115 Sediment Characterization Report (Anchor 2008b).

Sediment cores were collected on February 14, 2008. The target depth was -19 feet MLLW, which comprised a design depth of -15 feet MLLW, 1 foot of allowable overdredge, plus 3 feet for the collection of three 1-foot-increment Z-layer samples. These analyses indicated elevated concentrations of polychlorinated biphenyls (PCBs) and various PAH compounds in the composite samples and top Z-samples. Dioxin/furan Toxic Equivalents Quotient (TEQ) values were all greater than the average TEQ value at the proposed Elliott Bay open-water disposal site.

2.3 Project/Task Description and Schedule

The sampling of subsurface sediment cores will occur following completion of dredging activities at T-115 and following EPA's and Ecology's approval of this QAPP.

2.4 Data Quality Objectives and Criteria

The DQO for this project is to ensure that the data collected are of known and acceptable quality so that the project objectives described in this QAPP can be achieved. The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, and completeness (the "PARCC" parameters). These parameters are discussed, and specific data quality indicators (DQIs) for sediment chemistry analysis are presented in Section 3.4.1.

2.5 Special Training Requirements/Certifications

For sample collection and preparation tasks, it is important that field crews are trained in standardized data collection requirements, so that the data collected are consistent among the field crew. All field crew are fully trained in the collection and processing of subsurface sediment core samples, decontamination protocols, and chain-of-custody (COC) procedures.

In addition, the 29 CFR 1910.120 Occupational Safety and Health Administration (OSHA) regulations require training to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health. All sampling personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and 8-hour refresher courses, as necessary, to meet the OSHA regulations.

2.6 Documentation and Records

This project will require central project files to be maintained and stored in a secure manner. Each project team member is responsible for filing all necessary project information or providing it to the person responsible for the filing system. Individual team members may maintain files for individual tasks, but must provide such files to the central project files upon completion of each task. A project-specific index of file contents is to be kept with the project files. Hard copy documents will be kept on file for the duration of the project, and all electronic data will be maintained in a database.

2.6.1 Field Observation

All documents generated during the field effort are controlled documents that become part of the project file. Field team members will keep a record of significant events, observations, and measurements in a field log. All field activities will be recorded in a bound, paginated field logbook maintained by the FC or his designee for each activity. Field logbooks will be the main source of field documentation for all field activities. The on-site field representative will record in the field logbook information pertinent to the investigation program. The sampling documentation will contain information on each sample collected, and will include at a minimum the following information:

- Project name
- Field personnel on site
- Facility visitors
- Weather conditions
- Field observations and any deviations from this QAPP
- Date and time sample collected
- Sampling method and description of activities
- Identification of equipment used
- Deviations from the QAPP
- Conferences associated with field sampling activities

The person recording information in the log book will initial each page. In general, sufficient information will be recorded during sampling so that reconstruction of the event can occur without relying on the memory of the field personnel.

The field logbooks will be permanently bound and durable for adverse field conditions. All pages will be numbered consecutively. All pages will remain intact, and no page will be removed for any reason. Notes will be taken in indelible, waterproof blue or black ink. Errors will be corrected by crossing out with a single line, dating, and initialing. The front and inside of each field logbook will be marked with the project name, number, and logbook number. The field logbooks will be stored in the project files when not in use and upon completion of each sampling event.

2.6.2 Laboratory Records

Analytical data records will be retained by each laboratory and in the central project files. The laboratories will provide electronic copies of the reports and keep hard copies on file. For all analyses, the data reporting requirements will include those items necessary to complete data validation, including copies of all raw data.

2.6.2.1 Chemistry Data for Sediment Sample

The analytical laboratories will be responsible for internal checks on sample handling and analytical data report, and will correct errors identified during the QA review. The analytical laboratory will be required, where applicable, to report the following:

- **Project Narrative.** This summary, in the form of a cover letter, will discuss problems, if any, encountered during any aspect of analysis. This summary should discuss, but not be limited to, QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered, actual or perceived, and their resolutions will be documented in as much detail as appropriate.
- **Chain-of-Custody Records.** Legible copies of the COC forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented on a sample receipt form. The form must include all sample shipping container temperatures measured at the time of sample receipt.
- **Sample Results.** The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identification code and the corresponding laboratory identification code

- Sample matrix
- Date of sample extraction
- Date and time of analysis
- Weight and/or volume used for analysis
- Final dilution volumes or concentration factor for the sample
- Identification of the instrument used for analysis
- Method detection limits (MDLs)
- Method reporting limits accounting for sample-specific factors (e.g., dilution, total solids)
- Analytical results with reporting units identified
- Data qualifiers and their definitions
- A computer disk with the data in a format specified in advance

- **QA/QC Summaries.** This section will contain the results of the laboratory QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results (see above). No recovery or blank corrections will be made by the laboratory. The required summaries are listed below; additional information may be requested.
- **Calibration Data Summary.** This summary will report the concentrations of the initial calibration and daily calibration standards and the date and time of analysis. The response factor, percent relative standard deviation, percent difference, and retention time for each analyte will be listed, as appropriate. Results for standards to indicate instrument sensitivity will be documented.
- **Internal Standard Area Summary.** The stability of internal standard areas will be reported.
- **Method Blank Analysis.** The method blank analyses associated with each sample and the concentration of all compounds of interest identified in these blanks will be reported.
- **Surrogate Spike Recovery.** This will include all surrogate spike recovery data for organic compounds. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed.
- **Matrix Spike Recovery.** This will report all matrix spike recovery data for organic and metal compounds. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed. The relative percent difference (RPD) for all duplicate analyses will be included.

- **Matrix Duplicate.** This will include the percent recovery and associated RPD for all matrix duplicate analyses.
- **Laboratory Control Sample.** All laboratory control sample recovery data for organic and metal compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed. The RPD for all duplicate analyses will be included.
- **Relative Retention Time.** This will include a report of the relative retention time of each analyte detected in the samples for both primary and conformational analyses.
- **Original Data.** Legible copies of the original data generated by the laboratory will include:
  - Sample extraction, preparation, identification of extraction method used, and cleanup logs
  - Instrument specifications and analysis logs for all instruments used on days of calibration and analysis
  - Reconstructed ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials
  - Enhanced spectra of detected compounds with associated best-match spectra for each sample
  - Printouts of full scan chromatograms and quantitation reports for each instrument used, including reports for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials
  - Original data quantification reports for each sample
  - Original data for blanks and samples not reported

All instrument data shall be fully restorable at the laboratory from electronic backup. Laboratories will be required to maintain all records relevant to project analyses for a minimum of 7 years. Data validation reports will be maintained in the central project files with the analytical data reports.

2.6.3 Data Reduction

Data reduction is the process by which original data (analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which are subjected to further review by the Laboratory Manager, the SC Manager, the QA/QC Manager, and independent reviewers. Data reduction may be performed manually or electronically. If performed electronically, all software used must be demonstrated to be true and free from unacceptable error.

2.6.4 Data Report

A Sediment Evaluation Data Report will be prepared and submitted to the agencies for review and approval. The data report will document the results of the sampling and analysis program and, at a minimum, will contain the following information:

- A statement of the purpose of the investigation.
- A summary of the field sampling, field data, and laboratory analytical procedures. Deviations, whether intended or unintended, will be documented. Failure to meet sampling or data quality objectives of sufficient magnitude to lead to rejection of results will be well documented, as necessary.
- A general vicinity map showing the location of the site with respect to familiar landmarks and a sampling station map. Coordinates will be reported in an accompanying table for all stations. All geographical coordinates submitted to Ecology for inclusion in the EIM database will be in the North American Datum (NAD) 83, North Zone.
- Chemical analysis results data tables summarizing chemical and conventional variables, as well as all pertinent QA/QC data.
- An interpretation of the results against the DMMP interpretive criteria.
- Copies of complete laboratory data packages, as appendices or attachments.
- Laboratory QA/QC reports, as appendices or attachments.
- Copies of applicable sections of the field log, as appendices or attachments.
- Copies of signed COC forms, as appendices or attachments.
- Copies of validation reports and/or findings.

Chemistry data will be presented with accompanying regulatory criteria. Data exceeding the regulatory criteria will be highlighted or boxed, rather than shaded, to allow for photocopying.

3 DATA GENERATION AND ACQUISITION

This section briefly describes the collection and handling of sediment core samples for chemical analyses. Elements include sampling design, sampling methods, sample handling and custody requirements, analytical methods, QA/QC, instrument/equipment testing and frequency, inspection and maintenance, instrument calibration, supply inspection/acceptance, and data management.

3.1 Sampling Design

This section describes the sampling design developed to meet the data needs presented in Section 2.2.1 for the collection of subsurface sediment cores, and the chemical analyses of these samples.

3.1.1 Subsurface Sediment Core Samples

The key objective for sampling and analysis activities proposed to address the additional subsurface sediment characterization identified in Section 2.2.1 are:

- Collection of subsurface sediment cores at four locations within the postdredge footprint of the T-115 dredging prism, and analysis of PAH compounds, polychlorinated biphenyls (PCBs), semivolatile organic chemicals (SVOCs), and dioxin and furans congeners
- Analysis of four 1-foot intervals from each core

Subsurface core sample locations are depicted in Figure 3. The sampling program will entail a single subsurface sediment core sampling event in 2009. Sufficient subsurface sediment from four 1-foot sections of each core will be collected at each location to provide material for chemical analysis. A total of 16 sediment samples will be analyzed for PAH, PCBs, SVOCs and dioxins and furans. Conventional sediment analysis will include total solids, total organic carbon, and grain size. Table 1 lists all parameters to be analyzed for and provides associated regulatory standards and project specific target detection limits.

3.2 Sampling Methods

This section addresses the sampling program requirements for sample collection and processing. Subsurface sediment core samples will be collected at four locations (Figure 3). Table 2 includes a list of all stations, target global positioning system (GPS) locations, sample identifiers, and analyses. The sample identification scheme is described below.

3.2.1 Identification Scheme for All Locations and Samples

Each subsurface sediment sample will be assigned a unique alphanumeric identifier according to the following method:

- Each location will be identified by T115, and a number 01 through 04, identifying the station identifier (e.g., T115-04).
- Individual sediment samples at each location will be identified by the same alphanumeric used to identify the station followed by a matrix identifier of SC, and a Z layer indication of A through D, and the six digit date code YYMMDD format (e.g., T115-04-SC-ZA-090401 represents the upper Z layer sediment core sample collected from Station T115-04 on April 1, 2009).

The homogenization duplicate collected from one sediment core sample will be labeled T115-XX-SC-ZX-YYMMDD, where XX is the station number plus 50, ZX is the Z layer sample duplicated, and the date is appended in the YYMMDD format.

3.2.2 Location Positioning

Horizontal positioning will be determined by a differential global positioning system (DGPS) based on target coordinates shown in Table 2. The horizontal datum will be North American Datum (NAD) 83, Washington State Plane, Washington North Zone. Measured geographical coordinates for station positions will be recorded and reported to the nearest 0.01 second. The DGPS accuracy is less than 1 meter and generally less than 30 centimeters (cm) depending upon the satellite coverage and the number of the data points collected (i.e., sampling interval). The locations will be recorded at the actual sample location.

Vertical elevation of each sediment station will be measured using a fathometer or lead line and converted to MLLW elevation. Tidal elevations will be determined using measured data from the National Oceanic and Atmospheric Administration's (NOAA's) automated tide gage located in Elliott Bay, Washington.

3.2.3 Subsurface Sediment Collection

Subsurface sediment core samples will be collected at each location identified in Table 2 using a vibrocorer. The vibrocorer utilizes a rigid aluminum core tube approximately 4 inches in diameter. The following procedure will be used to decontaminate core sample tubes prior to use:

- Rinse and pre-clean with potable water
- Wash and scrub in a solution of laboratory grade, non-phosphate-based soap and potable water
- Rinse with potable water
- Rinse three times with distilled water
- Seal both ends of each core tube with aluminum foil

The core tube caps will be removed immediately prior to placement into the coring device. Care will be taken during sampling to avoid contact of the sample tube with potentially contaminated surfaces. Extra sample tubes will be available during sampling operations for uninterrupted sampling in the event of a potential core tube breakage or contamination. Core tubes suspected to have been accidentally contaminated will not be used.

The vibrocorer will be lowered to the bottom, where the unit will then be energized and allowed to penetrate. The target depth will be 4 feet below the dredged surface. Acceptance criteria for a sediment core sample are as follows:

- The core penetrated to, and retained material to, project depth.
- Recovery was at least 75 percent of the length of core penetration
- Cored material did not extend out the top of the core tube or contact any part of the sampling apparatus at the top of the core tube
- There are no obstructions in the cored material that might have blocked the subsequent entry of sediment into the core tube and resulted in incomplete core collection

If core rejections require the core station to be relocated, the proposed station relocation will be coordinated with the DMMP through the Dredge Material Management Office (DMMO). Recovered cores will be processed at a land based processing facility. Logs and field notes of all cores collected will be maintained as cores are collected and correlated to the sampling location map. The following information will be included in the logs:

- Elevation of each station sampled as measured from MLLW
- Location of each station as determined by DGPS
- Date and time of collection of each sediment core sample
- Names of field supervisor and person(s) collecting and handling the sample
- Observations made during sample collection including: weather conditions, complications, ship traffic, and other details associated with the sampling effort
- The sample station identification
- Length and depth intervals of each core section and estimated recovery for each sediment sample as measured from MLLW
- Qualitative notation of apparent resistance of sediment column to coring
- Any deviation from the approved QAPP

The steps for processing the samples are listed below:

1. Extrude sample material from sample core tube onto a stainless steel tray using a vibrating core-extruder. Alternatively, the core may be cut longitudinally using a circular saw, taking care not to penetrate the sediment while cutting.
2. Record the description of the core sample on the core processing log form (Appendix B) for the following parameters as appropriate and present:
   - Sample recovery (depth in feet of penetration and sample compaction)
   - Physical soil description in accordance with the Unified Soil Classification System (includes soil type, density/consistency of soil, and color)
   - Odor (e.g., hydrogen sulfide, petroleum, etc.)
   - Vegetation
   - Debris
   - Biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
   - Presence and depth (in feet) of the redox potential discontinuity layer
   - Presence of oil sheen

   - Any other distinguishing characteristics or features
3. Using a clean spoon, place sample material from individual core sections into a cleaned stainless steel bowl, and homogenize using a stainless spoon
4. Using a clean, stainless steel spoon, completely fill pre-labeled sample containers, as indicated in Table 3, for the specified analyses.
5. Immediately after filling the sample container with sediment, place the screw cap on the sample container and tighten.
6. Thoroughly check all sample containers for proper identification, analysis type, and lid tightness.
7. Pack each container carefully to prevent breakage and place inside of a cooler with ice for storage at the proper temperature (4° ±2°C for all samples).

3.2.4 Field Equipment

The following items will be needed in the field for sediment collection:

- QAPP
- Field sampling sheets
- Study area maps
- Field notebooks and pens/sharpies/pencils
- Cellular phone
- Digital camera
- White board and pen
- GPS
- Stainless-steel bowls and spoons
- Tape measure
- Lead line
- Alconox detergent
- Scrub brushes
- Distilled water
- Spray bottles for distilled water
- Coolers
- Powder-free exam gloves
- Steel toed rubber boots
- Duct tape
- Ziploc bags

- Aluminum foil
- Paper towels
- First aid kit
- Vibrocore equipment
- Core barrels
- Core barrel cutter
- Core caps
- Wet ice
- Personal flotation devices (PFDs)
- Hard hats
- Safety glasses
- Foul weather gear
- Waterproof labels
- Clear packing tape
- Box cutters
- Bubble wrap
- Chain-of-custody (COC) forms
- Sample jars
- Custody seals
- Cooler temperature blanks

Prior to mobilization, these lists will be consulted to ensure all equipment is available and pre-cleaned. As part of the mobilization process, each item will be double-checked by the FC.

3.2.5 Decontamination Procedures

To prevent sample cross-contamination, all sampling and processing equipment in contact with the sediment will undergo the following decontamination procedures prior to and between collection activities:

- Rinse with site water or tap water and wash with scrub brush until free of sediment
- Wash with phosphate-free detergent and tap water
- Rinse with tap water
- Rinse three times with distilled water

Acid or solvent washes will not be used in the field because of safety considerations and problems associated with rinsate disposal and sample integrity. Specifically:

- The use of acids or organic solvents may pose a safety hazard to the field crew
- Disposal and spillage of acids and solvents during field activities pose an environmental concern
- Residues of solvents and acids on sampling equipment may affect sample integrity for chemical testing

Any sampling equipment that cannot be cleaned to the satisfaction of the FC will not be used for further sampling activities.

3.2.6 Field-Generated Waste Disposal

All sediment remaining after sampling will be washed overboard at the collection site prior to moving to the next sampling station. Any sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site.

All disposable sampling materials and personnel protective equipment used in sample processing, such as disposable coveralls, gloves, and paper towels, will be placed in heavy duty garbage bags or other appropriate containers. Disposable supplies will be placed in a normal refuse container for disposal as solid waste.

3.3 Sample Handling and Custody Requirements

This section describes how individual samples will be processed, labeled, tracked, stored, and transported to the laboratory for analysis.

3.3.1 Sample Handling Procedures

Filled sample containers will be stored in coolers containing ice to maintain the samples at 4° ±2°C until delivery or shipping to the analytical laboratories.

All working surfaces and instruments will be thoroughly cleaned, decontaminated, and covered with aluminum foil to minimize outside contamination between sampling events.

Disposable gloves will be discarded after processing each core sample and replaced prior to handling decontaminated instruments or work surfaces.

Sample containers will be kept in packaging as received from the analytical laboratory until use; a sample container will be withdrawn only when a sample is to be collected and will be returned to a cooler containing completed samples.

3.3.2 Sample Custody Procedures

Samples are considered to be in one's custody if they are: 1) in the custodian's possession or view; 2) in a secured location (under lock) with restricted access; or 3) in a container that is secured with an official seal such that the sample cannot be reached without breaking the seal.

COC procedures will be followed for all samples throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the COC form. Each sample will be represented on a COC form the day it is collected. All data entries will be made using indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, then dating and initialing the change. Blank lines/spaces on the COC form will be lined-out and dated and initialed by the individual maintaining custody.

A COC form will accompany each cooler of samples to the analytical laboratories. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. Copies of all COC forms will be retained in the project files.

3.3.3 Shipping Requirements

All samples will be shipped or hand delivered to the analytical laboratory no later than the day after collection. If samples are collected on Friday, they may be held until the following Monday for shipment, provided that this does not adversely impact holding time requirements. Specific sample shipping procedures are as follows:

- Each cooler or container containing the samples for analysis will be shipped via overnight delivery to the appropriate analytical laboratory. In the event that

Saturday delivery is required, the FC will contact the analytical laboratory before 3 p.m. on Friday to ensure that the laboratory is aware of the number of coolers shipped and the airbill tracking numbers for those coolers. Following each shipment, the FC will call the laboratory and verify the shipment from the day before has been received and is in good condition.

- Coolant ice will be sealed in separate double plastic bags and placed in the shipping containers.
- Individual sample containers will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- Glass jars will be separated in the shipping container by shock absorbent material (e.g., bubble wrap) to prevent breakage.
- The shipping containers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container and consultant's office name and address) to enable positive identification.
- The shipping waybill number will be documented on all COC forms accompanying the samples.
- A sealed envelope containing COC forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- A minimum of two signed and dated COC seals will be placed on adjacent sides of each cooler prior to shipping.
- Each cooler will be wrapped securely with strapping tape, labeled "Glass – Fragile" and "This End Up," and will be clearly labeled with the laboratory's shipping address and the consultant's return address.

Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the shipping container seal will be broken and the receiver will record the condition of the samples on a sample receipt form. COC forms will be used internally in the lab to track sample handling and final disposition.

3.4 Analytical Methods

This section summarizes the target physical and chemical analyses. All sample analyses will be conducted in accordance with Ecology-approved methods. Prior to analysis, all samples will be maintained according to the appropriate holding times and temperatures for each analysis (Table 3). Table 1 presents the proposed analytes, the analytical methods to be used, and the targeted detection limits for the evaluation of sediment and field QA/QC samples. The analytical laboratory will prepare a detailed report in accordance with the QAPP to be included as an appendix in the Sediment Evaluation Data Report.

Prior to the analysis of the samples, the laboratory will calculate method detection limits for each analyte of interest, where applicable. Method reporting limits will be at or below the sediment criteria specified in Table 1, if technically feasible. To achieve the required reporting limits, some modifications to the methods may be necessary. These modifications from the specified analytical methods will be provided by the laboratory at the time of establishing the laboratory contract, and must be approved by Ecology prior to implementation.

Chemical/physical testing will be conducted by Ecology-accredited laboratories. All chemical and physical testing will adhere to the most recent PSEP QA/QC procedures (PSEP 1997a, and b) and PSEP analysis protocols. If more current analytical methods are available, the laboratory will use them.

In completing chemical analyses for this project, the laboratory is expected to meet the following minimum requirements:

- Adhere to the methods outlined in this QAPP, including methods referenced for each analytical procedure
- Provide a detailed discussion to any modifications made to approved analytical methods (e.g., Standard Operating Procedures [SOPs])
- Deliver scanned and electronic data as specified
- Meet reporting requirements for deliverables
- Meet turnaround times for deliverables
- Implement QA/QC procedures, including the QAPP data quality requirements, laboratory QA requirements, and performance evaluation testing requirements
- Allow laboratory and data audits to be performed, if deemed necessary

3.4.1 Chemical Analysis of Sediments

The parameters used to assess data quality are precision, accuracy, representativeness, comparability, completeness, and sensitivity. Table 4 lists specific DQOs for laboratory chemical analyses of sediment samples. These parameters are discussed in more detail in the following sections.

