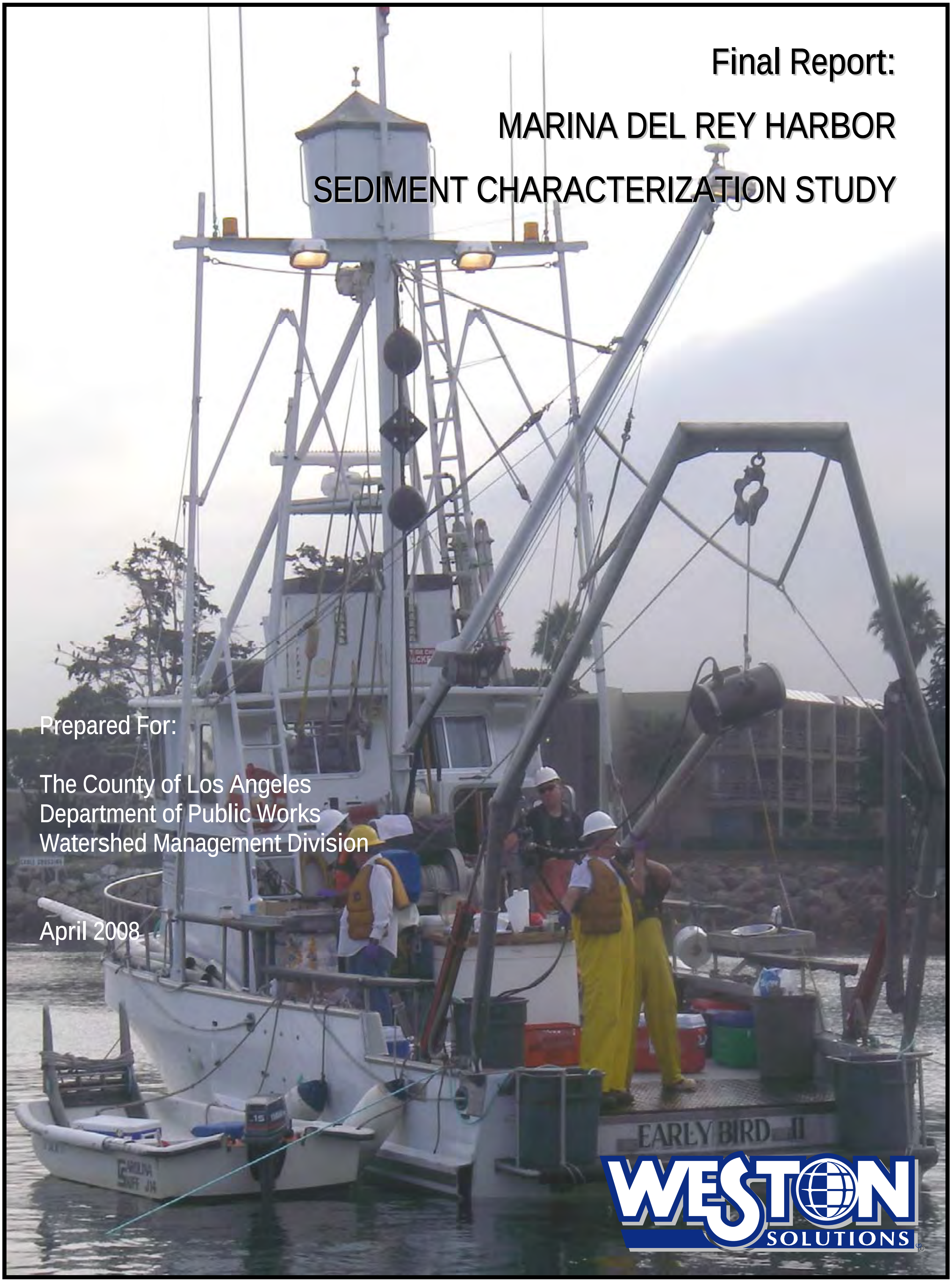

Final Report:

MARINA DEL REY HARBOR
SEDIMENT CHARACTERIZATION STUDY

Prepared For:

The County of Los Angeles
Department of Public Works
Watershed Management Division

April 2008

WESTON SOLUTIONS

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Prepared For:

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Watershed Management Division

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
BRI	Benthic Response Index
CA LRM	California Logistic Regression Model
Cal EPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
COC	Chain-of-Custody
CSI	Chemical Score Index
DDT	dichlorodiphenyltrichloroethane
DGPS	differential global positioning system
DO	dissolved oxygen
ER-L	effect range-low
ER-M	effect range-median
HDPE	high-density polyethylene
IBI	Index of Biotic Integrity
ITM	Inland Testing Manual
LACDBH	Los Angeles County Department of Beaches and Harbors
LACDPW	Los Angeles County Department of Public Works
LC_{50}	median lethal concentration
LOE	lines of evidence
MDL	method detection limit
MLLW	Mean Lower Low Water
MLOE	multiple lines of evidence
MRL	method reporting limit
NIT	negative indicator taxa
NOEC	no observable effect concentration
PCB	polychlorinated biphenyls
pH	hydrogen ion concentration
P_{MAX}	maximum probability model
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Program Plan
RIVPACS	River Invertebrate Prediction and Classification System
RBI	Relative Benthic Index
RV	Research Vessel
RWQCB-LA	California Regional Water Quality Control Board- Los Angeles Region
SAP	Sampling and Analysis Plan
SCCWRP	Southern California Coastal Water Research Project
SP	solid phase
SQO	sediment quality objective
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
TOC	total organic content
TTLC	total threshold limit concentration
TWV	Taxa Richness Weighted Value
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
WAAS	wide area augmentation system
Weston	Weston Solutions Inc.

UNITS OF MEASURE

cm	centimeter
cy	cubic yards
^{o}C	centigrade
ft	feet or foot
L	liter
m	meter
mg/kg	milligram per kilogram
mL	milliliter
µg/L	microgram per liter
µg/kg	microgram per kilogram
ng/L	nanogram per liter

1. INTRODUCTION

Five agencies, including the City of Culver City, the City of Los Angeles, Los Angeles County Department of Public Works (LACDPW), California Department of Transportation (Caltrans) and Los Angeles County Department of Beaches and Harbors (LACDBH) received a "Requirement to Submit Information" letter from the California Regional Water Quality Control Board- Los Angeles Region (RWQCB-LA) regarding sediment contamination in Marina del Rey Harbor. The letter specified that the agencies listed above were to design a study plan to assess the areal extent of sediment contamination in the Harbor for constituents listed in the Total Maximum Daily Load (TMDL) for toxic pollutants in Marina del Rey Harbor. Because implementation of the TMDL is unlikely to affect contaminant levels already present in the Harbor sediments, the RWQCB-LA directed staff to proceed with an investigation to determine the extent of contamination in Marina del Rey Harbor sediments and to assess the need for a remedial action. Thus, the intent of this program is to characterize the contamination in the Harbor sediment by examination of the physical, chemical, and toxic properties and through an assessment of the benthic infaunal community.

Sediment within Marina del Rey Harbor is comprised of native sediment, fill materials, and depositional sediments that have accrued since the harbor was first constructed in 1957.

The overall goal of the Marina del Rey Harbor sediment characterization study is to provide an assessment of the areal and vertical extent of sediment contamination within Marina del Rey Harbor for those constituents identified in the TMDL as contributing to sediment impairment by the RWQCB-LA. The constituents listed in the Marina del Rey Harbor Toxic Pollutants TMDL are total polychlorinated biphenyls (PCBs), chlordane, copper, lead, and zinc. Because previous studies within Marina del Rey Harbor have primarily focused on localized areas of contamination, additional data was needed to provide a more comprehensive evaluation of the harbor's sediment contamination.

The present report discusses the approved sediment characterization program described in the Sampling and Analysis Plan (SAP; Caltrans, 2006) and in Weston Solutions Inc. (Weston) Quality Assurance Program Plan (QAPP; Weston, 2007). The sediment characterization program used several types of sampling methods. Sediment core sampling was conducted at 23 sample locations throughout the harbor while surficial grab samples were collected at 16 of the 23 sample locations. Samples were analyzed for physical, chemical, biological, and toxicological characteristics. This report discusses chemical analyses, toxicity test results, and benthic community data and includes an analysis of sediment quality using the sediment quality objectives (SQOs) currently being developed for the State of California (http://www.waterboards.ca.gov/bptcp/sqoscientific.html). Results of this evaluation may lead to remedial activity in the future.

2. MATERIALS AND METHODS

2.1 FIELD COLLECTION PROGRAM

2.1.1 Equipment

Two research vessels were used during the sampling activities. The *Research Vessel (RV) Early Bird II*, a 40-foot survey vessel, was used for the collection of vibracore sediment chemistry, grain size and archival core samples (Figure 1), while the *RV Waterline*, a 24-foot fiberglass survey vessel, was used for the collection of benthic infaunal, sediment chemistry, grain size, and sediment toxicity (Figure 2). Core samples were collected using a P-3 electric vibracore. The vibracore was equipped with a pre-cleaned 4-inch-diameter aluminum barrel and stainless steel cutter head while the aluminum barrel was lined with food-grade pliable polyethylene liners for cores undergoing sub-sampling. The archived duplicate cores (one per site) were collected using a hard polybutyrate liner for the purpose of archiving entire sample cores. Archived samples were removed from the aluminum tube, while still inside the polybutyrate liner, capped, labeled, and frozen vertically so that the stratification of the core would be retained. The standard vibracore system used for this project was capable of collecting cores up to 30 feet (9 m) in length if necessary.

Surface samples were collected using a 0.1 m^2 stainless steel double Van Veen grab sampler, deployed from a davit on the port side of the *RV Waterline*. The double Van Veen grab sampler was capable of collecting concurrent sediment samples for paired chemistry and benthic analyses. It was capable of collecting a total of 36 L of sediment per grab (18 L per side). The Van Veen sampling followed Southern California Coastal Water Research Project (SCCWRP) Bight ’03 Field Operations protocols (Bight’03 Field Sampling and Logistics Committee, 2003).

2.1.2 Navigation

All station locations were pre-plotted on a field map of Marina del Rey Harbor prior to sampling activities (Figure 3). On the *RV Early Bird II*, pre-plotted station positions were located using the vessel’s differential global positioning system (DGPS). The system uses United States Coast Guard differential correction data and was accurate to less than 10 feet.

On the *RV Waterline*, pre-plotted station positions were located using a handheld Garmin GPS 76. The system uses wide area augmentation system (WAAS) correction data and was accurate to within 10 feet.

2.1.3 Sampling Locations and Depths

Cores within Marina del Rey Harbor were collected to project depth (the original dredged depth of the harbor) plus 1 foot [i.e., –10.0 + –1.0 = –11.0 feet Mean Lower Low Water (MLLW)] unless refusal was encountered. Refusal is defined as less than 2 inches of penetration per minute. If core refusal was encountered, the vessel was moved a short distance (i.e., 1-2 m) and a second core attempted. If refusal was encountered again, additional cores were not attempted unless operational problems were suspected. Two cores per location were needed to provide sufficient material for all required physical and chemical testing, and archival sample collection. The number of cores, their locations, core lengths and the water and penetration depths at each station are provided in the results section. Van Veen surface sediments were collected at the identical station locations as vibracore samples. Two surface grab samples per location were needed to provide sufficient material for all required physical, chemical, bioassay, and benthic infauna analysis and archival sample collection.

Figure 1. Vibracore sampling on the *RV Early Bird II* in Marina del Rey Harbor.

Figure 2. Van Veen grab sampling on the *RV Waterline* in Marina del Rey Harbor.

2.1.4 Sample Collection and Handling

2.1.4.1 Surface Sediments Collected by Van Veen

The Van Veen Grab Sampler was lowered from the side of the vessel using an electric winch. When the automatically triggered doors close the sample was retrieved. Each grab sample was checked for evidence of sample “washout” or significant disruption of the sediment surface layer. Acceptable grab samples showed little or no leakage of overlying water, the surface of the grab was even, with minimal surface disturbance. Upon retrieval, if the grab was acceptable, the overlying water was carefully drained, and the sediment was processed depending on analysis and use.

The Van Veen sampling team collected surface sediment grabs at 16 pre-determined stations for analyses of benthic infauna, toxicity and physical/chemical composition with regard to sediment grain size, total organic content (TOC), metals, organochlorine pesticides, and PCBs. At 5 of the 16 surface sediment locations (MC-3, MC-5, C-2, E-1, and G-2), material was collected for pore water analyses. Pore water stations were selected at locations within the harbor that were thought to best spatially represent the physical and chemical variability of the harbor’s sediment. For infaunal samples, the overlying water was screened; any organisms captured on the screen were added to the infaunal sample. The depth of the sediment in the grab was then measured to ensure acceptable penetration depth of at least 5 cm. If the grab was unacceptable, additional grab samples were taken. Samples for benthic infaunal analysis were screened onboard the vessel through a 1.0 mm mesh screen with filtered wash water. The material retained on the screen was placed into a jar and a solution of relaxant ($MgSO_4$) was added. After 30 minutes, buffered formalin was added to obtain approximately 10% formalin solution.

10-2007 MDR_ChannelDepths_Revised.mxd

Figure 3. Marina del Rey Harbor sample locations

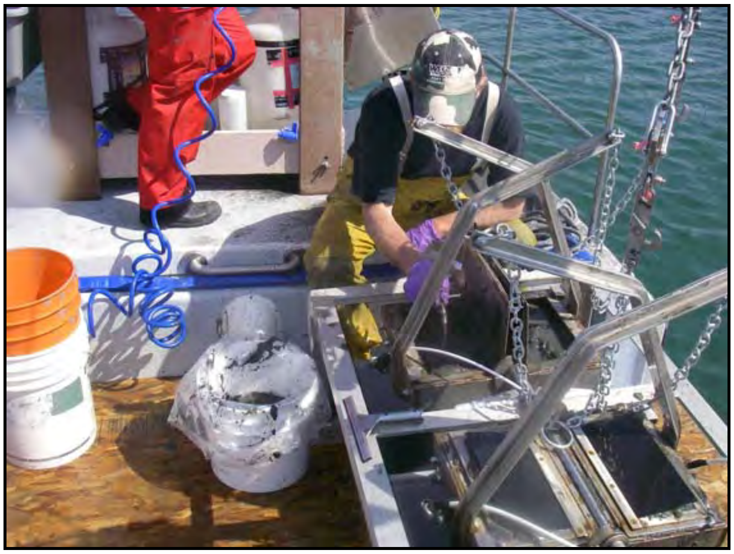

Figure 4. Processing surface sample collected using Van Veen grab sampler.

Samples for sediment chemistry were collected from the top 2 cm of the grab using a pre-cleaned stainless steel scoop (Figure 4). Sediment within 1 cm of the sides of the grab was avoided to prevent interaction of any contaminants and the steel sampling device. Both sediment grain size and TOC samples were placed into quart-sized Ziploc™ bags. Subsamples to be analyzed for trace metals and organics were transferred into pre-cleaned 8-oz glass jars with Teflon® lids for analyses, stored at 4°C, and frozen within 24 hr. Samples for sediment grain size analysis were stored at 4°C on ice. A minimum of 2.5 L of material per site was collected from the top 2 cm of the grab for the purpose of toxicity testing. These samples were placed in double, 20-L high-density polyethylene (HDPE) bags, maintained in the dark at 4°C on ice until used for testing. Subsamples for chemical analyses were also collected and were stored in a freezer at -15°C. Samples were transferred to either Weston's laboratories in Carlsbad, CA (grain size analysis, toxicity testing) or to CRG Marine Laboratories in Torrance, CA (analytical testing) within 72 hours of collection.

2.1.4.2 Subsurface Sediments

Each vibracore sample was retrieved to the vessel platform using an A-frame and hydraulic winch. The sediment sample was then extruded from the core barrel by pulling the polyethylene-liner out of the aluminum barrel; the sample contained within the liner was then placed on collection trays. Following extrusion, a California Professional Geologist examined the core sample to evaluate acceptability and identify and document the post-construction depositional interface depth. The core was photographed and a detailed description of the core, including observations and other pertinent data were recorded prior to sample processing and storage on ice.

One core per location was vertically sub-sectioned into two segments (Top and Bottom) as determined in the field by the certified geologist. The upper segment included the top 10 cm; the lower segment included the remaining core sample between the upper segment and the interface layer. The vertical subsections from individual cores were homogenized with a clean stainless steel mixing apparatus into a single sample. Sub-samples from each vertical core segment were placed into double, Ziploc™ bags for physical analyses and into one 8-oz jar with a Teflon-lined lid for chemical analyses. If the length of the core's depositional material was less than 10 cm (all Top material), a Bottom sample was not analyzed. No Bottom sample was collected for Station A-2 since the depositional/native material interface was at 10 cm in depth. Duplicate samples collected in polycarbonate tubing (Figure 5) for archival purposes in the event additional sediment is needed for further analyses. The archive cores were cut into shorter lengths, capped, labeled, and stored on ice in the field prior to being transported and placed into a freezer (set at -

15°C) at Weston for storage. The cores were kept in a vertical orientation until completely frozen to reduce the likelihood of the migration of particles within tubing. All field samples were transferred to their respective analytical laboratory within 72 hours of collection.

Figure 5. Core tube archive sample collected using vibracore grab sampler.

2.1.4.3 Geologic Description

A California Professional Geologist evaluated sediment and soil cores according to the Unified Soil Classification System (USCS; Figure 6). The geological description of each core included the texture, odor, color, length, approximate grain size distribution, plasticity characteristics of the fine-grained fraction, and any evident stratification of the sediment.

2.1.5 Sample Storage

Samples were labeled, placed on ice, and shielded from light until delivery to CRG Marine Laboratories or Weston's laboratory personnel for analyses. Archives of all sediment samples are currently preserved in freezers at 15°C at Weston's Carlsbad laboratory.

Figure 6. Geologist cutting polyethylene liner prior to logging the core's lithology.

2.1.6 Documentation and Chain-of-Custody

The principal documents used to identify samples and to document sample custody were Chain-of-Custody (COC) records, field logbooks, and field tracking forms. Weston's standard COC procedures were used for all samples throughout the collection, transport, and analytical process, and for all data documentation, whether in hard copy or electronic format.

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

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 container and secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). Minimum documentation of sample handling and custody included 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

2.1.7 Decontamination of Field and Laboratory Equipment

All vibracore equipment was cleaned prior to sampling. Between stations, the core barrel and deck of the vessel were rinsed with site water. Before creating each composite, all stainless steel utensils (stainless steel bowls, spoons, spatulas, mixers, and other utensils) were cleaned with soapy water, rinsed with tap water, and then rinsed three times with deionized water.

2.2 PHYSICAL AND CHEMICAL ANALYSES

Physical and chemical parameters to be measured in this testing program were selected to provide data on potential chemicals of concern in accordance with the SAP (Caltrans, 2006) and the QAPP (Weston, 2007). The constituents that will be analyzed in the Marina del Rey Harbor Sediment Characterization Study are included in Table 1. The analytical methods chosen for chemistry analyses provide the lowest method detection limits (MDLs) practical. Actual detection limits are provided in Appendix C.

Table 1. Constituents to be monitored and analytical methods performed for MdRH sediment samples.

Constituent	Methods	Target Volume	Method Notes
Surficial Sediment Samples (Top 2 cm) collected by Van Veen			
Total Organic Carbon (TOC)	EPA 415.1	200 grams	By Combustion or Oxidation
Grain Size Analysis	Plumb 1981	100 grams	Settling Tube
Trace Metals	EPA 6020	200 grams	ELAN 6000 Inductively Couple Plasma (ICP) – Mass Spectrometry (MS)
Pesticides	EPA 8270C	200 grams	Organochlorine pesticides
PCBs	EPA 8270C	200 grams	Aroclors and individual congeners will be analyzed
Acute Toxicity	EPA 1994	A minimum of 2.5 liters	10-day amphipod test using *E. estuarius* with reburial
Benthic Infauna	SCCWRP Bight '03	Penetration depth between 5-10 cm	BRI and other metrics
Vertical Core Samples (Sub-sectioned into Top and Bottom segments) collected by Vibracore			
Total Organic Carbon (TOC)	EPA 415.1	200 grams	By Combustion or Oxidation
Grain Size Analysis	Plumb 1981	100 grams	Settling Tube
Trace Metals	EPA 6020	200 grams	ELAN 6000 Inductively Couple Plasma (ICP) – Mass Spectrometry (MS)
Pesticides	EPA 8270C	200 grams	Organochlorine pesticides
PCBs	EPA 8270C	200 grams	Aroclors and individual congeners will be analyzed

2.3 SOLID PHASE TOXICITY TESTING

As outlined in the SAP (Caltrans, 2006), bioassay testing was performed on 16 surface grab samples. Testing for this project included one solid phase (SP) toxicity test with the amphipod *Eohaustorius estuarius*. The amphipod bioassay was performed to determine the potential impact of exposure to Marina del Rey Harbor sediments on benthic organisms. All testing and analysis was performed in accordance with Appendix E of the Inland Testing Manual (ITM; United States Environmental Protection Agency [USEPA]/United States Army Corps of Engineers [USACE], 1998), American Standard Testing Methods (ASTM) Standard E-1367-99 (ASTM, 2003), *Methods for Assessing Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods* (USEPA, 1994). Methods were consistent with testing performed for the Southern California Regional Marine Monitoring Survey (Bight, 2003).

2.3.1 10-day Acute Solid Phase Test

Surface sediment was tested in a 10-day acute test using the marine amphipod *E. estuarius*. Prior to testing, the test and control sediments were sieved to remove organisms. This was accomplished by press-sieving the sediment through a 2.0-mm mesh screen using only the water available in the sediment sample. Test organisms were supplied by Northwestern Aquatic Sciences, Newport, Oregon. Laboratory control sediment was collected from Yaquina Bay, Oregon, the same area the organisms were collected (i.e., native sediment). Each sediment type (test and control) was run with five replicates. Sediment was placed in 1- L glass jars to a thickness of 2 cm (150 mL), to which was added approximately 750 mL of 20 ± 2 ppt seawater. Additional surrogate replicates (no organisms) for each treatment were set up to obtain measurement of interstitial (pore water) ammonia. The test was run under static conditions with continuous light at a temperature of 15 ± 2°C. Gentle aeration was provided to each replicate to maintain dissolved oxygen (DO) levels, with care taken to avoid disturbing the sediment. At test initiation, test organisms were randomly distributed to test chambers. Initial stocking densities were 20 organisms per replicate. Amphipods remaining in the water column and exhibiting abnormal behavior were replaced after 1 hour. The chambers were covered with petri dishes to minimize evaporation. Daily water quality measurements, including DO, temperature, salinity, and hydrogen ion concentration (pH), were taken on one replicate from each treatment. Initial and final water quality measurements were taken on every replicate from each treatment. Ammonia was measured in both pore water and overlying water at the start and finish of the test at each site. Sediment pore water was extracted via centrifugation. All instruments used were calibrated and logged daily. Daily observations were also recorded. On Day 10, the amphipods were gently sieved from the sediment using a 0.5-mm screen. The amphipods were transferred to a sorting tray, and the number of survivors was recorded. Surviving organisms were placed in a 500 mL dish containing 2 cm of native sediment and allowed one hour to rebury. After one hour, the number of amphipods able to rebury was recorded. Test results were compared to test acceptability criterion (i.e., ≥ 90% mean survival in controls at test termination).

A reference toxicant test was conducted using cadmium chloride with concentrations of 0, 2.50, 5.00, 10.0, 20.0, and 40.0 mg Cd^{2+}/L to establish sensitivity of test organisms used in the evaluation of Marina del Rey Harbor sediments. An additional reference toxicant test was also conducted using ammonium chloride with actual concentrations of 0, 7.87, 16.9, 47.2, 85.4, and 148 mg total NH_3/L, and calculated un-ionized concentrations of 0, 0.385, 0.673, 1.21, 1.75, and 1.55 mg un-ionized NH_3/L to evaluate the potential influence of ammonia toxicity. The test conditions and acceptability criteria for the acute toxicity test using *E. estuarius* are shown in Table 2.

