Draft Sampling and Analysis Plan

Chemical and Physical Characterization of Sediments Within Slip 3 for the Pier E Redevelopment Program at the Port of Long Beach

Prepared for

The Port of Long Beach
925 Harbor Plaza
Long Beach, CA 90802

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ABBREVIATIONS AND ACRONYMS

ASTM	American Society for Testing and Materials
cm	centimeter
COC	chain of custody
CVAFS	cold vapor atomic fluorescence spectrophotometry
cy	cubic yards
DGPS	Differential Global Positioning System
DRET	dredged elutriate test
ft	feet or foot
g/cc	gram per cubic centimeter
GC-MS	gas chromatography-mass spectrometry
GC/MS SIM	gas chromatography-mass spectrometry selective ion monitoring
GFAAS	graphite furnace atomic absorption spectrophotometry
ICP-MS	inductively coupled plasma – mass spectrometry
ID	identification
L	liter
LA	Los Angeles
m^3	cubic meters
mg/kg	milligram per kilogram
µg/L	microgram per liter
µg/kg	microgram per kilogram
MLLW	mean lower low water
n/a	not applicable
ng/L	nanogram per liter
^oC	centigrade
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
POC	point of contact
POLB	Port of Long Beach
QA/QC	quality assurance/quality control
QAP	quality assurance plan
RIA	Regional Implementation Agreement
SAP	sampling and analysis plan
SIM	selective ion monitoring
SM	Standard Methods
SOP	standard operating procedure
SVOC	semivolatile organic compounds
TOC	total organic carbon
TRPH	total recoverable petroleum hydrocarbon
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
Weston	Weston Solutions, Inc.

1. INTRODUCTION

1.1 BACKGROUND

The Port of Long Beach (POLB) proposes to conduct dredging in Slip 3 as part of their Pier E Redevelopment Program in POLB, Long Beach, CA. Current plans involve dredging the existing depths ranging from – 36 to -54 feet Mean Lower Low Water (ft MLLW) to a uniform -55 ft MLLW. The project area lies between Piers D and E and is approximately 4500 ft northeast of the Outer Harbor opening. Slip 3 extends from North to South and is approximately 2100 ft in length, and approximately 350 ft across. The dredge footprint is represented by two sampling areas (Area PE-1 and Area PE-2), each containing six different sediment core locations, respectively. The proposed project consists of dredging approximately 110,667 cubic yards (cy; 84,611 meters^3 [m^3]) of material from Area PE-1 and 105,271 cy (80,485 m^3) from Area PE-2, to a design depth of –55 ft MLLW with a two foot over-dredge allowance, for a total depth of -57 ft MLLW. As part of the Pier E Redevelopment Program, dredged material from Slip 3 will be placed as a fill in Slip 1. Prior to disposal, potential dredged material must be evaluated for its suitability for use as fill material in Slip 1. The material will be evaluated based on applicable criteria outlined in the Regional Implementation Agreement (RIA) (USEPA Region IX/USACE-LA 1993) and/or Title 22 of the California Code of Regulations for the classification for hazardous material.

1.2 SAMPLING AND TESTING OBJECTIVES

The purpose of this investigation is to evaluate sediment and sediment elutriates from Slip 3, found between Piers D and E at the POLB, for their physical and chemical characteristics to determine acceptability of the material for use as fill material in Slip 1.

1.3 OVERVIEW OF FIELD ACTIVITIES AND ANALYSES

The area proposed for dredging, or Slip 3, is located in the POLB adjacent to Piers D and E. The project area has been subdivided into two areas (Figure 1) for the purposes of sampling and analysis activities. Area PE-1 is located in the northern portion of Slip 3 of and Area PE-2 is located in the southern portion of Slip 3. Both areas have a project depth of -57 ft MLLW and a sampling depth of -60 ft MLLW. Based on the dredge depth and on the projected bathymetry in each area, the volume of dredged material that will be removed is approximately 110,667 cy 84,611 m^3) for Area PE-1, and 105,271 cy (80,485 m^3) for Area PE-2, with a total dredge material volume of 215,938 cy (Table 1). With an additional two foot overdredge allowance, the potential dredged material volume to be managed is 283,123 cy (216,463 m^3).