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling, and in laboratory analysis. The American Society of Testing and Materials (ASTM 2002) recognizes two levels of precision: repeatability—the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions; and reproducibility—the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material.

In the laboratory, "within-batch" precision is measured using replicate sample or QC analyses and is expressed as the RPD between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of one blind field duplicate for chemistry samples at one randomly selected location. Field chemistry duplicate precision will be screened against a RPD of 50 percent for sediment samples. However, no data will be qualified based solely on field homogenization duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the MDL, where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$\mathrm{RPD} = \frac{(\mathrm{C}_1 - \mathrm{C}_2) \times 100\%}{(\mathrm{C}_1 + \mathrm{C}_2)/2}$$

where:

RPD = relative percent difference

C_1 = larger of the two observed values

C_2 = smaller of the two observed values

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory-fortified blanks, standard reference materials, and standard solutions. In addition, laboratory-fortified (i.e., matrix-spiked) samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery (%R) of the measured value, relative to the true or expected value. If a measurement process produces results for which the mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories utilize several QC measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples, and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

Laboratory accuracy will be evaluated against quantitative matrix spike and surrogate spike recovery performance criteria provided by the laboratory. Accuracy can be expressed as a percentage of the true or reference value, or as a %R in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\%R = 100\% \times (S-U)/C_{sa}$$

where:

%R = percent recovery

S = measured concentration in the spiked aliquot

U = measured concentration in the unspiked aliquot

C_{sa} = actual concentration of spike added

Field accuracy will be controlled by adherence to sample collection procedures outlined in this QAPP.

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias assessments for environmental measurements are made using personnel, equipment, and spiking materials or reference materials as independent as possible from those used in the calibration of the measurement system. When possible, bias assessments should be based on analysis of spiked samples rather than reference materials so that the effect of the matrix on recovery is incorporated into the assessment. A documented spiking protocol and consistency in following that protocol are important to obtaining meaningful data quality estimates.

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For the T-115 site, the list of analytes has been identified to provide a comprehensive assessment of the potential contaminants in the Z-layer sediments within the dredge prism following dredging activities of the proposed dredge operation. Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this program, comparability of data will be established through the use of standard analytical methodologies and reporting formats, and of common traceable calibration and reference materials.

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$C = \frac{(\text{Number of acceptable data points}) \times 100}{(\text{Total number of data points})}$$

The DQO for completeness for all components of this project is 90 percent. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

Analytical sensitivities must be consistent with or lower than the regulated criteria values as listed in Table 1 in order to demonstrate compliance with this QAPP. When they are achievable, target detection limits specified in this QAPP will be at least a factor of 2 less than the analyte's corresponding regulated criteria value.

The MDL is defined as the minimum concentration at which a given target analyte can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. Laboratory practical quantitation limits (PQLs) or reporting limits (RLs) are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Laboratory MDLs and RLs will be used to evaluate the method sensitivity and/or applicability prior to the acceptance of a method for this program.

The sample-specific MDL and RL will be reported by the laboratory and will take into account any factors relating to the sample analysis that might decrease or increase the reporting limit (e.g., dilution factor, percent moisture, sample volume, and sparge volume). In the event that the MDL and RL are elevated for a sample due to matrix interferences and subsequent dilution or reduction in the sample aliquot, the data will be evaluated to determine if an alternative course of action is required or possible. If this situation cannot be resolved readily (i.e., detection limits less than criteria are achieved), Ecology will be contacted to discuss an acceptable resolution.

3.5 Quality Assurance/Quality Control

Field and laboratory activities must be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols developed for the PSEP (1997a, and b), EPA 1986, the EPA Contract Laboratory Program (EPA 1999), and the cited methods.

3.5.1 Field Quality Control Samples

Field QA samples will be collected along with the environmental samples. Field QA samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field QA includes the collection of a sample homogenization duplicate. Field QA samples will also include the collection of additional sample volume at one location, to ensure that the laboratory has sufficient sample volume to run the program-required analytical QA/QC samples for analysis as specified in Table 5. All field QA samples will be documented in the field logbook and verified by the QA/QC Manager or designee.

3.5.2 Chemical Analysis Quality Control

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, matrix spikes, surrogate spikes (for organic analyses), and method blanks. Table 5 lists the frequency of analysis for laboratory QA/QC samples, and Table 4 summarizes the data quality objectives for precision, accuracy, and completeness.

Results of the QC samples from each sample group will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the sample group, the QA/QC Manager will be contacted immediately, and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

3.5.2.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used daily or per batch for inorganic analyses and after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria for organic analyses. A calibration verification sample will be analyzed following each initial calibration and will meet method criteria prior to analysis of samples. Continuing calibrations will be analyzed daily prior to any sample analysis to track instrument performance for gas chromatograph/mass spectrometer (GC/MS) methods. The frequency of continuing calibration will be one for every 10 samples for inorganic and GC methods. If the ongoing continuing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced to meet control specifications. All project samples analyzed while instrument calibration was out of control will be reanalyzed.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to or following continuing calibration verifications at the instrument for each type of applicable analysis.

3.5.2.2 Laboratory Duplicates/Replicates

Analytical duplicates and replicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample.

3.5.2.3 Matrix Spikes and Matrix Spike Duplicates

Analysis of matrix spike samples provides information on the extraction efficiency of the method on the sample matrix. By performing duplicate matrix spike analyses, information on the precision of the method is also provided for organic analyses.

3.5.2.4 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. The method blank for all analyses must contain less than five times the method detection limit of any single target analyte/compound. If a laboratory method blank exceeds this criterion for any analyte/compound, and the concentration of the analyte/compound in any of the samples is less than five times the concentration found in the blank, analyses must stop and the source of contamination must be eliminated or reduced.

3.5.2.5 Laboratory Control Samples

Laboratory control samples are analyzed to assess possible laboratory bias at all stages of sample preparation and analysis. The laboratory control sample is a matrix-dependent spiked sample prepared at the time of sample extraction along with the preparation of sample and matrix spikes. The laboratory control sample will provide information on the accuracy of the analytical process, and when analyzed in duplicate, will provide precision information as well.

3.5.2.6 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. Data quality will be assessed based on PSEP (1997b) protocols by considering the following:

- Holding times
- All compounds of interest reported
- Reporting limits
- Surrogate spike results
- MS/MSD results
- Blank spikes
- Laboratory control samples/laboratory control sample duplicates
- Standard reference material results
- Method blanks
- Detection limits

3.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

3.6.1 Field Equipment

The FC will be responsible for verifying that requisite field equipment is available and required maintenance has been performed prior to using the equipment in the field.

The FC or subcontractor responsible for navigation will confirm proper operation of the navigation equipment. This verification may consist of internal diagnostics or visiting a location with known coordinates to confirm the coordinates indicated by the navigation system. No other field equipment requires testing or calibration. The winch line and vibracore sampler will be inspected for fraying, loose connections, and any other applicable mechanical problems. Any problems will be noted in the field logbook and corrected prior to continuing sampling operations.

3.6.2 Laboratory Instruments/Equipment

In accordance with the QA program, the laboratory shall maintain an inventory of instruments and equipment and the frequency of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The laboratory preventative maintenance program, as detailed in their QA Plan, is organized to maintain proper instrument and equipment performance, and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment and parts that are subject to wear, deterioration, or other changes in operational characteristics, the availability of spare parts, and the frequency at which maintenance is required. Any equipment that has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure that it is in proper operational condition. The client will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. The client will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding times.

Laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. All maintenance records will be checked according to the schedule on an annual basis and recorded by the responsible individual. The Laboratory QA/QC Manager, or designee, shall be responsible for verifying compliance.

3.7 Instrument/Equipment Calibration and Frequency

Proper calibration of equipment and instrumentation is an integral part of the process that provides quality data. Instrumentation and equipment used to generate data must be calibrated at a frequency that ensures sufficient and consistent accuracy and reproducibility.

As part of their QC program, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals (i.e., balances, drying ovens, refrigerators and thermometers), and operational calibrations are performed daily, at a specified frequency, or prior to analysis (i.e., initial calibrations) according to method requirements. Calibration procedures and frequencies are discussed in the laboratory QA Plan. Calibrations are discussed in the laboratory SOPs for analyses.

The Laboratory QA/QC Manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program shall be the responsibility of the respective laboratory Group Supervisors. Recognized procedures (EPA, ASTM, or manufacturer's instructions) shall be used when available.

Physical standards (i.e., weights or certified thermometers) shall be traceable to nationally recognized standards such as the National Institute of Standards and Technology (NIST). Chemical reference standards shall be NIST Standard Reference Materials (SRMs) or vendor certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions shall be accessible, either in the laboratory SOPs or the laboratory's QA Plan for each instrument or analytical method in use. All calibrations shall be preserved on electronic media.

3.8 Inspection/Acceptance Requirements for Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory-prepared sampling bottles, will be performed by the FC. All primary chemical standards and standard solutions used in this project in the laboratory will be traceable to documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

3.9 Data Management

Field data sheets will be checked for completeness and accuracy by the FC prior to delivery to the Data Manager. All data generated in the field will be documented on hard copy and provided to the office Data Manager, who is responsible for the data's entry into the database. All manually entered data will be checked by a second party. Field documentation will be filed in the main project file after data entry and checking are complete.

Laboratory data will be provided to the Data Manager in the EQuIS electronic format. Laboratory data, provided electronically and loaded into the database, will undergo a 10 percent check against the laboratory hard copy data. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually or applied using a validator-generated electronic data deliverable. The accuracy of all manually entered data will be verified by a second party. Data tables and reports will be exported from EQuIS to MS Excel tables.

4 ASSESSMENTS AND OVERSIGHT

4.1 Compliance Assessments and Response Actions

EPA, Ecology, or their designees may observe field activities during each sampling event, as needed. If situations arise where there is an inability to follow QAPP methods precisely, the SC Manager will determine the appropriate actions or consult EPA and Ecology if the issue is significant.

4.1.1 Compliance Assessments

Laboratory and field performance audits consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement. Laboratory audits will not be conducted as part of this study; however, all laboratory audit reports will be made available to the project QA/QC Manager upon request. The laboratory is required to have written procedures addressing internal QA/QC; these procedures have been submitted and will be reviewed by the project QA/QC Manager to ensure compliance with the QAPP. The laboratory must ensure that personnel engaged in sampling and analysis tasks have appropriate training. The laboratory will, as part of the audit process, provide for consultant's review written details of any and all method modifications planned.

4.1.2 Response Actions for Field Sampling

The FC will be responsible for correcting equipment malfunctions during the field sampling effort. The project QA/QC Manager will be responsible for resolving situations identified by the FC that may result in noncompliance with this QAPP. All corrective measures will be immediately documented in the field logbook.

4.1.3 Corrective Action for Laboratory Analyses

The laboratory is required to comply with their SOPs. The Laboratory Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The Laboratory Manager will be notified immediately if any QC sample exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. The Laboratory Manager will document the corrective action taken in a memorandum submitted to the QA/QC Manager within 5 days of the initial notification. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and re-extraction) will be submitted with the data package in the form of a cover letter.

4.2 Reports to Management

Quality assurance reports to management include verbal status reports, written reports on field sampling activities and laboratory processes, data validation reports, and final project reports. These reports shall be the responsibility of the QA/QC Manager.

Progress reports will be prepared by the FC following each sampling event. The project QA/QC Manager will also prepare progress reports after the sampling is completed and samples have been submitted for analysis, when information is received from the laboratory, and when analysis is complete. The status of the samples and analysis will be indicated with emphasis on any deviations from the QAPP. A data report will be written after validated data are available for each sampling event. These reports will be delivered electronically to the SC Manager.

5 DATA VALIDATION AND USABILITY

5.1 Data Validation

During the validation process, analytical data will be evaluated for method quality control and laboratory quality control compliance, and its validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers will be entered into the project database, thus enabling this information to be retained or retrieved, as needed.

EPA level IV data validation will be performed on all data including the dioxin/furan analyses. This includes signed entries by the field and laboratory technicians on field data sheets and laboratory datasheets, respectively; review for completeness and accuracy by the FC and Laboratory Manager; review by the Data Manager for outliers and omissions; and the use of QC criteria to accept or reject specific data. All data will be entered into the EQuIS database and a raw data file printed. Ten percent verification of the database raw data file and 100 percent verification of the validation qualifiers will be performed by a second data manager or designee. Any errors found will be corrected on the raw data printout sheet. After the raw data is checked, the top sheet will be marked with the date the check is completed and the initials of the person doing the checking. Any errors in the raw data file will be corrected, and the database established.

All laboratory data will be reviewed and verified to determine whether all DQOs have been met and that appropriate corrective actions have been taken, when necessary. The project QA/QC Manager or designee will be responsible for the final review of all data generated from analyses of samples.

The first level of review will take place in the laboratory as the data are generated. The laboratory department manager or designee will be responsible for ensuring that the data generated meet minimum QA/QC requirements and that the instruments were operating under acceptable conditions during generation of data. DQOs will also be assessed at this point by comparing the results of QC measurements with pre-established criteria as a measure of data acceptability.

The analysts and/or laboratory department manager will prepare a preliminary QC checklist for each parameter and for each sample delivery group (SDG) as soon as analysis of an SDG has been completed. Any deviations from the DQOs listed on the checklist will be brought to the attention of the Laboratory Manager to determine whether corrective action is needed and to determine the impact on the reporting schedule.

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. Data quality will be assessed by a reviewer using current Functional Guidelines data validation requirements (EPA 1999) by considering the following:

- Holding times
- Initial calibrations
- Continuing calibrations
- Method blanks
- Surrogate recoveries
- Detection limits
- Reporting limits
- Laboratory control samples
- MS/MSD samples
- Laboratory replicates
- SRM results

The data will be validated in accordance with the project specific DQOs described above, analytical method criteria, and the laboratory's internal performance standards based on their SOPs.

The results of the data quality review, including text assigning qualifiers in accordance with the *EPA National Functional Guidelines* and a tabular summary of qualifiers, will be generated by the Data Manager and submitted to the project QA/QC Manager for final review and confirmation of the validity of the data (EPA 1999, 2004). A copy of the LDC validation report will be submitted by the QA/QC Manager and will be presented as an appendix to the Sediment Data Evaluation Report.

5.2 Reconciliation with Data Quality Objectives

The QA/QC Manager will review data after each survey to determine if DQOs have been met. If data do not meet the project's specifications, the QA/QC Manager will review the errors and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors, and will suggest corrective action. It is expected that the problem would be able to be corrected by retraining, revision of techniques, or replacement of supplies/equipment; if not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA/QC Manager will recommend appropriate modifications. Any revisions will require approval by Ecology.

6 REFERENCES

Anchor QEA, LLC. 2008a. *Sampling and Analysis Plan, Port of Seattle Terminal 115 Sediment Characterization.* Prepared for Port of Seattle, Seattle, Washington.

Anchor Environmental. 2008b. *Sediment Characterization Report*. Port of Seattle Terminal 115, Prepared for Port of Seattle, Seattle, Washington.

ASTM 177-90a. 2002. *Standard Practices for Use of the Term Precision and Bias in ASTM Test Methods*. ASTM International

PSEP. 1986. *Recommended protocols for measuring conventional sediment variables in Puget Sound.* Prepared for the U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

PSEP. 1997a. *Puget Sound Estuary Program: Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound.* Prepared for the U.S. Environmental Protection Agency Region 10, and the Puget Sound Water Quality Authority. Puget Sound Water Quality Authority, Olympia, Washington.

PSEP. 1997b. *Puget Sound Estuary Program: Recommended Guidelines for Measuring Organic Compounds in Puget Sound Sediment and Tissue Samples*. Prepared for the U.S. Environmental Protection Agency Region 10, and the Puget Sound Water Quality Authority. Puget Sound Water Quality Authority, Olympia, Washington.

U.S. Environmental Protection Agency (EPA). 1986*. Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods*. 3rd Edition. EPA SW-846, 1986.

U.S. Environmental Protection Agency (EPA). 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review.* EPA540/R-99/008, October 1999.

U.S. Environmental Protection Agency (EPA). 2001. USEPA Region 9 Superfund Data Evaluation/Validation Guidance R9QA/006.1. Draft December 2001

U.S. Environmental Protection Agency (EPA). 2002. *Guidance for quality assurance project plans*. EPA QA/G-5. Office of Environmental Information, US Environmental Protection Agency, Washington, DC

U.S. Environmental Protection Agency (EPA). 2004. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. EPA540-R-04-004, October 2004.

TABLES

Table 1
Parameters for Analysis, Evaluation Criteria, Methods, and Practical Quantitation Limits

Parameter	Dredged Material Management Program Criteria			Analytical Method	Practical Quantitation Limit
	Screening Level	Bioaccumulation Trigger	Maximum Level		
Conventional Parameters, %					
Gravel	---	---	---	PSEP	0.1
Sand	---	---	---	PSEP	0.1
Silt	---	---	---	PSEP	0.1
Clay	---	---	---	PSEP	0.1
Fines	---	---	---	PSEP	0.1
Total solids	---	---	---	PSEP	0.1
Total organic carbon	---	---	---	PSEP	0.1
Semivolatile Organic Compounds, ug/kg dry weight					
Polycyclic Aromatic Hydrocarbons, ug/kg dry weight					
Total LPAH	5,200	---	29,000		
Naphthalene	2,100	---	2,400	8270C SIM	5.0
Acenaphthylene	560	---	1,300	8270C SIM	5.0
Acenaphthene	500	---	2,000	8270C SIM	5.0
Fluorene	540	---	3,600	8270C SIM	5.0
Phenanthrene	1,500	---	21,000	8270C SIM	5.0
Anthracene	960	---	13,000	8270C SIM	5.0
2-Methylnaphthalene[a]	670	---	1,900	8270C SIM	5.0
Total HPAHs	12,000	---	69,000		
Fluoranthene	1,700	4,600	30,000	8270C SIM	5.0
Pyrene	2,600	11,980	16,000	8270C SIM	5.0
Benzo(a)anthracene	1,300	---	5,100	8270C SIM	5.0
Chrysene	1,400	---	21,000	8270C SIM	5.0
Total benzo(b+k)fluoranthenes	3,200	---	9,900	8270C SIM	5.0
Benzo(a)pyrene	1,600	---	3,600	8270C SIM	5.0
Indeno(1,2,3-cd)pyrene	600	---	4,400	8270C SIM	5.0
Dibenz(a,h)anthracene	230	---	1,900	8270C SIM	5.0
Benzo(g,h,i)perylene	670	---	3,200	8270C SIM	5.0
Chlorinated Hydrocarbons					
1,3-Dichlorbenzene	170	---	---	8270C	20
1,4-Dichlorbenzene	110	---	120	8270C	20
1,2-Dichlorbenzene	35	---	110	8270C	20
1,2,4-Trichlorbenzene	31	---	64	8270C	20
Hexachlorobenzene	22	168	230	8270C	20

Table 1
Parameters for Analysis, Evaluation Criteria, Methods, and Practical Quantitation Limits

Parameter	Dredged Material Management Program Criteria			Analytical Method	Practical Quantitation Limit
	Screening Level	Bioaccumulation Trigger	Maximum Level		
Phthalates					
Dimethyl phthalate	71	---	1,400	8270C	20
Diethyl phthalate	200	---	1,200	8270C	20
Di-n-butyl phthalate	1,400	---	5,100	8270C	20
Butyl benzyl phthalate	63	---	970	8270C	20
Bis(2-ethylhexyl) phthalate	1,300	---	8,300	8270C	20
Di-n-octyl phthalate	6,200	---	6,200	8270C	20
Phenols					
Phenol	420	---	1,200	8270C	20
2-Methylphenol	63	---	77	8270C	20
4-Methylphenol	670	---	3,600	8270C	20
2,4-Dimethylphenol	29	---	210	8270C	20
Pentachlorophenol	400	504	690	8270C	100
Miscellaneous Extractables					
Benzyl Alcohol	57	---	870	8270C	20
Benzoic Acid	650	---	760	8270C	20
Dibenzofuran	540	---	1,700	8270C	20
Hexachloroethane	1,400	---	14,000	8270C	20
Hexachlorobutadiene	29	---	270	8270C	20
N-Nitrosodiphenylamine	28	---	130	8270C	20
Polychlorinated Biphenyls, ug/kg dry weight					
Aroclor 1016	---	---	---	8082	10
Aroclor 1221	---	---	---	8082	10
Aroclor 1232	---	---	---	8082	10
Aroclor 1242	---	---	---	8082	10
Aroclor 1248	---	---	---	8082	10
Aroclor 1254	---	---	---	8082	10
Aroclor 1260	---	---	---	8082	10
Total PCBs	130	38	3100	8082	10

Table 1
Parameters for Analysis, Evaluation Criteria, Methods, and Practical Quantitation Limits

Parameter	Dredged Material Management Program Criteria			Analytical Method	Practical Quantitation Limit
	Screening Level	Bioaccumulation Trigger	Maximum Level		
Dioxin/Furans, ng/kg dry weight					
Dioxins					
2,3,7,8-TCDD	---	---	---	1613B	1.0
1,2,3,7,8-PeCDD	---	---	---	1613B	5.0
1,2,3,4,7,8-HxCDD	---	---	---	1613B	5.0
1,2,3,6,7,8-HxCDD	---	---	---	1613B	5.0
1,2,3,7,8,9-HxCDD	---	---	---	1613B	5.0
1,2,3,4,6,7,8-HpCDD	---	---	---	1613B	5.0
OCDD	---	---	---	1613B	10
Furans					
2,3,7,8-TCDF	---	---	---	1613B	1.0
1,2,3,7,8-PeCDF	---	---	---	1613B	5.0
2,3,4,7,8,-PeCDF	---	---	---	1613B	5.0
1,2,3,4,7,8-HxCDF	---	---	---	1613B	5.0
1,2,3,6,7,8-HxCDF	---	---	---	1613B	5.0
1,2,3,7,8,9-HxCDF	---	---	---	1613B	5.0
2,3,4,6,7,8-HxCDF	---	---	---	1613B	5.0
1,2,3,4,6,7,8-HpCDF	---	---	---	1613B	5.0
1,2,3,4,7,8,9-HpCDF	---	---	---	1613B	5.0
OCDF	---	---	---	1613B	10