Table 2. Test conditions for the 10-day Solid Phase test using *Eohaustorius estuarius*

Test Conditions: *Eohaustorius estuarius* Acute Toxicity Test		
Sample Identification	**H-2, MC-2, MC-1, F-1, MC-5, MC-3, E-1, G-2, C-2, B-2, A-2, MC-4, E-3, E-4, D-3, D-2**	
Date sampled	September 17 - 19, 2007	
Date received at Carlsbad Laboratory	September 21, 2007	
Approximate volume received	6 L per sample	
Sample storage conditions	4°C, dark, minimal head space	
Test Species	***E. estuarius***	
Supplier	Northwestern Aquatic Sciences, Newport, Oregon	
Date acquired	October 3, 2007	
Acclimation/holding time	2 days	
Age/Size class	3 – 5 mm	
Test Procedures	**ITM (USEPA/USACE, 1998), ASTM E1367-99 (ASTM 2003) and USEPA (1994)**	
Test location	Weston Solutions Carlsbad laboratory, Room 2	
Test type/duration	Static – Acute / 10 days	
Test dates	October 5 – 15, 2007	
Control water	Scripps Institute of Oceanography seawater; 3 µm filtered, UV sterilized	
Test temperature	Target: 15 ± 2°C	Actual: 13 - 17°C
Test Salinity	Target: 20 ± 2 ppt	Actual: 19 – 22 ppt
Test dissolved oxygen	Target: > 6.0 mg/L	Actual: 7.3 – 8.8 mg/L
Test pH	Target: monitor drift	Actual: 7.7 - 8.4
Test overlying total ammonia	No recommended concentration	Actual: <0.500 mg/L
Test overlying un-ionized ammonia	No recommended concentration	Actual: <0.012 - <0.023 mg/L
Test interstitial total ammonia	Target: < 60 mg/L	Actual: 0.571 – 4.79 mg/L
Test interstitial un-ionized ammonia	Target: <0.8 mg/L	Actual: 0.003 – 0.058 mg/L
Test photoperiod	Constant light	
Test chamber	1 L glass jars	
Replicates/treatment	5	
Organisms/replicate	20	
Exposure volume	2 cm sediment; 750 mL water	
Feeding	None	
Water renewal	None	
Deviations from Test Protocol	None	

2.3.2 Seawater for Bioassay Testing

Seawater used in this study came from the Scripps Institution of Oceanography in La Jolla, California. This control seawater source has been used successfully on similar bioassay testing programs by Weston. Extensive testing on a variety of test species and biannual chemical analysis of this seawater source has shown high survival of organisms in the control sediment utilized in this testing program and has been achieved consistently in previous sediment testing. As a result, there is no significant potential for toxicity or bioaccumulation from this water supply.

2.3.3 Water Quality

Water quality was monitored daily as appropriate for each test and was recorded on data sheets. DO and temperature were measured using Orion Model 830A oxygen meters and probes. pH was measured using Orion Model 230A pH meters and probes. Salinity was measured with Orion Model 142 conductivity/salinity meters. Ammonia was analyzed using an Orion 720 digital ion analyzer with a three-point calibration curve (1, 10, and 100 mg/L).

2.4 BENTHIC INFAUNA EVALUATION

The benthic samples were brought back from the field to the laboratory where they remained in a formalin solution for 7 days. The samples were then transferred from formalin to 70% ethanol for laboratory processing. The organisms were sorted using a dissecting microscope into five main taxonomic groups: polychaetes, crustaceans, molluscs, echinoderms, and miscellaneous minor phyla. While sorting, technicians kept a rough count for quality assurance/quality control (QA/QC) purposes. Qualified taxonomists identified each organism and kept an actual count. The organisms were identified to the lowest possible taxon for each phylum.

A QA/QC procedure was performed on each of the sorted samples to ensure a 95% sorting efficiency. A 10% aliquot of a sample was re-sorted by a senior technician trained in the QA/QC procedure. The number of organisms found in the aliquot was divided by 10% and added to the total number found in the sample. The original total was divided by the new total to calculate the percent sorting efficiency. When the sorting efficiency of the sample was below 95%, the remainder of the sample (90%) was re-sorted.

Quality control of the taxonomic analysis was performed by a re-identification of 10% of the samples. Secondary QA was conducted by taxonomists other than those that conducted the primary taxonomic identifications. Both the primary and secondary taxonomists worked together to reconcile any discrepancies.

2.5 APPLICATION OF CALIFORNIA'S SEDIMENT QUALITY OBJECTIVES USING THE MULTIPLE LINES OF EVIDENCE APPROACH

Sediment quality from Marina del Rey Harbor was assessed using California's SQOs as described in the *Draft Staff Report, Water Quality Control Plan for Enclosed Bays and Estuaries* (State Water Resources Control Board [SWRCB] – California Environmental Protection Agency [Cal EPA], 2007). These SQOs are based on a multiple lines of evidence (MLOE) approach in which the lines of evidence (LOE) are sediment toxicity, sediment chemistry, and benthic community condition. The MLOE results were integrated through the evaluation of the severity of biological effects and the potential for chemically-mediated effects to provide a final station level assessment. The specific methods associated with each LOE and the integration of the MLOE are described in detail below.

2.5.1 Sediment Toxicity

The *E. estuarius* sediment toxicity test results from each station were statistically compared to control test results using the procedures described in section 2.3.1, normalized to the control survival, and categorized according to Table 3. The categories shown below were established based on thresholds using test-specific characteristics as described in detail by Bay et al. (2007). As shown in the table below, the categorization of data depends on whether or not the survival of *E. estuarius* from a project station is statistically significant from the survival of organisms in the control. For example, if survival of *E. estuarius* in project A sediment was 81% (of control survival), and was significantly different from the control survival using the statistics described above, then this sample would be categorized as *Moderate Toxicity*.

Table 3. Sediment toxicity categorization values for *Eohaustorius estuarius*

% Survival of *E. estuarius* in Project Sediment		
If Significantly Different than Control Survival	**If Not Significantly Different from Control**	**Category**
90 – 100	82 – 100	**Nontoxic**
82 – 89[1]	59 – 81[1]	**Low Toxicity**
59 – 81[1]		**Moderate Toxicity**
< 59[1]	< 59[1]	**High Toxicity**

[1] These values are % of control survival

2.5.2 Sediment Chemistry

2.5.2.1 California Logistic Regression Model

Results of chemicals detected in project sediment were compared to the California Logistic Regression Model (CA LRM) and the Chemical Score Index (CSI). The CA LRM is a maximum probability model (P_{MAX}) developed by Field et al. (2002). This model is based on individual chemical logistic regression models developed from a large data set where results of sediment chemistry were matched with toxicity data from the standard 10 day SP test with the amphipods *Ampelisca abdita* or *Rhepoxynius abronius*. Each regression model estimates the probability of observing toxicity at the concentration of a contaminant of concern (or a class of contaminants of concern) in field collected sediments. The CA LRM follows this equation: $p = e^{B0+B1\,(x)} / (1 + e^{B0+B1\,(x)})$. To use the CA LRM, concentrations of each contaminant are entered into the corresponding logistic regression model and a single probability for causing toxicity is determined for each contaminant. The individual contaminant with the highest probability for causing toxicity is the P_{MAX} value. The P_{MAX} value determined for each project area is compared to the values in Table 4 and categorized according to the associated exposures (minimal, low, moderate or high). For example, if the P_{MAX} is determined to be 0.64, then this would be categorized as a moderate exposure.

Table 4. Sediment Chemistry Guideline Categorization

Sediment Chemistry Guideline		
CA LRM	**CSI**	**Category**
<0.33	<1.69	**Minimal Exposure**
0.33 - 0.49	1.69 - 2.33	**Low Exposure**
0.50 - 0.66	2.34 - 2.99	**Moderate Exposure**
>0.66	>2.99	**High Exposure**

2.5.2.2 Chemical Score Index

The CSI was developed by Ritter et al. (2007) for the SQO program and is based on the relationship between sediment chemical concentration and benthic community disturbance to southern California benthic macrofauna. The CSI index is the weighted mean of benthic community category scores (cat) based on guidelines developed for 13 contaminants and weighting factors for each contaminant (w_i). CSI is measured by the following equation: $CSI = \sum(w_i \text{ x cat}) / \sum w_i$. The weighting factors for each contaminant were determined by Ritter et al. (2007), based on a statistical optimization procedure. The higher the weighting factor, the better the predictive accuracy of a chemical to indicate benthic community disturbance (as compared to other chemicals). In the CSI method, the benthic community disturbance category is determined by comparing the contaminant concentration to the values associated with the following guidelines: Reference (<Low guideline), Low Disturbance, Moderate Disturbance, and

High Disturbance (>High guideline). These guidelines are specified in Table 6 of Appendix A of the *Draft Staff Report* (SWRCB, 2007). The CSI is then calculated using the equation above and the resulting value compared to the values in Table 4 and categorized according to the associated exposures (minimal, low, moderate or high). For example, if the CSI is calculated to be 2.25, then this would be categorized as a low exposure.

2.5.2.3 Integration of Sediment Chemistry Categories

The final sediment LOE category is the average of the two chemistry exposure categories. If the average falls midway in between the two categories it is rounded up to the higher of the two. For example if the CA LRM is low exposure and the CSI is moderate exposure, then the final sediment LOE category is moderate exposure.

2.5.3 Benthic Community Condition

Benthic community condition was assessed using a combination of four benthic indices: the Benthic Response Index (BRI), Relative Benthic Index (RBI), Index of Biotic Integrity (IBI), and a predictive model based on the River Invertebrate Prediction and Classification System (RIVPACS). The four indices were calculated following the January 21, 2008 guidance provided by the SCCWRP entitled *Determining Benthic Invertebrate Community Condition in Embayments* for southern California marine bays. Each benthic index result was categorized according to four levels of disturbance, with conditions ranging from a reference condition to high disturbance.

- Reference: Equivalent to a least affected or unaffected site
- Low Disturbance: Some indication of stress is present, but is within measurement error of unaffected condition
- Moderate Disturbance: Clear evidence of physical, chemical, natural, or anthropogenic stress
- High Disturbance: High magnitude of stress

Specific categorization values, which were specifically tailored to southern California marine bays, were assigned for each index (Table 5). The final step in determining the benthic community condition was the integration of the four indices into a single category. In doing so, the median of the four benthic index response categories was computed to determine the benthic condition. If the median fell between two categories, the value was rounded to the next higher category to provide the most conservative estimate of benthic community condition.

Table 5. Benthic Index Categorization Values for Southern California Marine Bays

Benthic Community Guideline				
BRI	**IBI**	**RBI**	**RIVPACS**	**Index**
< 39.96	0	> 0.27	> 0.90 to < 1.10	**Reference**
39.96 to 49.14	1	0.17 to 0.27	0.75 to 0.90 or 1.10 to 1.25	**Low Disturbance**
49.15 to 73.26	2	0.09 to 0.16	0.33 to 0.74 or > 1.25	**Moderate Disturbance**
> 73.26	3 or 4	< 0.09	< 0.33	**High Disturbance**

A description of the methods used to calculate the four indices is provided as follows.

Benthic Response Index

The BRI is the 'abundance-weighted pollution tolerance score' of infaunal species, with scores increasing from 0 to 100 with greater levels of disturbance (Smith et al., 2001 and 2003). The BRI scores were calculated using the abundances of species and their respective pollution-tolerance values (P) as shown in the following formula:

$$\text{BRI} = \frac{\sum\left(\sqrt[4]{Abundance}\right)\times P}{\sum\sqrt[4]{Abundance}}$$

The BRI scores then were compared to categorization values to determine the community condition category of the sample, as shown in Table 5.

Relative Benthic Index

The RBI was calculated as the weighted sum of (a) four community parameters (total number of taxa, number of crustacean taxa, number of molluscan taxa, and number of crustacean individuals), (b) three positive indicator organisms, and (c) two negative indicator taxa. Positive indicator taxa included an amphipod (*Monocorphium insidiosum*), a bivalve (*Asthenothaerus diegensis*), and a polychaete (*Goniada littorea*), and negative indicator taxa included Oligochaeta and *Capitella capitata* complex.

Calculations were completed in five steps. First, community parameters were normalized relative to the maximum values of the data used in calculating the southern California marine bays RBI (i.e., the parameters were scaled). Normalization involved dividing total number of taxa by 99, number of crustacean taxa by 29, number of molluscan taxa by 28, and number of crustacean individuals by 1693 to calculated the scaled values. Second, the Taxa Richness Weighted Value (TWV) was calculated as:

TWV = Scaled total number of taxa + Scaled number of crustacean taxa +Scaled number of molluscan taxa + (0.25 x Scaled abundance of crustaceans).

Third, the value for the two negative indicator taxa (NIT) was determined by subtracting 0.1 for the presence of each negative taxon; therefore, NIT could be one of three values: zero (neither taxon was present), -0.1 (one taxon was present), and -0.2 (both taxa were present). Fourth, a value for the three positive indicator taxa (PIT) was calculated as follows using the abundances of *M. insidiosum* (*Mi*), *A. diegensis* (*Ai*) and *G. littorea* (*Gl*) in the following equation:

$$\text{PIT} = \frac{\sqrt[4]{Mi}}{\sqrt[4]{473}} + \frac{\sqrt[4]{Ad}}{\sqrt[4]{27}} + \frac{\sqrt[4]{Gl}}{\sqrt[4]{15}}$$

Next, the Raw RBI was calculated as:

Raw RBI = TWV + NIT + (2 x PIT).

Finally, the RBI Score was calculated by normalizing the Raw RBI by the minimum and maximum Raw RBI values from the index development data:

RBI Score = (Raw RBI – 0.03)/4.69

The RBI values were scaled from 0 to 1.0, with lower values indicative of higher levels of disturbance. Scores then were compared to categorization values to determine the community condition category of the sample (Table 5).

Index of Biotic Integrity

Determination of the IBI involved comparisons of four community measures (total number of taxa, number of molluscan taxa, abundance of *Notomastus* sp., percentage of sensitive taxa) to reference conditions for southern California marina bays (Table 6). For every metric that exceeded a reference condition, the IBI value was increased by a score of one; therefore, IBI values potentially range from 0 to 4, with lower values indicative of lower levels of disturbance (Table 5).

Table 6. Reference Ranges for IBI Metrics in Southern California Marine Bays

Metric	**Reference**
Total Number of Taxa	13 to 99
Number of Mollusc Taxa	2 to 25
Abundance of *Notomastus* sp.	0 to 59
Percentage of Sensitive Species	19 to 47.1

River Invertebrate Prediction and Classification System Index

The RIVPACS index was used to compare the sample assemblages (Observed) to reference species compositions (Expected) from a similar habitat. Calculation of the RIVPACS score involved three steps. (1) The probability of the test sample belonging to the 12 southern California marine bays reference sample groups was calculated. (2) The identity and expected number of reference species were determined based on the probabilities of group membership. (3) The observed number of reference species in the sample was totaled, and then the Observed/Expected RIVPACS score was calculated for comparisons to benthic community categorization values (Table 5).

2.6 INTEGRATION OF MULTIPLE LINES OF EVIDENCE

The station level assessment provides an indication of whether the aquatic life SQOs are being met at each station of interest. The station level assessment is based upon the severity of biological effects (i.e., integration of toxicity LOE and benthic condition LOE categories) and the potential for chemically-mediated effects (i.e., the integration of the toxicity LOE and chemistry LOE categories), using the decision matrices presented in Table 7 and Table 8, respectively.

Table 7. Severity of Biological Effects Category

Benthic Condition LOE Category	**Toxicity LOE Category**	**Severity of Biological Effects Category**
Reference	Nontoxic	**Unaffected**
Reference	Low Toxicity	**Unaffected**
Reference	Moderate Toxicity	**Unaffected**
Reference	High Toxicity	**Low Effect**
Low Disturbance	Nontoxic	**Unaffected**
Low Disturbance	Low Toxicity	**Low Effect**
Low Disturbance	Moderate Toxicity	**Low Effect**
Low Disturbance	High Toxicity	**Low Effect**
Moderate Disturbance	Nontoxic	**Moderate Effect**
Moderate Disturbance	Low Toxicity	**Moderate Effect**
Moderate Disturbance	Moderate Toxicity	**Moderate Effect**
Moderate Disturbance	High Toxicity	**Moderate Effect**
High Disturbance	Nontoxic	**Moderate Effect**
High Disturbance	Low Toxicity	**High Effect**
High Disturbance	Moderate Toxicity	**High Effect**
High Disturbance	High Toxicity	**High Effect**

Table 8. Potential for Chemically Mediated Effects Category

Sediment Chemistry Category	**Toxicity LOE Category**	**Potential for Chemically Mediated Effects Category**
Minimal Exposure	Nontoxic	**Minimal Potential**
Minimal Exposure	Low Toxicity	**Minimal Potential**
Minimal Exposure	Moderate Toxicity	**Low Potential**
Minimal Exposure	High Toxicity	**Moderate Potential**
Low Exposure	Nontoxic	**Minimal Potential**
Low Exposure	Low Toxicity	**Low Potential**
Low Exposure	Moderate Toxicity	**Moderate Potential**
Low Exposure	High Toxicity	**Moderate Potential**
Moderate Exposure	Nontoxic	**Low Potential**
Moderate Exposure	Low Toxicity	**Moderate Potential**
Moderate Exposure	Moderate Toxicity	**Moderate Potential**
Moderate Exposure	High Toxicity	**Moderate Potential**
High Exposure	Nontoxic	**Moderate Potential**
High Exposure	Low Toxicity	**Moderate Potential**
High Exposure	Moderate Toxicity	**High Potential**
High Exposure	High Toxicity	**High Potential**

2.6.1 Station Level Assessment

The station level assessment can be determined by combining the severity of biological effects category as shown in Table 9 with the potential for chemically-mediated effect category which results in one of six possible station level assessments including unimpacted, likely unimpacted, possibly impacted, likely impacted, clearly impacted, and inconclusive.

Table 9. Station Level Assessment Matrix

Severity of Biological Effects Category	**Potential for Chemically Mediated Effects Category**	**Station Level Assessment**
Unaffected	Minimal Potential	**Unimpacted**
Unaffected	Low Potential	**Unimpacted**
Unaffected	Moderate Potential	**Likely Unimpacted**
Unaffected	High Potential	**Inconclusive**
Low Effect	Minimal Potential	**Likely Unimpacted**
Low Effect	Low Potential	**Likely Unimpacted**
Low Effect	Moderate Potential	**Possibly Impacted or Inconclusive**
Low Effect	High Potential	**Likely Impacted**
Moderate Effect	Minimal Potential	**Likely Unimpacted**
Moderate Effect	Low Potential	**Possibly Impacted**
Moderate Effect	Moderate Potential	**Likely Impacted**
Moderate Effect	High Potential	**Clearly Impacted**
High Effect	Minimal Potential	**Inconclusive**
High Effect	Low Potential	**Possibly Impacted**
High Effect	Moderate Potential	**Likely Impacted**
High Effect	High Potential	**Clearly Impacted**

3. RESULTS

3.1 SAMPLE COLLECTION AND HANDLING

Field activities were conducted on September 17-20, 2007 within Marina del Rey Harbor. Sampling was typically conducted under clear to partly cloudy skies with light winds increasing throughout the day. The seas were calm within the harbor. All samples were collected as proposed in the SAP (Caltrans, 2006).

The vibracore sampling team collected two cores at each of the 23 pre-determined stations within Marina del Rey Harbor. All vibracore field coordinates, penetration depths, water depths, final core length and core length retained for analyses are summarized in Table 10. Recent bathymetry was not available; therefore deeper cores were collected to ensure the native layer was captured within the sample. After the collection of the first vibracore sample at a given location, a California Professional Geologist examined and logged the core to evaluate acceptability and identify and document the post-construction deposition interface depth. Once it was determined that sufficient recovery had been obtained, the core was processed as described above. Vibracore logs are included in Appendix A; core photos are included in Appendix B.

Surface sediment samples were collected using a double Van Veen grab sampler as described in Section 2.1.4.1. Van Veen station field coordinates, penetration depths, water depths, color, odor, and grab acceptability data are summarized in Table 11.

Table 10. Vibracore stations, water depth, penetration depth, core length, core length used in analyses, and station location.

Station ID	**Date**	**Time**	**Attempt**	**Water depth (ft)**	**MLLW (ft)**	**Penetration (ft)**	**Final core length (ft)**	**Core length to pre-dredge depth and retained for analysis (ft)**	**Latitude**	**Longitude**
MC-3	9/17/2007	13:45	1	20	15.4	8	6	3.5	33° 58.516	-118° 26.887
MC-4	9/17/2007	15:31	1	20.5	16.7	8	5	1.5	33° 58.351	-118° 26.904
MC-2	9/17/2007	16:55	1	15.6	12.7	4	3	2	33° 58.672	-118° 26.880
MC-5	9/18/2007	8:09	1	24.9	21	7.5	3.5	2.3	33° 58.130	-118° 26.897
MC-1	9/18/2007	9:55	1	15	10.7	7	5.5	2.5	33° 58.834	-118° 26.882
F-1	9/18/2007	11:10	1	15.2	10.7	7	5.5	2.2	33° 58.913	-118° 26.717
E-1	9/18/2007	13:55	1	16.8	12.3	6	3.2	1.5	33° 58.966	-118° 26.942
E-2	9/18/2007	14:50	1	16	11.7	7	0.0	no recovery	33° 58.979	-118° 27.067
E-2	9/18/2007	15:14	2	16	11.8	5	3	1.7	33° 58.979	-118° 27.067
E-3	9/18/2007	16:49	1	15.8	11.8	4.5	3	1.7	33° 58.975	-118° 27.211
E-4	9/18/2007	16:58	1	0	-3.5	2	1.5	1	33° 58.972	-118° 27.357
D-1	9/19/2007	8:00	1	13.7	10.4	6	4.9	1	33° 58.821	-118° 27.004
D-2	9/19/2007	9:05	1	13.7	10.1	6	4.2	0.75	33° 58.823	-118° 27.229
D-3	9/19/2007	10:10	1	15.1	11.3	7	5	1.3	33° 58.829	-118° 27.392
C-1	9/19/2007	11:10	1	15.4	11.3	5	3.9	0.9	33° 58.664	-118° 27.074
C-2	9/19/2007	13:15	1	15	10.6	6	4	0.75	33° 58.666	-118° 27.316
B-1	9/19/2007	14:10	1	18.3	13.9	7	5.4	2	33° 58.509	-118° 27.076
B-2	9/19/2007	15:15	1	16.8	12.4	7	5.6	1	33° 58.509	-118° 27.306
H-2	9/19/2007	16:40	1	15.5	11.4	7	6	1	33° 58.629	-118° 26.579
G-2	9/20/2007	7:45	1	15.8	12.3	6	5.1	2	33° 58.802	-118° 26.567
G-1	9/20/2007	8:50	1	14.9	11.4	6	4.8	1	33° 58.730	-118° 26.713
A-2	9/20/2007	10:00	1	15	11.5	6.5	4.3	0.3	33° 58.351	-118° 27.251
A-1	9/20/2007	10:55	1	16.7	13.1	6	5.7	1.8	33° 58.349	-118° 27.070
H-1	9/20/2007	12:00	1	15	11.3	6.5	5	0.8	33° 58.561	-118° 26.720

Table 11. Surface sediment station names, water depth, sample type, penetration depth, acceptability, color, odor, and station location.