This sampling and analysis program will include collection of continuous sediment cores at six locations within each of two test areas, for a total of 12 project core locations (Figure 1). In areas PE-1 and PE-2, sediment core samples will be collected with a vibracore to the dredge depth plus five feet at each sample location, or to a target core depth of -60 ft MLLW. Existing depths at the designated sampling locations will be confirmed using a lead line or fathometer and compared to bathymetric depth calculations. Field sampling activities are expected to take a total of approximately two days.

Table 1. Proposed Dredge Volume for Material to be Removed from Areas PE-1 and PE-2 Within Slip 3, Port of Long Beach

Area	Dredge Volume (cy)	Dredge Volume + 2 ft overdredge (cy)
PE-1	110,667	143,097
PE-2	105,271	140,026
Total	215,938	283,123

Test sediment from areas PE-1 and PE-2 will be analyzed for heavy metals, organotins, pesticides, PCBs, PAHs, total phenols, and total phthalates. These chemicals will also be measured in sediment elutriate samples prepared from test sediment. Conventional chemical analyses will include total and dissolved sulfides, oil and grease, ammonia, total recoverable petroleum hydrocarbon (TRPH), total organic carbon (TOC), and percent solids. Physical analyses will include Atterberg limits, specific gravity, and grain size.

1.4 PROJECT MANAGEMENT AND TEAM RESPONSIBILITIES

1.4.1 Project Management

Ms. Christine Houston will be the Port of Long Beach Project Manager and will serve as the point-of-contact (POC) for this project. Dr. David Moore of Weston Solutions, Inc. (Weston) will serve as the overall Project Manager for the consultant team that will perform the work. He will coordinate the efforts of the various team members, respond to requests, provide technical consulting and coordination with USEPA or USACE, and ensure that project goals, budgets, and schedules are met. Dr. Shelly Anghera of Weston will serve as Assistant Project Manager and provide day to day technical oversight of the project. Mr. Brian Riley of Weston will serve as the Field Operation Project Manager. He will assist Dr. Moore in coordinating team efforts and will provide oversight for all field activities. Ms. Lin Craft of Weston will serve as the quality assurance/quality control (QA/QC) officer and will be responsible for adherence to QA/QC requirements specified for collection, handling, and analyses. Ms. Susie Watts of Weston will provide QA/QC review of all chemical data and interact with the analytical laboratories. Additional POC information for the POLB and participating team member laboratories is provided in Appendix A.

1.4.2 Team Responsibilities

Weston will provide field sampling equipment, coordinate field logistics with the POLB, and conduct the field sampling. Analytical chemistry for sediment and tissues will be provided by CRG Marine Laboratories, Inc. of Torrance, California. Applied Marine Sciences in League City, Texas will conduct analyses for Atterberg limits. Weston's laboratories in Carlsbad will perform grain size, percent total solids, total organic carbon (TOC), and specific gravity analyses. Weston will review all analytical data, and perform all data analyses. Weston will produce the final reports, with review and approval by the POLB.