Notes:
a 2-Methylnapthalene is not included in the sum of LPAHs
-- Not available

Table 2
Sample Location and Sample Matrix Summary for Sediment Samples

Station ID	Station Coordinates (Washington SP NAD 83 North Zone) Northing (ft)	Easting (ft)	Depth Below Mudline (feet)	Parameter / Container / Preservative — Laboratory Sample ID[a]	Dioxin/Furan 8-oz WM-G NA	SVOCs 16-oz WM-G NA	PCBs 16-oz WM-G NA	TS, TOC 8-oz WM-G NA	Grain Size 16-oz Plastic NA	Archive 16-oz WM-G Frozen	Archive 3x16-oz WM-G Frozen
Subsurface Core Sediments											
			0-1	T115-SC-01-ZA-YYMMDD	X	X	X	X	X	X	
			1-2	T115-SC-01-ZB-YYMMDD	X	X	X	X	X	X	
			2-3	T115-SC-01-ZC-YYMMDD	X	X	X	X	X	X	
			3-4	T115-SC-01-ZD-YYMMDD							X
			4-5	T115-SC-01-ZE-YYMMDD							X
T115-SC-01	202059.5	1268794.5	5-6	T115-SC-01-ZF-YYMMDD							X
			0-1	T115-SC-02-ZA-YYMMDD	X	X	X	X	X	X	
			1-2	T115-SC-02-ZB-YYMMDD	X	X	X	X	X	X	
			2-3	T115-SC-02-ZC-YYMMDD	X	X	X	X	X	X	
			3-4	T115-SC-02-ZD-YYMMDD							X
			4-5	T115-SC-02-ZE-YYMMDD							X
T115-SC-02	202142.5	1268767	5-6	T115-SC-02-ZF-YYMMDD							X
			0-1	T115-SC-03-ZA-YYMMDD	X	X	X	X	X	X	
			1-2	T115-SC-03-ZB-YYMMDD	X	X	X	X	X	X	
			2-3	T115-SC-03-ZC-YYMMDD	X	X	X	X	X	X	
			3-4	T115-SC-03-ZD-YYMMDD							X
			4-5	T115-SC-03-ZE-YYMMDD							X
T115-SC-03	202244.8	1268732.5	5-6	T115-SC-03-ZF-YYMMDD							X
			0-1	T115-SC-04-ZA-YYMMDD	X	X	X	X	X	X	
			1-2	T115-SC-04-ZB-YYMMDD	X	X	X	X	X	X	
			2-3	T115-SC-04-ZC-YYMMDD	X	X	X	X	X	X	
			3-4	T115-SC-04-ZD-YYMMDD							X
			4-5	T115-SC-04-ZE-YYMMDD							X
T115-SC-04	202375.7	1268689.1	5-6	T115-SC-04-ZF-YYMMDD							X
Field Homogenization Duplicate				T115-SC-XX(+50)-ZX-YYMMDD	X	X	X	X	X		

Notes:
- SC Sediment core
- PAH Polycyclic aromatic hydrocarbons
- TOC Total organic carbon
- WM-G Wide mouth glass jar
- TS Total solids
- TOC Total organic carbon
- NA Not applicable
- ZA Subsurface samples in 1 ft intervals

Table 3
Guidelines for Sample Handling and Storage

Parameter	Sample Size	Container Size and Type[a]	Holding Time	Preservative
Semivolatile Organic Compounds (SVOCs)	150 g	16-oz Glass	14 days until extraction	Cool/4° C
			1 year until extraction	Freeze/-18° C
			40 days after extraction	Cool/4° C
Polychlorinated Biphenyls (PCBs)	150 g	16-oz Glass	14 days until extraction	Cool/4° C
			1 year until extraction	Freeze/-18° C
			40 days after extraction	Cool/4° C
Dioxins/Furans	150 g	8-oz Glass	1 year to extraction	Freeze -18°C
			1 year after extraction	Freeze -18°C
Total solids	50 g	4-oz Glass	14 days	Cool/4° C
			6 months	Freeze -18°C
Total organic carbon	125 g	from TS container	14 days	Cool/4° C
			6 months	Freeze -18°C
Grain size	500 g	16-oz Glass	6 months	Cool/4° C

Notes:

a All sample containers will have lids with teflon inserts

Table 4
Data Quality Objectives

Parameter	Precision	Accuracy	Completeness
Grain size	± 20% RPD	NA	95%
Total solids	± 20% RPD	NA	95%
Total organic carbon	± 20% RPD	65-135% R	95%
Dioxin/Furans	± 50% RPD	50-140% R	95%
Polychlorinated Biphenyls (PCBs)	± 50% RPD	50-140% R	95%
Polycyclic aromatic hydrocarbons (PAH)	± 50% RPD	50-140% R	95%

Notes:

RPD Relative percent difference

R Recovery

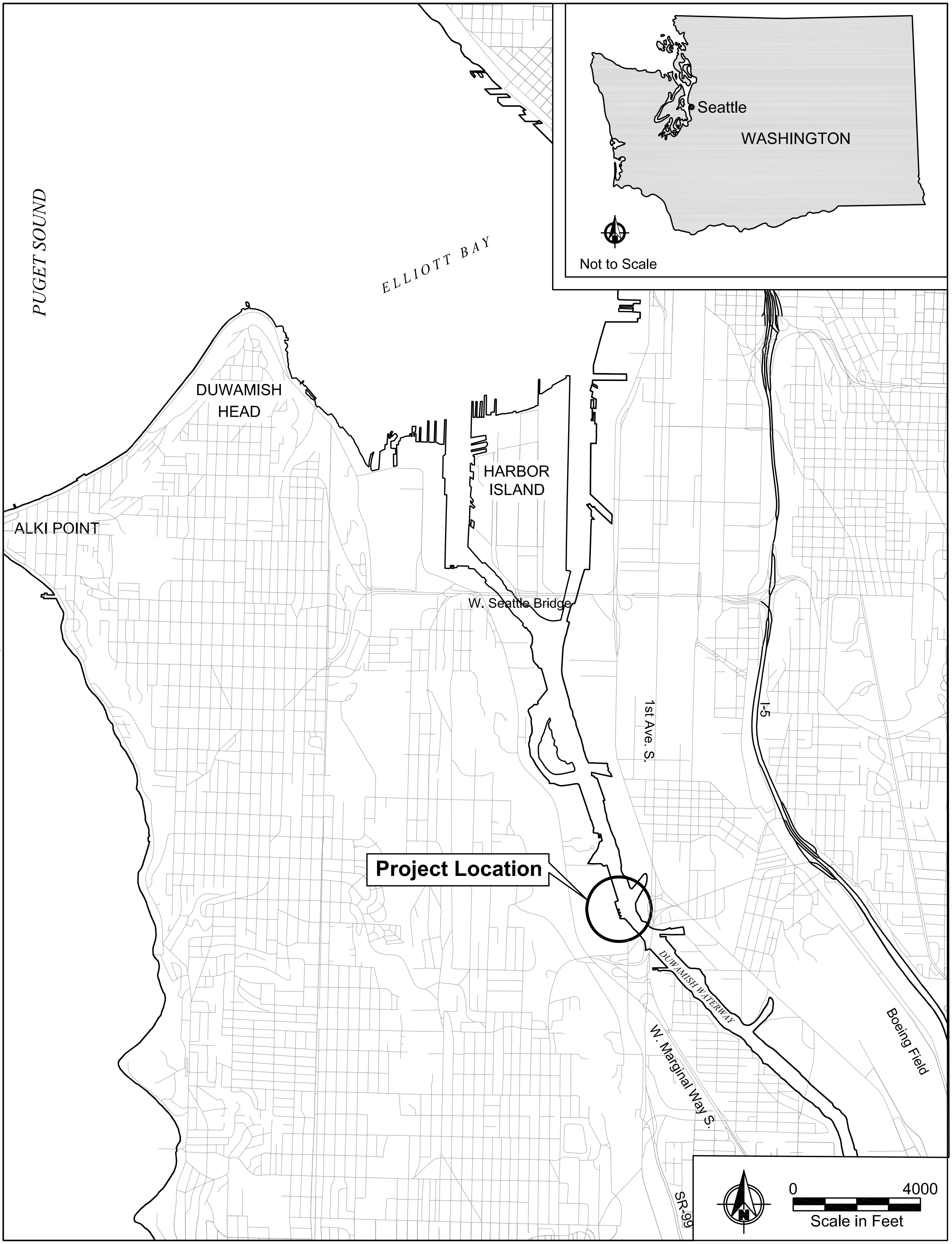
Table 5
Laboratory QA/QC Sample Analysis Summary

Analysis Type	Initial Calibration	Ongoing Calibration	Replicates	Matrix Spikes	SRM/LCS	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
Grain size	Each batch [a]	NA	1 per 20 samples	NA	NA	NA	NA	NA
Total solids	Each batch [b]	NA	1 per 20 samples	NA	NA	NA	NA	NA
Total organic carbon	Daily or each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Dioxin/Furans	As needed [c]	Every 12 hours	NA[d]	NA[d]	1 per 20 samples[e]	NA[d]	1 per 20 samples	NA[d]
Polycyclic aromatic hydrocarbons (PAH)	As needed [c]	Every 12 hours	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample

Notes:

a Calibration and certification of drying ovens and weighing scales are conducted bi-annually
b Initial calibration verification and calibration blank must be analyzed at the beginning of each batch
c Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new initial
d Isotope dilution required per method
e SRM NIST 1644 to be analyzed for dioxin/furans
NA Not applicable
SRM Standard reference material
LCS Laboratory control sample

FIGURES

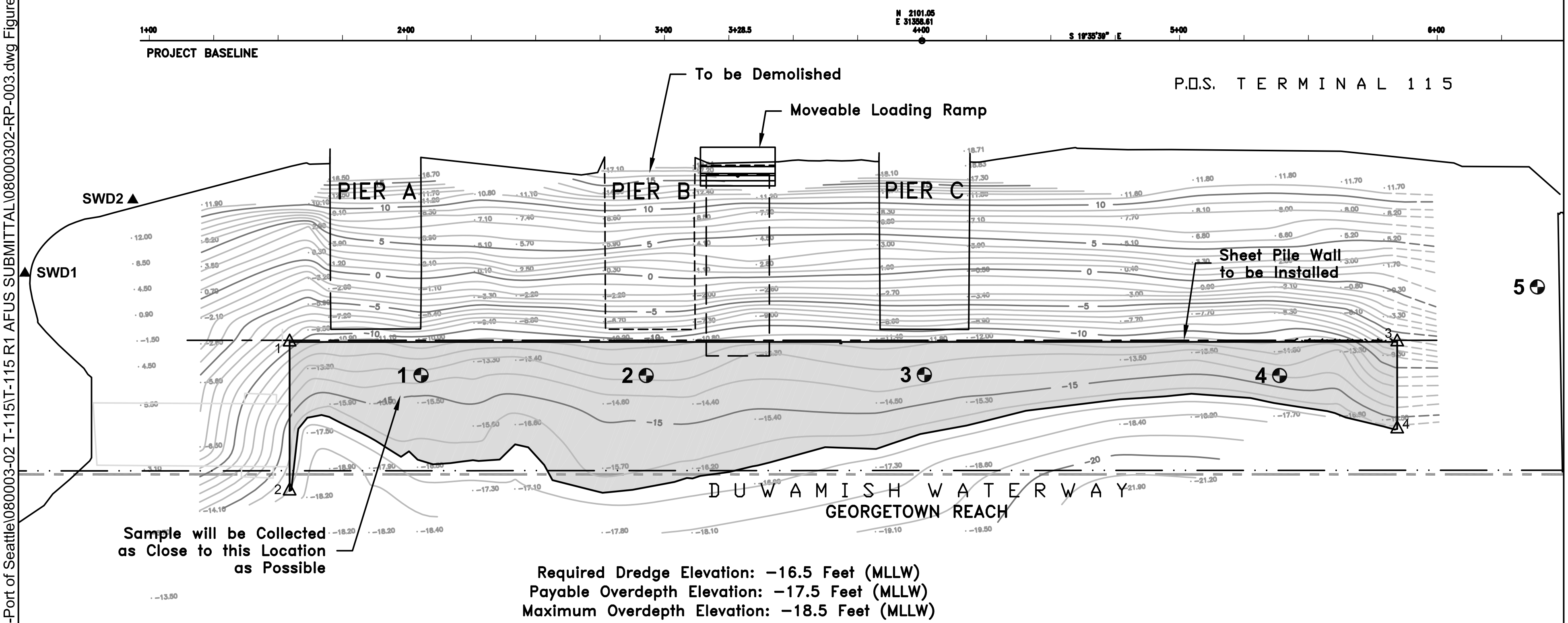


Oct 11, 2007 4:01pm cdavidson K:\Jobs\070003-Port of Seattle\070000302 T-115\07000302001.dwg Anc-A-Portrait WA VMAP

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1
Vicinity Map
Terminal 115
Port of Seattle

Figure 2
Previous Sediment Characterization Sampling Locations
Port of Seattle Terminal 115



Source: Bathymetry based on POS survey dated October 28, 2007. Additional lead line survey conducted by Sunchasers (2008) to define upper slope.
Horizontal Datum: Washington State Plane North, NAD83.
Vertical Datum: Mean Lower Low Water (MLLW).

Sample Locations		
Number	Easting	Northing
1	1268794.5	202059.5
2	1268767.0	202142.5
3	1268732.5	202244.8
4	1268689.1	202375.7

1 ⊕ Proposed Sample Location

Proposed Dredge Cut

SWD1 ▲ Outfall (Approximate)