Station ID	Date	Time	Attempt	Water depth (ft)	Sample Type: Infauna = I, Chemistry = C, Toxicity = T	Penetration Depth (cm) of Double Van Veen (V V1/ V V2)	Grade: Good (G), Fair (F), Poor (P)	Color	Odor	Latitude	Longitude
H-2	9/17/2007	13:45	1	15.0	I, C	17/ 17	G	Gray Green	None	33.58.637	118.26.547
H-2	9/17/2007	14:15	2	14.4	T	18/ 18	G	Gray Green	None	33.58.640	118.26.548
MC-2	9/17/2007	15:50	1	14.9	T	19/ 19	G	Gray Green	None	33.58.674	118.26.885
MC-2	9/17/2007	16:22	2	14.9	C, I, T	19/ 19	G	Gray Green	None	33.58.673	118.26.884
MC-1	9/17/2007	16:40	1	12.7	C, I, T	19/ 19	G	Gray Green	None	33.58.828	118.26.886
MC-1	9/17/2007	16:50	2	12.9	C, I, T	19/ 19	G	Gray Green	None	33.58.829	118.26.887
F-1	9/17/2007	17:20	1	12.3	C, I, T	19/ 19	G	Gray Green	None	33.58.910	118.26.716
F-1	9/17/2007	17:35	2	12.4	C, I, T	19/ 19	G	Gray Green	None	33.58.907	118.26.716
MC-5	9/18/2007	7:50	1	23.5	C, I, T	19/ 19	G	Gray Green	None	33.58.118	118.26.908
MC-5	9/18/2007	8:10	2	23.5	C, I, T	19/ 19	G	Gray Green	None	33.58.116	118.26.908
MC-3	9/18/2007	9:00	1	17.4	C, I, T	19/ 12	G	Gray Green	None	33.58.517	118.26.891
MC-3	9/18/2007	9:15	2	17.9	C, I, T	19/ 19	G	Gray Green	None	33.58.513	118.26.890
E-1	9/18/2007	9:45	1	14.4	C, I, T	19/ 19	G	Gray Green	None	33.58.961	118.26.945
E-1	9/18/2007	10:00	2	14.9	C, I, T	19/ 19	G	Gray Green	None	33.58.961	118.26.942
G-2	9/18/2007	10:45	1	15.1	C, I, T	19/ 19	G	Gray Green	None	33.58.801	118.26.575
G-2	9/18/2007	11:45	2	14.9	C, I, T	19/ 19	G	Gray Green	None	33.58.797	118.26.574
C-2	9/18/2007	12:10	1	14.9	C, I, T	19/ 19	G	Gray Green	None	33.58.664	118.27.315
C-2	9/18/2007	12:45	2	14.0	C, I, T	19/ 16	G	Gray Green	None	33.58.666	118.27.317
B-2	9/18/2007	14:17	1	15.4	C, I, T	19/ 19	G	Gray Green	None	33.58.506	118.27.306
B-2	9/18/2007	14:29	2	14.9	C, I, T	19/ 19	G	Gray Green	None	33.58.505	118.27.304
A-2	9/18/2007	15:00	1	14.9	C, I, T	19/ 19	G	Gray Green	None	33.58.352	118.27.254
A-2	9/18/2007	15:10	2	14.5	C, I, T	19/ 19	G	Gray Green	None	33.58.351	118.27.255
MC-4	9/18/2007	15:30	1	19.5	C, I, T	19/ 19	G	Gray Green	None	33.58.357	118.26.890
MC-4	9/18/2007	15:45	2	20	C, I, T	19/ 19	G	Gray Green	None	33.58.355	118.26.891
E-3	9/19/2007	8:00	1	13.8	C, I, T	19/ 19	G	Gray Green	None	33.58.981	118.27.212
E-3	9/19/2007	8:15	2	13.9	C, I, T	19/ 19	G	Gray Green	None	33.58.980	118.27.211
E-4	9/19/2007	8:45	1	14.8	C, I, T	19/ 19	G	Gray Green	None	33.58.974	118.27.355
E-4	9/19/2007	9:00	2	13.9	C, I, T	19/ 19	G	Gray Green	None	33.58.970	118.27.353
D-3	9/19/2007	9:45	1	12.5	C, I, T	19/ 19	G	Gray Green	None	33.58.818	118.27.399
D-3	9/19/2007	9:55	2	12.6	C, I, T	19/ 19	G	Gray Green	None	33.58.817	118.27.229
D-2	9/19/2007	10:15	1	12.6	C, I, T	19/ 19	G	Gray Green	None	33.58.823	118.27.229
D-2	9/19/2007	10:30	2	12.5	C, I, T	19/ 19	G	Gray Green	None	33.58.825	118.27.228

3.2 RESULTS OF SEDIMENT CHEMISTRY

Chemical analyses were performed on surficial sediments (0-2 cm) collected using a Van Veen grab sampler and on Top (0-10 cm) and Bottom (11 cm- project depth) core samples that were collected using an electric vibracore. Physical analysis of grain size distributions for each Van Veen and vibracore (Top and Bottom) sample was also performed.

3.2.1 Surface chemistry results from 16 Van Veen sampling locations

Surficial sediment collected using a Van Veen grab sampler was analyzed for metals, aroclor PCBs, PCB congeners, and chlorinated pesticides. Analyses of surficial samples were performed on the upper 0-2cm of material collected at each of 16 designated sampling locations. The effect range-low (ER-L) and effect range-median (ER-M) sediment quality values developed by Long et al., (1995) are included in Table 12 for comparative purposes only. Briefly, these values were developed from a large data set where results of both sediment bioassays (e.g., amphipod tests) and chemical analyses were available for individual samples. For each chemical, data were arranged in order of increasing concentration. Samples which showed no toxicity were excluded. The ER-L and the ER-M were then calculated as the lower 10th and 50th percentile, respectively, of the observed effects concentrations. While these values are useful in identifying elevated sediment-associated contaminants, they should not be used to infer toxicity because of the inherent variability and uncertainty of the approach.

For certain pesticide compounds (dieldrin and chlordane, for example) the ER-L (0.02 ng/dry g and 0.5 ng/dry g, respectively) and ER-M (8 ng/dry g and 6 ng/dry g, respectively) levels are so low as to make it largely impractical to detect them in typical harbor sediments using routine analytical procedures. Accordingly, having non-detect results that are greater than the ER-L or ER-M would not indicate these results as exceedances. The total threshold limit concentration (TTLC) of each target analyte is also provided in Table 12. TTLC values indicate the concentration at which target analytes would be classified as hazardous waste under Title 26 of the California Code of Regulations.

Test Sample Chemistry

Across all sample locations, several analytes exceeded ER-L and/or ER-M sediment quality values. Analytes detected above ER-M values included the copper, zinc, total detectable chlordane, total detectable dichlorodiphenyltrichloroethane (DDT), and total detectable PCBs. No analyte concentrations exceeded the TTLC at any of the sample locations.

Metals

In general the metals copper, lead, and zinc were detected at concentrations above the ER-L at most locations. Copper concentrations ranged from 136.7 μg/dry g to 433.6 μg/dry g and exceeded the ER-L at 16 of 16 sites (100%). The ER-M value of 270 μg/dry g for copper was exceeded at 7 of 16 sites (44%). None of the sites located in the Main Channel had copper concentrations above the ER-M. Lead concentrations (43.10 μg/dry g to 123.0 μg/dry g) were above the ER-L at all 16 sites, but did not exceed the ER-M at any site. Zinc concentrations ranged from 162.8 μg/dry g to 452.1 μg/dry g and were detected above the ER-L at every site. The ER-M for zinc was exceeded at site E-3.

Polychlorinated Biphenyls

Both aroclor groupings of PCBs and individual PCB congeners were analyzed. Aroclor 1254 was detected at every site and ranged in concentration from 13.50 ng/dry g to 40.10 ng/dry g. Aroclor 1260 was detected at 4 of 16 sites (25%), ranging in concentration from less than 10.00 ng/dry g at most sites to

40.30 ng/dry g at site C-2. Aroclor 1242 was also detected at C-2 at a concentration above the MDL but below the method reporting limit (MRL). No other aroclors were detected.

Site MC-1 had the highest concentration of total detectable PCB congeners (189.9 ng/ dry g), which slightly exceeded the total PCB ER-M value of 180 ng/dry g. All other sites, with the exception of site A-2, exceeded the ER-L for total detectable PCBs, but did not exceed the ER-M. The highest concentration of any individual PCB was PCB 119, detected at a concentration of 64.00 ng/dry g at site MC-1 located at the back of the Main Channel.

Chlorinated Pesticides

The chlorinated pesticides 4,4’-DDD and 4,4’-DDE were detected above ER-L values in 50 percent and 81 percent of samples, respectively. The ER-M value for total detectable DDTs was exceeded at site E-1 while total detectable DDT ER-L values were exceeded at all sites. Aside from DDTs, Total detectable chlordane was the only other chlorinated pesticide measured above reporting limits at any site location. Total detectable chlordane was measured above the ER-L at 13 of 16 sample locations and was measured above the ER-M at 5 of 16 site locations, 4 of which were in the Main Channel.

Table 12. Van Veen Surficial (top 2 cm) Grab Chemistry

Analyte	Units	ERL	ERM	TTLC	A-2	B-2	C-2	D-2	D-3	E-1	E-3	E-4	F-1	G-2	H-2	MC-1	MC-2	MC-3	MC-4	MC-5
Total Organic Carbon	%				1.18	2.46	1.32	1.11	1.76	1.33	2.16	1.74	1.85	1.86	0.80	1.46	1.39	2.28	1.42	3.35
Chlorinated Pesticides																				
2,4'-DDD	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	1.600J	<1.000	<1.000	<1.000	<1.000	1.400J	1.400J	1.600J	<1.000	<1.000	<1.000
2,4'-DDE	ng/dry g	.	.	.	<1.000	1.200J	<1.000	1.400J	<1.000	1.800J	2.300J	1.100J	1.100J	1.200J	<1.000	2.300J	1.800J	4.600J	1.600J	<1.000
2,4'-DDT	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
4,4'-DDD	ng/dry g	**2**	**20**	.	**3.000J**	<1.000	1.300J	1.200J	<1.000	**14.700**	**8.200**	**5.400**	**11.100**	**3.700J**	**7.400**	**9.600**	**11.000**	**7.100**	**3.800J**	<1.000
4,4'-DDE	ng/dry g	**2.2**	**27**	.	**7.000**	**14.700**	**13.600**	**13.700**	**9.000**	**32.500**	**26.000**	**20.400**	**28.100**	**21.700**	**14.100**	**17.800**	**27.600**	**19.900**	**19.100**	**24.500**
4,4'-DDT	ng/dry g	**1**	**7**	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	3.200J	<1.000	<1.000	2.600J	<1.000	<1.000	<1.000
Aldrin	ng/dry g	.	.	**1400**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-alpha	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-beta	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-delta	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-gamma	ng/dry g	.	.	**4000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Chlordane-alpha	ng/dry g	.	.	.	<1.000	1.100J	<1.000	<1.000	<1.000	2.200J	<1.000	1.400J	1.300J	1.800J	<1.000	1.100J	2.600J	3.600J	3.100J	4.500J
Chlordane-gamma	ng/dry g	.	.	.	<1.000	1.500J	<1.000	<1.000	<1.000	2.100J	<1.000	1.300J	1.200J	1.400J	<1.000	<1.000	2.700J	3.900J	3.200J	5.900
cis-Nonachlor	ng/dry g	.	.	.	1.600J	1.900J	<1.000	1.100J	1.300J	<1.000	<1.000	1.100J	1.600J	2.000J	<1.000	<1.000	2.700J	5.800	2.800J	4.800J
Dieldrin	ng/dry g	**0.02**	**8**	**8000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan Sulfate	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan-I	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan-II	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin	ng/dry g	.	.	**200**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin Aldehyde	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin Ketone	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Heptachlor	ng/dry g	.	.	**4700**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Heptachlor Epoxide	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Methoxychlor	ng/dry g	.	.	**100000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Mirex	ng/dry g	.	.	**21000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Oxychlordane	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Perthane	ng/dry g	.	.	.	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000
Total Detectable Chlordane	ng/dry g	**0.5**	**6**	**2500**	**1.600**	**5.600**	ND	**1.100**	**1.300**	**5.500**	ND	**3.800**	**5.200**	**6.400**	ND	**1.100**	**10.300**	**15.400**	**11.400**	**21.400**
Total Detectable DDTs	ng/dry g	**1.58**	**46.1**	.	**10.000**	**15.900**	**14.900**	**16.300**	**9.000**	**50.600**	**36.500**	**26.900**	**40.300**	**29.800**	**22.900**	**31.100**	**44.600**	**31.600**	**24.500**	**24.500**
Toxaphene	ng/dry g	.	.	**5000**	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
trans-Nonachlor	ng/dry g	.	.	.	<1.000	1.100J	<1.000	<1.000	<1.000	1.200J	<1.000	<1.000	1.100J	1.200J	<1.000	<1.000	2.300J	2.100J	2.300J	6.200
Metals																				
Copper (Cu)	µg/dry g	**34**	**270**	**2500**	**154.600**	**376.300**	**251.900**	**311.100**	**418.800**	**286.900**	**433.600**	**209.200**	**382.000**	**331.700**	**137.000**	**221.200**	**184.500**	**232.000**	**136.700**	**146.400**
Lead (Pb)	µg/dry g	**46.7**	**218**	**1000**	**71.170**	**116.900**	**64.700**	**60.620**	**68.780**	**63.230**	**98.730**	**55.060**	**95.540**	**105.200**	43.100	**65.850**	**62.070**	**97.840**	**74.460**	**123.000**
Zinc (Zn)	µg/dry g	**150**	**410**	**5000**	**184.500**	**404.500**	**286.700**	**298.100**	**368.900**	**293.700**	**452.100**	**295.800**	**384.500**	**323.500**	**162.800**	**246.900**	**219.600**	**301.000**	**204.100**	**309.000**
Aroclors																				
Aroclor 1016	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1221	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1232	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1242	ng/dry g	.	.	.	<10.000	<10.000	16.600J	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1248	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1254	ng/dry g	.	.	.	20.200	34.400	37.100	20.300	19.100J	20.300	40.100	20.800	31.100	25.700	13.500J	21.300	33.300	29.400	17.200J	38.800
Aroclor 1260	ng/dry g	.	.	.	40.100	<10.000	40.300	<10.000	<10.000	<10.000	30.600	<10.000	<10.000	<10.000	<10.000	14.300J	<10.000	<10.000	<10.000	<10.000
PCB Congeners																				
PCB008	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB128	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.800J	<1.000	<1.000	<1.000	<1.000
PCB167	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.300J	<1.000	<1.000	<1.000	<1.000
PCB195	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.900J	<1.000	<1.000	<1.000	<1.000
PCB209	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.100J	<1.000	<1.000	<1.000	<1.000
PCB018	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB028	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB031	ng/dry g	.	.	.	<1.000	<1.000	1.900J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB033	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB037	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000

Analyte	Units	ERL	ERM	TTLC	A-2	B-2	C-2	D-2	D-3	E-1	E-3	E-4	F-1	G-2	H-2	MC-1	MC-2	MC-3	MC-4	MC-5
PCB044	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.500J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB049	ng/dry g	.	.	.	1.000J	<1.000	<1.000	<1.000	<1.000	2.100J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB052	ng/dry g	.	.	.	<1.000	1.600J	3.100J	2.500J	<1.000	<1.000	<1.000	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB066	ng/dry g	.	.	.	<1.000	2.100J	3.600J	2.600J	1.000J	<1.000	2.900J	3.400J	3.400J	2.700J	1.200J	1.000J	3.400J	1.400J	3.000J	1.900J
PCB070	ng/dry g	.	.	.	<1.000	<1.000	2.200J	2.400J	<1.000	2.100J	<1.000	<1.000	1.200J	<1.000	<1.000	2.000J	<1.000	<1.000	<1.000	<1.000
PCB074	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	1.400J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.400J	<1.000	<1.000
PCB077	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB081	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB087	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB095	ng/dry g	.	.	.	1.200J	4.200J	3.800J	2.200J	1.900J	2.200J	3.200J	2.800J	2.300J	3.100J	1.000J	2.000J	3.400J	2.000J	2.800J	2.000J
PCB097	ng/dry g	.	.	.	<1.000	1.200J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB099	ng/dry g	.	.	.	2.200J	3.700J	4.400J	3.000J	1.100J	2.400J	3.100J	1.400J	3.300J	3.000J	1.600J	1.500J	1.800J	2.900J	2.100J	3.600J
PCB101	ng/dry g	.	.	.	1.600J	4.600J	4.500J	3.800J	3.700J	3.100J	4.400J	3.900J	3.900J	4.900J	1.700J	2.100J	4.500J	1.500J	4.900J	5.100
PCB105	ng/dry g	.	.	.	<1.000	<1.000	1.600J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.100J	<1.000	<1.000	<1.000	<1.000
PCB110	ng/dry g	.	.	.	2.500J	4.200J	4.600J	2.500J	2.300J	2.500J	4.900J	2.600J	3.800J	3.200J	1.700J	2.600J	4.100J	3.600J	2.100J	4.800J
PCB114	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB118	ng/dry g	.	.	.	1.200J	3.100J	4.400J	4.900J	4.000J	2.500J	1.000J	1.500J	3.800J	4.900J	1.100J	1.600J	4.200J	3.800J	3.400J	4.600J
PCB119	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	64.000	<1.000	<1.000	<1.000	<1.000
PCB123	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.500J	<1.000	<1.000	<1.000	<1.000
PCB126	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.000J	1.200J	<1.000	<1.000	<1.000
PCB138	ng/dry g	.	.	.	<1.000	5.400	5.300	9.300	4.300J	5.400	3.400J	2.200J	7.900	6.200	2.700J	4.900J	3.100J	4.200J	4.000J	6.300
PCB141	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB149	ng/dry g	.	.	.	1.800J	3.700J	3.700J	4.300J	3.200J	3.500J	4.200J	2.900J	3.800J	2.800J	1.100J	2.300J	4.800J	3.600J	3.200J	3.900J
PCB151	ng/dry g	.	.	.	<1.000	1.700J	<1.000	1.400J	1.000J	<1.000	1.000J	<1.000	<1.000	1.200J	<1.000	<1.000	<1.000	1.000J	<1.000	<1.000
PCB153	ng/dry g	.	.	.	<1.000	3.700J	6.600	4.600J	3.100J	3.700J	3.900J	<1.000	4.900J	5.400	2.500J	<1.000	3.500J	4.400J	3.300J	4.700J
PCB156	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.600J	<1.000	<1.000	2.200J	<1.000	<1.000	<1.000	<1.000
PCB157	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.100J	<1.000	<1.000	<1.000	<1.000
PCB158	ng/dry g	.	.	.	<1.000	<1.000	<1.000	5.400	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB168+132	ng/dry g	.	.	.	<1.000	2.100J	3.000J	1.200J	<1.000	<1.000	<1.000	<1.000	1.800J	1.800J	<1.000	3.800J	1.200J	<1.000	<1.000	<1.000
PCB169	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	7.300	7.700	<1.000	<1.000	<1.000
PCB170	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB177	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.000J	<1.000	1.600J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB180	ng/dry g	.	.	.	<1.000	3.400J	2.700J	5.900	<1.000	<1.000	4.100J	1.500J	3.900J	4.300J	<1.000	<1.000	2.200J	4.500J	5.500	9.400
PCB183	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.400J	<1.000	<1.000	1.800J	1.500J
PCB187	ng/dry g	.	.	.	1.000J	2.900J	1.800J	2.400J	2.600J	1.700J	2.300J	1.900J	<1.000	2.600J	<1.000	1.000J	1.500J	1.300J	2.200J	2.600J
PCB189	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.400J	<1.000	<1.000	<1.000	<1.000
PCB194	ng/dry g	.	.	.	5.000	<1.000	5.000	<1.000	<1.000	<1.000	3.800J	<1.000	<1.000	<1.000	<1.000	1.800J	<1.000	<1.000	<1.000	<1.000
PCB200	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	1.100J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB201	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB206	ng/dry g	.	.	.	<1.000	<1.000	3.500J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.300J	<1.000	<1.000	<1.000	<1.000
Total Detectable PCBs	ng/dry g	**22.7**	**180**	**50000**	17.500	**47.600**	**65.700**	**58.400**	**29.600**	**33.300**	**44.200**	**26.600**	**47.200**	**46.100**	**14.600**	**189.900**	**46.600**	**35.600**	**38.300**	**50.400**

ER-L exceedance is denoted by bold values.
ER-M exceedance is denoted by bold and underlined values.
Values followed by a J are below reporting limits.
Non-detectable totals noted by ND.

Table 13. Core Chemistry

Analyte	Units	ERL	ERM	TTLC	A-1 TOP	A-1 BOTTOM	A-2 TOP	B-1 TOP	B-1 BOTTOM	B-2 TOP	B-2 BOTTOM	C-1 TOP	C-1 BOTTOM	C-2 TOP	C-2 BOTTOM	D-1 TOP	D-1 BOTTOM	D-2 TOP	D-2 BOTTOM
Total Organic Carbon	%																		
					1.66	1.48	0.95	2.19	1.8	0.77	0.70	0.91	0.70	0.74	0.26	0.70	0.41	0.58	0.34
Chlorinated Pesticides																			
2,4'-DDD	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	1.700J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.600J	3.200J	<1.000	1.100J
2,4'-DDE	ng/dry g	.	.	.	3.500J	1.200J	1.900J	2.700J	3.500J	<1.000	<1.000	<1.000	1.500J	1.000J	<1.000	2.100J	1.200J	<1.000	<1.000
2,4'-DDT	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
4,4'-DDD	ng/dry g	**2.00**	**20.00**	.	**6.9**	**2.200J**	1.900J	**4.600J**	**3.700J**	<1.000	<1.000	1.800J	1.300J	<1.000	<1.000	**5.3**	**10.2**	1.600J	**3.400J**
4,4'-DDE	ng/dry g	**2.20**	**27.00**	.	**31.5**	**13.3**	**20.5**	**30.8**	**32.1**	**2.500J**	1.500J	**16.2**	**13.2**	**11.7**	**3.100J**	**24**	**16.3**	**10.8**	**9.3**
4,4'-DDT	ng/dry g	**1.00**	**7.00**	.	<1.000	<1.000	<1.000	<1.000	<1.000	**2.300J**	**2.100J**	<1.000	<1.000	**2.300J**	<1.000	**2.800J**	**2.100J**	<1.000	**3.000J**
Aldrin	ng/dry g	.	.	**1400**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-alpha	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-beta	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-delta	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-gamma	ng/dry g	.	.	**4000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Chlordane-alpha	ng/dry g	.	.	.	2.600J	<1.000	<1.000	2.900J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Chlordane-gamma	ng/dry g	.	.	.	4.600J	1.100J	1.100J	3.800J	1.900J	<1.000	<1.000	1.300J	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
cis-Nonachlor	ng/dry g	.	.	.	3.100J	<1.000	1.100J	3.000J	1.900J	<1.000	<1.000	<1.000	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Dieldrin	ng/dry g	**0.02**	**8.00**	**8000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan Sulfate	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan-I	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	4.500J	<1.000	<1.000	<1.000	<1.000	<1.000	5.200	<1.000
Endosulfan-II	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin	ng/dry g	.	.	**200**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin Aldehyde	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin Ketone	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Heptachlor	ng/dry g	.	.	**4700**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Heptachlor Epoxide	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Methoxychlor	ng/dry g	.	.	**100000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Mirex	ng/dry g	.	.	**21000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Oxychlordane	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Perthane	ng/dry g	.	.	.	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000
Total Detectable Chlordane	ng/dry g	**0.50**	**6.00**	**2500**	**12.7**	**1.1**	**2.2**	**12.1**	**3.8**	ND	ND	**1.3**	**2**	ND	ND	ND	ND	ND	ND
Total Detectable DDTs	ng/dry g	**1.58**	**46.10**	.	**41.9**	**16.7**	**24.3**	**38.1**	**41**	**4.8**	**3.6**	**18**	**16**	**15**	**3.1**	**35.8**	**33**	**12.4**	**16.8**
Toxaphene	ng/dry g	.	.	**5000**	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
trans-Nonachlor	ng/dry g	.	.	.	2.400J	<1.000	<1.000	2.400J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Metals																			
Copper (Cu)	µg/dry g	**34.00**	**270.00**	**2500**	**170.8**	**89.38**	**106.6**	**307**	**145.4**	21.65	21.89	**177.8**	**157.8**	**98.46**	21.34	**115.9**	33.69	**130.8**	30.52
Lead (Pb)	µg/dry g	**46.70**	**218.00**	**1000**	**126.100**	**61.060**	**73.350**	**146.400**	**93.050**	9.279	11.420	**80.130**	**64.330**	35.260	7.867	39.430	12.550	39.170	11.370
Zinc (Zn)	µg/dry g	**150.00**	**410.00**	**5000**	**228.8**	**152**	**150.2**	**324.3**	**193.1**	49.55	55.37	**197.6**	**151.2**	131.3	40.76	149.2	65.47	148	59.27
Aroclors																			
Aroclor 1016	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1221	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1232	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1242	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	13.000J	<10.000	<10.000	<10.000	<10.000	13.400J	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1248	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1254	ng/dry g	.	.	.	32.700	16.900J	26.300	49.700	39.900	<10.000	<10.000	24.600	21.900	19.500J	<10.000	23.900	<10.000	19.900J	<10.000
Aroclor 1260	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
PCB Congeners																			
PCB008	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.200J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB128	ng/dry g	.	.	.	<1.000	<1.000	<1.000	7.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB167	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB195	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB209	ng/dry g	.	.	.	1.300J	<1.000	<1.000	1.600J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB018	ng/dry g	.	.	.	2.300J	<1.000	<1.000	1.600J	<1.000	<1.000	<1.000	<1.000	4.300J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB028	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB031	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.100J	<1.000	<1.000	<1.000	<1.000	<1.000
PCB033	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	1.500J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000