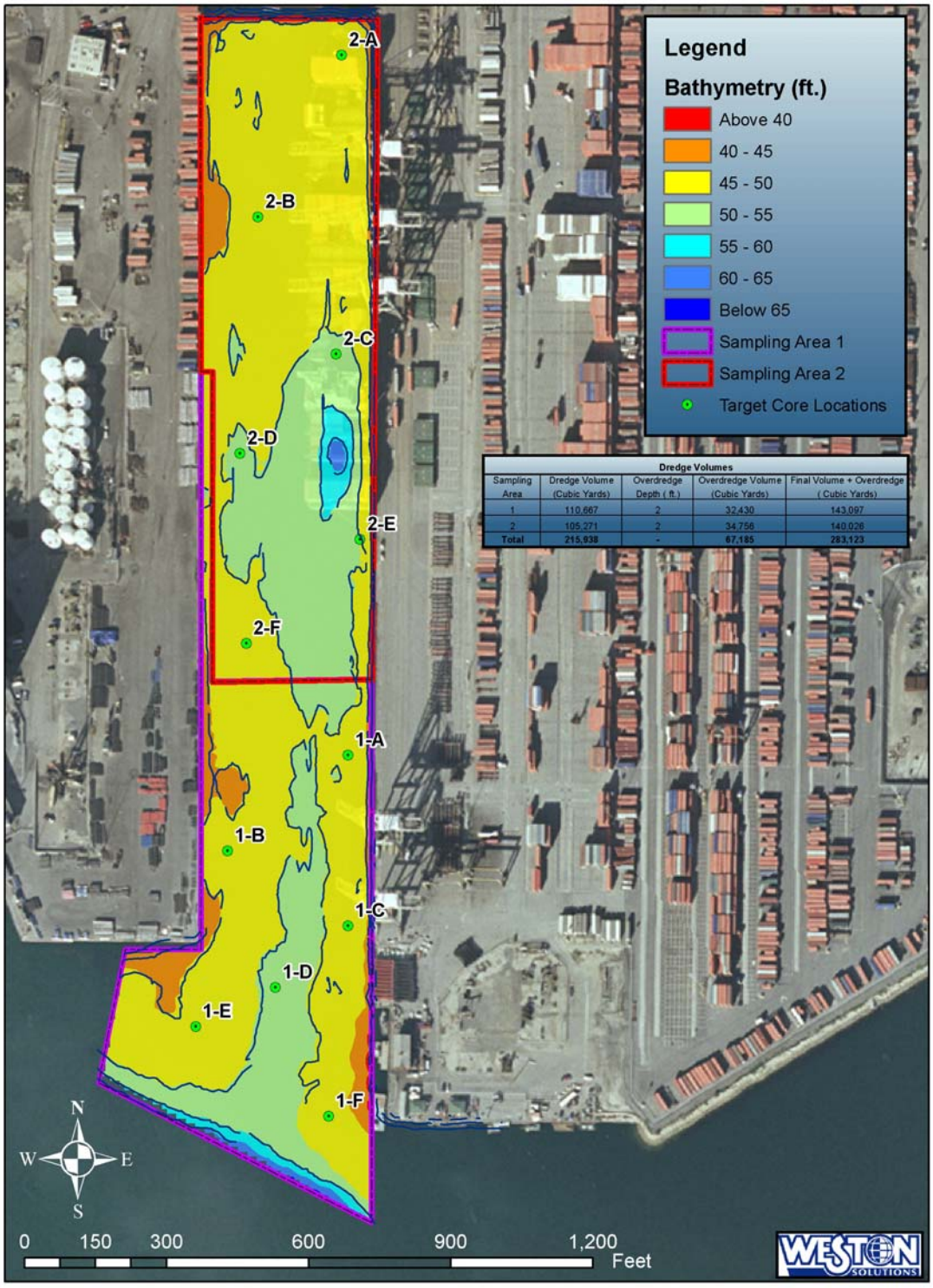

Figure 1. Project Area with Station Locations in Slip 3 Near Pier E of the Port of Long Beach, Long Beach, CA

2. MATERIALS AND METHODS

The sampling design involves collecting sediment core samples at 12 locations within the Slip 3 near Piers D and E (Figure 1).

2.1 FIELD COLLECTION PROGRAM FOR SEDIMENT CORE SAMPLES

2.1.1 Sampling Locations and Depths

Sediment samples from the two areas (PE-1 and PE-2) will be comprised of composited material from six sample locations within each of the areas (Figure 1). Each of the two composited samples will be analyzed for chemical constituents. The number of cores, core identification (ID) numbers, locations, and target lengths are provided in Table 2.The actual lengths of these cores are based on the bathymetric depth calculations and estimates may differ from predicted bathymetry.

Table 2. Core Locations, Target Lengths, Number of Cores, Composite ID, and Analyses for Samples Collected by Vibracore.

Core ID	Latitude (WGS 84)	Longitude (WGS 84)	Existing Water Depth (feet MLLW)	Dredge Depth (feet MLLW)	Project Depth (Dredge Depth + 2 feet)	Sampling Depth (Dredge Depth + 5 feet)	Target Core Length (feet)	Composite ID	Proposed Composite Analyses
PE-1A	33°45.504'	-118°12.842'	49	55	57	60	11	PE-1	Chemical, Physical
PE-1B	33°45.471'	-118° 12.893'	46	55	57	60	14		
PE-1C	33°45.444'	-118°12.842'	48	55	57	60	12		
PE-1D	33°45.423'	-118°12.873'	51	55	57	60	9		
PE-1E	33°45.409'	-118°12.906'	47	55	57	60	13		
PE-1F	33°45.378'	-118°12.850'	47	55	57	60	13		
PE-2A	33°45.748'	-118° 12.846'	47	55	57	60	13	PE-2	Chemical, Physical
PE-2B	33°45.691'	-118°12.880'	45	55	57	60	15		
PE-2C	33°45.644'	-118°12.848'	49	55	57	60	11		
PE-2D	33°45.609'	-118°12.888'	50	55	57	60	10		
PE-2E	33°45.579'	-118°12.838'	50	55	57	60	10		
PE-2F	33°45.543'	-118°12.885'	49	55	57	60	11		