0 50
Scale in Feet

ANCHOR QEA

Figure 3
Proposed Sample Locations
Port of Seattle Terminal 115

APPENDIX A
HISTORIC SEDIMENT CHEMISTRY RESULTS

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							LODRIV98	LODRIV98	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006
Location ID							DR130	DR154	LDW-SC34_LDWG	LDW-SC34_LDWG	LDW-SC34_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG
Sample ID							SD-130-0000	SD-154-0000	LDW-SC34-0-1	LDW-SC34-1-2	LDW-SC34-2-4	LDW-SC203-0-1	LDW-SC203-1-2	LDW-SC203-2-4	LDW-SC203-4-6
Sample Date							8/12/1998	8/13/1998	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006
Depth Interval		DMMP	DMMP	DMMP	SMS	SMS	0-10 cm	0-10 cm	0-1 FT	1-2 FT	2-4 FT	0-1 FT	1-2 FT	2-4 FT	4-6 FT
Sample Type		1998 SL	1998 BT	1998 ML	SQS	CSL	N	N	N	N	N	FR	FR	FR	FR
Conventionals															
Total solids	%						--	--	**46.1**	**50**	**59.9**	**45.5**	**47.3**	**52.9**	**58.8**
Total organic carbon	%						**2.87**	**2.33**	**2.9**	**3.02**	**2.05**	**3.27**	**2.91**	**2.59**	**2.44**
Sulfide	mg/kg						--	--	--	--	--	--	--	--	--
Ammonia	mg-N/kg						--	--	--	--	--	--	--	--	--
Liquid Limit	%						--	--	--	--	--	--	**62.7**	**55.5**	--
Plastic Limit	%						--	--	--	--	--	--	**44.9**	**40.7**	--
Dioxins/Furans															
1,2,3,4,6,7,8-HpCDD	ng/kg						--	**400**	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HpCDF	ng/kg						--	**66**	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HpCDF	ng/kg						--	**6.9 J**	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDD	ng/kg						--	3.8 U	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDF	ng/kg						--	**10**	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDD	ng/kg						--	**17**	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDF	ng/kg						--	3.2 U	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDD	ng/kg						--	**10**	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDF	ng/kg						--	0.57 U	--	--	--	--	--	--	--
1,2,3,7,8-PeCDD	ng/kg						--	--	--	--	--	--	--	--	--
1,2,3,7,8-PeCDF	ng/kg						--	1.4 U	--	--	--	--	--	--	--
2,3,4,6,7,8-HxCDF	ng/kg						--	2 U	--	--	--	--	--	--	--
2,3,4,7,8-PeCDF	ng/kg						--	3 U	--	--	--	--	--	--	--
2,3,7,8-TCDD	ng/kg						--	0.91 U	--	--	--	--	--	--	--
2,3,7,8-TCDF	ng/kg						--	**2.3**	--	--	--	--	--	--	--
OCDD	ng/kg						--	**4000**	--	--	--	--	--	--	--
OCDF	ng/kg						--	**230**	--	--	--	--	--	--	--
Total TEQ (other)	ng/kg						--	**9.08 J**	--	--	--	--	--	--	--
Grain Size															
Gravel	%						**0.38**	**0.06**	--	--	--	--	--	--	--
Sand	%						**17 J**	**18.9 J**	--	--	--	--	--	--	--
Silt	%						--	--	--	--	--	--	--	--	--
Clay	%						--	--	--	--	--	--	--	--	--
Fines	%						**82.6 J**	**81.1 J**	**71.6**	**76**	**50.1**	**71.6**	**74**	**58.9**	--
Phi class +1 to +2	%						--	--	**6.3**	**3.1**	**17**	**4.4**	**3.2**	**12.9**	--
Phi class +2 to +3	%						--	--	**7.7**	**4.7**	**6.3**	**2.4**	**4.6**	**6.5**	--
Phi class +3 to +4	%						--	--	**7.7**	**8.7**	**5.3**	**13.8**	**10.1**	**5.5**	--
Phi class +4 to +5	%						--	--	**9.9**	**10**	**6.6**	**10.5**	**14.4**	**6.6**	--
Phi class +5 to +6	%						--	--	**15.6**	**22**	**11.8**	**16.6**	**22.1**	**15.6**	--
Phi class +6 to +7	%						--	--	**15.8**	**23.9**	**16.4**	**18.8**	**19.4**	**19.4**	--
Phi class +7 to +8	%						--	--	**9.5**	**6.1**	**5.1**	**7.8**	**5.4**	**5.8**	--
Phi class +8 to +9	%						--	--	**6.6**	**3.7**	**2.7**	**5.1**	**3.4**	**3**	--
Phi class +9 to +10	%						--	--	**3.7**	**2.3**	**2.3**	**3.8**	**2.3**	**2.6**	--
Phi class > +10	%						--	--	**10.5**	**7.7**	**5.2**	**9**	**7**	**5.9**	--
Phi class 0 to +1	%						--	--	**3.6**	**2.7**	**11.4**	**3**	**2.7**	**8.7**	--
Phi class -1 to 0	%						--	--	**1.7**	**2.6**	**4.1**	**1.6**	**2.5**	**3**	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code Location ID Sample ID Sample Date Depth Interval Sample Type		DMMP 1998 SL	DMMP 1998 BT	DMMP 1998 ML	SMS SQS	SMS CSL	LODRIV98 DR130 SD-130-0000 8/12/1998 0-10 cm N	LODRIV98 DR154 SD-154-0000 8/13/1998 0-10 cm N	LDWRI-SubSed2006 LDW-SC34_LDWG LDW-SC34-0-1 2/17/2006 0-1 FT N	LDWRI-SubSed2006 LDW-SC34_LDWG LDW-SC34-1-2 2/17/2006 1-2 FT N	LDWRI-SubSed2006 LDW-SC34_LDWG LDW-SC34-2-4 2/17/2006 2-4 FT N	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-0-1 2/17/2006 0-1 FT FR	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-1-2 2/17/2006 1-2 FT FR	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-2-4 2/17/2006 2-4 FT FR	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-4-6 2/17/2006 4-6 FT FR
Metals															
Aluminum	mg/kg						**19500**	**19000**	--	--	--	--	--	--	--
Antimony	mg/kg	150	150	200			10 UJ	10 UJ	10 UJ	10 UJ	8 UJ	9 UJ	10 UJ	9 UJ	--
Arsenic	mg/kg	57	507	700	57	93	**10.2**	**10.9**	**20**	**20**	**15**	**20**	**20**	**15**	--
Arsenic	mg/kg	57	507	700	57	93	--	--	--	--	--	--	--	--	--
Barium	mg/kg						**80**	**74**	--	--	--	--	--	--	--
Beryllium	mg/kg						**0.33**	**0.46**	--	--	--	--	--	--	--
Cadmium	mg/kg	5.1		14	5.1	6.7	**0.3**	**0.37**	0.4 U	**0.9**	0.3 U	**0.6**	**0.7**	0.4 U	--
Calcium	mg/kg						**5620**	**5190**	--	--	--	--	--	--	--
Chromium	mg/kg				260	270	**28**	**29**	**34**	**50**	**30.9**	**39.5**	**41**	**32**	--
Cobalt	mg/kg						**10**	**9**	**9.6**	**8.9**	**8.6**	**8.9**	**9.8**	**8.9**	--
Copper	mg/kg	390		1300	390	390	**67**	**57**	**78.4**	**91.4**	**51.3**	**102**	**88.1**	**66.9**	--
Iron	mg/kg						**29000 J**	**30000 J**	--	--	--	--	--	--	--
Lead	mg/kg	450		1200	450	530	**33.9**	**39**	**60**	**87**	**78**	**78**	**68**	**58**	--
Magnesium	mg/kg						**8150**	**7250**	--	--	--	--	--	--	--
Manganese	mg/kg						**310**	**328**	--	--	--	--	--	--	--
Mercury	mg/kg	0.41	1.5	2.3	0.41	0.59	**0.18**	**0.17**	**0.26**	**0.25**	**0.12**	**0.23**	**0.2**	**0.17**	--
Mercury	mg/kg	0.41	1.5	2.3	0.41	0.59	--	--	--	--	--	--	--	--	--
Molybdenum	mg/kg						--	--	**1**	**4**	**1.3**	**2.8**	**3**	**1.3**	--
Nickel	mg/kg	140	370	370			**16.3**	**20.9**	**26**	**29**	**33**	**29**	**28**	**27**	--
Nickel	mg/kg						--	--	--	--	--	--	--	--	--
Potassium	mg/kg						**2700**	**2500**	--	--	--	--	--	--	--
Selenium	mg/kg						**0.8 J**	**5**	10 U	10 U	8 U	9 U	10 U	9 U	--
Silver	mg/kg	6.1	6.1	8.4	6.1	6.1	**0.28**	**0.31**	0.6 U	0.6 U	0.5 U	0.6 U	0.7 U	0.5 U	--
Sodium	mg/kg						**14300**	**11000**	--	--	--	--	--	--	--
Thallium	mg/kg						**0.09**	**0.09**	10 U	10 U	8 U	9 U	10 U	9 U	--
Tin	mg/kg						**5**	**6**	--	--	--	--	--	--	--
Vanadium	mg/kg						**56**	**54**	**67.5**	**65.7**	**60.4**	**67.1**	**73.1**	**61.8**	--
Zinc	mg/kg	410		3800	410	960	**125**	**133**	**188**	**253**	**136**	**204**	**225**	**137**	--
Zinc	mg/kg				410	960	--	--	--	--	--	--	--	--	--
Organometals															
Butyltin ion	µg/kg						--	**17 J**	--	--	--	--	--	--	--
Dibutyltin	µg/kg						--	**25**	--	--	--	--	--	--	--
Tributyltin	µg/kg						--	**69**	--	--	--	--	--	--	--
Tributyltin ion	µg/kg						--	--	--	--	--	--	--	--	--
Tetrabutyltin	µg/kg						--	5 U	--	--	--	--	--	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							LODRIV98	LODRIV98	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006
Location ID							DR130	DR154	LDW-SC34_LDWG	LDW-SC34_LDWG	LDW-SC34_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG
Sample ID							SD-130-0000	SD-154-0000	LDW-SC34-0-1	LDW-SC34-1-2	LDW-SC34-2-4	LDW-SC203-0-1	LDW-SC203-1-2	LDW-SC203-2-4	LDW-SC203-4-6
Sample Date							8/12/1998	8/13/1998	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006
Depth Interval		DMMP	DMMP	DMMP	SMS	SMS	0-10 cm	0-10 cm	0-1 FT	1-2 FT	2-4 FT	0-1 FT	1-2 FT	2-4 FT	4-6 FT
Sample Type		1998 SL	1998 BT	1998 ML	SQS	CSL	N	N	N	N	N	FR	FR	FR	FR
PCB Congeners															
PCB-18	µg/kg						**1 J**	1 UJ	--	--	--	--	--	--	--
PCB-28	µg/kg						**3 J**	**1 J**	--	--	--	--	--	--	--
PCB-44	µg/kg						**2 J**	**1 J**	--	--	--	--	--	--	--
PCB-52	µg/kg						**4 J**	**3 J**	--	--	--	--	--	--	--
PCB-66	µg/kg						**10**	**6 J**	--	--	--	--	--	--	--
PCB-77	µg/kg						1 U	1 UJ	--	--	--	--	--	--	--
PCB-81	µg/kg						1 UJ	1 UJ	--	--	--	--	--	--	--
PCB-101	µg/kg						**6 J**	**5 J**	--	--	--	--	--	--	--
PCB-105	µg/kg						**3 J**	**2 J**	--	--	--	--	--	--	--
PCB-110	µg/kg						--	--	--	--	--	--	--	--	--
PCB-114	µg/kg						1 UJ	1 UJ	--	--	--	--	--	--	--
PCB-118	µg/kg						**6**	**4 J**	--	--	--	--	--	--	--
PCB-123	µg/kg						2 UJ	1 UJ	--	--	--	--	--	--	--
PCB-126	µg/kg						1 U	1 UJ	--	--	--	--	--	--	--
PCB-128	µg/kg						**2 J**	**1 J**	--	--	--	--	--	--	--
PCB-138	µg/kg						**13 J**	**8 J**	--	--	--	--	--	--	--
PCB-153	µg/kg						**9 J**	**6 J**	--	--	--	--	--	--	--
PCB-156	µg/kg						**1 J**	1 UJ	--	--	--	--	--	--	--
PCB-157	µg/kg						1 UJ	1 UJ	--	--	--	--	--	--	--
PCB-167	µg/kg						1 UJ	1 UJ	--	--	--	--	--	--	--
PCB-169	µg/kg						1 U	1 UJ	--	--	--	--	--	--	--
PCB-170	µg/kg						**4 J**	**3 J**	--	--	--	--	--	--	--
PCB-180	µg/kg						**7 J**	**4 J**	--	--	--	--	--	--	--
PCB-187	µg/kg						**4 J**	**3 J**	--	--	--	--	--	--	--
PCB-189	µg/kg						1 UJ	1 UJ	--	--	--	--	--	--	--
PCB-195	µg/kg						1 UJ	1 UJ	--	--	--	--	--	--	--
PCB-206	µg/kg						1 U	1 UJ	--	--	--	--	--	--	--
Decachlorobiphenyl (total)	µg/kg						1 U	1 U	--	--	--	--	--	--	--
PCBs															
Aroclor 1016	µg/kg						20 UJ	20 UJ	20 U	20 U	19 U	20 U	39 U	20 U	12 U
Aroclor 1221	µg/kg						40 U	40 U	20 U	20 U	19 U	20 U	39 U	20 U	12 U
Aroclor 1232	µg/kg						20 U	20 U	20 U	20 U	19 U	20 U	39 U	20 U	12 U
Aroclor 1242	µg/kg						20 U	20 U	20 U	20 U	19 U	20 U	39 U	20 U	**41**
Aroclor 1248	µg/kg						20 U	20 U	99 U	**82**	**58**	**60**	330 U	**38**	12 U
Aroclor 1254	µg/kg						**82**	**57**	**110**	**120**	**110**	**110**	**110**	**81**	**80**
Aroclor 1260	µg/kg						**75**	**44 J**	**100**	**77**	**81**	**84**	140 U	**55**	**60**
Total PCBs (SMS)	µg/kg	130	38*	3,100			**157 J**	**101 J**	--	--	--	--	--	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							LODRIV98	LODRIV98	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006
Location ID							DR130	DR154	LDW-SC34_LDWG	LDW-SC34_LDWG	LDW-SC34_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG
Sample ID							SD-130-0000	SD-154-0000	LDW-SC34-0-1	LDW-SC34-1-2	LDW-SC34-2-4	LDW-SC203-0-1	LDW-SC203-1-2	LDW-SC203-2-4	LDW-SC203-4-6
Sample Date							8/12/1998	8/13/1998	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006
Depth Interval		DMMP	DMMP	DMMP	SMS	SMS	0-10 cm	0-10 cm	0-1 FT	1-2 FT	2-4 FT	0-1 FT	1-2 FT	2-4 FT	4-6 FT
Sample Type		1998 SL	1998 BT	1998 ML	SQS	CSL	N	N	N	N	N	FR	FR	FR	FR
Pesticides															
2,4'-DDD	µg/kg						--	--	2 U	9.8 U	1.9 U	9.8 U	9.8 U	9.7 U	--
2,4'-DDE	µg/kg						--	--	5.7 U	9.8 U	1.9 U	9.8 U	9.8 U	9.7 U	--
2,4'-DDT	µg/kg						--	--	2 U	9.8 U	1.9 U	9.8 U	9.8 U	9.7 U	--
4,4'-DDD	µg/kg						--	2 U	2 U	9.8 U	3.6 U	9.8 U	9.8 U	9.7 U	--
4,4'-DDE	µg/kg						--	1 U	2 U	9.8 U	1.9 U	9.8 U	9.8 U	9.7 U	--
4,4'-DDT	µg/kg						--	2 U	13 U	41 U	8.3 U	32 U	12 U	9.7 U	--
Aldrin	µg/kg						--	1 UJ	0.98 U	4.9 U	0.96 U	4.9 U	4.9 U	4.9 U	--
alpha-BHC	µg/kg						--	1 U	0.98 U	4.9 U	0.96 U	4.9 U	4.9 U	4.9 U	--
beta-BHC	µg/kg						--	1 U	0.98 U	4.9 U	2 U	4.9 U	4.9 U	4.9 U	--
delta-BHC	µg/kg						--	--	**7**	**19**	0.96 U	**23**	**60**	**29**	--
gamma-BHC (Lindane)	µg/kg						--	1 U	3.1 U	4.9 U	0.96 U	4.9 U	4.9 U	4.9 U	--
alpha-Chlordane	µg/kg						--	1 U	0.98 U	9.2 U	2.3 U	4.9 U	4.9 U	4.9 U	--
gamma-Chlordane	µg/kg						--	1 U	3.2 U	14 U	1.7 U	9.2 U	4.9 U	4.9 U	--
Dieldrin	µg/kg						--	2 UJ	2 U	9.8 U	1.9 U	9.8 U	9.8 U	9.7 U	--
Endosulfan I	µg/kg						--	1 U	0.98 U	4.9 U	0.96 U	4.9 U	4.9 U	4.9 U	--
Endosulfan II	µg/kg						--	2 U	2 U	9.8 U	1.9 U	9.8 U	9.8 U	9.7 U	--
Endosulfan sulfate	µg/kg						--	3 U	9.2 U	9.8 U	3.4 U	9.8 U	9.8 U	9.7 U	--
Endrin	µg/kg						--	2 U	11 U	9.8 U	1.9 U	9.8 U	9.8 U	9.7 U	--
Endrin aldehyde	µg/kg						--	2 U	2 U	23 U	1.9 U	9.8 U	9.8 U	9.7 U	--
Endrin ketone	µg/kg						--	2 U	2 U	9.8 U	1.9 U	9.8 U	9.8 U	9.7 U	--
Heptachlor	µg/kg						--	1 U	0.98 U	4.9 U	0.96 U	4.9 U	4.9 U	4.9 U	--
Heptachlor epoxide	µg/kg						--	2 U	2.5 U	4.9 U	4.1 U	4.9 U	4.9 U	4.9 U	--
Methoxychlor	µg/kg						--	1 U	9.8 U	49 U	9.6 U	49 U	49 U	49 U	--
Toxaphene	µg/kg						--	10 U	98 U	490 U	96 U	490 U	490 U	490 U	--
cis-Nonachlor	µg/kg						--	--	2 U	9.8 U	1.9 U	9.8 U	9.8 U	9.7 U	--
trans-Nonachlor	µg/kg						--	--	2 U	9.8 U	1.9 U	9.8 U	9.8 U	9.7 U	--
Total chlordane (SMS)	µg/kg						--	1 U	--	--	--	--	--	--	--
Total Chlordane (U=1/2; max RL)	µg/kg						--	1 U	--	--	--	--	--	--	--
Total DDT (SMS)	µg/kg	6.9	50	69			--	2 U	--	--	--	--	--	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code / Location ID / Sample ID / Sample Date / Depth Interval / Sample Type		DMMP 1998 SL	DMMP 1998 BT	DMMP 1998 ML	SMS SQS	SMS CSL	LODRIV98 DR130 SD-130-0000 8/12/1998 0-10 cm N	LODRIV98 DR154 SD-154-0000 8/13/1998 0-10 cm N	LDWRI-SubSed2006 LDW-SC34_LDWG LDW-SC34-0-1 2/17/2006 0-1 FT N	LDWRI-SubSed2006 LDW-SC34_LDWG LDW-SC34-1-2 2/17/2006 1-2 FT N	LDWRI-SubSed2006 LDW-SC34_LDWG LDW-SC34-2-4 2/17/2006 2-4 FT N	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-0-1 2/17/2006 0-1 FT FR	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-1-2 2/17/2006 1-2 FT FR	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-2-4 2/17/2006 2-4 FT FR	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-4-6 2/17/2006 4-6 FT FR
SVOCs															
1,2,3-Trichlorobenzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	µg/kg	31		64			20 U	20 U	6.7 UJ	7.8 UJ	6 UJ	9.3 UJ	11 UJ	6.9 UJ	6.6 U
1,2,4-Trimethylbenzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,2-Dichlorobenzene	µg/kg	35	37	110			20 U	20 U	6.7 U	**4.6 J**	6 U	9.3 U	11 U	6.9 U	6.6 U
1,3,5-Trimethylbenzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,3-Dichlorobenzene	µg/kg	170					20 U	20 U	110 U	130 U	99 U	160 U	110 U	69 U	6.6 U
1,4-Dichlorobenzene	µg/kg	110	120	120			20 U	20 U	**4 J**	**7 J**	6 U	**5.6 J**	**6.5 J**	6.9 U	6.6 U
2,2'-oxybis (1-chloropropane)	µg/kg						--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	µg/kg						200 U	200 U	560 U	650 U	500 U	780 U	540 U	350 U	330 U
2,4,6-Trichlorophenol	µg/kg						200 U	200 U	560 U	650 U	500 U	780 U	540 U	350 U	330 U
2,4-Dichlorophenol	µg/kg						60 U	60 U	560 U	650 U	500 U	780 U	540 U	350 U	330 U
2,4-Dimethylphenol	µg/kg	29		210	29	29	20 U	20 U	6.7 U	7.8 U	6 U	9.3 U	11 U	6.9 U	6.6 U
2,4-Dinitrophenol	µg/kg						200 U	200 U	1100 UJ	1300 U	990 UJ	1600 UJ	1100 UJ	690 UJ	660 U
2,4-Dinitrotoluene	µg/kg						200 U	200 U	560 U	650 U	500 U	780 U	540 U	350 U	330 U
2,6-Dinitrotoluene	µg/kg						200 U	200 U	560 U	650 U	500 U	780 U	540 U	350 U	330 U
2-Chloronaphthalene	µg/kg						20 U	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
2-Chlorophenol	µg/kg						20 U	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
2-Methylnaphthalene	µg/kg	670		1900			**20**	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
2-Methylphenol	µg/kg	63		77	63	63	20 U	20 U	**6.7 J**	**9.3 J**	6 U	**20 J**	11 U	6.9 U	6.6 U
2-Nitroaniline	µg/kg						100 U	100 U	560 U	650 U	500 U	780 U	540 U	350 U	330 U
2-Nitrophenol	µg/kg						100 U	100 U	560 U	650 U	500 U	780 U	540 U	350 U	330 U
3&4-Methylphenol	µg/kg						20 U	20 U	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	µg/kg						200 U	200 U	560 UJ	650 UJ	500 UJ	780 UJ	540 UJ	350 UJ	330 U
3-Nitroaniline	µg/kg						200 U	200 U	560 UJ	650 UJ	500 UJ	780 UJ	540 UJ	350 UJ	330 U
4,6-Dinitro-2-methylphenol	µg/kg						200 U	200 U	1100 U	1300 UJ	990 U	1600 U	1100 UJ	690 UJ	660 U
4-Bromophenyl-phenylether	µg/kg						40 U	40 U	110 U	130 UJ	99 U	160 U	110 U	69 U	66 U
4-Chloro-3-methylphenol	µg/kg						40 U	40 U	560 U	650 U	500 U	780 U	540 U	350 U	330 U
4-Chloroaniline	µg/kg						60 U	60 U	560 UJ	650 UJ	500 UJ	780 UJ	540 UJ	350 UJ	330 U
4-Chlorophenyl-phenylether	µg/kg						20 U	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
4-Methylphenol	µg/kg	670		3600	670	670	--	--	110 U	130 U	99 U	160 U	110 U	69 U	66 U
4-Nitroaniline	µg/kg						100 U	100 U	560 U	650 U	500 U	780 U	540 U	350 U	330 U
4-Nitrophenol	µg/kg						100 U	100 U	560 U	650 U	500 U	780 U	540 U	350 U	330 U
Acenaphthene	µg/kg	500		2000			**70**	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
Acenaphthylene	µg/kg	560		1300			20 U	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
Aniline	µg/kg						--	--	110 UJ	130 UJ	99 UJ	160 UJ	110 UJ	69 UJ	66 U
Anthracene	µg/kg	960		13000			**90**	**40**	**84 J**	**160 J**	99 U	**140 J**	**170**	**160**	**74**
Benzo(a)anthracene	µg/kg	1300		5100			**260**	**170**	**260**	**430**	**130**	**350**	**480**	**250**	**240**
Benzo(a)pyrene	µg/kg	1600	3600	3600			**220**	**150**	**230**	**400**	**150**	**330**	**450**	**190**	**180**
Benzo(b)fluoranthene	µg/kg						**320**	**210**	**380**	**530**	**220**	**540**	**640**	**280**	**340**
Benzo(g,h,i)perylene	µg/kg	670		3200			**150**	**110**	**63 J**	**200**	99 U	**84 J**	**140**	**60 J**	**89**
Benzo(k)fluoranthene	µg/kg						**240**	**170**	**280**	**470**	**210**	**400**	**550**	**260**	**150**
Benzoic acid	µg/kg	650		760	650	650	200 U	200 U	160 U	140 U	110 U	**420**	140 U	**570**	590 U
Benzyl alcohol	µg/kg	57		870	57	73	50 U	50 U	**34**	**210**	**20 J**	**66**	**41 J**	35 U	33 U
bis(2-Chloroethoxy)methane	µg/kg						40 U	40 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
bis(2-Chloroethyl)ether	µg/kg						40 U	40 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
bis(2-Chloroisopropyl)ether	µg/kg						40 U	40 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
bis(2-Ethylhexyl)phthalate	µg/kg	8300	13870				**510**	390 UJ	**920**	**3900**	**670**	**1800**	**2600**	**590**	**770**
Butylbenzylphthalate	µg/kg	970					**50**	20 U	**440**	**400**	**44**	**380**	**400**	**140**	**48**