Analyte	Units	ERL	ERM	TTLC	A-1 TOP	A-1 BOTTOM	A-2 TOP	B-1 TOP	B-1 BOTTOM	B-2 TOP	B-2 BOTTOM	C-1 TOP	C-1 BOTTOM	C-2 TOP	C-2 BOTTOM	D-1 TOP	D-1 BOTTOM	D-2 TOP	D-2 BOTTOM
PCB037	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB044	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	2.200J	<1.000	<1.000	<1.000	<1.000	1.100J	<1.000	1.000J	<1.000	<1.000	<1.000
PCB049	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.900J	1.600J	<1.000	2.000J	<1.000	1.600J	<1.000
PCB052	ng/dry g	.	.	.	1.700J	1.000J	<1.000	<1.000	1.300J	<1.000	<1.000	4.000J	<1.000	1.100J	<1.000	<1.000	<1.000	<1.000	<1.000
PCB066	ng/dry g	.	.	.	3.300J	<1.000	1.900J	3.400J	3.200J	<1.000	<1.000	1.800J	3.100J	2.100J	<1.000	2.700J	<1.000	2.000J	<1.000
PCB070	ng/dry g	.	.	.	2.700J	<1.000	1.600J	2.000J	1.700J	<1.000	<1.000	1.000J	2.300J	1.600J	<1.000	1.300J	<1.000	1.200J	<1.000
PCB074	ng/dry g	.	.	.	1.100J	<1.000	<1.000	1.200J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB077	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB081	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB087	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	2.500J	<1.000	<1.000	<1.000	1.300J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB095	ng/dry g	.	.	.	3.800J	1.400J	2.400J	5.500	4.500J	<1.000	<1.000	2.800J	2.400J	2.000J	<1.000	2.300J	<1.000	2.000J	1.100J
PCB097	ng/dry g	.	.	.	<1.000	<1.000	<1.000	2.700J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB099	ng/dry g	.	.	.	3.200J	<1.000	2.100J	3.500J	3.700J	<1.000	<1.000	1.800J	2.400J	2.400J	<1.000	2.500J	1.000J	2.600J	<1.000
PCB101	ng/dry g	.	.	.	7.100	2.200J	3.800J	10.100	7.000	<1.000	<1.000	3.700J	3.300J	3.400J	1.100J	3.400J	<1.000	3.100J	1.600J
PCB105	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB110	ng/dry g	.	.	.	4.000J	2.100J	3.200J	6.100	4.900J	<1.000	<1.000	3.000J	2.700J	2.400J	<1.000	2.900J	<1.000	2.400J	1.500J
PCB114	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	4.900J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB118	ng/dry g	.	.	.	3.300J	1.100J	2.300J	3.700J	3.600J	<1.000	<1.000	2.300J	2.500J	1.900J	<1.000	2.200J	<1.000	2.600J	<1.000
PCB119	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB123	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.300J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB126	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB138	ng/dry g	.	.	.	3.300J	<1.000	6.500	7.700	5.500	<1.000	<1.000	2.400J	4.000J	2.200J	1.300J	3.800J	<1.000	2.200J	1.400J
PCB141	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB149	ng/dry g	.	.	.	4.900J	2.100J	2.900J	6.000	5.500	<1.000	<1.000	3.100J	2.600J	2.200J	<1.000	2.400J	<1.000	2.100J	<1.000
PCB151	ng/dry g	.	.	.	<1.000	<1.000	1.100J	2.600J	1.800J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB153	ng/dry g	.	.	.	6.900	2.300J	2.600J	8.000	7.000	<1.000	<1.000	4.900J	2.800J	2.900J	<1.000	2.400J	<1.000	2.700J	<1.000
PCB156	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB157	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB158	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB168+132	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.200J	2.300J	<1.000	<1.000	<1.000	<1.000	1.100J	<1.000
PCB169	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	5.000	<1.000
PCB170	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.900J	<1.000	<1.000	<1.000	2.300J	<1.000
PCB177	ng/dry g	.	.	.	2.400J	<1.000	1.000J	3.300J	1.900J	<1.000	<1.000	1.100J	1.100J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB180	ng/dry g	.	.	.	4.400J	2.400J	1.200J	7.000	2.800J	<1.000	<1.000	3.300J	3.000J	1.800J	<1.000	2.000J	<1.000	1.300J	<1.000
PCB183	ng/dry g	.	.	.	1.200J	<1.000	<1.000	1.500J	1.500J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB187	ng/dry g	.	.	.	3.300J	1.000J	1.300J	3.600J	3.200J	<1.000	<1.000	1.600J	1.600J	<1.000	<1.000	1.100J	<1.000	1.000J	<1.000
PCB189	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB194	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB200	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB201	ng/dry g	.	.	.	<1.000	<1.000	<1.000	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB206	ng/dry g	.	.	.	1.800J	<1.000	<1.000	2.700J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Total Detectable PCBs	ng/dry g	**22.70**	**<u>180.00</u>**	**<u>50000</u>**	**62**	15.6	**33.9**	**91.8**	**65.3**	ND	ND	**47.4**	**43.6**	**31.7**	2.4	**32**	1	**35.2**	5.6

ER-L exceedance is denoted by bold values.
ER-M exceedance is denoted by bold and underlined values.
Values followed by a J are below reporting limits.
Non-detectable totals noted by ND.

Table 13. Continued.

Analyte	Units	ERL	ERM	TTLC	D-3 TOP	D-3 BOTTOM	E-1 TOP	E-1 BOTTOM	E-2 TOP	E-2 BOTTOM	E-3 TOP	E-3 BOTTOM	E-4 TOP	E-4 BOTTOM	F-1 TOP	F-1 BOTTOM	G-1 TOP	G-1 BOTTOM	G-2 TOP	G-2 BOTTOM
Total Organic Carbon	%																			
					1.05	0.86	0.78	0.42	1.26	0.75	1.28	0.79	0.34	0.23	1.10	0.75	1.43	0.87	1.11	0.41
Chlorinated Pesticides																				
2,4'-DDD	ng/dry g	.	.	.	<1.000	1.500J	9.900	28.600	4.200J	10.800	3.200J	5.900	1.300J	<1.000	10.000	84.800	1.000J	7.200	5.300	14.900
2,4'-DDE	ng/dry g	.	.	.	2.600J	<1.000	3.100J	5.500	4.200J	3.200J	3.700J	2.600J	<1.000	1.900J	5.600	8.100	3.200J	3.500J	2.800J	2.500J
2,4'-DDT	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
4,4'-DDD	ng/dry g	**2.00**	**20.00**	.	<1.000	1.200J	**27.5**	**84.7**	**20.2**	**39.9**	**21**	**22.3**	**4.800J**	**11.3**	**56.1**	**330.7**	**3.500J**	**19.7**	**12.4**	**29.4**
4,4'-DDE	ng/dry g	**2.20**	**27.00**	.	**18.9**	**11.6**	**56.5**	**103.4**	**64.6**	**66.5**	**54.7**	**47.4**	**3.800J**	**7.6**	**87.9**	**234.5**	**36.1**	**53.1**	**46.2**	**63.9**
4,4'-DDT	ng/dry g	**1.00**	**7.00**	.	**2.200J**	**3.600J**	<1.000	**3.300J**	<1.000	**3.100J**	<1.000	**4.600J**	**2.500J**	<1.000	**11.9**	**11.2**	<1.000	**4.000J**	<1.000	**4.900J**
Aldrin	ng/dry g	.	.	**1400**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-alpha	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-beta	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-delta	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-gamma	ng/dry g	.	.	**4000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Chlordane-alpha	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Chlordane-gamma	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
cis-Nonachlor	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Dieldrin	ng/dry g	**0.02**	**8.00**	**8000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan Sulfate	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan-I	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan-II	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin	ng/dry g	.	.	**200**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin Aldehyde	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin Ketone	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Heptachlor	ng/dry g	.	.	**4700**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Heptachlor Epoxide	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Methoxychlor	ng/dry g	.	.	**100000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Mirex	ng/dry g	.	.	**21000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Oxychlordane	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Perthane	ng/dry g	.	.	.	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000
Total Detect. Chlordane	ng/dry g	**0.50**	**6.00**	**2500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Detectable DDTs	ng/dry g	**1.58**	**46.10**	.	**23.7**	**17.9**	**97**	**225.5**	**93.2**	**123.5**	**82.6**	**82.8**	**12.4**	**20.8**	**171.5**	**669.3**	**43.8**	**87.5**	**66.7**	**115.6**
Toxaphene	ng/dry g	.	.	**5000**	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
trans-Nonachlor	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Metals																				
Copper (Cu)	µg/dry g	**34.00**	**270.00**	**2500**	**225.3**	**64.12**	**55.4**	22.86	**66.78**	**34.62**	**92.69**	**42.07**	20.02	14.28	**65.23**	**41.75**	**168.2**	**65.75**	**107.3**	28.03
Lead (Pb)	µg/dry g	**46.70**	**218.00**	**1000**	**56.900**	22.090	15.700	6.686	33.460	12.550	41.660	16.590	7.173	4.829	24.330	11.340	**107.400**	32.800	39.870	7.294
Zinc (Zn)	µg/dry g	**150.00**	**410.00**	**5000**	**237.6**	102.6	98.91	53.32	143.3	80.61	**166.9**	88.73	47.23	36.52	129.1	91.73	**216.7**	116.3	143.9	52.15
Aroclors																				
Aroclor 1016	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1221	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1232	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1242	ng/dry g	.	.	.	10.200J	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	16.500J	<10.000	<10.000	16.600J	<10.000	<10.000	<10.000
Aroclor 1248	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1254	ng/dry g	.	.	.	24.900	<10.000	<10.000	<10.000	12.100J	<10.000	25.500	<10.000	<10.000	<10.000	25.000	<10.000	38.400	20.700	10.100J	<10.000
Aroclor 1260	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	11.000J	<10.000	<10.000	<10.000
PCB Congeners																				
PCB008	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	3.000J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB128	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB167	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB195	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB209	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB018	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.900J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB028	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB031	ng/dry g	.	.	.	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	8.000	<1.000	<1.000	1.500J	<1.000	<1.000	<1.000
PCB033	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.200J	<1.000	<1.000	<1.000	1.500J	<1.000	<1.000	<1.000

Analyte	**Units**	**ERL**	**ERM**	**TTLC**	**D-3 TOP**	**D-3 BOTTOM**	**E-1 TOP**	**E-1 BOTTOM**	**E-2 TOP**	**E-2 BOTTOM**	**E-3 TOP**	**E-3 BOTTOM**	**E-4 TOP**	**E-4 BOTTOM**	**F-1 TOP**	**F-1 BOTTOM**	**G-1 TOP**	**G-1 BOTTOM**	**G-2 TOP**	**G-2 BOTTOM**
PCB037	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB044	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	1.000J	<1.000	1.400J	<1.000	4.700J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB049	ng/dry g	.	.	.	2.200J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	8.100	<1.000	<1.000	2.400J	<1.000	<1.000	<1.000
PCB052	ng/dry g	.	.	.	1.500J	1.000J	<1.000	<1.000	1.200J	<1.000	<1.000	<1.000	<1.000	3.900J	2.600J	<1.000	2.100J	1.200J	<1.000	<1.000
PCB066	ng/dry g	.	.	.	2.100J	<1.000	<1.000	<1.000	1.400J	<1.000	2.000J	<1.000	<1.000	<1.000	2.000J	<1.000	3.900J	1.900J	<1.000	<1.000
PCB070	ng/dry g	.	.	.	1.200J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	7.700	<1.000	<1.000	3.200J	1.300J	<1.000	<1.000
PCB074	ng/dry g	.	.	.	1.200J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.700J	<1.000	<1.000	<1.000
PCB077	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB081	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB087	ng/dry g	.	.	.	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.000J	1.000J	1.200J	<1.000
PCB095	ng/dry g	.	.	.	2.600J	1.200J	<1.000	<1.000	1.500J	<1.000	2.200J	<1.000	<1.000	<1.000	2.000J	<1.000	3.800J	1.900J	<1.000	<1.000
PCB097	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB099	ng/dry g	.	.	.	3.400J	1.000J	<1.000	<1.000	1.200J	<1.000	1.300J	<1.000	<1.000	<1.000	2.800J	<1.000	3.500J	2.600J	1.300J	<1.000
PCB101	ng/dry g	.	.	.	5.900	2.200J	<1.000	<1.000	2.100J	<1.000	2.300J	<1.000	<1.000	<1.000	3.600J	<1.000	6.100	3.100J	1.800J	<1.000
PCB105	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB110	ng/dry g	.	.	.	3.100J	1.200J	<1.000	<1.000	1.500J	<1.000	3.100J	<1.000	<1.000	<1.000	3.100J	<1.000	4.700J	2.500J	1.200J	<1.000
PCB114	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB118	ng/dry g	.	.	.	3.500J	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	3.300J	1.900J	<1.000	<1.000
PCB119	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB123	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	8.400	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB126	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB138	ng/dry g	.	.	.	2.200J	1.300J	<1.000	<1.000	<1.000	<1.000	2.900J	<1.000	<1.000	<1.000	<1.000	<1.000	6.500	2.200J	1.200J	<1.000
PCB141	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB149	ng/dry g	.	.	.	3.200J	1.300J	<1.000	<1.000	1.400J	<1.000	2.600J	<1.000	<1.000	<1.000	2.500J	<1.000	4.300J	2.000J	1.200J	<1.000
PCB151	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.400J	<1.000	<1.000	<1.000
PCB153	ng/dry g	.	.	.	3.600J	1.700J	<1.000	<1.000	2.200J	<1.000	1.100J	<1.000	<1.000	4.700J	1.500J	<1.000	4.300J	2.400J	2.100J	<1.000
PCB156	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB157	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB158	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB168+132	ng/dry g	.	.	.	1.300J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.100J	<1.000
PCB169	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	3.400J	<1.000	<1.000	<1.000	<1.000	2.100J	<1.000	<1.000	<1.000	<1.000
PCB170	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB177	ng/dry g	.	.	.	1.400J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.000J	<1.000	<1.000	<1.000
PCB180	ng/dry g	.	.	.	2.200J	1.100J	<1.000	<1.000	1.800J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	3.100J	1.500J	<1.000	<1.000
PCB183	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB187	ng/dry g	.	.	.	1.700J	<1.000	<1.000	<1.000	<1.000	<1.000	1.100J	<1.000	<1.000	<1.000	<1.000	<1.000	2.000J	<1.000	<1.000	<1.000
PCB189	ng/dry g	.	.	.	<1.000	<1.000	1.300J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB194	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.400J	<1.000	<1.000	<1.000
PCB200	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB201	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB206	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Total Detectable PCBs	ng/dry g	**22.70**	**<u>180.00</u>**	**<u>50000</u>**	44.3	13	1.3	ND	14.3	1	22	1.4	1.2	50.4	20.1	2.1	62.7	25.5	12.1	ND

ER-L exceedance is denoted by bold values.

ER-M exceedance is denoted by bold and underlined values.

Values followed by a J are below reporting limits.

Non-detectable totals noted by ND.

Table 13. Continued.

Analyte	Units	ERL	ERM	TTLC	H-1 TOP	H-1 BOTTOM	H-2 TOP	H-2 BOTTOM	MC-1 TOP	MC-1 BOTTOM	MC-2 TOP	MC-2 BOTTOM	MC-3 TOP	MC-3 BOTTOM	MC-4 TOP	MC-4 BOTTOM	MC-5 TOP	MC-5 BOTTOM
Total Organic Carbon	%																	
					1.05	1.07	0.76	0.63	0.78	0.80	0.93	0.64	1.41	1.03	0.58	0.43	2.72	1.79
Chlorinated Pesticides																		
2,4'-DDD	ng/dry g	.	.	.	<1.000	<1.000	4.900J	5.600	9.700	15.900	2.700J	6.300	2.900J	7.200	1.500J	<1.000	3.900J	2.300J
2,4'-DDE	ng/dry g	.	.	.	<1.000	1.400J	2.200J	2.200J	3.200J	3.800J	1.700J	2.000J	3.500J	2.600J	1.000J	<1.000	3.900J	7.000
2,4'-DDT	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
4,4'-DDD	ng/dry g	**2.00**	**20.00**	.	**3.100J**	**4.200J**	**16.2**	**19.6**	**34.4**	**56**	**8.6**	**19.6**	**6.6**	**20.4**	**4.600J**	1.400J	**10.8**	**7.9**
4,4'-DDE	ng/dry g	**2.20**	**27.00**	.	**10.2**	**13.4**	**29.4**	**33**	**59.3**	**70.4**	**22.7**	**33.4**	**38**	**53.5**	**12.1**	2.100J	**41**	**40.4**
4,4'-DDT	ng/dry g	**1.00**	**7.00**	.	<1.000	<1.000	**4.200J**	**14.9**	**3.800J**	**6.3**	<1.000	<1.000	<1.000	<1.000	<1.000	**1.600J**	<1.000	<1.000
Aldrin	ng/dry g	.	.	**1400**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-alpha	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-beta	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-delta	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
BHC-gamma	ng/dry g	.	.	**4000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Chlordane-alpha	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.200J	<1.000	1.000J	<1.000	1.000J	<1.000	8.900	4.200J
Chlordane-gamma	ng/dry g	.	.	.	<1.000	1.400J	<1.000	<1.000	<1.000	<1.000	1.600J	<1.000	1.500J	<1.000	1.300J	<1.000	13.100	8.100
cis-Nonachlor	ng/dry g	.	.	.	<1.000	1.200J	<1.000	<1.000	<1.000	<1.000	1.300J	<1.000	1.200J	<1.000	<1.000	<1.000	7.600	4.700J
Dieldrin	ng/dry g	**0.02**	**8.00**	**8000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan Sulfate	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan-I	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endosulfan-II	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin	ng/dry g	.	.	**200**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin Aldehyde	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Endrin Ketone	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Heptachlor	ng/dry g	.	.	**4700**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Heptachlor Epoxide	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Methoxychlor	ng/dry g	.	.	**100000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Mirex	ng/dry g	.	.	**21000**	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Oxychlordane	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Perthane	ng/dry g	.	.	.	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000
Total Detect. Chlordane	ng/dry g	**0.50**	**6.00**	**2500**	ND	**2.6**	ND	ND	ND	ND	**5.1**	ND	**3.7**	ND	**2.3**	ND	**38.1**	**20.7**
Total Detectable DDTs	ng/dry g	**1.58**	**46.10**	.	**13.3**	**19**	**56.9**	**75.3**	**110.4**	**152.4**	**35.7**	**61.3**	**51**	**83.7**	**19.2**	**5.1**	**59.6**	**57.6**
Toxaphene	ng/dry g	.	.	**5000**	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
trans-Nonachlor	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	8.500	3.700J
Metals																		
Copper (Cu)	µg/dry g	**34.00**	**270.00**	**2500**	**170**	**148.6**	**79.46**	**63.11**	**49.43**	**36.74**	**117**	**47.45**	**86.53**	**36.81**	**42.82**	11.8	**129.5**	**74.26**
Lead (Pb)	µg/dry g	**46.70**	**218.00**	**1000**	**77.410**	**82.890**	34.200	41.510	18.860	12.140	**49.010**	17.610	**50.910**	12.400	28.860	8.184	**140.100**	**119.000**
Zinc (Zn)	µg/dry g	**150.00**	**410.00**	**5000**	**206.1**	**185.8**	110.8	93.55	99.25	83.86	**153**	96.62	**150.7**	87.24	88.43	32.58	**286.4**	**159.4**
Aroclors																		
Aroclor 1016	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1221	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1232	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1242	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	11.700J	12.000J
Aroclor 1248	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aroclor 1254	ng/dry g	.	.	.	16.600J	19.500J	15.800J	11.100J	<10.000	<10.000	10.400J	<10.000	16.800J	<10.000	<10.000	<10.000	20.400	33.000
Aroclor 1260	ng/dry g	.	.	.	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
PCB Congeners																		
PCB008	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB128	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB167	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB195	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB209	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.400J	1.200J
PCB018	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.100J
PCB028	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB031	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.100J
PCB033	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.800J	4.400J

Analyte	Units	ERL	ERM	TTLC	H-1 TOP	H-1 BOTTOM	H-2 TOP	H-2 BOTTOM	MC-1 TOP	MC-1 BOTTOM	MC-2 TOP	MC-2 BOTTOM	MC-3 TOP	MC-3 BOTTOM	MC-4 TOP	MC-4 BOTTOM	MC-5 TOP	MC-5 BOTTOM
PCB037	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB044	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	1.500J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.900J	2.000J
PCB049	ng/dry g	.	.	.	1.100J	<1.000	1.100J	<1.000	<1.000	<1.000	3.200J	<1.000	<1.000	<1.000	1.400J	<1.000	11.600	3.200J
PCB052	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.800J	<1.000	<1.000	<1.000	<1.000	1.900J
PCB066	ng/dry g	.	.	.	<1.000	1.500J	1.400J	1.600J	<1.000	<1.000	1.200J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	4.500J
PCB070	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.100J
PCB074	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.100J
PCB077	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB081	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB087	ng/dry g	.	.	.	<1.000	<1.000	1.100J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB095	ng/dry g	.	.	.	1.200J	1.900J	1.300J	1.000J	<1.000	<1.000	1.400J	<1.000	2.800J	<1.000	1.200J	<1.000	4.100J	3.800J
PCB097	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	3.000J
PCB099	ng/dry g	.	.	.	1.000J	1.700J	1.400J	<1.000	<1.000	<1.000	1.000J	<1.000	1.500J	<1.000	1.100J	<1.000	2.100J	2.600J
PCB101	ng/dry g	.	.	.	2.400J	3.300J	2.300J	1.800J	<1.000	<1.000	2.200J	1.100J	3.700J	<1.000	1.400J	<1.000	5.600	7.100
PCB105	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	3.500J
PCB110	ng/dry g	.	.	.	2.000J	2.400J	1.900J	1.400J	<1.000	<1.000	1.300J	<1.000	2.100J	<1.000	<1.000	<1.000	2.500J	4.100J
PCB114	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB118	ng/dry g	.	.	.	1.200J	1.800J	1.100J	<1.000	<1.000	<1.000	<1.000	<1.000	1.600J	<1.000	<1.000	<1.000	3.200J	2.700J
PCB119	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB123	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.300J	<1.000
PCB126	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB138	ng/dry g	.	.	.	1.200J	2.200J	1.600J	2.300J	<1.000	<1.000	<1.000	<1.000	1.800J	<1.000	<1.000	<1.000	<1.000	5.400
PCB141	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB149	ng/dry g	.	.	.	1.500J	2.600J	1.400J	1.100J	<1.000	<1.000	1.700J	<1.000	2.400J	<1.000	1.500J	<1.000	4.500J	6.000
PCB151	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.100J	<1.000	<1.000	<1.000	<1.000	2.200J
PCB153	ng/dry g	.	.	.	2.000J	3.900J	1.800J	1.500J	<1.000	<1.000	3.200J	1.200J	3.200J	<1.000	<1.000	<1.000	4.600J	5.500
PCB156	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.100J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB157	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB158	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.200J	<1.000
PCB168+132	ng/dry g	.	.	.	1.000J	1.100J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB169	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB170	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB177	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.000J	<1.000	<1.000	<1.000	<1.000	<1.000	1.400J	<1.000
PCB180	ng/dry g	.	.	.	1.400J	2.800J	1.100J	<1.000	<1.000	<1.000	1.700J	<1.000	1.700J	<1.000	<1.000	<1.000	6.000	5.900
PCB183	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.700J	2.400J
PCB187	ng/dry g	.	.	.	<1.000	1.300J	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.500J	<1.000	1.100J	<1.000	3.700J	3.600J
PCB189	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB194	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB200	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
PCB201	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.300J
PCB206	ng/dry g	.	.	.	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.400J	1.600J
Total Detectable PCBs	ng/dry g	**22.70**	**180.00**	**50000**	16	**26.5**	17.5	10.7	1.5	ND	20	2.3	**25.2**	ND	7.7	ND	**61**	**83.3**

ER-L exceedance is denoted by bold values.
ER-M exceedance is denoted by bold and underlined values.
Values followed by a J are below reporting limits.
Non-detectable totals noted by ND.