2.1.2 Core Collection

Cores will be collected using an electric vibracore in all areas accessible by boat (Figure 2). This unit will be deployed from the *Christopher G* landing craft. The vibracore will be equipped with a 4-inch (~10 cm) outer diameter aluminum barrel and stainless steel cutter head. The standard system is capable of collecting cores up to ~20 ft (~6 m) long and can be equipped to handle greater depths, up to an additional 10 ft (~3 m), which is more than sufficient to cover the target sampling depths identified in this project (Figure 1).

All sediment cores will be collected to the appropriate depth unless refusal is encountered. Refusal is defined as less than 2 inches (~5 cm) of penetration per minute. If refusal is encountered, the vessel will be moved and a second core attempted. If refusal is encountered again, additional cores will not be attempted unless operational problems are suspected.

2.1.3 Navigation

Pre-plotted station positions will be located using the *Christopher G's* Differential Global Positioning System (DGPS) or a handheld Garmen eTrex DGPS. The systems use U.S. Coast Guard differential correction data, and are accurate to less than 10 ft (3 m). In the event of differential failure, stations will be located using visual lineups. All final station locations will be recorded in the field using positions from the DGPS or through lineups on the field map.

2.1.4 Core Handling and Description

Each vibracore sample will be brought to the vessel platform, where the sediment sample will be extruded from the core barrel onto polyethylene-lined collection trays. Then each core will be examined by a qualified scientist and photographed. The geologic description of each core will include the texture, odor, color, length, approximate grain size distribution, plasticity characteristics of the fine-grained fraction, Unified Soils Classification System (USCS) designation, and any evident stratification of the sediment. This description will be documented in a core log (Appendix B).

2.1.5 Decontamination of Equipment

All vibracore equipment will be cleaned prior to sampling. Between stations, core barrels and the deck of the vessel will be rinsed with site water. New plastic liners will be used at each sample location. Before creating each composite, all stainless steel utensils (stainless steel bowls, spoons, spatulas, mixers, and other utensils) will be cleaned with soapy water, rinsed with tap water, and then rinsed three times with deionized water.

2.1.6 Sample Processing and Storage

Sediment cores from each sampling location will be examined for stratification, and if stratified cores are present, these will be split into top and bottoms based on stratigraphy. If no stratification is evident, the bottom five foot (2' of overdredge plus 3') of the core will be separated from the overlying (top) portion of the core. Top and bottom core samples will be separately composited from areas PE-1A to PE-1F for chemical and physical analyses, while top and bottom core samples will be separately composited from areas PE-2A to PE-2F, for a total of four composite samples (i.e., Area PE-1 top, Area PE-1 bottom, Area PE-2 top, and Area PE-2 bottom. Each composite will be homogenized in a stainless steel bowl with stainless steel utensils. Material will be placed in glass jars with Teflon lined-lids; 500 mL of material will be archived at Weston's laboratory in Carlsbad, 500 mL will be analyzed for chemical constituents at CRG Marine Laboratories, 500 mL will be analyzed for Atterberg limits at Applied Marine Sciences, and 500 mL will be analyzed by Weston's Benthic Laboratory in Carlsbad for grain size, specific gravity, percent total solids, and total organic carbon (TOC). In addition, CRG Marine Laboratories, will receive 2 L of each composite to prepare sediment elutriate samples as described in section 2.3.3 for chemical analyses.

Samples will be labeled, placed on ice, and shielded from light until delivered to CRG or Weston laboratory personnel for analysis. Any sediment not immediately analyzed will be stored at 4°C at the Weston's laboratory in Carlsbad until chemical and geotechnical characterization is complete.