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							**LODRIV98**	**LODRIV98**	**LDWRI-SubSed2006**	**LDWRI-SubSed2006**	**LDWRI-SubSed2006**	**LDWRI-SubSed2006**	**LDWRI-SubSed2006**	**LDWRI-SubSed2006**	**LDWRI-SubSed2006**
Location ID							**DR130**	**DR154**	**LDW-SC34_LDWG**	**LDW-SC34_LDWG**	**LDW-SC34_LDWG**	**LDW-SC203_LDWG**	**LDW-SC203_LDWG**	**LDW-SC203_LDWG**	**LDW-SC203_LDWG**
Sample ID							**SD-130-0000**	**SD-154-0000**	**LDW-SC34-0-1**	**LDW-SC34-1-2**	**LDW-SC34-2-4**	**LDW-SC203-0-1**	**LDW-SC203-1-2**	**LDW-SC203-2-4**	**LDW-SC203-4-6**
Sample Date							**8/12/1998**	**8/13/1998**	**2/17/2006**	**2/17/2006**	**2/17/2006**	**2/17/2006**	**2/17/2006**	**2/17/2006**	**2/17/2006**
Depth Interval		**DMMP**	**DMMP**	**DMMP**	**SMS**	**SMS**	**0-10 cm**	**0-10 cm**	**0-1 FT**	**1-2 FT**	**2-4 FT**	**0-1 FT**	**1-2 FT**	**2-4 FT**	**4-6 FT**
Sample Type		**1998 SL**	**1998 BT**	**1998 ML**	**SQS**	**CSL**	**N**	**N**	**N**	**N**	**N**	**FR**	**FR**	**FR**	**FR**
Carbazole	µg/kg						**40**	20 U	--	--	--	--	--	--	--
Chrysene	µg/kg	1400		21000			**440**	**230**	**360**	**720**	**190**	**530**	**680**	**370**	**310**
Dibenzo(a,h)anthracene	µg/kg	230		1900			**40**	**30**	110 U	130 U	99 U	160 U	110 U	69 U	**39**
Dibenzofuran	µg/kg	540		1700			**50**	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
Diethylphthalate	µg/kg	1200					20 U	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
Dimethylphthalate	µg/kg	1400	1400				**20**	20 U	110 U	130 U	99 U	**1700**	110 U	**8800**	**210**
Di-n-butylphthalate	µg/kg	5100	10220				20 U	20 U	110 U	180 UJ	99 U	160 U	110 U	69 U	66 U
Di-n-octylphthalate	µg/kg	6200					20 U	20 U	110 U	**220**	**64 J**	160 U	110 U	69 U	66 U
Fluoranthene	µg/kg	1700	4600	30000			**990**	**430**	**810**	**1300 J**	**300**	**1100**	**1300**	**700**	**760**
Fluorene	µg/kg	540		3600			**70**	20 U	110 U	130 U	99 U	160 U	110 U	69 U	**39 J**
Hexachlorobenzene	µg/kg	22	168	230			20 U	20 U	0.98 U	4.9 U	0.96 U	4.9 U	4.9 U	4.9 U	6.6 U
Hexachlorobutadiene	µg/kg	29	212	270			20 U	20 U	0.98 U	4.9 U	0.96 U	4.9 U	4.9 U	4.9 U	6.6 U
Hexachlorocyclopentadiene	µg/kg						100 U	100 UJ	560 UJ	650 UJ	500 UJ	780 UJ	540 UJ	350 UJ	330 U
Hexachloroethane	µg/kg	1400	10220	14000			20 U	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
Indeno(1,2,3-cd)pyrene	µg/kg	600		4400			**160**	**110**	**75 J**	**200**	**52 J**	**100 J**	**160**	**71**	**66**
Indeno(1,2,3-cd)pyrene	µg/kg	600		4400			--	--	--	--	--	--	--	--	--
Isophorone	µg/kg						20 U	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
Naphthalene	µg/kg	2100		2400			20 U	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
Nitrobenzene	µg/kg						20 U	20 U	110 U	130 U	99 U	160 U	110 U	69 U	66 U
n-Nitroso-di-methylamine	µg/kg						--	--	34 U	39 U	30 U	47 U	54 U	35 U	33 U
n-Nitroso-di-n-propylamine	µg/kg						40 U	40 U	34 U	39 U	30 U	47 U	54 U	35 U	33 U
n-Nitroso-di-phenylamine	µg/kg	28	130	130			40 U	40 U	48 U	290 U	32 U	98 U	200 U	28 U	62 U
Pentachlorophenol	µg/kg	400	504	690	360	690	100 U	100 U	**76**	39 U	30 U	47 U	54 U	35 U	**63**
Phenanthrene	µg/kg	1500		21000			**500**	**120**	**280**	**340 J**	**110**	**180**	**440**	**170**	**170**
Phenol	µg/kg	420	876	1200	420	1200	20 U	**40**	110 U	130 U	99 U	160 U	110 U	**62 J**	66 U
Pyrene	µg/kg	2600		16000			**800**	**360**	**540**	**920 J**	**460**	**800**	**910**	**630**	**690**
Total benzofluoranthenes (SMS)	µg/kg	3200		9900			**560 J**	**380 J**	--	--	--	--	--	--	--
Total LPAH (SMS)	µg/kg	5200		29000			**730 J**	**160 J**	--	--	--	--	--	--	--
Total HPAH (SMS)	µg/kg	12000		69000			**3620 J**	**1970 J**	--	--	--	--	--	--	--
Volatiles															
1,1,1,2-Tetrachloroethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,1,1-Trichloroethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,1,2-Trichloroethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	µg/kg						--	77.5 U	--	--	--	--	--	--	--
1,1-Dichloroacetone	µg/kg						--	38.8 U	--	--	--	--	--	--	--
1,1-Dichloroethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,1-Dichloroethene	µg/kg						--	7.8 U	--	--	--	--	--	--	--
1,1-Dichloropropene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,2,3-Trichloropropane	µg/kg						--	19.4 U	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	µg/kg						--	7.8 UJ	--	--	--	--	--	--	--
1,2-Dibromoethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,2-Dichloroethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,2-Dichloropropane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1,3-Dichloropropane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
1-Chlorobutane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
2,2-Dichloropropane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
2-Butanone (MEK)	µg/kg						--	**34.5**	--	--	--	--	--	--	--
2-Chlorotoluene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
2-Hexanone	µg/kg						--	7.8 U	--	--	--	--	--	--	--
2-Nitropropane	µg/kg						--	19.4 U	--	--	--	--	--	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							LODRIV98	LODRIV98	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006	LDWRI-SubSed2006
Location ID							DR130	DR154	LDW-SC34_LDWG	LDW-SC34_LDWG	LDW-SC34_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG	LDW-SC203_LDWG
Sample ID							SD-130-0000	SD-154-0000	LDW-SC34-0-1	LDW-SC34-1-2	LDW-SC34-2-4	LDW-SC203-0-1	LDW-SC203-1-2	LDW-SC203-2-4	LDW-SC203-4-6
Sample Date							8/12/1998	8/13/1998	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006	2/17/2006
Depth Interval		DMMP	DMMP	DMMP	SMS	SMS	0-10 cm	0-10 cm	0-1 FT	1-2 FT	2-4 FT	0-1 FT	1-2 FT	2-4 FT	4-6 FT
Sample Type		1998 SL	1998 BT	1998 ML	SQS	CSL	N	N	N	N	N	FR	FR	FR	FR
4-Chlorotoluene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
4-Isopropyltoluene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
4-Methyl-2-pentanone (MIBK)	µg/kg						--	7.8 U	--	--	--	--	--	--	--
Acetone	µg/kg						--	124 UJ	--	--	--	--	--	--	--
Allyl chloride	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Benzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Bromobenzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Bromochloromethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Bromodichloromethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Bromoform	µg/kg						--	7.8 U	--	--	--	--	--	--	--
Bromomethane	µg/kg						--	19.4 U	--	--	--	--	--	--	--
Carbon disulfide	µg/kg						--	**3.2 J**	--	--	--	--	--	--	--
Carbon tetrachloride	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Chlorobenzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Chloroethane	µg/kg						--	19.4 U	--	--	--	--	--	--	--
Chloroform	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Chloromethane	µg/kg						--	19.4 U	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	µg/kg						--	4.1 U	--	--	--	--	--	--	--
Dibromochloromethane	µg/kg						--	7.8 U	--	--	--	--	--	--	--
Dibromomethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Dichloromethane	µg/kg						--	19.4 U	--	--	--	--	--	--	--
Diethylether	µg/kg						--	7.8 U	--	--	--	--	--	--	--
Ethyl methacrylate	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Ethylbenzene	µg/kg	10	27	50			--	3.9 U	--	--	--	--	--	--	--
Iodomethane	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Isopropylbenzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Methacrylonitrile	µg/kg						--	7.8 U	--	--	--	--	--	--	--
Methyl acrylate	µg/kg						--	7.8 U	--	--	--	--	--	--	--
Methyl methacrylate	µg/kg						--	3.9 U	--	--	--	--	--	--	--
n-Butylbenzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
n-Propylbenzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Pentachloroethane	µg/kg						--	7.8 U	--	--	--	--	--	--	--
sec-Butylbenzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Styrene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
tert-Butylbenzene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Methyltert-butylether	µg/kg						--	7.8 U	--	--	--	--	--	--	--
Tetrachloroethene	µg/kg	57	102	210			--	3.9 U	--	--	--	--	--	--	--
Toluene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	µg/kg						--	3.6 U	--	--	--	--	--	--	--
trans-1,4-Dichloro-2-butene	µg/kg						--	19.4 U	--	--	--	--	--	--	--
Trichloroethene	µg/kg	160	1168	1600			--	3.9 U	--	--	--	--	--	--	--
Trichlorofluoromethane	µg/kg						--	77.5 UJ	--	--	--	--	--	--	--
Vinyl chloride	µg/kg						--	19.4 U	--	--	--	--	--	--	--
m,p-Xylenes	µg/kg						--	7.8 U	--	--	--	--	--	--	--
o-Xylene	µg/kg						--	3.9 U	--	--	--	--	--	--	--
Total xylene (SMS)	µg/kg	40		160			--	7.8 U	--	--	--	--	--	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code Location ID Sample ID Sample Date Depth Interval Sample Type		DMMP 1998 SL	DMMP 1998 BT	DMMP 1998 ML	SMS SQS	SMS CSL	LODRIV98 DR130 SD-130-0000 8/12/1998 0-10 cm N	LODRIV98 DR154 SD-154-0000 8/13/1998 0-10 cm N	LDWRI-SubSed2006 LDW-SC34_LDWG LDW-SC34-0-1 2/17/2006 0-1 FT N	LDWRI-SubSed2006 LDW-SC34_LDWG LDW-SC34-1-2 2/17/2006 1-2 FT N	LDWRI-SubSed2006 LDW-SC34_LDWG LDW-SC34-2-4 2/17/2006 2-4 FT N	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-0-1 2/17/2006 0-1 FT FR	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-1-2 2/17/2006 1-2 FT FR	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-2-4 2/17/2006 2-4 FT FR	LDWRI-SubSed2006 LDW-SC203_LDWG LDW-SC203-4-6 2/17/2006 4-6 FT FR
PCBs															
Total PCBs (SMS)	mg/kg-OC				12	65	**5.47 J**	**4.33 J**	--	--	--	--	--	--	--
SVOCs															
1,2,4-Trichlorobenzene	mg/kg-OC				0.81	1.8	0.69 U	0.85 U	--	--	--	--	--	--	--
1,2-Dichlorobenzene	mg/kg-OC				2.3	2.3	0.69 U	0.85 U	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg-OC				3.1	9	0.69 U	0.85 U	--	--	--	--	--	--	--
2-Methylnaphthalene	mg/kg-OC				38	64	**0.69**	0.85 U	--	--	--	--	--	--	--
Acenaphthene	mg/kg-OC				16	57	**2.43**	0.85 U	--	--	--	--	--	--	--
Acenaphthylene	mg/kg-OC				66	66	0.69 U	0.85 U	--	--	--	--	--	--	--
Anthracene	mg/kg-OC				220	1200	**3.13**	**1.71**	--	--	--	--	--	--	--
Benzo(a)anthracene	mg/kg-OC				110	270	**9.05**	**7.29**	--	--	--	--	--	--	--
Benzo(a)pyrene	mg/kg-OC				99	210	**7.66**	**6.43**	--	--	--	--	--	--	--
Benzo(b)fluoranthene	mg/kg-OC						--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	mg/kg-OC				31	78	**5.22**	**4.72**	--	--	--	--	--	--	--
Benzo(k)fluoranthene	mg/kg-OC						--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	mg/kg-OC				47	78	**17.77**	16.73 UJ	--	--	--	--	--	--	--
Butylbenzylphthalate	mg/kg-OC				4.9	64	**1.74**	0.85 U	--	--	--	--	--	--	--
Chrysene	mg/kg-OC				110	460	**15.33**	**9.87**	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	mg/kg-OC				12	33	**1.39**	**1.28**	--	--	--	--	--	--	--
Dibenzofuran	mg/kg-OC				15	58	**1.74**	0.85 U	--	--	--	--	--	--	--
Diethylphthalate	mg/kg-OC				61	110	0.69 U	0.85 U	--	--	--	--	--	--	--
Dimethylphthalate	mg/kg-OC				53	53	**0.69**	0.85 U	--	--	--	--	--	--	--
Di-n-butylphthalate	mg/kg-OC				220	1700	0.69 U	0.85 U	--	--	--	--	--	--	--
Di-n-octylphthalate	mg/kg-OC				58	4500	0.69 U	0.85 U	--	--	--	--	--	--	--
Fluoranthene	mg/kg-OC				160	1200	**34.49**	**18.45**	--	--	--	--	--	--	--
Fluorene	mg/kg-OC				23	79	**2.43**	0.85 U	--	--	--	--	--	--	--
Hexachlorobenzene	mg/kg-OC				0.38	2.3	0.69 U	0.85 U	--	--	--	--	--	--	--
Hexachlorobutadiene	mg/kg-OC				3.9	6.2	0.69 U	0.85 U	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC				34	88	**5.57**	**4.72**	--	--	--	--	--	--	--
Naphthalene	mg/kg-OC				99	170	0.69 U	0.85 U	--	--	--	--	--	--	--
n-Nitroso-di-phenylamine	mg/kg-OC				11	11	1.39 U	1.71 U	--	--	--	--	--	--	--
Phenanthrene	mg/kg-OC				100	480	**17.42**	**5.15**	--	--	--	--	--	--	--
Pyrene	mg/kg-OC				1000	1400	**27.87**	**15.45**	--	--	--	--	--	--	--
Total benzofluoranthenes (SMS)	mg/kg-OC				230	450	**19.51 J**	**16.3 J**	--	--	--	--	--	--	--
Total LPAH (SMS)	mg/kg-OC				370	780	**25.43 J**	**6.86 J**	--	--	--	--	--	--	--
Total HPAH (SMS)	mg/kg-OC				960	5300	**126.13 J**	**84.54 J**	--	--	--	--	--	--	--

µg/kg = micrograms per kilogram
BT = Bioaccumulation Trigger
CSL = Cleanup Screening Level
DMMP = Dredged Material Management Program
J = Indicates an estimated value.
mg/kg-OC = miligrams per kilogram, Organic Carbon Normalized
ML = Maximum Level
ng/kg = nonograms per kilogram
PCB = Polychlorinated biphenyl
SL = Screening Level
SMS = Sediment Management Standards
SQS = Sediment Quality Standards (SMS)
U = The compound was analyzed for but not detected at or above the method detection limit.
UJ = Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
* = Value normalized to total organic carbon, mg/kg (TOC normalized)
= Value exceeds DMMP and/or SMS screening criteria