Grain Size Distribution

In general grain size among the 16 site locations in which surficial sediment was collected was comprised of predominantly silt and clay with some sand and little to no gravel (Table 14). Silt and clay comprised more than 70 percent of the grains at all sites with the exception of sites A-2, D-3, E-4, and H-2, Site E-4, located at the back of the harbor in Basin E had the highest concentration of coarse grained sediment (60.8 percent sand and gravel) of any site. Sites H-2 and A-2 also had high concentrations of coarse grained sediment relative to other sites within Marina del Rey Harbor (47.2 percent and 46.1 percent sand and gravel, respectively). In contrast, sites B-2, E-1, E-3, F-1, and G-2 had greater than 90 percent fine grained material (i.e., silt and clay).

Table 14. Grain size distribution in surficial sediment (0-2 cm) at 16 sites within Marina del Rey Harbor.

Site ID	Coarse Grained		Fine Grained	
	Gravel (%)	**Sand (%)**	**Silt (%)**	**Clay (%)**
A-2	0.01	46.08	27.18	26.73
B-2	0.01	2.33	55.56	42.11
C-2	0.00	26.09	42.11	31.79
D-2	0.00	21.61	50.81	27.58
D-3	0.00	34.84	34.97	30.19
E-1	0.00	5.89	61.22	32.90
E-3	0.00	1.11	42.59	56.31
E-4	1.21	59.55	15.16	24.08
F-1	0.00	0.99	55.98	43.03
G-2	0.05	5.54	51.22	43.19
H-2	0.02	47.23	35.40	17.35
MC-1	0.00	10.67	60.31	29.02
MC-2	0.00	18.33	60.26	21.42
MC-3	0.00	8.27	60.18	31.55
MC-4	0.02	25.61	55.49	18.88
MC-5	0.00	3.37	70.91	25.72

3.2.2 Surface and sub-surface chemistry results from 23 vibracore sampling locations

Surface and sub-surface sediment collected using a P-3 electric vibracore was analyzed for metals, aroclor PCBs, PCB congeners, and chlorinated pesticides. Analysis of surface (Top) samples was performed on the upper 0-10 cm of material while analysis of sub-surface (Bottom) was performed on the portion of the core sample below 10 cm in depth down to the project depth (original dredged floor of the harbor). ER-L and ER-M sediment quality values developed by Long et al., (1995), as well as TTLC values are included in Table 13 for comparative purposes only.

Test samples

Across all sample locations, several analytes exceeded ER-L and/or ER-M sediment quality values (Table 13). Analytes detected above ER-M values included copper, total detectable chlordane, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT and total detectable chlordane and DDTs. No analyte concentrations exceeded the TTLC at any of the sample locations.

Basin-A

In Top sediment within Basin-A, concentrations of 4,4-DDE were above the ER-L at site A-2 and above the ER-M at site A-1. Total detectable DDTs were above the ER-L in both A-1 and A-2 Top samples.

Total detectable chlordane exceeded the ER-M in Top sediment from A-1 and the ER-L in Top sediment from A-2. Top sediment collected at both sites in Basin-A was above ER-L values for the metals copper and zinc. Aroclor 1254 was detected in Top sediment at both sites, as were several individual PCB congeners. Total detectable PCBs were detected above the ER-L in A-1 and A-2 Top sediment. No other constituents were detected above ER-L values at either site.

It should be noted that because the depth of the post-construction depositional interface occurred within the top 10 cm at site A-2, there was no A-2 Bottom sample. Bottom sediment from A-1 exceeded the ER-L for 4,4'-DDE, total detectable chlordane, total detectable DDTs, copper, and zinc. Concentrations of most constituents were lower in Bottom sediment than in Top sediment.

Basin-B

In sediment collected from Basin-B, concentrations of nearly every analyzed constituent were higher in B-1 Top and Bottom samples than in B-2 Top and Bottom samples. Station B-1 is located just off the Main Channel, while station B-2 is located near the terminal end of Basin B. B-1 Top sediment exceeded ER-L values for zinc, total detectable DDTs, and total detectable PCBs, and exceeded ER-M values for 4,4'-DDE, total detectable chlordane, and copper. The B-1 Bottom sample exceeded ER-L values for copper, zinc, total detectable chlordane, total detectable DDTs, and total detectable PCBs, and exceeded ER-M values for 4,4'-DDE. In B-2 Top and Bottom sediment, the only constituent measured above the ER-L was total detectable DDTs. No constituents exceeded ER-M values in B-2 Top and Bottom sediments.

Basin-C

In Top sediment within Basin-C, concentrations of constituents that exceeded ER-L values included 4,4'-DDE, total detectable DDTs, total detectable chlordane (site C-1 only), copper (site C-1 only), zinc (site C-1 only), and total detectable PCBs. No constituent concentrations were measured above ER-M values. In Basin-C Bottom samples, constituent concentrations at C-1 were typically higher than at C-2. ER-L values that were exceeded at site C-1 included 4,4'-DDE, total detectable DDTs, total detectable chlordane, copper, zinc, and total detectable PCBs, where as ER-L values that were exceeded in Bottom samples collected at site C-2 included 4,4'-DDE and total detectable DDTs. No constituents exceeded ER-M values in either C-1 or C-2 Bottom sediments.

Basin-D

In Top sediment within Basin-D, concentrations of constituents that exceeded ER-L values across all three sample locations included 4,4'-DDE, total detectable DDTs, copper, and total detectable PCBs. Additional ER-L values that were exceeded in Top sediments at one or more of the sample locations include 4,4'-DDD (D-1) and zinc (D-3). No constituent concentrations in Basin-D Top sediments were measured above ER-M values. In Basin-D Bottom samples, constituent concentrations above the ER-L at one or more sites included 4,4'-DDD (D-1 and 2), 4,4'-DDE (D-1, 2, and 3), total detectable DDTs (D-1, 2, and 3), arsenic (D-3), copper (D-3), and nickel (D-3). No constituents exceeded ER-M values in D-1, D-2, or D-3 Bottom sediments.

Basin-E

In Top sediment within Basin-E, concentrations of 4,4'-DDD, 4,4'-DDE, and total detectable DDTs were above the ER-M for sites E-1, E-2, and E-3. Copper and nickel concentrations were measured above the ER-L at sites E-1, E-2, and E-3; arsenic was measured above the ER-L at sites E-2 and E-3 and zinc was measured above the ER-L at site E-3. Aroclor 1254 and several individual PCB congeners were detected at sites E-2 and E-3. Total detectable PCBs, however, were below ER-L values in Top sediment across all four sites within Basin-E.

In Bottom sediment within Basin-E, concentrations of 4,4'-DDD, 4,4'-DDE, and total detectable DDTs were above the ER-M for sites E-1, E-2, and E-3 and were above the ER-L at site E-4. Copper was measured above the ER-L at sites E-2 and E-3. Total detectable PCBs were 1.0 ng/dry g at site E-2 and 1.4 ng/dry g at site E-3. Total detectable PCBs were above the ER-L at Site E-4 (50.4 ng/dry g).

Basin-F

In F-1 Top sediment, concentrations of 4,4'-DDD, 4,4'-DDE, 4,4'-DDT and total detectable DDTs were above the ER-M. Copper concentrations were measured above the ER-L in F-1 Top sediment. Aroclor 1254 was measured at a concentration of 25 ng/dry g in Top sediment, while total detectable PCBs were measured reported at 20.1 ng/dry g. Concentrations of 4,4'-DDD, 4,4'-DDE, 4,4'-DDT and total detectable DDTs in F-1 Bottom sediment were above the ER-M. No aroclors or individual PCB congeners were detected above method reporting limits.

Basin-G

In Top sediment within Basin-G, concentrations of 4,4'-DDE were above the ER-M at sites G-1 and G-2, while 4,4'-DDD was above the ER-L at site G-2. Total detectable DDTs in Top sediment exceeded the ER-L at site G-1 and the ER-M at site G-2. Copper concentrations were measured above the ER-L at both sites within Basin-G, while zinc concentrations were measured above ER-L at site G-1. Aroclor 1254, detected at a concentration of 38.4 ng/dry g at site G-1 was the only PCB grouping detected above reporting limits in Top sediment. Total detectable PCBs were above the ER-L at site G-1 but were below the ER-L at site G-2.

In Bottom sediment within Basin-G, concentrations of 4,4'-DDE and total detectable DDTs were above the ER-M at both sites while concentrations of 4,4'-DDD were above the ER-L at site G-1 and were above the ER-M at site G-2. Copper was measured above the ER-L in Bottom sediment at site G-1. Aroclor 1254, the only aroclor group detected, was measured at a concentration of 20.7 ng/dry g in G-1 Bottom sediment. Total detectable PCBs (25.5 ng/dry g) were above the ER-L (22.7 ng/dry g) in G-1 Bottom sediment. No aroclor PCBs or individual PCB congeners were detected in G-2 Bottom sediment.

Basin-H

Basin-H Top sediment exceeded the 4,4'-DDE ER-L at site H-1 and the 4,4'-DDE ER-M at site H-2. Total detectable DDTs in Top sediment exceeded the ER-L at H-1 and the ER-M at H-2. Copper, lead, and zinc concentrations were measured above the ER-L in H-1 Top sediment, while only copper exceeded the ER-L in H-2 Top sediment. No aroclors or PCB congeners were measured above reporting limits in Basin-H Top sediments.

Basin-H Bottom sediment collected from site H-2 had concentrations of 4,4'-DDE, 4,4'-DDT, and total detectable DDTs that were above ER-M values. H-2 Bottom sediment exceeded ER-L values for 4,4'-DDD and copper. No aroclors or PCB congeners were measured above reporting limits in H-2 Bottom sediment. H-1 Bottom sediment exceeded ER-L values for 4,4'-DDE, 4,4'-DDD, total detectable chlordane, total detectable PCBs, copper, and zinc.

Main Channel

In Top sediment within the Main Channel, concentrations of 4,4'-DDD, 4,4'-DDE, and total detectable DDTs were above the ER-M for site MC-1. Sites MC-2, MC-3, and MC-5 contained concentrations of 4,4'-DDE which exceeded the ER-M and 4,4'-DDD which exceeded the ER-L. Total detectable DDTs in Top sediments were above the ER-M at sites MC-3 and MC-5, and were above the ER-L at sites MC-2 and MC-4. Total detectable chlordane was above the ER-L at sites MC-2, MC-3, and MC-4 and was above the ER-M at site MC-5. In general, copper was above the ER-L in Top sediment across all sites, while lead and zinc were above ER-Ls at three site locations. No metal concentrations were measured above ER-M values in Main Channel Top sediment. Aroclor 1254 in MC-5 Top sediment was the only aroclor measured above method reporting limits. The ER-L value for total detectable PCBs was exceeded in MC-3 and MC-5 Top sediments.

In Bottom sediment within the Main Channel, concentrations of 4,4'-DDD, 4,4'-DDE, and total detectable DDTs were above the ER-M for site MC-1. Sites MC-2, MC-3, and MC-5 contained concentrations of 4,4'-DDE which exceeded the ER-M. Concentrations of 4,4'-DDD exceeded the ER-L at sites MC-2 and MC-5, and exceeded the ER-M at site MC-3. Total detectable DDTs in Bottom sediments were above the ER-M at sites MC-1, MC-2, MC-3, and MC-5, while total detectable chlordane was above the ER-M at site MC-5. Copper was measured above the ER-L in Bottom sediment across all sites, with the exception of site MC-4. Lead and zinc were above the ER-L at MC-5. No metal concentrations were measured above ER-M values in Main Channel Bottom sediment. Aroclor 1254 in MC-5 Bottom sediment was the only aroclor measured above method reporting limits. Total detectable PCBs exceeded the ER-L in MC-5 Bottom sediments.

Grain Size Distribution

In general grain size among the 23 Top and Bottom site locations in which surficial sediment was collected was comprised of mostly sand, silt, and clay with little to no gravel (Table 15). Top sediments at sites B-1, E-2, E-3, F-1, G-1, G-2, MC-3, and MC-5 were comprised of greater than 90 percent fine-grained material (i.e., silt and clay). With the exception of site F-1, sites with greater than 90 percent fine-grained material in Top sediments were located on, or directly adjacent to, the Main Channel. Sites located near the back of the Harbor's Basins and at the back of the Main Channel tended to have higher percentages of sand in Top sediment than sites located near the Main channel.

Bottom sediment at nearly all stations tended to be comprised of a higher percentage of coarse-grained material (i.e., sand and gravel) than Top sediment. Sediment from sites E-1, G-2, and MC-2 had greater than 5 percent gravel while all other sites, with the exception of MC-4, had less than 1 percent gravel. Sites C-2, MC-1, and MC-4 were comprised of greater than 70 percent coarse grained materials. In Bottom sediments, only eight sites contained greater than 25 percent clays, while in Top sediments, 12 sites had greater than 25 percent clays. Within each basin, grain size compositions varied significantly among Bottom core samples.

Table 15. Grain size distribution in Top (0-10 cm) and Bottom sediment (10 cm to original dredged depth of harbor) at 23 sites within Marina del Rey Harbor.

Site ID	Sample Type	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
A-1	Top	0.39	13.16	55.77	30.67
	Bottom	0.00	12.58	47.67	39.75
A-2	Top	0.02	48.33	29.91	21.74
B-1	Top	0.00	1.36	55.34	43.31
	Bottom	0.07	2.02	48.07	49.84
B-2	Top	0.25	52.63	28.04	19.08
	Bottom	0.40	54.56	26.10	18.93
C-1	Top	0.00	44.87	30.72	24.40
	Bottom	0.00	55.13	25.51	19.35
C-2	Top	0.00	36.77	40.74	22.49
	Bottom	0.00	72.54	18.31	9.15
D-1	Top	0.00	23.90	56.31	19.78
	Bottom	0.00	42.33	47.43	10.24
D-2	Top	0.00	41.99	41.63	16.37
	Bottom	0.02	47.26	42.77	9.95
D-3	Top	0.01	37.19	33.30	29.51
	Bottom	0.00	24.18	44.08	31.74
E-1	Top	0.00	49.81	41.13	9.07
	Bottom	6.99	57.72	20.69	14.59
E-2	Top	0.00	0.50	46.25	53.25
	Bottom	1.09	18.78	45.96	34.17
E-3	Top	0.00	0.94	39.57	59.48
	Bottom	0.00	42.31	39.74	17.95
E-4	Top	0.00	21.95	44.95	33.10
	Bottom	0.15	24.38	55.23	20.24
F-1	Top	0.01	0.69	48.89	50.42
	Bottom	0.00	42.79	47.03	10.18
G-1	Top	0.00	5.29	57.96	36.76
	Bottom	0.00	19.07	47.17	33.76
G-2	Top	0.20	9.34	48.19	42.27
	Bottom	7.98	49.55	27.80	14.68
H-1	Top	0.11	14.99	62.81	22.09
	Bottom	0.11	16.15	62.49	21.24
H-2	Top	0.42	20.50	62.22	16.86
	Bottom	0.02	29.19	56.86	13.93
MC-1	Top	0.30	19.69	45.75	34.26
	Bottom	0.00	74.44	17.04	8.51
MC-2	Top	0.99	34.77	46.44	17.80
	Bottom	5.64	26.80	40.80	26.75
MC-3	Top	0.11	2.77	49.70	47.43
	Bottom	0.10	5.93	54.00	39.98
MC-4	Top	0.08	58.69	28.02	13.21
	Bottom	1.40	76.57	14.23	7.81
MC-5	Top	0.32	5.20	69.30	25.19
	Bottom	0.00	25.43	45.84	28.73

3.2.3 Interpolative Maps

Target analytical and grain size data collected from the surface (0 to 10 centimeter [cm]) and subsurface (10 cm to design depth) intervals of sediment along the inlet channels were analyzed to produce Isopleth maps (Figure 7 through Figure 20). The intent of these maps is to show parameter concentrations as they are dispersed within the inlet and determine any possible distribution trends. To produce the figures, the data were brought into the software Surfer 8, made by Golden Software, Inc. To perform the interpolation, the Kriging gridding method was applied using a Linear Variogram Model at a Slope and Anisotropy value of 1. In order to account for the impermeability of the bulkheads, a Breakline was applied to the interpolation that represented the outline of the inlet with a concentration value set to the lowest result of the dataset for the particular compound. For example, the lowest concentration of zinc in the surface data set was approximately 50 ppm, therefore the edges (bulkheads) of the harbor were assigned the value of 50 ppm to display the patterns. Once the Isopleth contours were generated, they were exported from Surfer to a standard Computer-Aided Design (CAD) format and brought into the software ESRI ArcGIS. Three-Dimensional (3D) surfaces were created based off of these contours using the ArcGIS extension toolset 3D Analyst. Two-Dimensional (2D) representations of these surfaces are presented in the attached figures.

The surface interval core was consistently 10 cm throughout entire project area. However, the subsurface interval core varied from 0 cm (A-2) to more than 80 cm (MC3). To illustrate the differences in the subsurface interval core length, an additional metric was included in the subsurface maps.

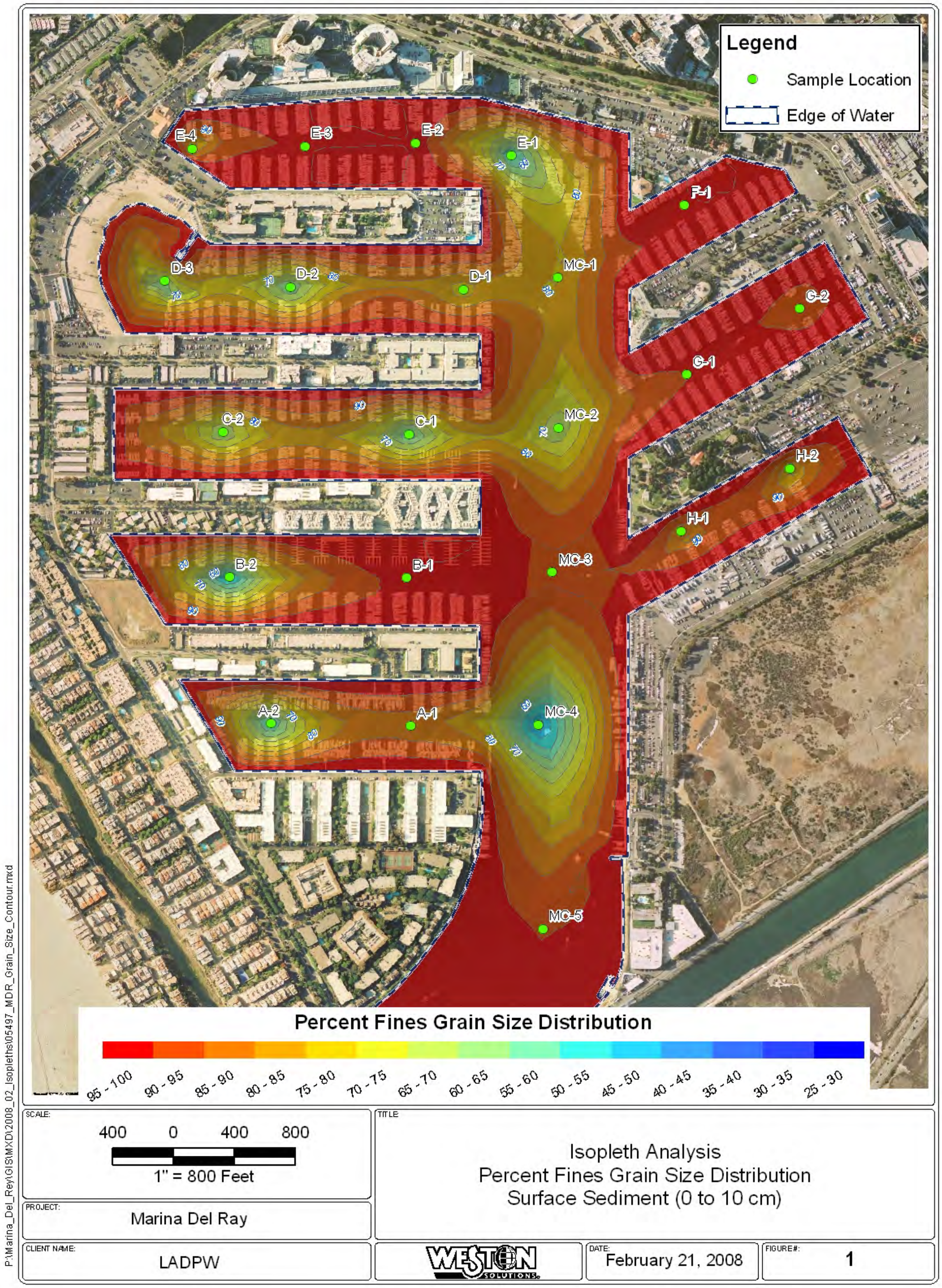

Figure 7. Distribution of fine grain material in surface sediments in Marina del Rey Harbor.