2.1.7 Shipping

Prior to shipping, sample containers will be placed in sealable plastic bags and securely packed inside the cooler with ice. COC forms will be filled out as described in section 2.2, and the original signed COC forms will be placed in a sealable plastic bag and placed inside the cooler. The cooler lids will be securely taped shut. Samples will be delivered to the analytical laboratories for analysis. The laboratories,

particular analyses to be performed by each, and the point of contact and relevant shipping information for each laboratory are shown in Appendix A.

2.2 DOCUMENTATION AND CHAIN-OF-CUSTODY

This section describes the program requirements for sample handling and COC procedures. Samples are considered to be in custody if they are: (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a secured container. The principal documents used to identify samples and to document possession are COC records, field log books, and field tracking forms. COC procedures will be used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation, whether in hard copy or electronic format.

COC procedures will be initiated during sample collection. A COC record will be provided with each sample or sample group. An example of a COC form is provided in Appendix C. Each person who has custody of the samples will sign the form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include the following:

- Sample identification
- Sample collection date and time
- Any special notations on sample characteristics
- Initials of the person collecting the sample
- Date the sample was sent to the laboratory
- Shipping company and waybill information

The completed COC form will be placed in a sealable plastic envelope that will travel inside the ice chest containing the listed samples. The COC form will be signed by the person transferring custody of the samples. The condition of the samples will be recorded by the receiver. COC records will be included in the final analytical report prepared by the laboratory, and will be considered an integral part of that report.

Figure 2. Electric Vibracore Sampler

2.3 PHYSICAL AND CHEMICAL ANALYSES

Physical and chemical analytes to be measured in this testing program will be selected to provide data on potential chemicals of concern in POLB sediments. All analytical methods used to obtain contaminant concentrations follow USEPA or Standard Methods (SM). In addition, chemical and physical measures selected for this evaluation are consistent with those recommended for assessing dredged material in Los Angeles (USEPA/USACE 1991; USEPA Region IX/USACE-LA 1993). The specific sediment analyses and target detection limits are listed in Table 3.

2.3.1 Physical Analyses

Physical analyses of the sediment will include grain size, specific gravity, TOC, Atterberg limits and percent total solids. Grain size will be analyzed to determine the general size classes that make up the sediment (e.g., gravel, sand, silt, and clay) using the gravimetric procedure described in Plumb (1981). The frequency distribution of the size ranges (reported in millimeters [mm]) of the sediment will be reported in the final data report. The TOC, made up of volatile and nonvolatile organic compounds, will be determined by Lloyd Kahn (1988), a modified USEPA 9060. This procedure involves dissolving inorganic carbon (carbonates and bicarbonates) with hydrochloric acid or sulfuric acid prior to TOC analysis (Plumb 1981). Total solids will also be measured to convert concentrations of the chemical analytes from a wet-weight to a dry-weight basis. Total solids will be determined by SM 2540G (Clesceri et al. 2000). Atterberg limits will be evaluated by ASTM D4318 (ASTM 2003).

2.3.2 Sediment Chemistry

The analysis for priority pollutant metals (except mercury) will be conducted using an inductively coupled plasma emissions spectrometer equipped with a mass detector (ICP-MS), in accordance with USEPA 6020M. Mercury analysis will be conducted using cold vapor atomic fluorescence spectrophotometry (CVAFS) in accordance with USEPA 245.7m. The analysis for total and dissolved sulfides followed SM 4500-S2 D while the analysis for dissolved ammonia will follow SM 4500-NH_3.. Oil and grease will be measured using USEPA 1664A and total recoverable petroleum hydrocarbons (TRPH) will be measured by USEPA 418.1. Acid extractable compounds and semivolatile organic compounds (SVOC) including PAHs, phthalates, and phenols, chlorinated pesticides, and PCBs, will be analyzed using gas chromatography-mass spectrometry with selective ion monitoring (GC/MS SIM) according to USEPA Method 8270M. This method will follow serial extraction with methylene chloride and alumina and gel permeation column cleanup procedures. PCBs will be identified as Aroclors and individual congeners, separately. Tributyltin and its derivatives will be analyzed by GC/MS according to Krone et al. (1989), following a cleanup procedure involving methylene chloride extraction and Grignard derivatization. Sediment chemical concentrations will be compared to sediment quality guidelines.