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							LDWRI-SurfSedRd2	LDWRI-SurfSedRd1	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	NOAA97	NOAA97
Location ID							LDW-SS68	LDW-SS70_LDWG	R1	R2	R3	R4	WST350	WST351
Sample ID							LDW-SS68-010_B	LDW-SS70-010_B	SD0057	SD0058	SD0054	SD0059	WST17-01	WST17-02
Sample Date							3/7/2005	1/21/2005	10/15/1997	10/15/1997	10/15/1997	10/15/1997	10/22/1997	10/6/1997
Depth Interval		DMMP	DMMP	DMMP	SMS	SMS	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm
Sample Type		1998 SL	1998 BT	1998 ML	SQS	CSL	N	N	N	N	N	N	N	N
Conventionals														
Total solids	%						**47.1**	**56.3**	**48.6**	**47.3**	**41**	**48.8**	--	--
Total organic carbon	%						**2.58**	**3.05**	**1.9 J**	**1.9**	**3.7**	**3.8**	**2.25**	**2.12**
Sulfide	mg/kg						**80**	**320 J**	--	--	--	--	--	--
Ammonia	mg-N/kg						**9.78**	**8.34**	--	--	--	--	--	--
Liquid Limit	%						--	--	--	--	--	--	--	--
Plastic Limit	%						--	--	--	--	--	--	--	--
Dioxins/Furans														
1,2,3,4,6,7,8-HpCDD	ng/kg						--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HpCDF	ng/kg						--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HpCDF	ng/kg						--	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDD	ng/kg						--	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDF	ng/kg						--	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDD	ng/kg						--	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDF	ng/kg						--	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDD	ng/kg						--	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDF	ng/kg						--	--	--	--	--	--	--	--
1,2,3,7,8-PeCDD	ng/kg						--	--	--	--	--	--	--	--
1,2,3,7,8-PeCDF	ng/kg						--	--	--	--	--	--	--	--
2,3,4,6,7,8-HxCDF	ng/kg						--	--	--	--	--	--	--	--
2,3,4,7,8-PeCDF	ng/kg						--	--	--	--	--	--	--	--
2,3,7,8-TCDD	ng/kg						--	--	--	--	--	--	--	--
2,3,7,8-TCDF	ng/kg						--	--	--	--	--	--	--	--
OCDD	ng/kg						--	--	--	--	--	--	--	--
OCDF	ng/kg						--	--	--	--	--	--	--	--
Total TEQ (other)	ng/kg						--	--	--	--	--	--	--	--
Grain Size														
Gravel	%						--	--	--	--	--	--	**0.07**	**0**
Sand	%						--	--	--	--	--	--	**6.81**	**10.43**
Silt	%						--	--	--	--	--	--	**65.28**	**63.36**
Clay	%						--	--	--	--	--	--	**27.84**	**26.21**
Fines	%						**77.5**	**39.4**	**85**	**87**	**45**	**79**	**93.12**	**89.57**
Phi class +1 to +2	%						**5**	**18.7**	**1**	**2**	**15**	**5**	--	--
Phi class +2 to +3	%						**4**	**17.2**	**3**	**1**	**17**	**4**	--	--
Phi class +3 to +4	%						**10.4**	**10.8**	**8**	**7**	**12**	**7**	--	--
Phi class +4 to +5	%						**13.1**	**5.2**	**13**	**19**	**10**	**14**	--	--
Phi class +5 to +6	%						**19.4**	**8.4**	**21**	**21**	**9**	**19**	--	--
Phi class +6 to +7	%						**15**	**7.2**	**18**	**17**	**8**	**18**	--	--
Phi class +7 to +8	%						**10.2**	**5.6**	**12**	**11**	**5**	**9**	--	--
Phi class +8 to +9	%						**5.5**	**3.5**	**7**	**6**	**5**	**7**	--	--
Phi class +9 to +10	%						**3.7**	**2.5**	**4**	**4**	**2**	**3**	--	--
Phi class > +10	%						**10.6**	**7**	**10**	**9**	**6**	**9**	--	--
Phi class 0 to +1	%						**2.6**	**7.9**	**2**	**1**	**6**	**2**	--	--
Phi class -1 to 0	%						**.4**	**3.2**	1 UJ	**2**	**4**	**2**	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							**LDWRI-SurfSedRd2**	**LDWRI-SurfSedRd1**	**Boeing SiteChar**	**Boeing SiteChar**	**Boeing SiteChar**	**Boeing SiteChar**	**NOAA97**	**NOAA97**
Location ID							**LDW-SS68**	**LDW-SS70_LDWG**	**R1**	**R2**	**R3**	**R4**	**WST350**	**WST351**
Sample ID							**LDW-SS68-010_B**	**LDW-SS70-010_B**	**SD0057**	**SD0058**	**SD0054**	**SD0059**	**WST17-01**	**WST17-02**
Sample Date							**3/7/2005**	**1/21/2005**	**10/15/1997**	**10/15/1997**	**10/15/1997**	**10/15/1997**	**10/22/1997**	**10/6/1997**
Depth Interval		**DMMP**	**DMMP**	**DMMP**	**SMS**	**SMS**	**0-10 cm**	**0-10 cm**	**0-10 cm**	**0-10 cm**	**0-10 cm**	**0-10 cm**	**0-10 cm**	**0-10 cm**
Sample Type		**1998 SL**	**1998 BT**	**1998 ML**	**SQS**	**CSL**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Metals														
Aluminum	mg/kg						--	--	--	--	--	--	--	--
Antimony	mg/kg	150	150	200			.4 UJ	.3 UJ	--	--	--	--	--	--
Arsenic	mg/kg	57	507	700	57	93	**12.1**	**14.8**	**12.2**	**12.8**	**17.7**	**13.8**	--	--
Arsenic	mg/kg	57	507	700	57	93	--	--	--	--	**18.7**	--	--	--
Barium	mg/kg						--	--	--	--	--	--	--	--
Beryllium	mg/kg						--	--	--	--	--	--	--	--
Cadmium	mg/kg	5.1		14	5.1	6.7	**.6**	**.7**	0.4 U	0.4 U	**0.9**	**0.5**	--	--
Calcium	mg/kg						--	--	--	--	--	--	--	--
Chromium	mg/kg				260	270	**36**	**38.3**	**32**	**30**	**46**	**33**	--	--
Cobalt	mg/kg						**10.3**	**8.2**	--	--	--	--	--	--
Copper	mg/kg	390		1300	390	390	**87.4**	**84.2**	**62**	**58**	**78**	**68**	--	--
Iron	mg/kg						--	--	--	--	--	--	--	--
Lead	mg/kg	450		1200	450	530	**47**	**84**	**34**	**31**	**140**	**54**	--	--
Magnesium	mg/kg						--	--	--	--	--	--	--	--
Manganese	mg/kg						--	--	--	--	--	--	--	--
Mercury	mg/kg	0.41	1.5	2.3	0.41	0.59	**.2**	**.14**	**0.1**	**0.13**	**0.13**	**0.12**	--	--
Mercury	mg/kg	0.41	1.5	2.3	0.41	0.59	--	--	--	--	**0.12**	--	--	--
Molybdenum	mg/kg						**2**	**2.6**	--	--	--	--	--	--
Nickel	mg/kg	140	370	370			**24**	**28**	32 UJ	**29**	**43**	**32**	--	--
Nickel	mg/kg						--	--	**32**	--	--	--	--	--
Potassium	mg/kg						--	--	--	--	--	--	--	--
Selenium	mg/kg						10 U	8 U	--	--	--	--	--	--
Silver	mg/kg	6.1	6.1	8.4	6.1	6.1	.6 U	.5 U	0.4 U	**0.5**	0.4 U	**0.4**	--	--
Sodium	mg/kg						--	--	--	--	--	--	--	--
Thallium	mg/kg						.4 U	.3 U	--	--	--	--	--	--
Tin	mg/kg						--	--	--	--	--	--	--	--
Vanadium	mg/kg						**75.4**	**59.9**	--	--	--	--	--	--
Zinc	mg/kg	410		3800	410	960	**152**	**277**	128 UJ	**111**	**292**	**171**	--	--
Zinc	mg/kg				410	960	--	--	**128**	--	**288**	--	--	--
Organometals														
Butyltin ion	µg/kg						--	--	--	--	--	--	--	--
Dibutyltin	µg/kg						--	--	--	--	--	--	--	--
Tributyltin	µg/kg						--	--	--	--	--	--	--	--
Tributyltin ion	µg/kg						--	--	--	--	--	--	--	--
Tetrabutyltin	µg/kg						--	--	--	--	--	--	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							LDWRI-SurfSedRd2	LDWRI-SurfSedRd1	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	NOAA97	NOAA97
Location ID							LDW-SS68	LDW-SS70_LDWG	R1	R2	R3	R4	WST350	WST351
Sample ID							LDW-SS68-010_B	LDW-SS70-010_B	SD0057	SD0058	SD0054	SD0059	WST17-01	WST17-02
Sample Date							3/7/2005	1/21/2005	10/15/1997	10/15/1997	10/15/1997	10/15/1997	10/22/1997	10/6/1997
Depth Interval		DMMP	DMMP	DMMP	SMS	SMS	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm
Sample Type		1998 SL	1998 BT	1998 ML	SQS	CSL	N	N	N	N	N	N	N	N
PCB Congeners														
PCB-18	µg/kg						--	--	--	--	--	--	--	--
PCB-28	µg/kg						--	--	--	--	--	--	--	--
PCB-44	µg/kg						--	--	--	--	--	--	--	--
PCB-52	µg/kg						--	--	--	--	--	--	--	--
PCB-66	µg/kg						--	--	--	--	--	--	--	--
PCB-77	µg/kg						--	--	--	--	--	--	0.33 U	0.45 U
PCB-81	µg/kg						--	--	--	--	--	--	--	--
PCB-101	µg/kg						--	--	--	--	--	--	**33 J**	**66 J**
PCB-105	µg/kg						--	--	--	--	--	--	**4.3**	**8.4**
PCB-110	µg/kg						--	--	--	--	--	--	**8.7**	**20**
PCB-114	µg/kg						--	--	--	--	--	--	--	--
PCB-118	µg/kg						--	--	--	--	--	--	**8.5**	**15**
PCB-123	µg/kg						--	--	--	--	--	--	--	--
PCB-126	µg/kg						--	--	--	--	--	--	0.29 U	0.41 U
PCB-128	µg/kg						--	--	--	--	--	--	4.4 U	**8.5 J**
PCB-138	µg/kg						--	--	--	--	--	--	**7.8**	**15**
PCB-153	µg/kg						--	--	--	--	--	--	**23 J**	**49 J**
PCB-156	µg/kg						--	--	--	--	--	--	0.26 U	**1.4**
PCB-157	µg/kg						--	--	--	--	--	--	0.23 U	0.32 U
PCB-167	µg/kg						--	--	--	--	--	--	--	--
PCB-169	µg/kg						--	--	--	--	--	--	0.73 U	1 U
PCB-170	µg/kg						--	--	--	--	--	--	**4.8**	**8.8**
PCB-180	µg/kg						--	--	--	--	--	--	**6.8**	**13**
PCB-187	µg/kg						--	--	--	--	--	--	--	--
PCB-189	µg/kg						--	--	--	--	--	--	0.33 U	0.46 U
PCB-195	µg/kg						--	--	--	--	--	--	--	--
PCB-206	µg/kg						--	--	--	--	--	--	--	--
Decachlorobiphenyl (total)	µg/kg						--	--	--	--	--	--	--	--
PCBs														
Aroclor 1016	µg/kg						20 U	20 U	20 U	18 U	18 U	19 U	--	--
Aroclor 1221	µg/kg						20 U	20 U	40 U	36 U	37 U	37 U	--	--
Aroclor 1232	µg/kg						20 U	20 U	20 U	18 U	18 U	19 U	--	--
Aroclor 1242	µg/kg						20 U	20 U	**24**	**25**	**17 J**	**23**	--	--
Aroclor 1248	µg/kg						**52**	40 U	20 UJ	18 U	18 U	19 U	--	--
Aroclor 1254	µg/kg						**82**	**46**	**79**	**79**	**57 J**	**84**	--	--
Aroclor 1260	µg/kg						**59**	**50**	**54**	**60**	**63**	**65**	--	--
Total PCBs (SMS)	µg/kg	130	38*	3,100			--	--	**157**	**164**	**137**	**172**	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code Location ID Sample ID Sample Date Depth Interval Sample Type		DMMP 1998 SL	DMMP 1998 BT	DMMP 1998 ML	SMS SQS	SMS CSL	LDWRI-SurfSedRd2 LDW-SS68 LDW-SS68-010_B 3/7/2005 0-10 cm N	LDWRI-SurfSedRd1 LDW-SS70_LDWG LDW-SS70-010_B 1/21/2005 0-10 cm N	Boeing SiteChar R1 SD0057 10/15/1997 0-10 cm N	Boeing SiteChar R2 SD0058 10/15/1997 0-10 cm N	Boeing SiteChar R3 SD0054 10/15/1997 0-10 cm N	Boeing SiteChar R4 SD0059 10/15/1997 0-10 cm N	NOAA97 WST350 WST17-01 10/22/1997 0-10 cm N	NOAA97 WST351 WST17-02 10/6/1997 0-10 cm N
Pesticides														
2,4'-DDD	µg/kg						--	2 U	--	--	--	--	--	--
2,4'-DDE	µg/kg						--	2 U	--	--	--	--	--	--
2,4'-DDT	µg/kg						--	2 U	--	--	--	--	--	--
4,4'-DDD	µg/kg						--	2 U	--	--	--	--	--	--
4,4'-DDE	µg/kg						--	2 U	--	--	--	--	--	--
4,4'-DDT	µg/kg						--	2 U	--	--	--	--	--	--
Aldrin	µg/kg						--	.98 U	--	--	--	--	--	--
alpha-BHC	µg/kg						--	.98 U	--	--	--	--	--	--
beta-BHC	µg/kg						--	.98 U	--	--	--	--	--	--
delta-BHC	µg/kg						--	.98 U	--	--	--	--	--	--
gamma-BHC (Lindane)	µg/kg						--	.98 U	--	--	--	--	--	--
alpha-Chlordane	µg/kg						--	.98 U	--	--	--	--	--	--
gamma-Chlordane	µg/kg						--	.98 U	--	--	--	--	--	--
Dieldrin	µg/kg						--	2 U	--	--	--	--	--	--
Endosulfan I	µg/kg						--	.98 U	--	--	--	--	--	--
Endosulfan II	µg/kg						--	2 U	--	--	--	--	--	--
Endosulfan sulfate	µg/kg						--	2 U	--	--	--	--	--	--
Endrin	µg/kg						--	2 U	--	--	--	--	--	--
Endrin aldehyde	µg/kg						--	2 UJ	--	--	--	--	--	--
Endrin ketone	µg/kg						--	2 U	--	--	--	--	--	--
Heptachlor	µg/kg						--	.98 U	--	--	--	--	--	--
Heptachlor epoxide	µg/kg						--	.98 U	--	--	--	--	--	--
Methoxychlor	µg/kg						--	9.8 U	--	--	--	--	--	--
Toxaphene	µg/kg						--	98 U	--	--	--	--	--	--
cis-Nonachlor	µg/kg						--	2 U	--	--	--	--	--	--
trans-Nonachlor	µg/kg						--	2 U	--	--	--	--	--	--
Total chlordane (SMS)	µg/kg						--	--	--	--	--	--	--	--
Total Chlordane (U=1/2; max RL)	µg/kg						--	--	--	--	--	--	--	--
Total DDT (SMS)	µg/kg	6.9	50	69			--	--	--	--	--	--	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							LDWRI-SurfSedRd2	LDWRI-SurfSedRd1	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	NOAA97	NOAA97
Location ID							LDW-SS68	LDW-SS70_LDWG	R1	R2	R3	R4	WST350	WST351
Sample ID							LDW-SS68-010_B	LDW-SS70-010_B	SD0057	SD0058	SD0054	SD0059	WST17-01	WST17-02
Sample Date							3/7/2005	1/21/2005	10/15/1997	10/15/1997	10/15/1997	10/15/1997	10/22/1997	10/6/1997
Depth Interval		DMMP	DMMP	DMMP	SMS	SMS	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm
Sample Type		1998 SL	1998 BT	1998 ML	SQS	CSL	N	N	N	N	N	N	N	N
SVOCs														
1,2,3-Trichlorobenzene	µg/kg						--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	µg/kg	31		64			6.5 U	180 U	20 U	19 U	38 UJ	19 U	--	--
1,2,4-Trimethylbenzene	µg/kg						--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	µg/kg	35	37	110			6.5 U	180 U	20 U	19 U	38 U	19 U	--	--
1,3,5-Trimethylbenzene	µg/kg						--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	µg/kg	170					98 U	180 U	20 UJ	19 U	38 UJ	19 U	--	--
1,4-Dichlorobenzene	µg/kg	110	120	120			6.5 U	180 U	20 U	19 U	38 U	19 U	--	--
2,2'-oxybis (1-chloropropane)	µg/kg						--	--	20 U	19 U	38 U	19 U	--	--
2,4,5-Trichlorophenol	µg/kg						490 U	890 U	100 U	95 U	190 U	97 U	--	--
2,4,6-Trichlorophenol	µg/kg						490 U	890 U	100 U	95 U	190 U	97 U	--	--
2,4-Dichlorophenol	µg/kg						490 U	890 U	60 U	57 U	120 U	58 U	--	--
2,4-Dimethylphenol	µg/kg	29		210	29	29	6.5 U	180 U	20 U	19 U	38 U	19 U	--	--
2,4-Dinitrophenol	µg/kg						980 U	1800 U	200 U	190 UJ	380 U	190 U	--	--
2,4-Dinitrotoluene	µg/kg						490 U	890 U	100 U	95 U	190 U	97 U	--	--
2,6-Dinitrotoluene	µg/kg						490 U	890 U	100 U	95 U	190 U	97 U	--	--
2-Chloronaphthalene	µg/kg						98 U	180 U	20 U	19 U	38 U	19 U	--	--
2-Chlorophenol	µg/kg						98 U	180 U	20 U	19 U	38 U	19 U	--	--
2-Methylnaphthalene	µg/kg	670		1900			98 U	180 U	20 U	**20**	**110**	**32**	--	--
2-Methylphenol	µg/kg	63		77	63	63	6.5 U	180 U	20 U	19 U	38 U	19 U	--	--
2-Nitroaniline	µg/kg						490 U	890 U	100 U	95 U	190 U	97 U	--	--
2-Nitrophenol	µg/kg						490 U	890 U	100 U	95 U	190 U	97 U	--	--
3&4-Methylphenol	µg/kg						--	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	µg/kg						490 U	890 U	100 U	95 U	190 U	97 U	--	--
3-Nitroaniline	µg/kg						490 U	890 U	120 U	110 U	230 U	120 U	--	--
4,6-Dinitro-2-methylphenol	µg/kg						980 U	1800 U	200 U	190 UJ	380 U	190 UJ	--	--
4-Bromophenyl-phenylether	µg/kg						98 U	180 U	20 U	19 U	38 U	19 U	--	--
4-Chloro-3-methylphenol	µg/kg						490 U	890 U	40 U	38 U	77 UJ	39 U	--	--
4-Chloroaniline	µg/kg						490 U	890 U	60 U	57 U	120 U	58 U	--	--
4-Chlorophenyl-phenylether	µg/kg						98 U	180 U	20 U	19 U	38 U	19 U	--	--
4-Methylphenol	µg/kg	670		3600	670	670	98 U	180 U	20 U	**86**	**65**	**27**	--	--
4-Nitroaniline	µg/kg						490 U	890 U	100 U	95 UJ	190 U	97 UJ	--	--
4-Nitrophenol	µg/kg						490 U	890 U	100 U	95 U	190 U	97 U	--	--
Acenaphthene	µg/kg	500		2000			98 U	180 U	**25**	**120**	**180**	**70**	--	--
Acenaphthylene	µg/kg	560		1300			98 U	180 U	20 U	19 U	38 U	19 U	--	--
Aniline	µg/kg						98 U	180 U	--	--	--	--	--	--
Anthracene	µg/kg	960		13000			**72 J**	180 U	**180**	**140**	**360**	**170**	--	--
Benzo(a)anthracene	µg/kg	1300		5100			**210**	**300**	**200**	**280**	**660**	**310**	--	--
Benzo(a)pyrene	µg/kg	1600	3600	3600			**210**	**240**	**180**	**220**	**580**	**270**	--	--
Benzo(b)fluoranthene	µg/kg						**380**	**410**	**220**	**310**	**630**	**310**	--	--
Benzo(g,h,i)perylene	µg/kg	670		3200			**54 J**	180 U	**120**	**150**	**460**	**180**	--	--
Benzo(k)fluoranthene	µg/kg						**240**	**470**	**230**	**250**	**580**	**290**	--	--
Benzoic acid	µg/kg	650		760	650	650	65 U	1800 U	200 U	190 U	380 U	190 U	--	--
Benzyl alcohol	µg/kg	57		870	57	73	33 U	180 U	20 U	19 U	38 U	19 UJ	--	--
bis(2-Chloroethoxy)methane	µg/kg						98 U	180 U	20 U	19 U	38 U	19 U	--	--
bis(2-Chloroethyl)ether	µg/kg						98 U	180 U	40 U	38 U	77 U	39 U	--	--
bis(2-Chloroisopropyl)ether	µg/kg						98 U	180 U	20 U	19 U	38 U	19 U	--	--
bis(2-Ethylhexyl)phthalate	µg/kg	8300	13870				**310**	**1700**	**430**	**440**	**3500**	**1200**	--	--
Butylbenzylphthalate	µg/kg	970					**12**	180 U	**30**	**42**	**320**	**89 J**	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							LDWRI-SurfSedRd2	LDWRI-SurfSedRd1	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	NOAA97	NOAA97
Location ID							LDW-SS68	LDW-SS70_LDWG	R1	R2	R3	R4	WST350	WST351
Sample ID							LDW-SS68-010_B	LDW-SS70-010_B	SD0057	SD0058	SD0054	SD0059	WST17-01	WST17-02
Sample Date							3/7/2005	1/21/2005	10/15/1997	10/15/1997	10/15/1997	10/15/1997	10/22/1997	10/6/1997
Depth Interval		DMMP	DMMP	DMMP	SMS	SMS	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm
Sample Type		1998 SL	1998 BT	1998 ML	SQS	CSL	N	N	N	N	N	N	N	N
Carbazole	µg/kg						98 U	180 U	**97**	**71**	**240**	**61 J**	--	--
Chrysene	µg/kg	1400		21000			**340**	**550**	**300**	**390**	**970**	**460**	--	--
Dibenzo(a,h)anthracene	µg/kg	230		1900			98 U	180 U	**43**	**50**	**170**	**73**	--	--
Dibenzofuran	µg/kg	540		1700			98 U	180 U	**30**	**100**	**160**	**65**	--	--
Diethylphthalate	µg/kg	1200					6.5 U	180 U	20 U	19 U	38 U	19 U	--	--
Dimethylphthalate	µg/kg	1400	1400				6.5 U	180 U	20 U	19 U	**160**	**48**	--	--
Di-n-butylphthalate	µg/kg	5100	10220				98 U	180 U	20 U	19 U	**76**	**21**	--	--
Di-n-octylphthalate	µg/kg	6200					98 U	**1000**	20 U	19 U	38 U	**40 J**	--	--
Fluoranthene	µg/kg	1700	4600	30000			**470**	**1100**	**550**	**910**	**1400**	**930**	--	--
Fluorene	µg/kg	540		3600			98 U	180 U	**37**	**160**	**220**	**74**	--	--
Hexachlorobenzene	µg/kg	22	168	230			**95 J**	.98 U	1 U	**0.8 J**	**2.8**	**1.4 J**	--	--
Hexachlorobutadiene	µg/kg	29	212	270			6.5 U	.98 U	20 U	19 U	38 U	19 U	--	--
Hexachlorocyclopentadiene	µg/kg						490 U	890 U	100 U	95 UJ	190 U	97 UJ	--	--
Hexachloroethane	µg/kg	1400	10220	14000			98 U	180 U	20 U	19 U	38 U	19 U	--	--
Indeno(1,2,3-cd)pyrene	µg/kg	600		4400			**14**	180 U	**120**	**150**	400 UJ	**170**	--	--
Indeno(1,2,3-cd)pyrene	µg/kg	600		4400			--	--	--	--	**400**	--	--	--
Isophorone	µg/kg						98 U	180 U	20 U	19 U	38 U	19 U	--	--
Naphthalene	µg/kg	2100		2400			98 U	180 U	20 U	19 U	**120**	**46**	--	--
Nitrobenzene	µg/kg						98 U	180 U	20 U	19 U	38 U	19 U	--	--
n-Nitroso-di-methylamine	µg/kg						33 U	890 U	--	--	--	--	--	--
n-Nitroso-di-n-propylamine	µg/kg						33 U	890 U	40 U	38 U	77 U	39 U	--	--
n-Nitroso-di-phenylamine	µg/kg	28	130	130			6.5 U	180 U	20 U	19 U	38 U	19 U	--	--
Pentachlorophenol	µg/kg	400	504	690	360	690	33 U	890 U	100 U	95 U	190 U	97 U	--	--
Phenanthrene	µg/kg	1500		21000			**140**	**200**	**170**	**710**	**1100**	**360**	--	--
Phenol	µg/kg	420	876	1200	420	1200	98 U	180 U	20 U	**46**	**68 J**	**53**	--	--
Pyrene	µg/kg	2600		16000			**360**	**860**	**580**	**910**	**2400 J**	**800**	--	--
Total benzofluoranthenes (SMS)	µg/kg	3200		9900			--	--	**450**	**560**	**1210**	**600**	--	--
Total LPAH (SMS)	µg/kg	5200		29000			--	--	**412**	**1130**	**1980**	**720**	--	--
Total HPAH (SMS)	µg/kg	12000		69000			--	--	**2543**	**3620**	**8250**	**3793**	--	--
Volatiles														
1,1,1,2-Tetrachloroethane	µg/kg						--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	µg/kg						--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	µg/kg						--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	µg/kg						--	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	µg/kg						--	--	--	--	--	--	--	--
1,1-Dichloroacetone	µg/kg						--	--	--	--	--	--	--	--
1,1-Dichloroethane	µg/kg						--	--	--	--	--	--	--	--
1,1-Dichloroethene	µg/kg						--	--	--	--	--	--	--	--
1,1-Dichloropropene	µg/kg						--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	µg/kg						--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	µg/kg						--	--	--	--	--	--	--	--
1,2-Dibromoethane	µg/kg						--	--	--	--	--	--	--	--
1,2-Dichloroethane	µg/kg						--	--	--	--	--	--	--	--
1,2-Dichloropropane	µg/kg						--	--	--	--	--	--	--	--
1,3-Dichloropropane	µg/kg						--	--	--	--	--	--	--	--
1-Chlorobutane	µg/kg						--	--	--	--	--	--	--	--
2,2-Dichloropropane	µg/kg						--	--	--	--	--	--	--	--
2-Butanone (MEK)	µg/kg						--	--	--	--	--	--	--	--
2-Chlorotoluene	µg/kg						--	--	--	--	--	--	--	--
2-Hexanone	µg/kg						--	--	--	--	--	--	--	--
2-Nitropropane	µg/kg						--	--	--	--	--	--	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							LDWRI-SurfSedRd2	LDWRI-SurfSedRd1	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	NOAA97	NOAA97
Location ID							**LDW-SS68**	**LDW-SS70_LDWG**	**R1**	**R2**	**R3**	**R4**	**WST350**	**WST351**
Sample ID							**LDW-SS68-010_B**	**LDW-SS70-010_B**	**SD0057**	**SD0058**	**SD0054**	**SD0059**	**WST17-01**	**WST17-02**
Sample Date							**3/7/2005**	**1/21/2005**	**10/15/1997**	**10/15/1997**	**10/15/1997**	**10/15/1997**	**10/22/1997**	**10/6/1997**
Depth Interval		**DMMP**	**DMMP**	**DMMP**	**SMS**	**SMS**	**0-10 cm**	**0-10 cm**	**0-10 cm**	**0-10 cm**	**0-10 cm**	**0-10 cm**	**0-10 cm**	**0-10 cm**
Sample Type		**1998 SL**	**1998 BT**	**1998 ML**	**SQS**	**CSL**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
4-Chlorotoluene	µg/kg						--	--	--	--	--	--	--	--
4-Isopropyltoluene	µg/kg						--	--	--	--	--	--	--	--
4-Methyl-2-pentanone (MIBK)	µg/kg						--	--	--	--	--	--	--	--
Acetone	µg/kg						--	--	--	--	--	--	--	--
Allyl chloride	µg/kg						--	--	--	--	--	--	--	--
Benzene	µg/kg						--	--	--	--	--	--	--	--
Bromobenzene	µg/kg						--	--	--	--	--	--	--	--
Bromochloromethane	µg/kg						--	--	--	--	--	--	--	--
Bromodichloromethane	µg/kg						--	--	--	--	--	--	--	--
Bromoform	µg/kg						--	--	--	--	--	--	--	--
Bromomethane	µg/kg						--	--	--	--	--	--	--	--
Carbon disulfide	µg/kg						--	--	--	--	--	--	--	--
Carbon tetrachloride	µg/kg						--	--	--	--	--	--	--	--
Chlorobenzene	µg/kg						--	--	--	--	--	--	--	--
Chloroethane	µg/kg						--	--	--	--	--	--	--	--
Chloroform	µg/kg						--	--	--	--	--	--	--	--
Chloromethane	µg/kg						--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	µg/kg						--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	µg/kg						--	--	--	--	--	--	--	--
Dibromochloromethane	µg/kg						--	--	--	--	--	--	--	--
Dibromomethane	µg/kg						--	--	--	--	--	--	--	--
Dichloromethane	µg/kg						--	--	--	--	--	--	--	--
Diethylether	µg/kg						--	--	--	--	--	--	--	--
Ethyl methacrylate	µg/kg						--	--	--	--	--	--	--	--
Ethylbenzene	µg/kg	10	27	50			--	--	--	--	--	--	--	--
Iodomethane	µg/kg						--	--	--	--	--	--	--	--
Isopropylbenzene	µg/kg						--	--	--	--	--	--	--	--
Methacrylonitrile	µg/kg						--	--	--	--	--	--	--	--
Methyl acrylate	µg/kg						--	--	--	--	--	--	--	--
Methyl methacrylate	µg/kg						--	--	--	--	--	--	--	--
n-Butylbenzene	µg/kg						--	--	--	--	--	--	--	--
n-Propylbenzene	µg/kg						--	--	--	--	--	--	--	--
Pentachloroethane	µg/kg						--	--	--	--	--	--	--	--
sec-Butylbenzene	µg/kg						--	--	--	--	--	--	--	--
Styrene	µg/kg						--	--	--	--	--	--	--	--
tert-Butylbenzene	µg/kg						--	--	--	--	--	--	--	--
Methyltert-butylether	µg/kg						--	--	--	--	--	--	--	--
Tetrachloroethene	µg/kg	57	102	210			--	--	--	--	--	--	--	--
Toluene	µg/kg						--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	µg/kg						--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	µg/kg						--	--	--	--	--	--	--	--
trans-1,4-Dichloro-2-butene	µg/kg						--	--	--	--	--	--	--	--
Trichloroethene	µg/kg	160	1168	1600			--	--	--	--	--	--	--	--
Trichlorofluoromethane	µg/kg						--	--	--	--	--	--	--	--
Vinyl chloride	µg/kg						--	--	--	--	--	--	--	--
m,p-Xylenes	µg/kg						--	--	--	--	--	--	--	--
o-Xylene	µg/kg						--	--	--	--	--	--	--	--
Total xylene (SMS)	µg/kg	40		160			--	--	--	--	--	--	--	--