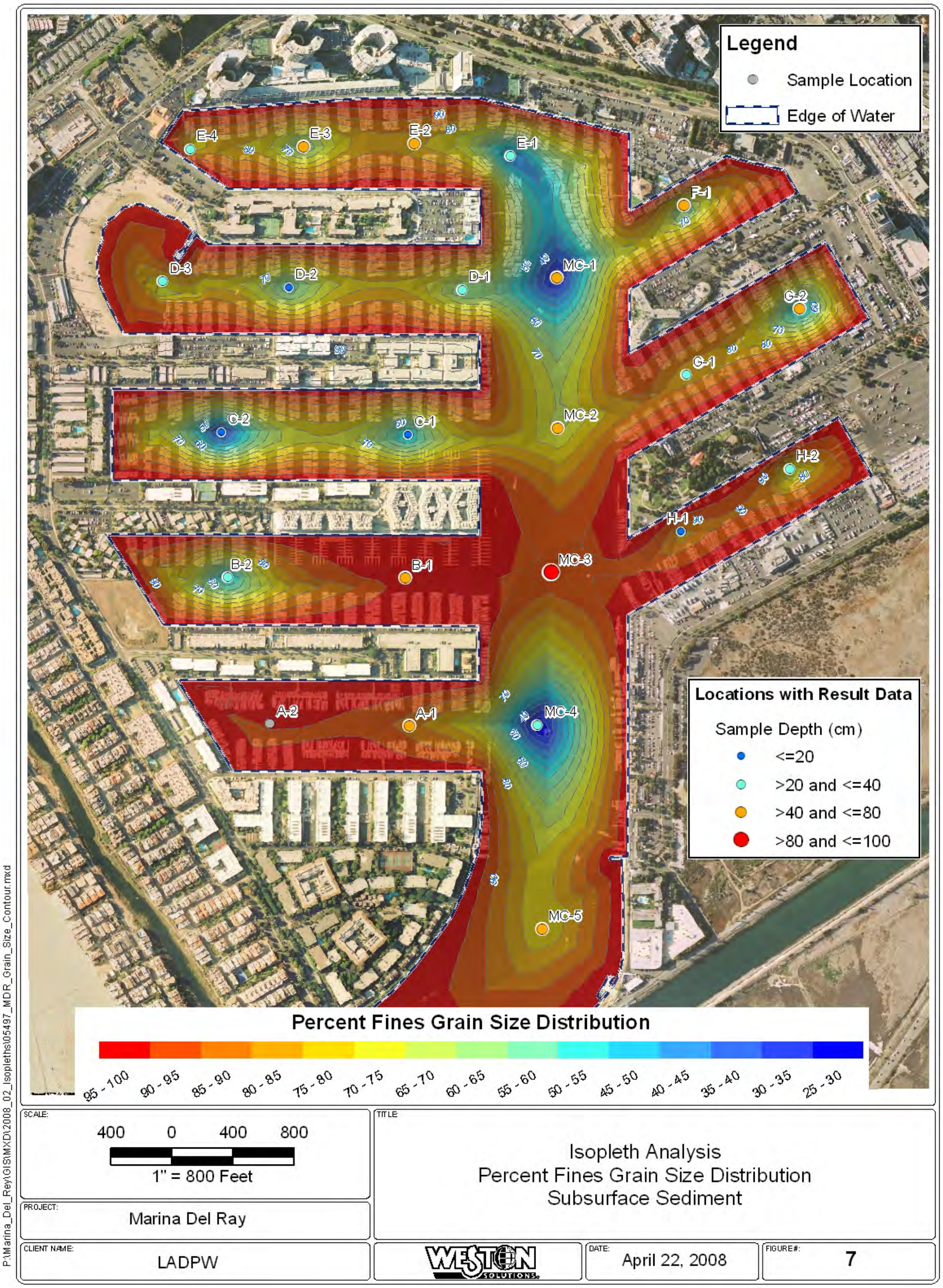

Figure 8. Distribution of fine grain material in subsurface sediments in Marina del Rey Harbor.

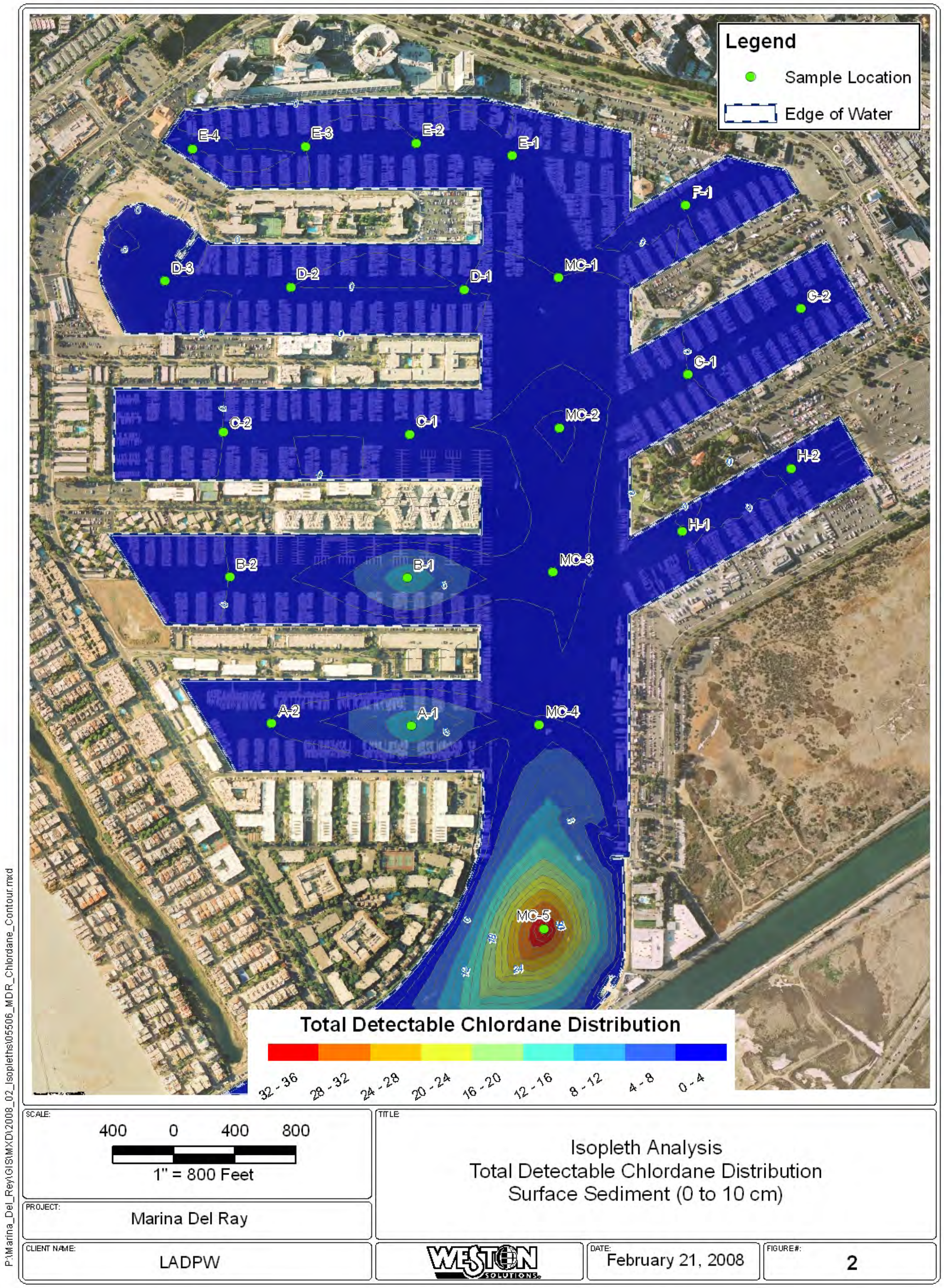

Figure 9. Distribution of total chlordane in surface sediment in Marina del Rey Harbor.

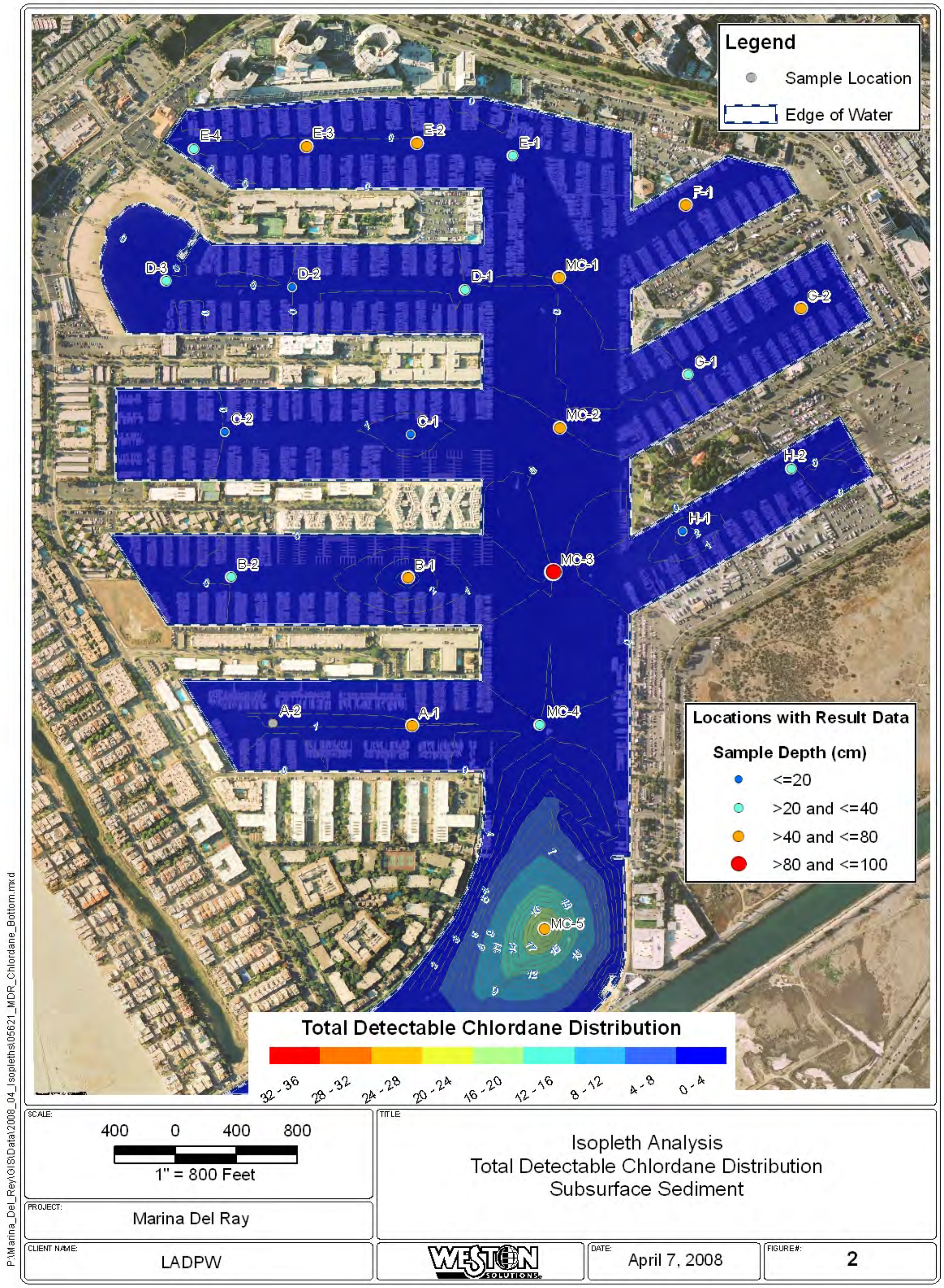

Figure 10. Distribution of total chlordane in subsurface sediment in Marina del Rey Harbor.

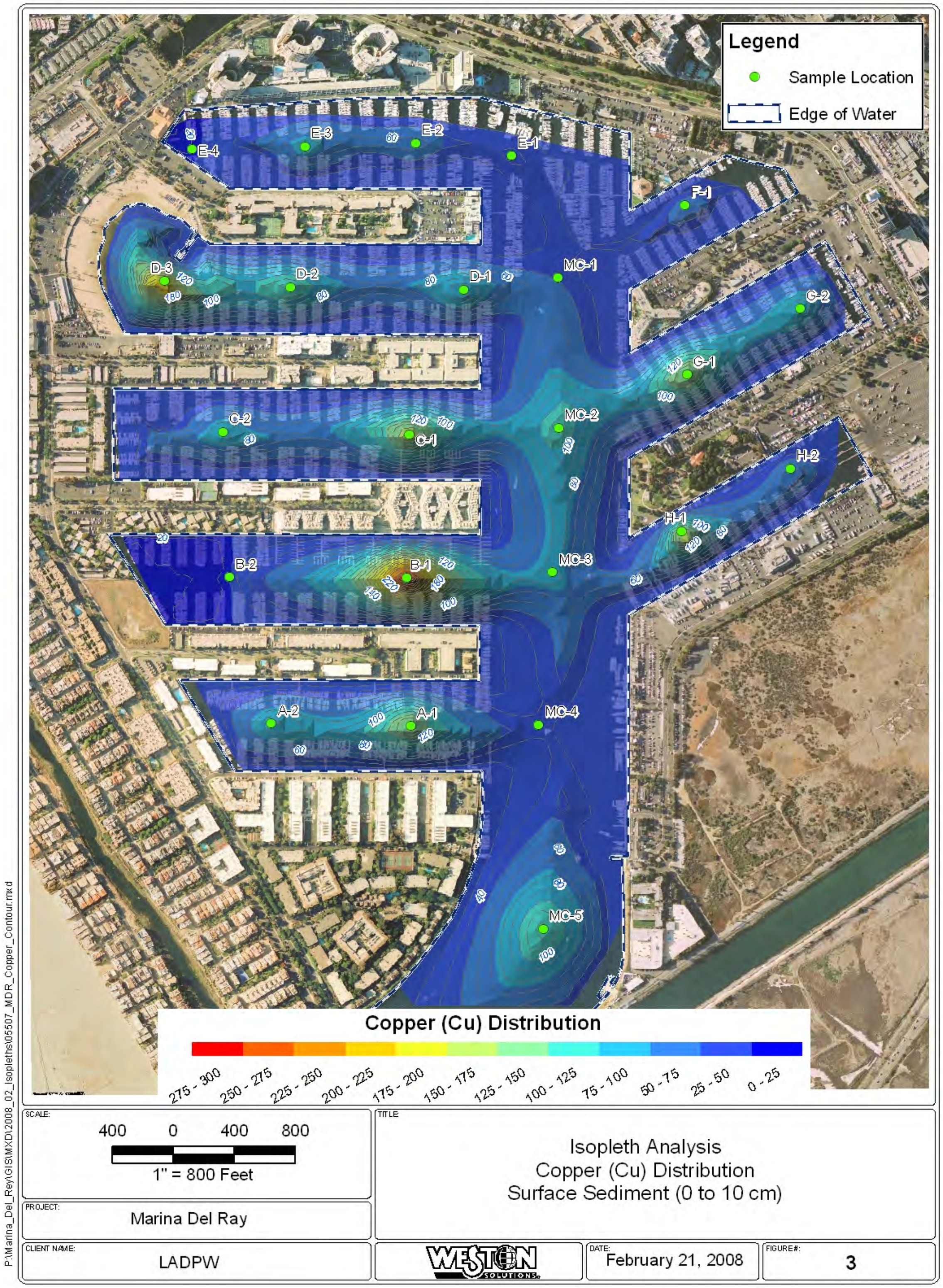

Figure 11. Distribution of copper in surface sediment in Marina del Rey Harbor.

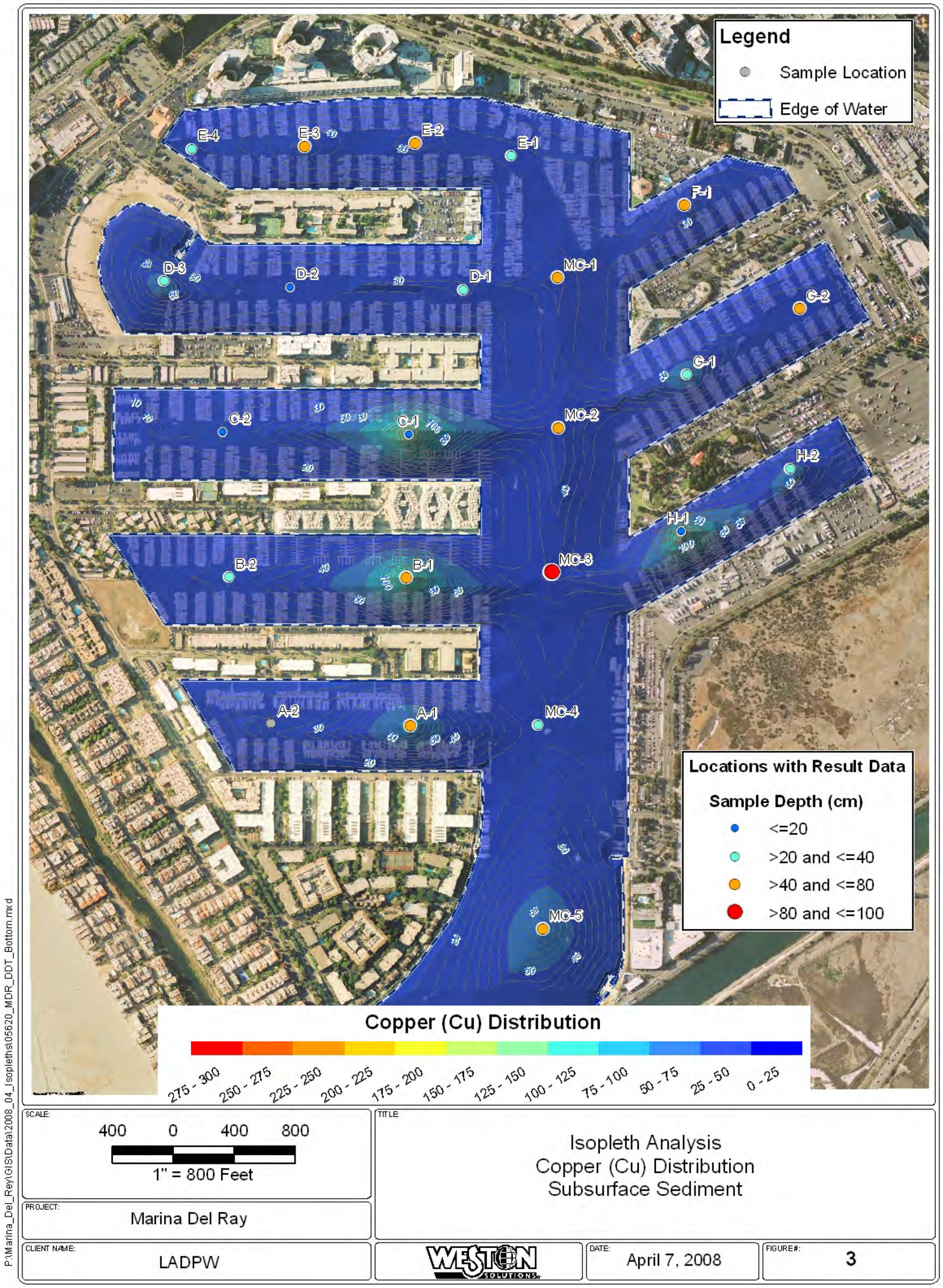

Figure 12. Distribution of copper in subsurface sediment in Marina del Rey Harbor.

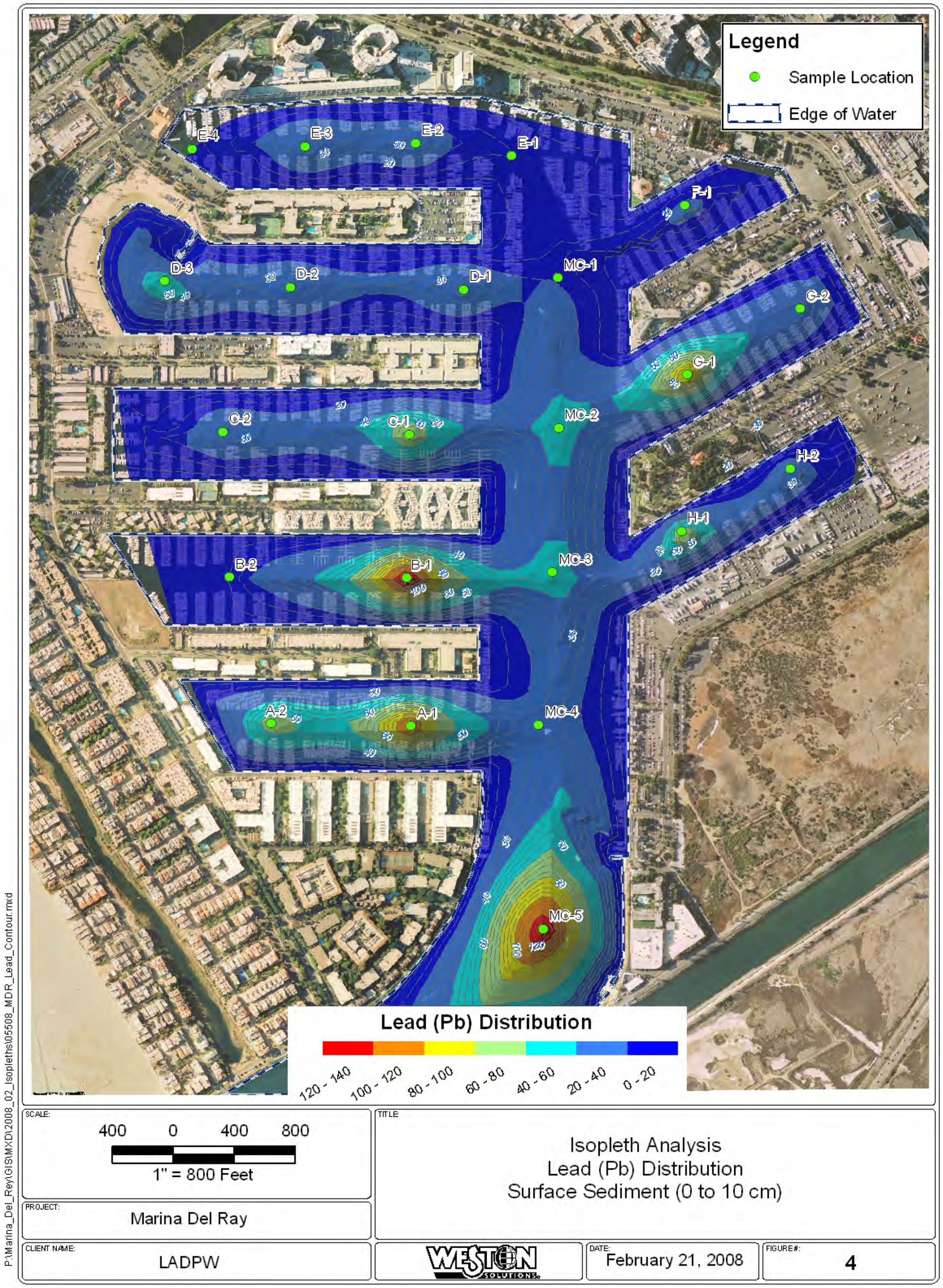

Figure 13. Distribution of lead in surface sediment in Marina del Rey Harbor.