2.3.3 Elutriate Chemistry

Elutriate samples will be prepared by using a modified dredged elutriate test (DRET) method. The extraction and analysis of the metals, ammonia, semivolatile (phenols), organochlorine pesticides (endosulfan, endrin, BCH) will be similar to methods described in above. Elutriate test results will be compared to the California Ocean Plan (2001) water quality objectives.

2.3.4 Quality Assurance/Quality Control

The quality assurance/quality control (QA/QC) objectives for chemical analysis conducted by the participating analytical laboratories are detailed in their Laboratory QA Manual(s). These objectives for accuracy and precision involve all aspects of the testing process, including the following:

- Methods and standard operating procedures (SOPs)
- Calibration methods and frequency
- Data analysis, validation, and reporting
- Preventive maintenance
- Internal QC
- Procedures to ensure data accuracy and completeness

Results of all laboratory QC analyses will be reported with the final data. Any QC samples that fail to meet the specified QC criteria in the methodology or quality assurance plan (QAP) will be identified, and the corresponding data will be appropriately qualified in the final report.

Table 3. Chemical/Physical Measures, Analytical Methods, and Target Detection Limits for Sediments

Chemical/Physical Measure	Method	Procedure	Sediment Target Detection Limit (dry weight)	Sediment Elutriate Detection Limit
Physical / Conventional Tests				
Grain Size	Plumb (1981)	Sieve/Pipette	1.0%	n/a
Specific Gravity	Plumb (1981)	Gravimetric	0.001 g/cc	n/a
Atterberg Limit	ASTMD4318 (ASTM 2003)	Wet Preparation	1%	n/a
TOC	LIoyd Kahn (1988)	Combustion IR	0.1%	n/a
Percent Total Solids	SM 2540G	Gravimetric	0.1%	n/a
Dissolved Ammonia	SM 4500-NH_3	Titrametric	0.001 mg/kg	n/a
Total Sulfides	SM 4500-S2 D	Titrametric	0.1 mg/kg	n/a
Dissolved Sulfides	SM 4500-S2 D	Titrametric	0.1 mg/kg	n/a
Oil and Grease	USEPA 1664A	Gravimetric	0.1 mg/kg	n/a
TRPH	USEPA 418.1	IR Spectroscopy	0.1 mg/kg	n/a
Metals				
Arsenic (As)	USEPA 6020M	ICP-MS	0.025 mg/kg	0.01 µg/L
Cadmium (Cd)	USEPA 6020M	ICP-MS	0.025 mg/kg	0.005 µg/L
Chromium (Cr)	USEPA 6020M	ICP-MS	0.025 mg/kg	0.05 µg/L
Copper (Cu)	USEPA 6020M	ICP-MS	0.025 mg/kg	0.02 µg/L
Lead (Pb)	USEPA 6020M	ICP-MS	0.025 mg/kg	0.005 µg/L
Mercury (Hg)	USEPA 245.7M	CVAFS	0.005 mg/kg	0.01 µg/L
Nickel (Ni)	USEPA 6020M	ICP-MS	0.025 mg/kg	0.005 µg/L
Selenium (Se)	USEPA 6020M	ICP-MS	0.025 mg/kg	0.01 µg/L
Silver (Ag)	USEPA 6020M	ICP-MS	0.025 mg/kg	0.02 µg/L
Zinc (Zn)	USEPA 6020M	ICP-MS	0.025 mg/kg	0.005 µg/L
Pesticides				
4-4’ DDD	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
4-4’-DDE	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
4-4’-DDT	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Aldrin	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Chlordane and derivatives	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Dieldrin	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Endosulfan and derivatives	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Endrin and derivatives	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Hexachlorocyclohexane and derivatives	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Toxaphene	USEPA 8270M	GC/MS SIM	1 µg/kg	10 ng/L
PCBs				
Aroclor 1016	USEPA 8270M	GC/MS SIM	10 µg/kg	10 ng/L
Aroclor 1221	USEPA 8270M	GC/MS SIM	10 µg/kg	10 ng/L
Aroclor 1232	USEPA 8270M	GC/MS SIM	10 µg/kg	10 ng/L
Aroclor 1242	USEPA 8270M	GC/MS SIM	10 µg/kg	10 ng/L
Aroclor 1248	USEPA 8270M	GC/MS SIM	10 µg/kg	10 ng/L
Aroclor 1254	USEPA 8270M	GC/MS SIM	10 µg/kg	10 ng/L
Aroclor 1260	USEPA 8270M	GC/MS SIM	10 µg/kg	10 ng/L
Individual Congeners	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Total PCBs	USEPA 8270M	GC/MS SIM	n/a	n/a
Semivolatile Organic Compounds				
Pentachlorophenol	USEPA 8270M	GC/MS SIM	50 µg/kg	50 ng/L
Naphthalene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Acenaphthylene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Acenaphthene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Fluorene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Phenanthrene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L