Table A-1
Historical Sediment Chemistry Data in the Vicinity of Terminal 115

Task Code							LDWRI-SurfSedRd2	LDWRI-SurfSedRd1	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	Boeing SiteChar	NOAA97	NOAA97
Location ID							LDW-SS68	LDW-SS70_LDWG	R1	R2	R3	R4	WST350	WST351
Sample ID							LDW-SS68-010_B	LDW-SS70-010_B	SD0057	SD0058	SD0054	SD0059	WST17-01	WST17-02
Sample Date							3/7/2005	1/21/2005	10/15/1997	10/15/1997	10/15/1997	10/15/1997	10/22/1997	10/6/1997
Depth Interval		DMMP	DMMP	DMMP	SMS	SMS	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm
Sample Type		1998 SL	1998 BT	1998 ML	SQS	CSL	N	N	N	N	N	N	N	N
PCBs														
Total PCBs (SMS)	mg/kg-OC				12	65	--	--	**8.26**	**8.63**	**3.7**	**4.52**	**4.30666**	**9.67452**
SVOCs														
1,2,4-Trichlorobenzene	mg/kg-OC				0.81	1.8	--	--	1.05 U	1 U	1.02 U	0.5 U	--	--
1,2-Dichlorobenzene	mg/kg-OC				2.3	2.3	--	--	1.05 U	1 U	1.02 U	0.5 U	--	--
1,4-Dichlorobenzene	mg/kg-OC				3.1	9	--	--	1.05 U	1 U	1.02 U	0.5 U	--	--
2-Methylnaphthalene	mg/kg-OC				38	64	--	--	1.05 U	**1.05**	**2.97**	**0.84**	--	--
Acenaphthene	mg/kg-OC				16	57	--	--	**1.31**	**6.31**	**4.86**	**1.84**	--	--
Acenaphthylene	mg/kg-OC				66	66	--	--	1.05 U	1 U	1.02 U	0.5 U	--	--
Anthracene	mg/kg-OC				220	1200	--	--	**9.47**	**7.36**	**9.72**	**4.47**	--	--
Benzo(a)anthracene	mg/kg-OC				110	270	--	--	**10.52**	**14.73**	**17.83**	**8.15**	--	--
Benzo(a)pyrene	mg/kg-OC				99	210	--	--	**9.47**	**11.57**	**15.67**	**7.1**	--	--
Benzo(b)fluoranthene	mg/kg-OC						--	--	**11.579**	--	**17.027**	**8.158**	--	--
Benzo(g,h,i)perylene	mg/kg-OC				31	78	--	--	**6.31**	**7.89**	**12.43**	**4.73**	--	--
Benzo(k)fluoranthene	mg/kg-OC						--	--	**12.105**	**13.158**	**15.676**	**7.632**	--	--
bis(2-Ethylhexyl)phthalate	mg/kg-OC				47	78	--	--	**22.63**	**23.15**	**94.59**	**31.57**	--	--
Butylbenzylphthalate	mg/kg-OC				4.9	64	--	--	**1.57**	**2.21**	**8.64**	**2.34**	--	--
Chrysene	mg/kg-OC				110	460	--	--	**15.78**	**20.52**	**26.21**	**12.1**	--	--
Dibenzo(a,h)anthracene	mg/kg-OC				12	33	--	--	**2.26**	**2.63**	**4.59**	**1.92**	--	--
Dibenzofuran	mg/kg-OC				15	58	--	--	**1.57**	**5.26**	**4.32**	**1.71**	--	--
Diethylphthalate	mg/kg-OC				61	110	--	--	1.05 U	1 U	1.02 U	0.5 U	--	--
Dimethylphthalate	mg/kg-OC				53	53	--	--	1.05 U	1 U	**4.32**	**1.26**	--	--
Di-n-butylphthalate	mg/kg-OC				220	1700	--	--	1.05 U	1 U	**2.05**	**0.55**	--	--
Di-n-octylphthalate	mg/kg-OC				58	4500	--	--	1.05 U	1 U	1.02 U	**1.05**	--	--
Fluoranthene	mg/kg-OC				160	1200	--	--	**28.94**	**47.89**	**37.83**	**24.47**	--	--
Fluorene	mg/kg-OC				23	79	--	--	**1.94**	**8.42**	**5.94**	**1.94**	--	--
Hexachlorobenzene	mg/kg-OC				0.38	2.3	--	--	0.05 U	**0.04 J**	**0.07**	**0.03**	--	--
Hexachlorobutadiene	mg/kg-OC				3.9	6.2	--	--	1.05 U	1 U	1.02 U	0.5 U	--	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC				34	88	--	--	**6.31**	**7.89**	**10.81**	**4.47**	--	--
Naphthalene	mg/kg-OC				99	170	--	--	1.05 U	1 U	**3.24**	**1.21**	--	--
n-Nitroso-di-phenylamine	mg/kg-OC				11	11	--	--	1.05 U	1 U	1.02 U	0.5 U	--	--
Phenanthrene	mg/kg-OC				100	480	--	--	**8.94**	**37.36**	**29.72**	**9.47**	--	--
Pyrene	mg/kg-OC				1000	1400	--	--	**30.52**	**47.89**	**64.86**	**21.05**	--	--
Total benzofluoranthenes (SMS)	mg/kg-OC				230	450	--	--	**23.68**	**29.47**	**32.7**	**15.78**	--	--
Total LPAH (SMS)	mg/kg-OC				370	780	--	--	**21.68**	**59.47**	**53.51**	**18.94**	--	--
Total HPAH (SMS)	mg/kg-OC				960	5300	--	--	**133.84**	**190.52**	**222.97**	**99.81**	--	--

µg/kg = micrograms per kilogram
BT = Bioaccumulation Trigger
CSL = Cleanup Screening Level
DMMP = Dredged Material Management Program
J = Indicates an estimated value.
mg/kg-OC = miligrams per kilogram, Organic Carbon Normalized
ML = Maximum Level
ng/kg = nonograms per kilogram
PCB = Polychlorinated biphenyl
SL = Screening Level
SMS = Sediment Management Standards
SQS = Sediment Quality Standards (SMS)
U = The compound was analyzed for but not detected at or above the method detection limit.
UJ = Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
* = Value normalized to total organic carbon, mg/kg (TOC normalized)
(shaded) = Value exceeds DMMP and/or SMS screening criteria

APPENDIX B
FIELD COLLECTION FORMS

Sediment Core Collection Log

Project: ______________________ **Station ID:** ______________________

Project No: ______________________ **Attempt No:** ______________________

Field Staff (in): ______________________ **Date (mm/dd/yy):** ______________________

Contractor: ______________________ **Logged By:** ______________________

Vertical Datum: ______________________ **Horizontal Datum:** ______________________

Time (hhmm): ___ __

Type of Core: **Piston** **Shelby** **Vibro** **Other**

Diameter of Core (inches):

Core Quality: **Good** **Fair** **Poor** **Disturbed**

Field Collection Coordinates:

Lat/Northing: ______________________ Long/Easting: ______________________

A. Water Depth (ft)

DTM Depth Sounder: ____________

DTM Lead Line: ____________

B. Tide Measurements

Time (hhmm): ____________

Height (ft): ____________

C. Mudline Elevation

(-A+B=C)

Core Collection Recovery Details:

Core Accepted: Yes / No

Core Tube Length: Units: (in ft m cm)

Drive Penetration (A):

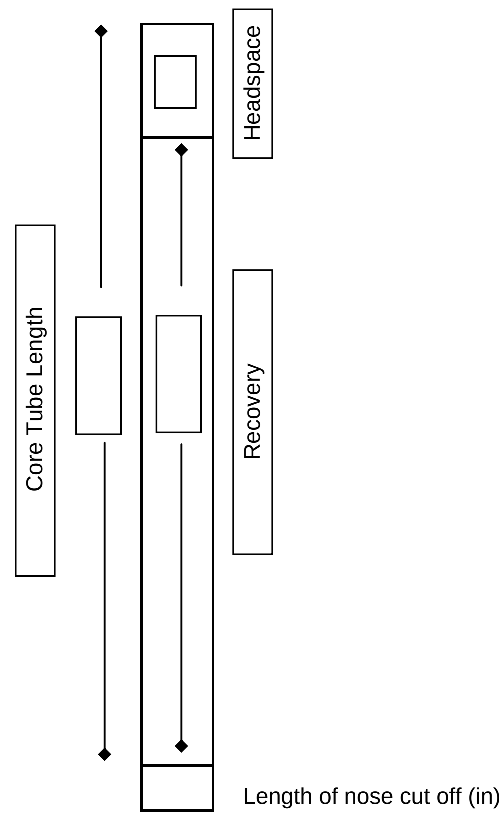
Headspace Measurement:

Recovery Measurement (B):

Recovery Percentage (B/A): %

Total Length of Core To Process:

Refusal Encountered? Yes No



Drive Notes: freefall, easy penetration, moderate penetration, hard penetration, refusal

Core Field Observations and Description: Sediment type, moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Rinsate Blank Samples Collected **Yes** **No**

Visual Classification of Subsurface Core

Project:	Date
Project No:	Core Pushed By
Station ID:	Core Logged By
Core No.	Type of Core ☐ Shelby ☐ Piston Core ☐ Other
Water Depth/Elevation of Core	Diameter of Core (inches)
Cored Length (feet; from log)	Core Quality ☐ Good ☐ Fair ☐ Poor ☐ Disturbed
Core Recovery (feet)	Average % Recovery =

Sample Interval	Sample Analytes	Theoretical / Depth in ( ) / Actual Core Sections	Classification and Remarks (Color, Consistency, Moisture, Grain Size, Sheen, Odor)

Core logged by:

APPENDIX C
HEALTH AND SAFETY PLAN

APPENDIX C
HEALTH AND SAFETY PLAN

QUALITY ASSURANCE PROJECT PLAN
PORT OF SEATTLE TERMINAL 115
POST-DREDGE SEDIMENT CHARACTERIZATION

Prepared for

The Port of Seattle

P.O. Box 1209

2711 Alaskan Way

Seattle, Washington 98111

Prepared by

Anchor QEA, LLC

1423 Third Avenue, Suite 300

Seattle, Washington 98101

April 2009

TABLE OF CONTENTS

List of Tables

List of Figures

List of Attachments

LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COC	chain-of-custody
CSO	combined sewer overflow
cy	cubic yards
FC	Field Coordinator
HSM	Health and Safety Manager
HSP	Health and Safety Plan
MTCA	Model Toxics Control Act
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbons
PFD	personal flotation device
PPE	personnel protective equipment
QAPP	Quality Assurance Project Plan
SC Manager	Sediment Characterization Manager
T-115	Terminal 115
VOC	volatile organic compound

1 INTRODUCTION

This site-specific health and safety plan (HSP) covers elements as specified in 29 CFR 1910.120.

This HSP addresses activities associated with collection of subsurface sediment core samples and handling marine sediments for the characterization of subsurface sediment below the dredge prism of the area proposed for dredging at Terminal 115 (T-115) along the western bank of the Duwamish Waterway, in Seattle, Washington. During site work the Field Coordinator (FC), will implement this HSP. The Sediment Characterization Manager (SC Manager) and Health and Safety Manager (HSM) will support the FC.

All field personnel involved in field work on this project are required to comply with this HSP. The contents of this HSP reflect the types of activities to be performed, the physical characteristics of the sampling areas, and preliminary chemical data from previous investigations. The HSP may be revised based on new information and/or changed conditions during site activities. Revisions will be documented in the project records.

Section 12 of this document is an emergency response plan. It lists emergency telephone contacts and emergency procedures, and includes a map and detailed directions to the nearest emergency medical facility.

2 SITE DESCRIPTION AND PROJECT SCOPE

2.1 Site Description

The Port of Seattle (Port) proposes to conduct maintenance dredging to re-establish adequate depth to accommodate barge loading and unloading and to support new construction at the Berth 1 facilities at T-115, which includes the removal of existing wooden Pier B and fabrication of a new loading ramp (Ramp 1). T-115 is located at 6700 West Marginal Way Southwest in the City of Seattle, along the western shore of the Duwamish River. The site is located in the Joint Model Toxics Control Act (MTCA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Lower Duwamish Waterway (LDW) Superfund Site. The LDW Group (LDWG), which includes the Port, City of Seattle, King County, and the Boeing Company, have agreed to conduct a remedial investigation/ feasibility study (RI/FS) for the entire LDW, which includes T-115.

T-115 includes approximately 70 acres of upland yard space, a 1,200-linear-foot main pier, and a 400-linear-foot finger pier. T-115 supports marine uses such as receipt and shipment of bulk cargo using deep-draft vessels; barge cargo operation; repair and maintenance of cargo shipping containers; cargo warehouse activities; warehouse and storage of metal and wood construction materials; and vessel outfitting, maintenance, and repair. Several stormwater outfalls are present near the site (shown in Figure 2 of the Quality Assurance Project Plan (QAPP) to which this document is attached). SWD1 on Figure 2 of the QAPP represents a King County combined sewer overflow (CSO) outfall. SWD2 and SWD3 are approximately 30-inch stormwater outfalls that primarily drain the Northlands and Northwest Container Services properties.

The Port proposes to dredge approximately 3,750 cubic yards (cy) of material from the pier face of Berth 1 and adjacent to a new ramp. The area proposed for dredging, including navigational access, is approximately 180 feet wide and 430 feet long. As a requirement of obtaining the dredging permit, the Port is required to collect four core samples from within the dredge prism following dredge activities in the proposed dredge area. Sampling will be accomplished by collecting and processing four subsurface sediment cores. Collected sediments will be analyzed for polycyclic aromatic hydrocarbons (PAH) and dioxin/furans.

2.2 Scope and Duration of Work

The work involves collecting and handling marine subsurface sediment cores and subsequent processing of sediment core samples. Associated tasks are as follows:

- Collecting subsurface sediment core samples using a vibrocorer within the dredge prism following dredge activities in the project area
- Sediment core sample processing, handling, packaging, and shipping
- Decontamination of equipment

Sediment cores will be collected using vibrocoring equipment deployed from a vessel. Cores will be processed in the ARI laboratory. Core tubes will be split horizontially using an electric saw to access sediments. Core samples will be processed in the laboratory using stainless steel bowls and spoons. The estimated duration for sampling and processing is 2 days.

3 HEALTH AND SAFETY PERSONNEL

Key health and safety personnel and their responsibilities are described below. These individuals are responsible for the implementation of this HSP.

SC Manager: The SC Manager has overall responsibility for the successful outcome of the project. The SC Manager will ensure that adequate resources and budget are provided for the health and safety staff to carry out their responsibilities during field work. The SC Manager, in consultation with the HSM, makes final decisions concerning implementation of the HSP.

Field Coordinator: The FC will support field sampling activities and coordinate between the technical and health and safety components of the field program. The FC has the responsibility to ensure that work is performed according to the FSP. The FC also has the authority to stop work if conditions arise that pose an unacceptable health and safety risk to field crew. The FC will also be responsible for ensuring the implementation of this HSP aboard the sampling vessel and at the core processing facility. The FC is responsible for initiating changes to the HSP, which must be approved by the HSM. The FC or designee shall be present during field sampling and handling operations.

Project Health and Safety Manager: The HSM has overall responsibility for preparation, approval, and revisions of this HSP. The HSM will not necessarily be present during field work, but will be readily available, if required, for consultation regarding health and safety issues during field work.

Field Crew: All field crew have the responsibility to report any potentially unsafe or hazardous conditions to the vessel Captain or FC immediately.

4 HAZARD EVALUATION AND CONTROL MEASURES

This section covers potential physical and chemical hazards that may be associated with the proposed project activities and presents control measures for addressing these hazards. The activity hazard analysis, Section 4.3, lists the potential hazards associated with each site activity and the recommended site control to be used to minimize each potential hazard. Confined space entry will not be necessary for this project, so hazards associated with this activity are not discussed in this HSP.

4.1 Physical Hazards

4.1.1 Slips, Trips, and Falls

As with all field work sites, caution should be exercised to prevent slips on slick surfaces. In particular, sampling from a vessel requires careful attention to minimize the risk of slipping, falling down, or falling in the water. The same care should be used in rainy conditions. Wearing boots with good tread made of material that does not become overly slippery when wet can minimize slips.

Trips are always a hazard on the uneven surfaces of a vessel. The vessel deck contains sampling equipment that present potential slip hazards and potential tripping hazards. For this project, the potential for falling is associated primarily with tripping on equipment on the vessel and slipping into the water.

4.1.2 Sampling Equipment

Sampling equipment includes a vibrocorer deployed from a vessel. All field personnel will discuss prior to sample collection the hazards of working on the vessel. A safe operation of a sediment core sampler discussion will occur prior to sampling from the vessel.

4.1.3 Falling in the Water

All sampling activities will be performed on a vessel and there is a chance of falling or slipping into the water. A personal flotation device (PFD) for each crew person will be worn at all times while working on the vessel.

4.1.4 Manual Lifting

Equipment and samples must be lifted into the truck after sample collection. Back strain can result if lifting is done improperly. During any manual handling tasks, personnel should lift with the load supported by their legs and not their backs. For heavy loads, an adequate number of people will be used, or if possible, a mechanical lifting/handling device.

4.1.5 Heat Stress

The potential for heat stress may occur if impermeable personal protective equipment (PPE) is worn or if strenuous work is performed under hot conditions with inadequate water. When the core body temperature rises above 100.4°F, the body cannot sweat to cool down, and heat stress can occur. Heat stress may be identified by the following symptoms: dizziness, profuse sweating, skin color change, vision problems, confusion, nausea, fatigue, fainting, and clammy skin. Personnel exhibiting such symptoms will be removed to a cool shady area, given water, and allowed to rest. Fresh drinking water will be provided at the site. All field team members will monitor their own condition and that of their co-workers to detect signs of heat stress.

4.1.6 Hypothermia

Hypothermia is abnormal lowering of the core body temperature caused by exposure to a cold environment. Wind chill, as well as wetness or water immersion, can play a significant role. Typical signs of hypothermia include fatigue, weakness, and lack of coordination, apathy, and drowsiness. Confusion is a key symptom of hypothermia. Shivering and pallor are usually absent, and the face may appear puffy and pink.

Body temperatures below 90°F require immediate treatment to restore the temperature to normal. Current medical practice recommends slow warming of the individual followed by professional medical care. Moving the person to a sheltered area and wrapping them in blanket can accomplish this portion of the task. If possible, the person should be placed in a warm room. In emergency situations where body temperature falls below 90°F and shelter is not available, a sleeping bag, blankets, and body heat from another individual can be used to help raise body temperature.

4.1.7 Weather

In general, field team members will be equipped for the normal range of weather conditions. The FC will be aware of current weather conditions the potential for those conditions to pose a hazard to the field crew. Some conditions that might force work stoppage are electrical storms or high winds.

4.2 Chemical Hazards

For investigative purposes, chemicals of concern (COCs) are metals, PAHs, and dioxin/furans. In addition, there is potential for exposure to hydrogen sulfide gas from sediments used for sample preservation in the field. These COCs may be introduced to the body through three exposure routes.

4.2.1 Exposure Routes

Potential routes of chemical exposure include inhalation, dermal contact, and ingestion. Providing personnel with appropriate training, using safe work practices, and wearing the appropriate PPE will minimize exposure. Further discussion of PPE requirements is presented in Section 7.

4.2.1.1 Inhalation

Because wet sediments do not generate dust particles, and surface water spray is expected to be minimal, inhalation of particulates is not expected to be an important route of exposure. Potential exposure via inhalation of hydrogen sulfide gas emitted from sediments is possible. However, sediment handling activities will occur outdoors or in a ventilated space, reducing the risk of inhalation exposure.

4.2.1.2 Skin Contact

Dermal exposure to potentially contaminated sediments, surface water, or equipment will be controlled by the use of PPE and by adherence to detailed sampling and decontamination procedures.

4.2.1.3 Ingestion

Ingestion is not considered a major route of exposure for this project. Accidental ingestion of sediment is possible, but proper sediment handling should prevent sediment splattering, which will ensure that sediment droplets do not become airborne. Accidental ingestion of site water is possible. However, careful handling of equipment and containers should prevent the occurrence of water splashing or spilling during sample collection and handling activities.

4.2.2 Description of Chemical Hazards

4.2.2.1 Polycyclic Aromatic Hydrocarbons

Because PAHs are relatively non-volatile, respiratory hazards are expected to occur only under dusty and windy conditions. However, sediment contact with the skin and eyes can cause irritation and burning.

4.3 Activity Hazard Analysis

The activity hazard analysis summarizes the field activities to be performed during sample collection and processing, outlines the hazards associated with each activity, and presents controls that can reduce or eliminate the risk of the hazard occurring.

- Table 1 presents the activity hazard analysis for the following activities:
- Collection of sediment core
- Core processing
- Sediment sample handling, packaging, processing, and shipping
- Working on uneven surfaces
- Equipment decontamination

Table 1
Activity Hazard Analysis

Activity	Hazard	Control
Collecting sediment cores from the vessel	Falling overboard	Avoid working near the edge of the vessel, if possible. Stay inside of perimeter barriers on the deck. Wear PFD during sample collection.
	Cuts, amputations	Use care at all times while using coring equipment and never carry core barrels from the end.
	Back or muscle strain	Use appropriate lifting technique when handling pieces of potentially heavy equipment. Enlist help if necessary.
	Skin or eye contact with potentially contaminated sediments or liquids	Wear modified Level D PPE, including eye protection.
	Electric shock	Use ground fault-indicator extension cords, and seal plug connections with electrical tape.
	Slipping/tripping on slick or uneven deck	Wear steel-toed boots with gripping tread. Be aware of obstacles and wet patches on deck and select a path to avoid them.
	Injury from equipment falling or swinging	Wear a hard hat and steel-toed boots at all times; be in the appropriate position on deck when equipment is in operation.
	Fire	Avoid fueling operations near hot engines. Mop up any spilled flammable liquids and dispose of absorbent. No smoking or flame sources on the vessel. Evacuate the vessel according to procedures outlined in the training session given by the captain.
	Injury from winch line snapping	Ensure that winch line is not frayed.
Core processing in the laboratory	Injuries from electrical saw	Take special care when working with the electric saw when cutting cores. Always wear eye and ear protection.
	Electric shock	Use ground fault-indicator extension cords, and seal plug connections with electrical tape.
	Back or muscle strain	Use appropriate lifting technique when handling sediment core tubes or any other piece of potentially heavy equipment. Enlist help if necessary. Never carry a core tube by the ends.
	Skin or eye contact with potentially contaminated	Wear modified Level D PPE, including eye protection.