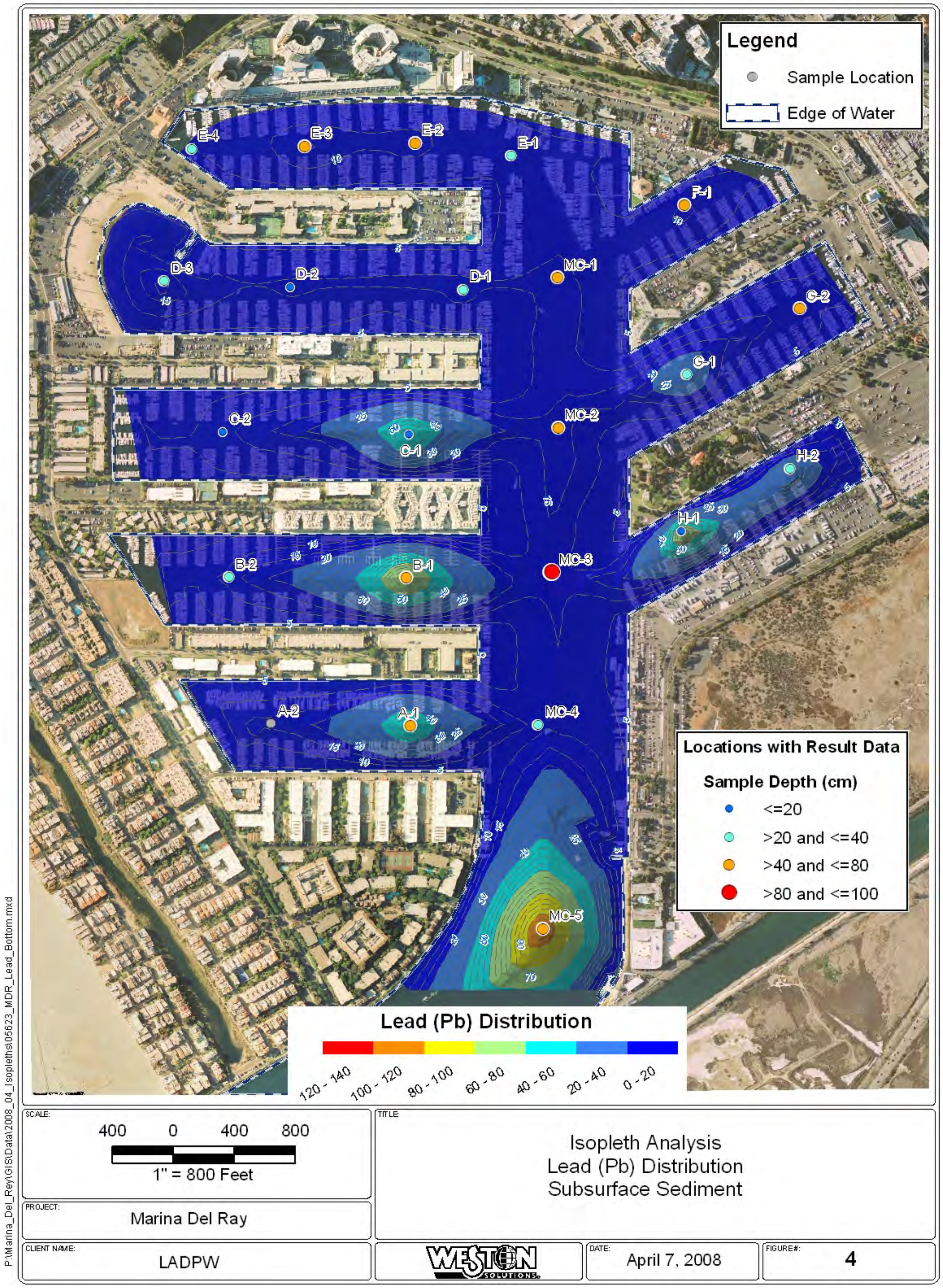

Figure 14. Distribution of lead in subsurface sediment in Marina del Rey Harbor.

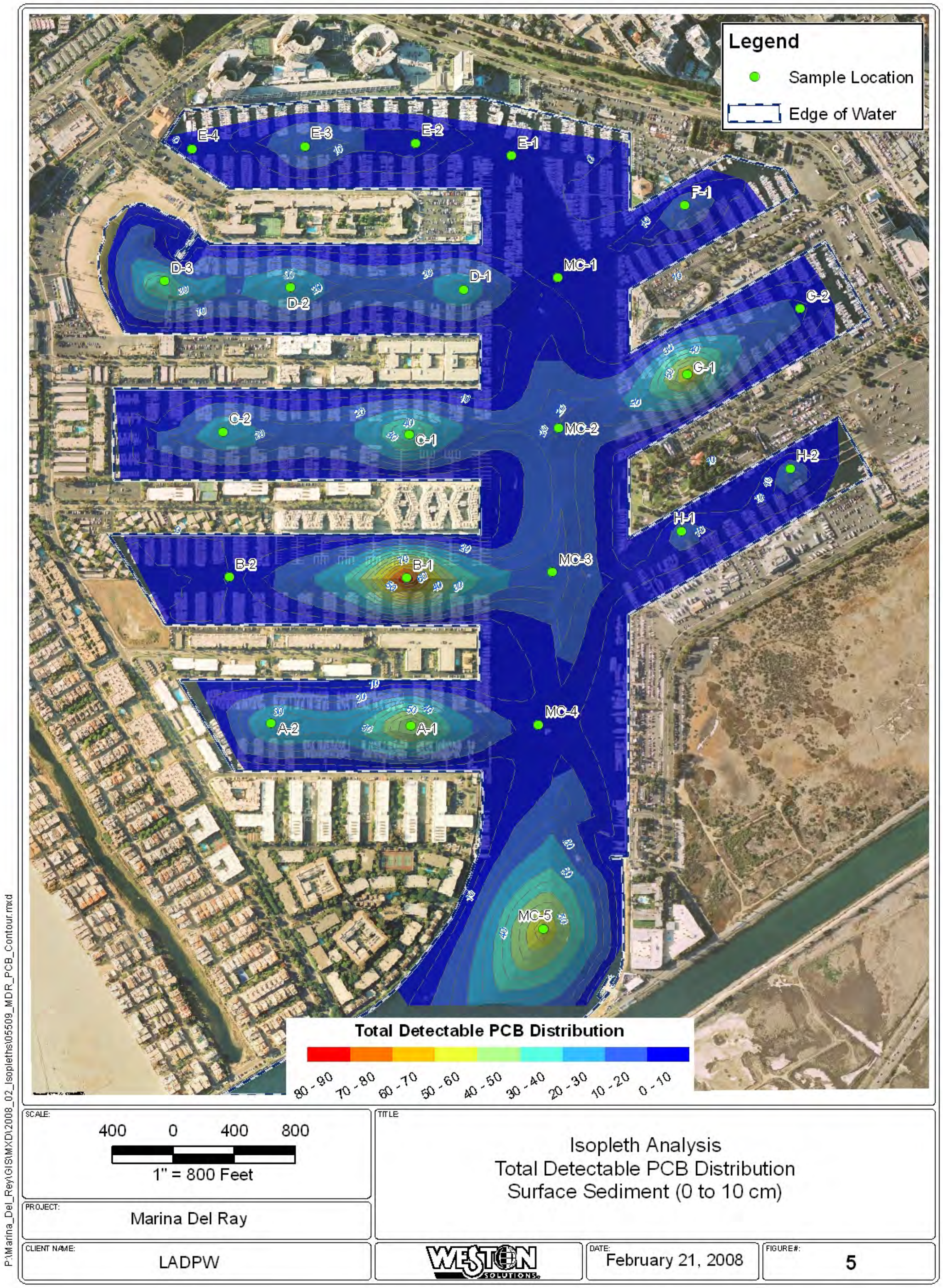

Figure 15. Distribution of total PCBs in surface sediment in Marina del Rey Harbor.

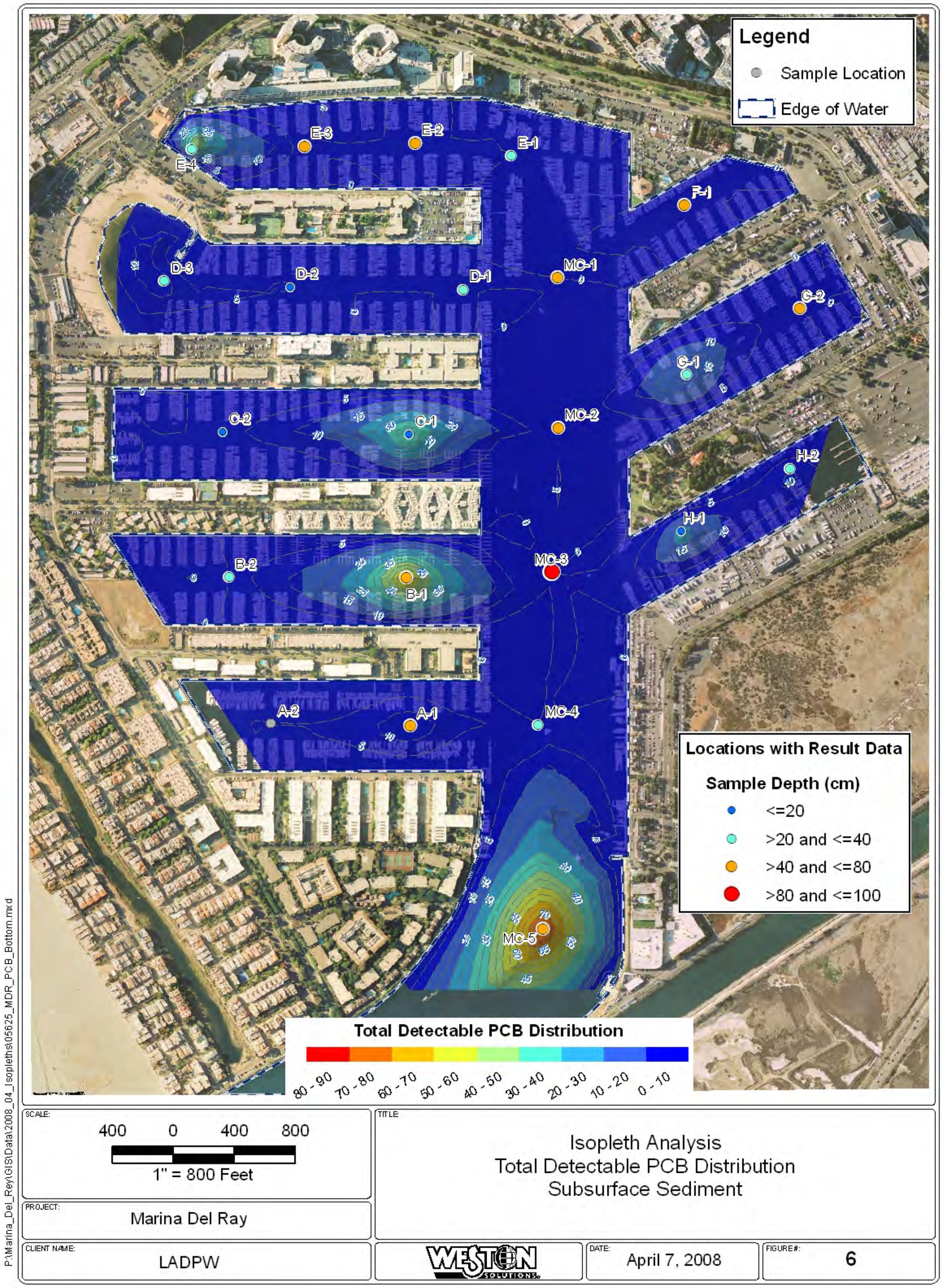

Figure 16. Distribution of total PCBs in subsurface sediment in Marina del Rey Harbor.

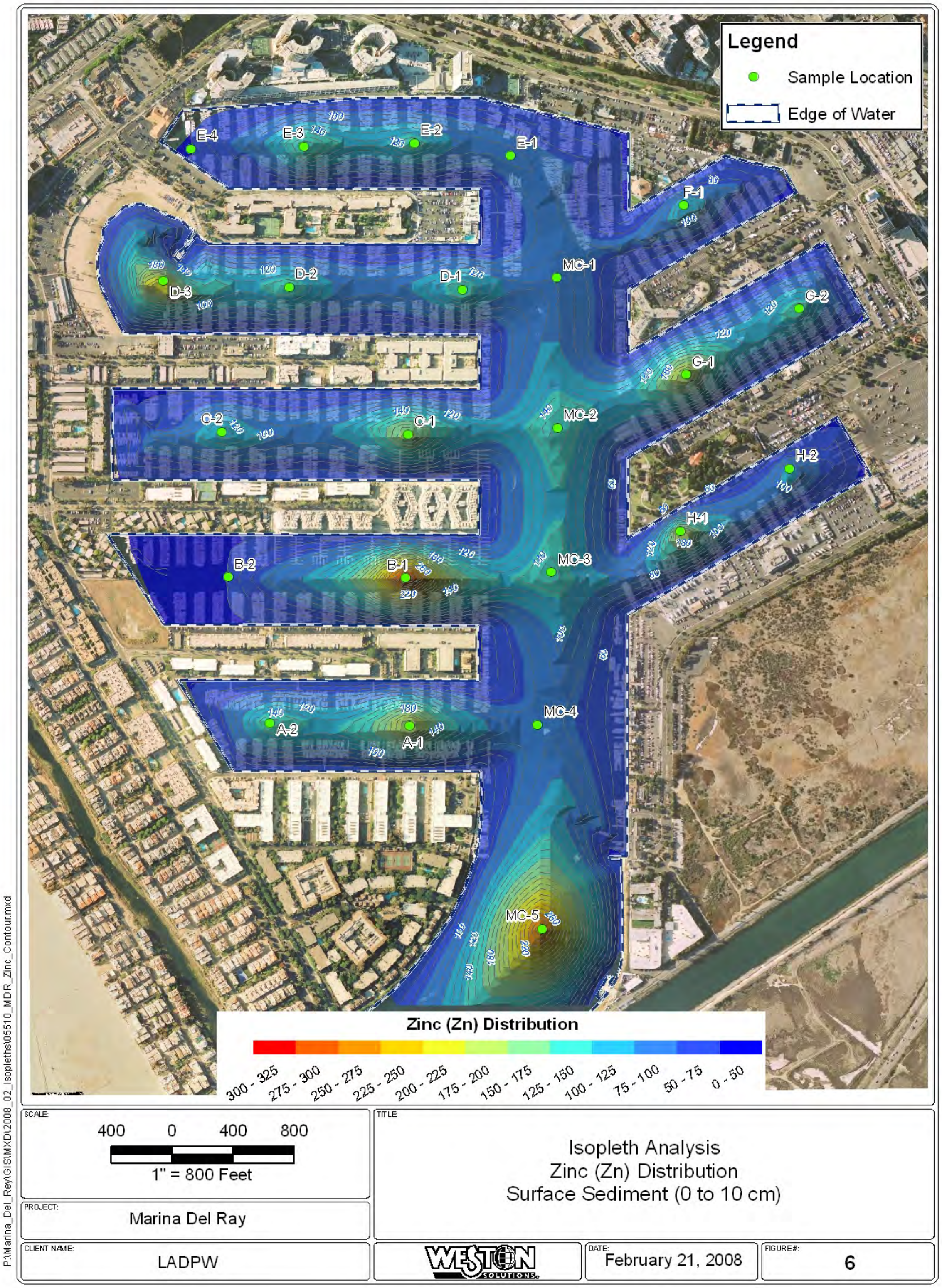

Figure 17. Distribution of zinc in surface sediment in Marina del Rey Harbor.

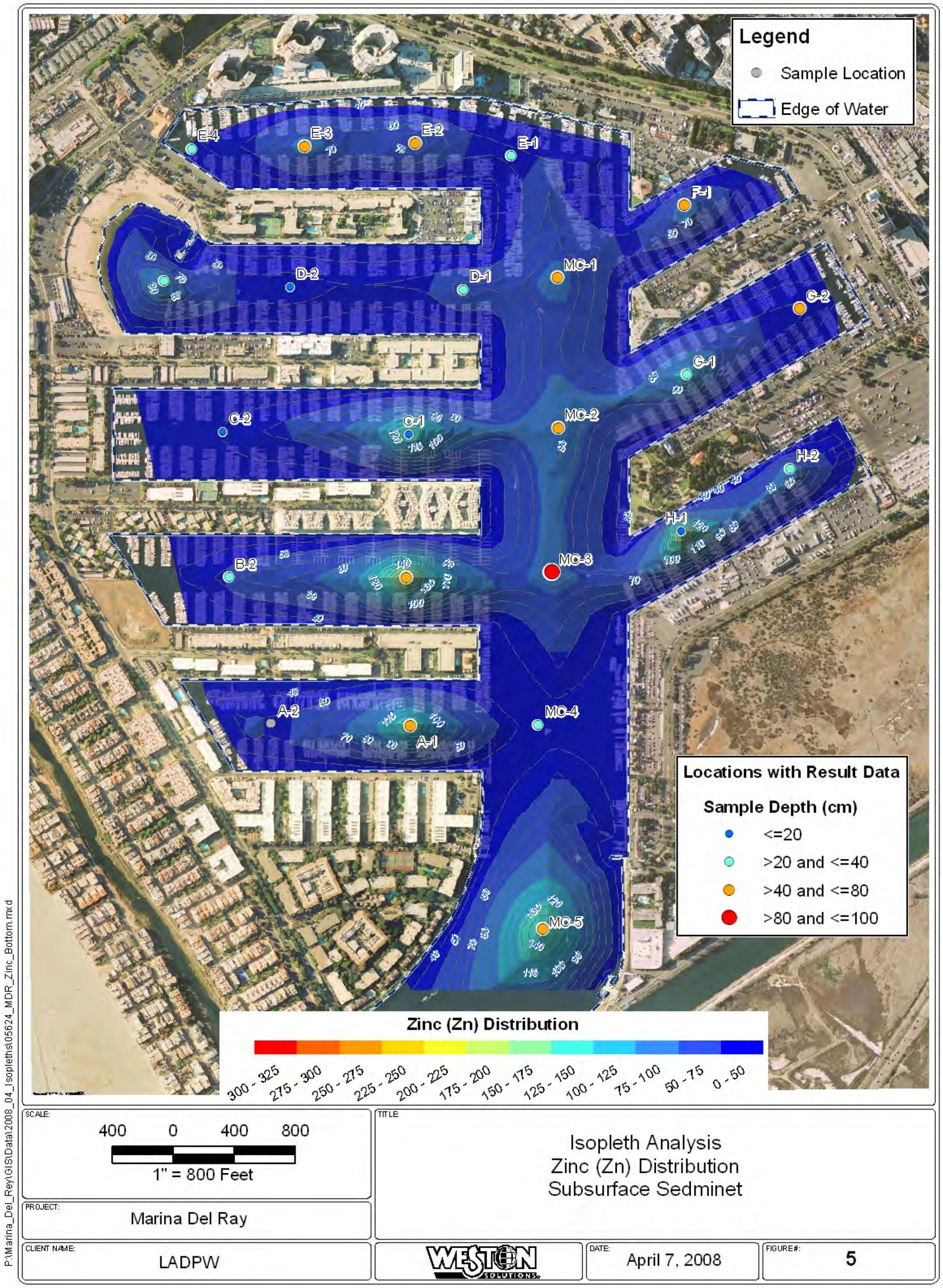

Figure 18. Distribution of zinc in subsurface sediment in Marina del Rey Harbor.

3.3 RESULTS OF SOLID PHASE TOXICITY TESTING

3.3.1 Eohaustorius estuarius

This test was divided into two batches due to the large number of test samples. The two batches were run concurrently on different shelves in the 15ºC test room. A separate control was associated with each batch of tests. Control 1 was associated with test samples D-3, E-4, F-1, B-2, MC-2, MC-3, MC-5, and MC-4. Control 2 was associated with samples E-3, E-1, MC-1, G-2, D-2, H-2, A-2, and C-2.

Water quality parameters were within the recommended protocol limits (Table 2). Mean percent survival of *E. estuarius* was 95.0 and 91.0% in the batch 1 and batch 2 controls, respectively, which met the minimum acceptable control survival criterion ($\geq$ 90%). Over 20 amphipods were recovered at test termination from replicate 2 of sample A-2. Because it was not possible to confirm the number of organisms added at test initiation, this replicate was dropped from statistical analysis. Mean percent survival was generally low across all samples (45.0 – 77.0%) with the exception of MC-4 (91.0%), H-2 (85.0%), and A-2 (83.8%). Samples D-3, E-4, F-1, B-2, MC-2, MC-3, MC-5, E-3, E-1, MC-1, G-2, D-2, and C-2 had less than 80% survival and were significantly different from the associated control (using an ANOVA). A summary of test results is presented in Table 16. The laboratory bench sheets and summary tables are presented in Appendix C.

The cadmium chloride reference toxicant test was conducted at concentrations of 0, 2.50, 5.00, 10.0, 20.0 and 40.0 mg Cd^{2+}/L. The median lethal concentration (LC_{50}) was 6.67 mg Cd^{2+}/L, which was within two standard deviations (± 4.32 mg Cd^{2+}/L) of the Weston laboratory mean of 6.90 mg Cd^{2+}/L. This indicates that the sensitivity of *E. estuarius* used in the assessment of test sediments fell within the normal range.

In the ammonium chloride reference toxicant test, LC_{50} values of 109 mg total NH_3/L and 1.67 mg un-ionized NH_3/L were determined from survivorship at measured concentrations of 0, 7.87, 16.9, 47.2, 85.4, and 148 mg total NH_3/L, and calculated un-ionized concentrations of 0, 0.385, 0.673, 1.21, 1.75, and 1.55 mg un-ionized NH_3/L. Measured total ammonia and un-ionized ammonia in tests conducted with project materials were below concurrent reference toxicant effect levels (LC_{50} = 109 mg total NH_3/L; no observable effect concentration [NOEC] = 85.4 mg total NH_3/L). Therefore, ammonia is not expected to have contributed to any toxicity found in tests using project materials.

Table 16. Results of Solid Phase Test using *Eohaustorius estuarius*

Sample ID	**Amphipods (*Eohaustorius estuarius*)**						
	Overlying Total Ammonia Concentration (mg/L)		Interstitial Total Ammonia Concentration (mg/L)		% Survival	% Mortality	% Effective Mortality[1]
	Initial	Day 10	Initial	Day 10			
Control 1	<0.500	<0.500	1.19	0.571	95.0	5.00	6.00
D-3	<0.500	<0.500	1.56	0.977	75.0	25.0	25.0
E-4	<0.500	<0.500	1.27	1.22	63.0	37.0	37.0
F-1	<0.500	<0.500	1.67	0.973	57.0	43.0	43.0
B-2	<0.500	<0.500	2.03	0.946	55.0	45.0	45.0
MC-2	<0.500	<0.500	2.75	1.46	74.0	26.0	26.0
MC-3	<0.500	<0.500	2.88	2.29	77.0	23.0	23.0
MC-5	<0.500	<0.500	4.79	3.00	67.0	33.0	33.0
MC-4	<0.500	<0.500	3.71	1.63	91.0	9.00	9.00
Control 2	<0.500	<0.500	0.866	0.858	91.0	9.00	9.00
E-3	<0.500	<0.500	1.20	0.587	57.0	43.0	44.0
E-1	<0.500	<0.500	1.76	1.33	65.0	35.0	35.0
MC-1	<0.500	<0.500	1.93	0.896	59.0	41.0	41.0
G-2	<0.500	<0.500	1.69	1.32	45.0	55.0	55.0
D-2	<0.500	<0.500	2.54	1.16	69.0	31.0	31.0
H-2	<0.500	<0.500	3.13	2.70	85.0	15.0	15.0
A-2	<0.500	<0.500	3.25	1.04	83.8[2]	16.3	16.3
C-2	<0.500	<0.500	2.42	1.66	72.0	28.0	28.0

	Concentration (mg/L)	% Survival	LC$_{50}$ (mg/L)
Cadmium Chloride Reference Toxicant	Control	96.7	6.67
	2.50	86.7	
	5.00	73.3	
	10.0	16.7	
	20.0	0.00	
	40.0	0.00	

	Total NH$_3$	Un-ionized NH$_3$	% Survival	Total NH$_3$		Un-ionized NH$_3$	
	Actual Concentration (mg/L)	Calculated Concentration (mg/L)		LC$_{50}$ (mg/L)	NOEC (mg/L)	LC$_{50}$ (mg/L)	NOEC (mg/L)
Ammonium Chloride Reference Toxicant	Control	Control	83.3	109	85.4	1.67	1.75
	7.87	0.385	93.3				
	16.9	0.673	96.7				
	47.2	1.21	90.0				
	85.4	1.75	73.3				
	148	1.55	0.00				

[1] Sum of dead animals plus those survivors that fail to rebury.

[2] Over 20 amphipods were recovered at test termination from one replicate. Unable to confirm the number of organisms added at test initiation, therefore this replicate was dropped from statistical analysis.