Chemical/Physical Measure	Method	Procedure	Sediment Target Detection Limit (dry weight)	Sediment Elutriate Detection Limit
Anthracene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Fluoranthene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Pyrene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Chrysene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Benzo(a)anthracene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Benzo(b)fluoranthene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Benzo(a)pyrene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Indeno(1,2,3-cd)pyrene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Dibenzo(a,h)anthracene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Benzo(g,h,i) perylene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Benzo(k)fluoranthene	USEPA 8270M	GC/MS SIM	1 µg/kg	1 ng/L
Total PAHs	USEPA 8270M	GC/MS SIM	n/a	n/a
Total Phenol	USEPA 8270M	GC/MS SIM	n/a	n/a
Total Phthalates	USEPA 8270M	GC/MS SIM	n/a	n/a
Organotins				
Monobutyltin	Krone et al. (1989)	GC/MS	1 µg/kg	1 ng/L
Dibutyltin	Krone et al. (1989)	GC/MS	1 µg/kg	1 ng/L
Tributyltin	Krone et al. (1989)	GC/MS	1 µg/kg	1 ng/L
Tetrabutyltin	Krone et al. (1989)	GC/MS	1 µg/kg	1 ng/L

%	percent
µg/kg	microgram per kilogram
g/cc	gram per cubic centimeter
n/a	not applicable
CVAFS	cold vapor atomic fluorescence spectrofluorometry
GC/MS	gas chromatography/mass spectrometry
ICP/MS	
SIM	selected ion monitoring

2.4 DATA REVIEW, MANAGEMENT, AND ANALYSIS

2.4.1 Data Review

All data will be reviewed and verified by participating team laboratories to determine whether all data quality objectives have been met, and that appropriate corrective actions have been taken, when necessary. Weston's QA Officer (Lin Craft) will be responsible for the final review of all data generated.

2.4.2 Data Management

All laboratories will supply analytical results in both hard copy and electronic formats. Laboratories will have the responsibility of ensuring that both forms are accurate.

After completion of the sediment data review by participating team laboratories, hard copy results will be placed in the project file at Weston and the results in electronic format will be imported into Weston's database system.

2.4.3 Data Analysis

Data analysis will consist of tabulation and comparison with regulatory guidelines. Patterns will be examined in the chemistry data to describe the contaminant concentration and distribution within Slip 3. Long et al. (1995) screening criteria and total threshold limit concentration regulatory levels will be included in a sediment chemistry results summary table for comparison.

2.5 REPORTING

2.5.1 Draft and Final Reports

After all results are received, statistical analyses completed, and all evaluations made, draft and final reports will be prepared. These will include summaries of all activities associated with collecting, transporting, and the chemical and physical analyses of sediment samples. The chemical and geotechnical data reports will be included as appendices. As a minimum, the following will be included in the final report:

- Summary of all field activities, including a description of any deviations from the approved sampling and analysis plan (SAP) and QAP
- Descriptions of each sample and all original core logs
- Locations of sediment sampling stations, reported in latitude and longitude (DD MM.MMMM) (WGS 84)
- Final QA/QC report, as described in Section 2.5.2
- Data Results. In addition to hard copies of field data, laboratory analysis results, and associated QA/QC data, electronic copies for all data will be stored

2.5.2 QA/QC and Laboratory Data Report

Analytical laboratories will provide a QA/QC narrative that describes the results of the standard QA/QC protocols that accompany analysis of field samples. The QAP details these protocols. All hard copies of results will be maintained in a project and included in the final report. In addition, back-up copies of results generated by the contract chemistry laboratory will be maintained at their facility. At a minimum, the laboratory reports will contain results of the laboratory analysis, QA/QC results, all protocols and any deviations from the project SAP and QAP, and a case narrative of COC details.