Activity	Hazard	Control
	sediments or liquids	
	Slipping/tripping on slick or uneven surfaces	Wear steel-toed boots with gripping tread. Be aware of obstacles and slippery surfaces on the floor.
Handling, packaging, and shipping samples	Skin or eye contact with potentially contaminated solids, liquids, or sediments	Wear Level D or modified Level D PPE, including eye protection.
	Back strain	Use appropriate lifting technique when handling filled sample coolers, or seek help.
Decontaminating equipment	Inhalation of or eye contact with airborne mists or vapors	Wear safety glasses. Perform decontamination activities outdoors or in a well-ventilated area. Stay upwind when spray-rinsing equipment.
	Skin contact with potentially contaminated materials	Wear modified Level D PPE.
	Ingestion of contaminated materials	Decontaminate clothing and skin prior to eating, drinking, smoking, or other hand-to-mouth activities. Follow the decontamination procedure for personal decontamination.

5 WORK ZONES AND ACCESS CONTROL

The FC will delineate the boundaries of the work zones at the site. The purpose of the zones is to limit the migration of sample material out of the zones and to restrict access to active work areas by defining work zone boundaries.

5.1 Work Zones

The work zone is expected to be the forward deck of the sampling vessel during core collection and at the laboratory in the immediate area of core processing.

5.2 Decontamination Area

A station will be set up in the lab for decontaminating sample processing equipment and personnel gear such as boots or PPE. The station will have the buckets, brushes, soapy water, rinse water, or wipes necessary to perform decontamination operations. Plastic bags will be provided for expendable and disposable materials. The decontamination zone will be set up at the sink area in the laboratory.

5.3 Access Control

Prior to sampling, the FC will determine how the sampling locations will be accessed.

6 SAFE WORK PRACTICES

Following common sense rules will minimize the risk of exposure or accidents at a work site. These general safety rules will be followed on site:

- Always use the buddy system.
- Be aware of overhead and underfoot hazards at all times.
- Do not eat, drink, smoke, or perform other hand-to-mouth transfers in the work zones.
- Get immediate first aid for all cuts, scratches, abrasions, or other minor injuries.
- Report all accidents, no matter how minor, to the FC.
- Be alert to your own and other workers' physical condition.
- Do not climb over or under obstacles of questionable stability.

7 PERSONAL PROTECTIVE EQUIPMENT AND SAFETY EQUIPMENT

Appropriate PPE will be worn as protection against potential hazards. In addition, a PFD will be required when working on the vessel. Prior to donning PPE, the workers will inspect their equipment for any defects that might render the equipment ineffective.

Field work will be conducted in Level D or modified Level D PPE, as discussed below in Sections 7.1 and 7.2. Situations requiring PPE beyond modified Level D are not anticipated for this project. Should the FC determine that PPE beyond modified Level D is necessary at a given location, the FC will notify the HSM to select an alternative.

7.1 Level D Personal Protective Equipment

Workers performing general activities in which skin contact with contaminated materials is unlikely and in which inhalation risks are not expected will wear Level D PPE. Level D PPE includes the following:

- Cotton overalls or lab coats.
- Chemical-resistant steel-toed boots.
- Leather, cotton, or chemical-resistant gloves, as the type of work requires.
- Safety glasses.
- Hard hat (if overhead hazard exists).
- Hearing protection, if necessary.

7.2 Modified Level D Personal Protective Equipment

Workers performing activities where skin contact with contaminated materials is possible will wear chemical-resistant outer gloves and an impermeable outer suit. The type of outerwear will be chosen according to the types of chemical contaminants that might be encountered. Modified Level D PPE includes the following:

- Outer garb such as rain gear or rubber or vinyl aprons.
- Chemical-resistant steel-toed boots.
- Surgical rubber inner gloves.
- Chemical-resistant outer gloves.
- Safety glasses (or face shield, if significant splash hazard exists).
- Hard hat (if overhead hazard exists).

- Hearing protection, if necessary.

7.3 Safety Equipment

In addition to PPE that will be worn by shipboard personnel, basic emergency and first aid equipment will also be provided. Equipment will include:

- A copy of this HSP.
- PFD
- First aid kit adequate for the number of personnel.
- Emergency eyewash.

The designated contractor will provide this equipment, which must be at the location(s) where field activities are being performed. Equipment will be checked daily to ensure its readiness for use.

8 MONITORING PROCEDURES FOR SITE ACTIVITIES

A monitoring program that addresses the potential site hazards will be maintained. For this project, air and dust monitoring will not be necessary. No volatile organic compounds (VOCs) have been identified at elevated concentrations among the expected contaminants, and the sampled media will be wet and will not pose a dust hazard. Monitoring procedures will consist of crew self-monitoring.

All personnel will be instructed to look for and inform each other of any deleterious changes in their physical or mental condition during the performance of all field activities. Examples of such changes are as follows:

- Headaches
- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory system
- Changes in complexion or skin color
- Changes in apparent motor coordination
- Increased frequency of minor mistakes
- Excessive salivation or changes in papillary response
- Changes in speech ability or speech pattern
- Symptoms of heat stress or heat exhaustion (Section 4.1.5)
- Symptoms of hypothermia (Section 4.1.6)

If any of these conditions develop, the affected person(s) will be moved from the immediate work location and evaluated. If further assistance is needed, personnel at the local hospital will be notified, and an ambulance will be summoned if the condition is thought to be serious. If the condition is the result of sample collection or processing activities, procedures and/or PPE will be modified to address the problem.

9 DECONTAMINATION

Decontamination is necessary to prevent the migration of contaminants from the work zone(s) into the surrounding environment and to minimize the risk of exposure of personnel to contaminated materials that might adhere to PPE. The following sections discuss personnel and equipment decontamination. The following supplies will be available to perform decontamination activities:

- Wash and rinse buckets
- Tap water and phosphate-free detergent
- Scrub brushes
- Distilled/deionized water
- Spray bottle
- Paper towels and plastic garbage bags

9.1 Minimization of Contamination

The following measures will be observed to prevent or minimize exposure to potentially contaminated materials:

- Personnel:
  - Do not handle, touch, or smell sediment directly
  - Make sure PPE has no cuts or tears prior to use
  - Protect and cover any skin injuries
  - Stay upwind of airborne dusts and vapors
  - Do not eat, drink, chew tobacco, or smoke in the work zones
- Sampling Equipment and Vessel:
  - Use care to avoid getting sampled media on the outside of sample containers
  - If necessary, bag sample containers before filling with sampled media
  - Place clean equipment on a plastic sheet to avoid direct contact with contaminated media
  - Keep contaminated equipment and tools separate from clean equipment and tools
  - Clean up spilled material immediately to avoid tracking into the vehicle

9.2 Personal Decontamination

The FC will ensure that all site personnel are familiar with personnel decontamination procedures. Personnel will perform decontamination procedures, as appropriate, when exiting work areas. Following is a description of the Decontamination Procedure:

1. Wash and rinse outer gloves and boots in portable buckets
2. If suit is heavily soiled, rinse it off
3. Remove outer gloves; inspect and discard if damaged; leave inner gloves on
4. Remove inner gloves and wash hands if taking a break
5. Don necessary PPE before returning to work
6. Dispose of soiled PPE before leaving for the day

9.3 Sampling and Homogenizing Equipment Decontamination

Sample homogenization implements and mixing containers will be decontaminated between successive compositing operations and at the end of each work day.

1. The homogenization equipment decontamination procedure is as follows:
2. Rinse with tap water and scrub with brush to remove sediment
3. Wash with phosphate-free soap solution
4. Rinse with tap water
5. Rinse with deionized/distilled water and air dry

The core sampling gear decontamination procedure aboard the vessel is as follows:

1. Rinse with site water and scrub with brush until free of sediment
2. Wash with phosphate-free soap solution (optional)
3. Rinse with site water
4. Visually inspect the equipment and repeat the scrub and rinse step if necessary
5. Rinse with deionized water

10 TRAINING REQUIREMENTS

Individuals performing work at locations where potentially hazardous materials and conditions may be encountered must meet specific training requirements. It is not anticipated that personnel will encounter hazardous concentrations of contaminants in sampled material, so training will consist of site-specific instruction for all personnel and oversight of inexperienced personnel for one working day. The following sections describe the training requirements for work at this site.

10.1 Project Specific Training

All personnel must read this HSP and be familiar with its contents before beginning work. They shall acknowledge reading the HSP by signing the Field Team HSP Review Form contained in Attachment A-1. The form will be kept in the project files.

The FC or a designee will provide and document project-specific training during the project kickoff meeting and whenever new workers arrive on site. Field personnel will not be allowed to begin work until project-specific training is completed and documented by the FC. Training will address the HSP and all health and safety issues and procedures pertinent to field operations. Training will include, but not be limited to, the following topics:

- Activities with the potential for chemical exposure
- Activities that pose physical hazards, and actions to control the hazards
- Use and limitations of PPE
- Decontamination procedures
- Emergency procedures
- Use and hazards of sampling equipment
- Location of emergency equipment

10.2 Daily Safety Briefings

The FC or a designee will present safety briefings before the start of each day's activities. These safety briefings will outline the activities expected for the day, update work practices and hazards, address any specific concerns associated with the work location, and review emergency procedures and routes. The safety briefings will be documented in the logbook

11 RECORDING AND RECORD KEEPING

The FC or a designee will record health and safety-related details of the project in the field logbook. The logbook must be bound and the pages must be numbered consecutively. Entries will be made with indelible ink. At a minimum, each day's entries must include the following information:

- Project name or location
- Names of all personnel
- Level of PPE worn and any other specifics regarding PPE
- Weather conditions
- Type of field work being performed

The person maintaining the entries will initial and date the bottom of each completed page. Blank space at the bottom of an incompletely filled page will be lined out. Each day's entries will begin on the first blank page after the previous work day's entries.

As necessary, other documentation will be obtained or initiated by the FC. Other documentation may include field change requests, medical and training records, exposure records, accident/incident report forms, Occupational Safety and Health Administration (OSHA) Form 200s, and material safety data sheets. Attachment A-1 contains copies of key health and safety forms.

12 EMERGENCY RESPONSE PLAN

As a result of the health and safety hazards associated with the field sampling and sample handling activities, the potential exists for an emergency situation to occur. Emergencies may include personal injury and exposure to hazardous substances. OSHA regulations require that an emergency response plan be available for use to guide actions in emergency situations.

Onshore organizations will be relied upon to provide response in emergency situations. The local fire department and ambulance service can provide timely response. All personnel and subcontractors will be responsible for identifying an emergency situation, providing first aid if applicable, notifying the appropriate personnel or agency, and evacuating any hazardous area.

The following sections address pre-emergency preparation, identify individual(s) who should be notified in case of emergency, provide a list of emergency telephone numbers, offer guidance for particular types of emergencies, and provide directions and a map for getting from any sampling location to a hospital.

12.1 Pre-Emergency Preparation

Before the start of field activities, the FC will ensure that preparation has been made in anticipation of emergencies. Preparatory actions include the following:

- Meeting with the field personnel concerning the emergency procedures in the event that a person is injured. Appropriate actions for specific scenarios will be reviewed. These scenarios will be discussed and responses determined before the sampling event commences.
- Ensuring that field personnel are aware of the existence of the emergency response plan and its location as Section 12 of the HSP, and ensuring that a copy of the HSP accompanies the field team(s).

12.2 Site Emergency Coordinator

The FC will serve as the Project Emergency Coordinator in the event of an emergency. The FC will designate a replacement for times when he or she is not available or is not serving as the Project Emergency Coordinator. The designation will be noted in the logbook. The Project Emergency Coordinator will be notified immediately when an emergency is recognized. The Project Emergency Coordinator will be responsible for evaluating the emergency situation, notifying the appropriate emergency response units, coordinating access with those units, and directing interim actions onboard before the arrival of emergency response units. The Project Emergency Coordinator will notify the HSM and the SC Manager as soon as possible after initiating an emergency response action. The SC Manager will have responsibility for notifying the client.

12.3 Emergency Response Contacts

All personnel must know who to notify in the event of an emergency situation, even though the FC has primary responsibility for notification. Table 2 lists the names and phone numbers for emergency response services and individuals.

12.4 Recognition of Emergency Situations

Emergency situations will generally be recognizable by observation. An injury or illness will be considered an emergency if it requires treatment by a medical professional and cannot be treated with simple first aid techniques.

Table 2
Emergency Response Contacts

Contact	Telephone Number
Emergency Numbers	
Ambulance	911
Police	911
Fire	911
Harborview Medical Center	(206) 731-3074
Emergency Responders	
U.S. Coast Guard Emergency General information	(206) 217-6400 (press 1) (206) 220-7000
National Response Center	(800) 424-8802
Emergency Contacts	
SC Manager	
Health and Safety Manager	
Field Coordinator	
Field Personnel	

12.5 Decontamination

In the case of evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. If an injured individual is also heavily contaminated and must be transported by emergency vehicle, the emergency response team will be told of the type of contamination. To the extent possible, contaminated PPE will be removed, but only if doing so does not exacerbate the injury.

Plastic sheeting will be used to reduce the potential for spreading contamination to the inside of the emergency vehicle.

12.6 Personal Injury

In the event of serious personal injury, including unconsciousness, possibility of broken bones, severe bleeding or blood loss, burns, shock, or trauma, the first responder will immediately do the following:

- Administer first aid, if qualified
- If not qualified, seek out an individual who is qualified to administer first aid, if time and conditions permit
- Notify the Project Emergency Coordinator of the incident, the name of the individual, the location, and the nature of the injury

The Project Emergency Coordinator will immediately do the following:

- Notify the appropriate emergency response organization
- Assist the injured individual
- Designate someone to accompany the injured individual to the hospital
- If an emergency situation (i.e., broken bones or injury where death is imminent without immediate treatment) occurs, the FC will call 911
- Notify the HSM and the SC Manager

If the Project Emergency Coordinator determines that emergency response is not necessary, he or she may direct someone to decontaminate and transport the individual by vehicle to the nearest hospital. Directions and a map showing the route to the hospital are in Section 12.10.

If a worker leaves the site to seek medical attention, another worker should accompany him or her to the hospital. When in doubt about the severity of an injury or exposure, always seek medical attention as a conservative approach and notify the Project Emergency Coordinator.

The Project Emergency Coordinator will have responsibility for completing all accident/incident field reports, OSHA Form 200s, and other required follow-up forms.

12.7 Overt Personal Exposure or Injury

If an overt exposure to toxic materials occurs, the first responder to the victim will initiate actions to address the situation. The following actions should be taken, depending on the type of exposure.

Skin Contact:

- Wash/rinse the affected area thoroughly with copious amounts of soap and water
- If eye contact has occurred, eyes should be rinsed for at least 15 minutes using the eyewash that is part of the emergency equipment onboard and in the lab
- After initial response actions have been taken, seek appropriate medical attention

Inhalation:

- Move victim to fresh air
- Seek appropriate medial attention

Ingestion:

- Seek appropriate medical attention

Puncture Wound or Laceration:

- Seek appropriate medical attention

12.8 Spills and Spill Containment

Sources of bulk chemicals or other materials subject to spillage are not expected to be used during this project. Accordingly, a spill containment procedure is not required for this project.

12.9 Emergency Route to the Hospital

The name, address, and telephone number of the hospital that will be used to provide medical care is as follows:

Harborview Medical Center
325 Ninth Avenue
Seattle, WA 98104
(206) 731-3074

Figure 1 is a map of the route from T-115 to the Harborview Medical Center. Directions are as follows (travel distance is approximately 6.7 miles):

1. Start out going NORTHWEST on W MARGINAL WAY SW toward NORTH ACCESS RD. (1.9 miles)
2. Stay STRAIGHT to go onto CHELAN AVE SW. (0.1 miles)
3. Turn LEFT to take the ramp toward I-5/WA-99 N. (0.2 miles)
4. Merge onto WEST SEATTLE BRIDGE. (1.8 miles)
5. Merge onto I-5 N via the ramp on the LEFT toward VANCOUVER BC. (1.2 miles)
6. Take the DEARBORN ST./JAMES ST. exit, EXIT 164A, toward MADISON ST. (1.0 miles)
7. Take the JAMES ST exit. (0.3 miles)
8. Turn RIGHT onto JAMES ST. (0.1 miles)
9. Turn RIGHT onto 9TH AVE. (0.2 miles)
10. End at 325 9th Ave Seattle, WA 98104-2420

Estimated Time: 12 minutes Estimated Distance: 6.68 miles

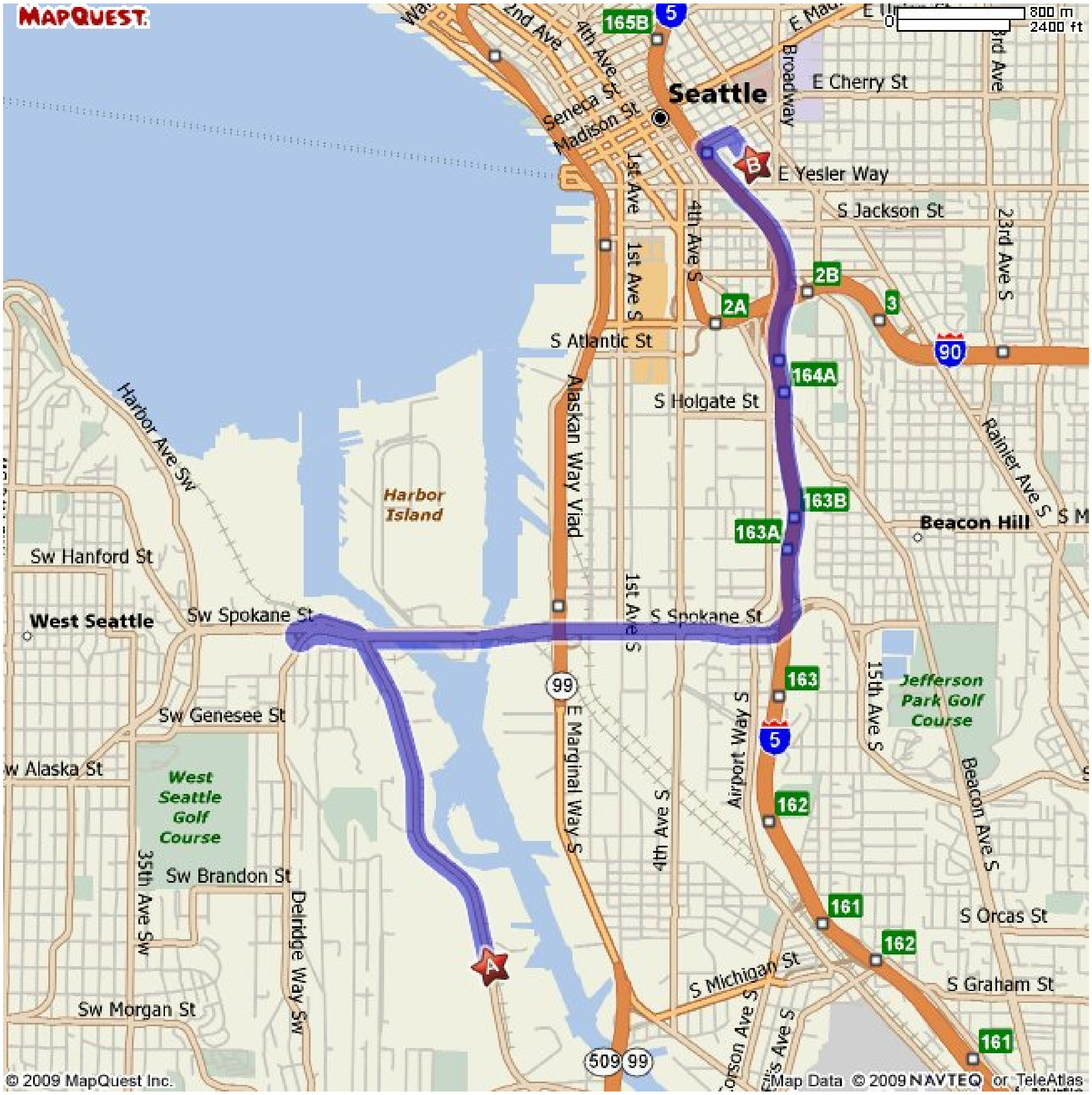


Figure 1

Map to the Nearest Hospital

13 HEALTH AND SAFETY PLAN APPROVAL RECORD

By their signature, the undersigned certify that this HSP is approved and that it will be used to govern health and safety aspects of field work conducted to investigate areas associated with the Terminal 115 Sediment Characterization.

Project Health and Safety Manager	Date
Project Health and Safety Manager	Date

ATTACHMENT A-1
SAFETY RECORD FORM

FIELD TEAM HEALTH AND SAFETY PLAN REVIEW

I have read a copy of this Health and Safety Plan, which covers field activities that will be conducted to investigate specified areas at Terminal 115 in Seattle, Washington. I understand the health and safety requirements of the project, which are detailed in this Health and Safety Plan.

Signature Date

Signature Date

Signature Date

Signature Date