3.3.2 Relationship between Grain Size, Chemistry, and Observed Amphipod Toxicity

The indigenous habitat of *E. estuarius* typically is a sandy sediment. While these organisms are tolerant of a wide variety of grain sizes, extremely fine sediments may not be suitable. Studies have shown that survival of many organisms may be affected by grain size distribution (DeWitt et al., 1989). In addition, previous studies conducted by Weston (formerly MEC Analytical) have demonstrated that survival of *E. estuarius* is affected by grain size extremes (i.e., >75% sand or >75% clay). Specifically, increased mortality associated with increased proportions of sand or clays in sediment. To determine whether toxicity measured in the present study was confounded by grain size and not entirely due to contaminants in the sediment, a correlation analysis was performed on the Marina del Rey Harbor sediment grain size data and toxicity test results. Figure 19 demonstrates a statistically significant correlation between survival of *E. estuarius* and percent clay in the Marina del Rey Harbor sediment. Increased mortality is associated with increased proportions of fine grained sediment. Because DDTs, PCBs, copper, and zinc sometimes exceeded the ER-M in the Marina del Rey Harbor sediments, correlation analyses were also performed on these analytes against the amphipod survival data. Results show that there were statistically significant correlations between survival of *E. estuarius* and zinc and copper ($P<0.05$); however, no significant correlations were found between survival and DDTs or PCBs ($P>0.05$).

As shown in Figure 20, if the ER-M value is plotted on the graph, it is evident that for zinc, there is only one ER-M exceedance and it corresponds to survival of *E. estuarius* of approximately 60% survival (i.e., only slightly toxic). This indicates that factors other than zinc (which is primarily found at concentrations below the ER-M) were contributing to the toxicity observed. Similarly, the ER-M value for copper is plotted in Figure 9, showing the correlation between copper concentration and survival of *E. estuarius*, which shows that 7 out of the 16 points exceed an ER-M value. In the case of copper, although the samples with the highest copper do not show the highest toxicity, it is possible that copper contributed to decreased survival. Nonetheless, because copper and zinc are significantly correlated to the percent of clay in sediment (Figure 22 and Figure 23), it is likely that grain size (or percent clay) interferes with the test result or the ability to discern whether these metals have an effect on toxicity of the amphipods.

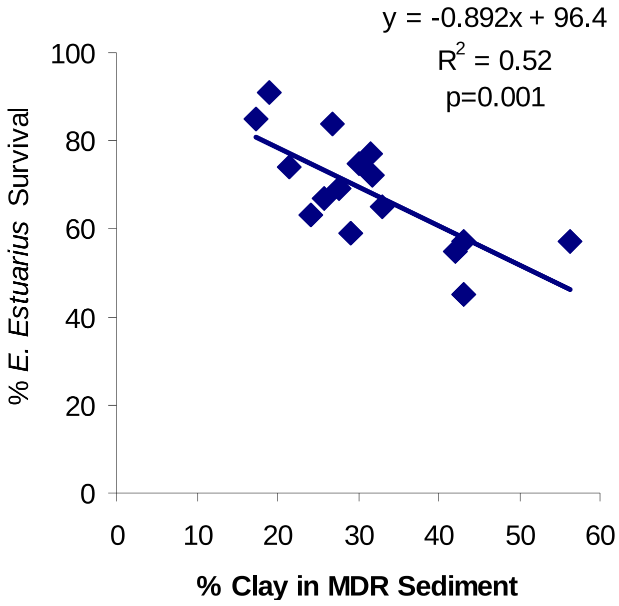

Figure 19. Correlation between survival of *E. estuarius* and percent clay in the Marina del Rey Harbor sediment.

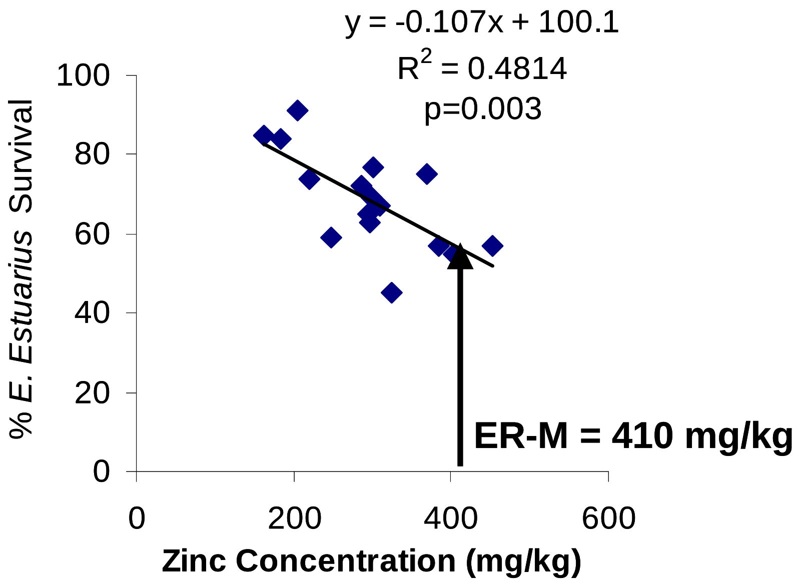

Figure 20. Correlation between survival of *E. estuarius* and zinc concentrations in the Marina del Rey Harbor sediment.

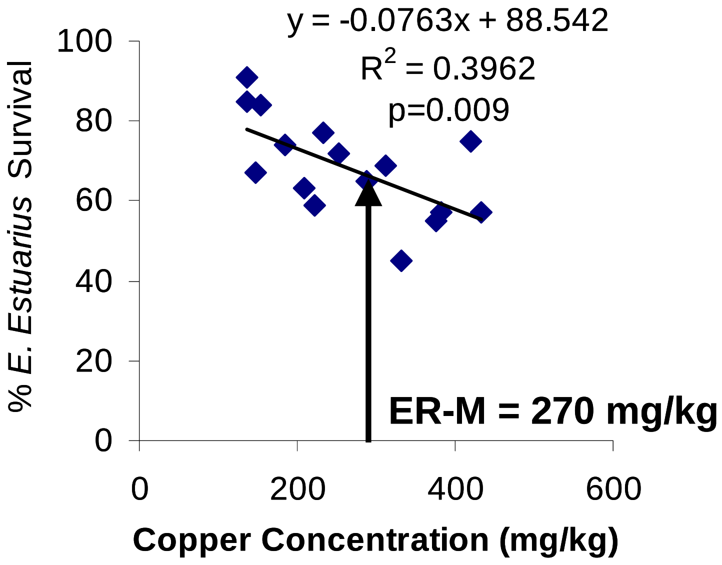

Figure 21. Correlation between survival of *E. estuarius* and copper concentrations in the Marina del Rey Harbor sediment.

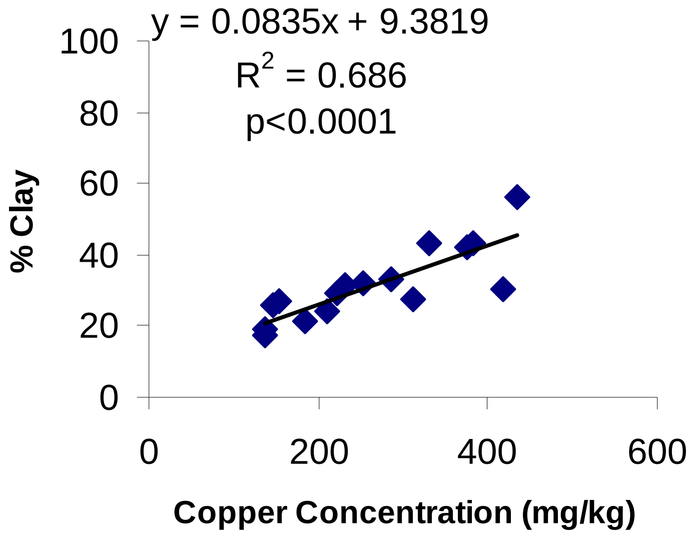

Figure 22. Correlation between percent clay and copper concentrations in the Marina del Rey Harbor sediment.

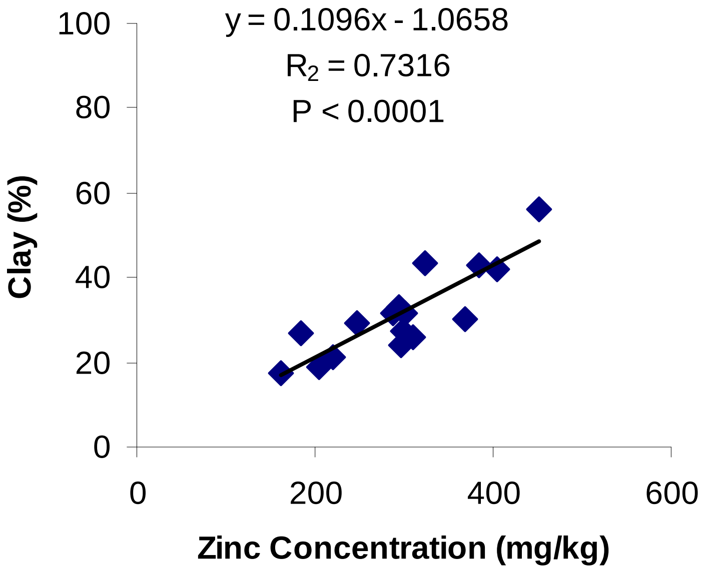

Figure 23. Correlation between percent clay and zinc concentrations in the Marina del Rey Harbor sediment.

3.4 BENTHIC COMMUNITY EVALUATION

Benthic infaunal samples were collected from 16 stations located throughout the main channel and basins of Marina del Rey. Benthic abundance by species is shown in Table 17. Total abundance per sample location ranged from 151 specimens at station E-3 to 1930 specimens at station A-2. Samples were largely comprised of polychaetes and a lesser extent, crustaceans. There were low abundances of molluscs and the dominant species in the miscellaneous phyla were phoronids.

Table 17. Total abundance of benthic infauna per station.

Taxon	**Species**	**A-2**	**B-2**	**C-2**	**D-2**	**D-3**	**E-1**	**E-3**	**E-4**	**F-1**	**G-2**	**H-2**	**MC-1**	**MC-2**	**MC-3**	**MC-4**	**MC-5**
Crustaceans	*Alpheus clamator*											1	2	1			
Crustaceans	*Amphideutopus oculatus*														4	20	142
Crustaceans	*Anoplodactylus erectus*						5							3			1
Crustaceans	*Caprella californica*											1					
Crustaceans	*Deltamysis* sp A											3	2	8	13		
Crustaceans	*Euphilomedes carcharodonta*								1								11
Crustaceans	*Grandidierella japonica*	25	22	9	2		4			29	2	2	1	1		1	2
Crustaceans	*Heteroserolis carinata*															2	3
Crustaceans	*Mayerella acanthopoda*	2		5	5	13	2	6	1	2	2		1		3	8	13
Crustaceans	*Monocorophium acherusicum*		1														
Crustaceans	Mysidacea										1						
Crustaceans	*Paranthura elegans*	2			7							2			1	1	
Crustaceans	*Podocerus fulanus*	10		2			2			7				3			2
Crustaceans	*Pseudotanais* sp 1	17															
Crustaceans	*Synaptotanais notabilis*	571	70	25	15						2		1		1		
Crustaceans	*Zeuxo normani*									2							
Total Abundance for Crustaceans		**627**	**93**	**41**	**29**	**13**	**13**	**6**	**2**	**40**	**7**	**9**	**7**	**16**	**22**	**32**	**174**
Echinoderms	*Amphipholis squamata*															3	
Echinoderms	Amphiuridae		1														
Total Abundance for Echinoderms		**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**
Minor Phyla	Actiniaria								1								
Minor Phyla	*Corymorpha palma*	7		4	1	2				1	2	1					
Minor Phyla	Diadumenidae								2								
Minor Phyla	*Edwardsia juliae*																1
Minor Phyla	*Euphysa* sp	1															
Minor Phyla	Lineidae	1														1	2
Minor Phyla	*Lineus bilineatus*														1		3
Minor Phyla	Nemertea																13
Minor Phyla	*Notoplana* sp				1												
Minor Phyla	Paleonemertea	4								1							
Minor Phyla	*Paranemertes californica*			1	1					1			2				2
Minor Phyla	Phoronida	44	17	20	190	26	53	5	1	8	62	14	5	2	4	7	
Minor Phyla	*Tetrastemma nigrifrons*													1			
Minor Phyla	*Tubulanus polymorphus*										1						
Minor Phyla	*Zygeupolia rubens*												1				
Total Abundance for Minor Phyla		**57**	**17**	**25**	**193**	**28**	**53**	**5**	**4**	**11**	**65**	**15**	**8**	**3**	**5**	**8**	**21**
Molluscs	*Acteocina inculta*			1	6					7	2						
Molluscs	*Caecum californicum*												1				
Molluscs	*Cooperella subdiaphana*															2	2
Molluscs	*Haminoea vesicula*													6	1		
Molluscs	*Laevicardium substriatum*											1					1
Molluscs	*Lyonsia californica*																3
Molluscs	*Macoma nasuta*																1

Taxon	Species	A-2	B-2	C-2	D-2	D-3	E-1	E-3	E-4	F-1	G-2	H-2	MC-1	MC-2	MC-3	MC-4	MC-5
Molluscs	Mactridae																7
Molluscs	*Neolepton* sp	3	1														
Molluscs	*Parvilucina tenuisculpta*														1		
Molluscs	*Periploma discus*																1
Molluscs	*Protothaca* sp						2					1				1	1
Molluscs	*Protothaca staminea*	1															
Molluscs	*Rochefortia mortoni*															1	
Molluscs	*Simomactra falcata*														1	2	1
Molluscs	*Tagelus subteres*			1	1					1		1	1	1		8	16
Molluscs	*Tellina cadieni*															1	2
Molluscs	*Tellina meropsis*						1			1							
Molluscs	*Tellina* sp																2
Molluscs	*Theora lubrica*				1				1		1				1	4	14
Molluscs	*Thracia* sp														1		
Total Abundance for Molluscs		**4**	**1**	**2**	**8**	**0**	**3**	**0**	**1**	**9**	**3**	**3**	**2**	**7**	**5**	**19**	**51**
Polychaetes	*Ampharete labrops*														1		1
Polychaetes	*Amphicteis scaphobranchiata*															2	2
Polychaetes	*Anotomastus gordiodes*								1								
Polychaetes	*Aphelochaeta* sp SD5	17	12					1		1	11	42	2	1	6	22	61
Polychaetes	*Apoprionospio pygmaea*																2
Polychaetes	*Aricidea (Acmira) catherinae*														1	1	2
Polychaetes	*Armandia brevis*			3	3		6			4	10	1	7	4	9		1
Polychaetes	*Boccardiella hamata*			1													
Polychaetes	*Capitella capitata* Cmplx	2											1		3		
Polychaetes	*Chaetozone corona*																1
Polychaetes	Cirratulidae		1	1													
Polychaetes	*Cirriformia* sp	1		2													
Polychaetes	*Cirriformia* sp SD1											1				2	
Polychaetes	*Cossura* sp A															5	7
Polychaetes	*Dipolydora socialis*		1														
Polychaetes	*Dorvillea (Schistomeringos) annulata*	17	12	22	16	2	4	2	8		4		1		1	1	
Polychaetes	*Euchone limnicola*	406	38	85	22	29	139	5	3	44	14	36	91	114	212	107	175
Polychaetes	*Euclymeninae* sp A																1
Polychaetes	*Exogone lourei*	24	1	2						1		1	1				4
Polychaetes	*Exogone* sp	2															
Polychaetes	*Exogone* sp A	30	13				2		2	1	2	1	1			1	5
Polychaetes	*Glycera americana*													1	1	1	1
Polychaetes	*Goniada littorea*											3				3	
Polychaetes	*Harmothoe imbricata* Cmplx		1									2					
Polychaetes	*Hydroides pacificus*		1														
Polychaetes	*Leitoscoloplos pugettensis*	55	92	132	59	66	61	35	39	37	39	58	23	21	21	43	135
Polychaetes	*Mediomastus* sp	86	9	33	38	5	17	1	11	12	23		28	11	90	45	127
Polychaetes	*Melinna oculata*		1													1	
Polychaetes	*Metasychis disparidentatus*		1							2				1	1		3
Polychaetes	*Monticellina siblina*																2
Polychaetes	*Neanthes acuminata* Cmplx	1		6			1					1					
Polychaetes	*Nephtys caecoides*		1									1				3	
Polychaetes	*Nereis procera*																1

Taxon	**Species**	**A-2**	**B-2**	**C-2**	**D-2**	**D-3**	**E-1**	**E-3**	**E-4**	**F-1**	**G-2**	**H-2**	**MC-1**	**MC-2**	**MC-3**	**MC-4**	**MC-5**
Polychaetes	*Notomastus* sp A	1															1
Polychaetes	Oligochaeta	1							1		1	1					
Polychaetes	*Pherusa capulata*	11	2				1		1	2	2	1	1	2	1	1	
Polychaetes	*Pista wui*														1	1	2
Polychaetes	*Podarkeopsis glabrus*														1		
Polychaetes	*Polydora cornuta*		1	2	4	6	3	1	2		2		2	1	3		
Polychaetes	*Praxillella pacifica*																3
Polychaetes	*Prionospio heterobranchia*	58	15	26	6		17	1		9	8	1	9	3	34	6	11
Polychaetes	*Prionospio lighti*															1	
Polychaetes	*Prionospio pinnata*							50									
Polychaetes	*Pseudopolydora paucibranchiata*	434	394	459	295	26	358		27	172	41	163	327	245		373	293
Polychaetes	*Scolelepis* sp SD1	2		1	4	2	2								2		13
Polychaetes	*Scoletoma erecta*		1		5	25	3	19	35		1		4		1		
Polychaetes	*Scoletoma* sp	1	1				3	1	4			1	1	2	2	4	6
Polychaetes	*Scoletoma* sp A												3	2	3	11	9
Polychaetes	*Scoletoma* sp B																1
Polychaetes	*Scoletoma* sp C	82	91	27	34	34	75	24	37	45	39	25	99	77	194	104	107
Polychaetes	*Scoloplos acmeceps*	5	1	1	14	2	1		3								
Polychaetes	*Sphaerosyllis californiensis*	6															
Polychaetes	*Spiochaetopterus costarum*																1
Polychaetes	*Spiophanes duplex*											1	1		1	8	3
Polychaetes	*Streblosoma* sp B															1	
Polychaetes	*Streblospio benedicti*								18								
Polychaetes	*Syllides reishi*								2								
Polychaetes	*Syllis (Typosyllis) nipponica*											1		2	1		
Total Abundance Polychaetes		**1242**	**690**	**803**	**500**	**197**	**693**	**140**	**194**	**330**	**197**	**341**	**602**	**487**	**590**	**747**	**981**
Total Abundance for All Taxa		**1930**	**802**	**871**	**730**	**238**	**762**	**151**	**201**	**390**	**272**	**368**	**619**	**513**	**622**	**809**	**1227**

4. CALIFORNIA SEDIMENT QUALITY OBJECTIVES: ASSESSMENT

Sediment quality from Marina del Rey Harbor was assessed using California's SQOs as described in the *Draft Staff Report, Water Quality Control Plan for Enclosed Bays and Estuaries* (SWRCB –Cal EPA, 2007). These SQOs are based on a multiple lines of evidence (MLOE) approach in which the LOE are sediment chemistry (Table 18), sediment toxicity (Table 19), and benthic community condition (Table 20).

Table 18. Sediment Chemistry Category

Sample Name	**Chemistry Guideline**		**Sediment Chemistry Category**
	CA LRM	**CSI**	
A-2	0.63	2.18	Moderate Exposure
B-2	0.76	2.79	High Exposure
C-2	0.69	2.47	High Exposure
D-2	0.70	2.31	Moderate Exposure
D-3	0.77	2.66	High Exposure
E-1	0.70	2.97	High Exposure
E-3	0.79	2.74	High Exposure
E-4	0.70	2.72	High Exposure
F-1	0.75	2.86	High Exposure
G-2	0.74	2.86	High Exposure
H-2	0.56	2.12	Moderate Exposure
MC-1	0.66	2.68	Moderate Exposure
MC-2	0.63	2.97	Moderate Exposure
MC-3	0.72	2.97	High Exposure
MC-4	0.64	2.97	Moderate Exposure
MC-5	0.77	2.89	High Exposure

Table 19. Sediment Toxicity Category

Sample Name	**Amphipod Toxicity** (% diff from control)	
A-2	84	Non-toxic
B-2	55	High Toxicity
C-2	72	Moderate Toxicity
D-2	69	Moderate Toxicity
D-3	75	Moderate Toxicity
E-1	65	Moderate Toxicity
E-3	57	Moderate Toxicity
E-4	63	Moderate Toxicity
F-1	57	Moderate Toxicity
G-2	45	High Toxicity
H-2	85	Non-toxic
MC-1	59	Moderate Toxicity
MC-2	74	Moderate Toxicity
MC-3	77	Moderate Toxicity
MC-4	91	Non-toxic
MC-5	67	Moderate Toxicity

Table 20. Sediment Benthic Category

Station Name	**IBI Score**	**RBI Score**	**BRI Score**	**RIVPAC Score**	**Benthic Score**
A-2	1	0.10	43.98	0.73	Moderate Disturbance
B-2	2	0.08	46.00	0.36	Moderate Disturbance
C-2	0	0.09	55.32	0.61	Moderate Disturbance
D-2	1	0.10	52.64	0.61	Moderate Disturbance
D-3	2	0.03	47.54	0.24	High Disturbance
E-1	1	0.09	49.63	0.48	Moderate Disturbance
E-3	2	0.03	36.86	0.12	High Disturbance
E-4	2	0.04	38.46	0.36	Moderate Disturbance
F-1	0	0.10	54.95	0.61	Moderate Disturbance
G-2	1	0.07	47.81	0.61	Moderate Disturbance
H-2	0	0.38	47.04	0.73	Low Disturbance
MC-1	1	0.08	48.42	0.61	Moderate Disturbance
MC-2	1	0.10	52.38	0.48	Moderate Disturbance
MC-3	1	0.12	41.33	0.24	Moderate Disturbance
MC-4	0	0.45	36.10	0.73	Reference
MC-5	1	0.23	31.03	0.85	Low Disturbance

Integration: Station Assessment

The severity of biological effects (i.e., integration of toxicity LOE and benthic condition LOE categories) and the potential for chemically-mediated effects (i.e., the integration of the toxicity LOE and chemistry LOE categories) was used to determine the station level assessment. Two stations were found to be likely unimpacted and one possibly impacted. Four stations were found to be likely impacted and nine stations clearly impacted. A gradient of cleaner stations near the mouth of Marina del Rey is suggested.

Station Name	**Severity of Biological Effects**	+	**Potential for Chemically Mediated Effects**	=	**Station Assessment**
A-2	Moderate Effect	+	Low Potential	=	Possibly Impacted
B-2	Moderate Effect	+	High Potential	=	Clearly Impacted
C-2	Moderate Effect	+	High Potential	=	Clearly Impacted
D-2	Moderate Effect	+	High Potential	=	Likely Impacted
D-3	High Effect	+	High Potential	=	Clearly Impacted
E-1	Moderate Effect	+	High Potential	=	Clearly Impacted
E-3	High Effect	+	High Potential	=	Clearly Impacted
E-4	Moderate Effect	+	High Potential	=	Clearly Impacted
F-1	Moderate Effect	+	High Potential	=	Clearly Impacted
G-2	Moderate Effect	+	High Potential	=	Clearly Impacted
H-2	Unaffected	+	Low Potential	=	Likely Unimpacted
MC-1	Moderate Effect	+	Moderate Potential	=	Likely Impacted
MC-2	Moderate Effect	+	Moderate Potential	=	Likely Impacted
MC-3	Moderate Effect	+	High Potential	=	Clearly Impacted
MC-4	Unaffected	+	Low Potential	=	Likely Unimpacted
MC-5	Low Effect	+	High Potential	=	Likely Impacted

The grain size data suggest toxicity test results may have been confounded by percent fines. If it is assumed fines contributed to 10% mortality, then C-2, D-3 and MC-4 change from “clearly impacted” to “likely impacted” and MC-2 is reduced to “possibly impacted”. If we assume fines contributed to 20% mortality, then E-1 and E-4 also change from “clearly impacted” to “likely impacted”.

5. REFERENCES

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