2.6 SCHEDULE

Scheduling of proposed activities will be dependent upon final approval of the SAP. Once initiated, field sampling activities are anticipated to take approximately two days. Upon completion of the field sampling effort, chemical analysis of sediment will be completed in approximately four weeks the time of sample collection. Once all data have been collected and undergone QA/QC review, a draft report will be prepared. When comments have been made by the POLB, a final report will be prepared.

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Appendix A
Point-of-Contact Information

Table A-1. Analytical Laboratories, Points of Contact, and Shipping Information

Laboratory	Analyses Performed	Point of Contact	Shipping Information
Weston Solutions, Inc. Carlsbad, CA	Grain size, specific gravity, % Solids	Dr. David Moore and Mr. Chris Osuch (760) 931-8081	Weston Solutions, Inc. 2433 Impala Dr. Carlsbad, CA 92010
CRG Marine Laboratories	Sediment Chemistry	Mr. Rich Gossett (310) 533-5190	CRG Marine Laboratories 2020 Del Amo Blvd., Suite 200 Torrance, CA 90501
Applied Marine Sciences	TOC and Atterberg analysis	Mr. Ken Davis (281) 554-7272	Applied Marine Sciences 502 N. Hwy 3, Suite B League City, TX 77573

Appendix B
Field Core Logs

VIBRACORE SEDIMENT CORING LOG

PROJECT/SURVEY	DATE	PROJECT MANAGER	RECORDER

STATION ID	NAV DATUM	LATITUDE	LONGITUDE
	NAD83		

WATER DEPTH (FT)	TIDE (FT)	MLLW (FT) = WATER DEPTH - TIDE	SAP DEPTH (FT)

TARGET CORE LENGTH (FT) (SAP DEPTH - MLL	FINAL CORE LENGTH (FT)	PENETRATION (FT)	CORE LENGTH COLLECTED FOR ANALYSIS (FT)

CORE DIAMETER (IN)	ATTEMPT	TIME STARTED	TIME FINISHED
4	of		

PEN. DEP.(FT)	RETRV. DEP.(FT)	SEDIMENT TYPE	ODOR	COLOR (HUE_VALUE/CHROMA)	SAMPLE ID BY DEPTH	MISC
1	1					
2	2					
3	3					
4	4					
5	5					
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					

NOTES

Appendix C
Chain of Custody Form

WESTON SOLUTIONS

☐ 2433 Impala Drive • Carlsbad, CA 92008 • (760) 931-8081, FAX 931-1580
☐ 98 Main St., Ste. #428 • Tiburon, CA 94920 • (415) 435-1847, FAX 435-0479
☐ 1440 Broadway, Ste. 908 • Oakland, CA 94612 • (510) 808-0302, FAX 891-9710
☐ 152 Sunset View Lane • Sequim, WA 98382 • (360) 582-1758, FAX 582-1679
☐ 4729 NE View Drive • Port Gamble, WA 98364 • (360) 297-6903, FAX 297-6905

CHAIN OF CUSTODY

№ 10150

DATE_____ PAGE_____ OF_____

PROJECT NAME / SURVEY / PROJECT NUMBER

PROJECT MANAGER

COMPANY

ADDRESS

PHONE/FAX

SAMPLE I.D.	DATE	TIME	MATRIX	INITIALS	NUMBER &TYPE OF CONTAINERS	ANALYSIS/TEST REQUESTED					PRESERVED HOW/ COMMENTS	FOR WESTON USE ONLY: SAMPLE TEMP. UPON RECEIPT	FOR WESTON USE ONLY: WESTON LAB ID

SPECIAL INSTRUCTIONS/COMMENTS:

SHIPPING:

Shipping VIA: Airbill No:

SAMPLE CONDITION UPON RECEIPT (FOR WESTON USE ONLY):

RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
Signature	Signature	Signature	Signature	Signature	Signature
Firm	Firm	Firm	Firm	Firm	Firm
Date/Time	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time

WHITE – return to originator • YELLOW – lab • PINK – retained by originator