DRAFT ENVIRONMENTAL ASSESSMENT LOS ANGELES RIVER ESTUARY AND PORT OF LONG BEACH ENTRANCE CHANNEL MAINTENANCE DREDGING PROJECT LOS ANGELES COUNTY

JANUARY 2020

U.S. ARMY CORPS OF ENGINEERS
Los Angeles District

FINDING OF NO SIGNIFICANT IMPACT

Draft Environmental Assessment

Los Angeles River Estuary and Port of Long Beach Entrance Channel Maintenance Dredging

Los Angeles County, California

The U.S. Army Corps of Engineers, Los Angeles District (Corps) has conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The draft Environmental Assessment (EA) January 2020, for the Los Angeles River Estuary and Port of Long Beach Entrance Channel Maintenance Dredging addresses the need to remove shoals in Los Angeles River Estuary and Port of Long Beach federal navigation channels to provide continued safe and reliable commercial and recreational navigation.

The draft EA, incorporated herein by reference, evaluated various alternatives that would accomplish maintenance dredging of the federal navigation channels and ocean disposal of dredged material. The recommended plan is the Proposed Action and includes:

- Mechanical (clamshell with scow) dredging approximately 330,000 cubic yards of sandy material from the LARE inner channel and placement at LA-2 Ocean Dredged Material Disposal Site;

- Hydraulically (hopper) or mechanically (clamshell with scow) dredging approximately 40,000 cubic yards from the Port of Long Beach entrance channel and transporting it to LA-2 Ocean Dredged Material Disposal Site.

For all alternatives, the potential effects were evaluated, as appropriate. A summary assessment of the potential effects of the recommended plan (Proposed Action) are listed in Table 1:

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the recommended plan. Best management practices (BMPs) as detailed in the draft EA will be implemented, if appropriate, to minimize impacts.[1] The following monitoring measures are proposed in the draft EA:

Surveys for Caulerpa taxifolia in the vicinity of the LARE dredge area prior to dredging.

Water quality monitoring to be implemented at the dredge sites during dredging operations.

[1] 40 CFR 1505.2(C) all practicable means to avoid and minimize environmental harm are adopted.

No compensatory mitigation is required as part of the recommended plan.

Table 1: Summary of Potential Effects of the Recommended Plan

	Insignificant effects	Insignificant effects as a result of mitigation*	Resource unaffected by action
Aesthetics	☒	☐	☐
Air quality	☒	☐	☐
Aquatic resources/wetlands	☐	☐	☒
Invasive species	☐	☐	☒
Fish and wildlife habitat	☒	☐	☐
Threatened/Endangered species/critical habitat	☐	☐	☒
Historic properties	☐	☐	☒
Other cultural resources	☐	☐	☒
Floodplains	☐	☐	☒
Hazardous, toxic & radioactive waste	☒	☐	☐
Hydrology	☒	☐	☐
Land use	☐	☐	☒
Navigation	☒	☐	☐
Noise levels	☒	☐	☐
Recreation	☒	☐	☐
Socio-economics	☐	☐	☒
Environmental justice	☐	☐	☒
Soils	☒	☐	☐
Tribal trust resources	☐	☐	☒
Water quality	☒	☐	☐
Climate change	☐	☐	☒

Public review of the draft EA and FONSI was completed on **DATE DRAFT EA AND FONSI REVIEW PERIOD ENDED**. All comments submitted during the public review period were responded to in the Final EA and FONSI.

OTHER ENVIRONMENTAL AND CULTURAL COMPLIANCE REQUIREMENTS:

ENDANGERED SPECIES ACT

NO EFFECT:

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, the U.S. Army Corps of Engineers determined that the recommended plan will have no effect on federally listed species or their designated critical habitat.

NATIONAL HISTORIC PRESERVATION ACT

NO EFFECT TO HISTORIC PROPERTIES:

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, the U.S. Army Corps of Engineers determined that the recommended plan has no effect on historic properties.

CLEAN WATER ACT SECTION 404(B)(1) COMPLIANCE

The proposed project consists of maintenance dredging with ocean disposal. This does not include the discharge of dredged or fill materials if a clamshell dredge is employed for all work. Corps' regulations exclude from 404 regulation at 33 CFR 323.3(d)(3)(iii) "incidental movement of dredged material" associated with normal dredging operations." As such, provisions of the Clean Water Act do not apply to the proposed project.

CLEAN WATER ACT SECTION 401 COMPLIANCE:

The USACE is not required to apply for a Water Quality Certification under Section 401 of the Clean Water Act. The certification requirement of Section 401 of the Clean Water Act applies to any activity which could result in a discharge. As discussed above such a discharge does not occur for the project. However, in the unlikely event that a hopper dredge is employed, provisions, of the CWA would apply, including Sections 401 and 404 and the USACE would apply for a 401 Water Quality Certification for the Los Angeles County Regional Water Quality Control Board.

COASTAL ZONE MANAGEMENT ACT

CZMA CONSISTENCY ISSUED:

A determination of consistency with the California Coastal Zone Management program pursuant to the Coastal Zone Management Act of 1972 has been requested from the California Coastal Commission in the form of a Negative Determination. All conditions of the consistency determination shall be implemented in order to minimize adverse impacts to the coastal zone.

OTHER SIGNIFICANT ENVIRONMENTAL COMPLIANCE:

All applicable environmental laws have been considered and coordination with appropriate agencies and officials has been completed as documented in Section 5 and Table 4 of the draft EA.

DETERMINATION AND SATEMENT OF FINDING

Technical, environmental, and economic criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives.[2] Based on this report, the reviews by other Federal, State, and local agencies, Tribes, input of the public, and the review by my staff, it is my determination that the recommended plan would not

[2] 40 CFR 1505.2(B) requires identification of relevant factors including any essential to national policy which were balanced in the agency decision.

cause significant adverse effects on the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.[3]

___________________________	_______DRAFT____________________________
Date	Aaron Barta Colonel, Corps of Engineers District Commander

[3] 40 CFR 1508.13 stated the FONSI shall include an EA or a summary of it and shall note any other environmental documents related to it. If an assessment is included, the FONSI need not repeat any of the discussion in the assessment but may incorporate by reference.

1 Table of Contents

Appendices:

A: Mailing List

B: Southern California Dredged Material Management Team Notes and Sediment Test Results

C: Air Quality Emissions Calculations

Acronyms

1 INTRODUCTION

1.1 PURPOSE AND NEED

The National Environmental Policy Act (NEPA) requires that an Environmental Assessment (EA) contain a statement of purpose and need (40 Code of Federal Regulations [C.F.R.] § 1502.13). The need is the broad underlying necessity or requirement to which the NEPA lead agency is responding. Statements of purpose and need are intended to be comprehensive enough to adequately encompass the need, and specific enough to guide the development of alternatives.

The purpose of this project is to perform maintenance dredging to provide for the need of continued safe and reliable commercial and recreational navigation. Over time, shoaling of the federal Los Angeles River Estuary (LARE) and Port of Long Beach (POLB) Channels results in reduced depths that limit navigation, especially for larger commercial vessels.

1.2 Background

The LARE is located in the City of Long Beach, California, approximately 32 kilometers (km)(20 miles) south of downtown Los Angeles. Figure 1 shows the location and features surrounding the estuary. Flows from the Los Angeles River enter into the estuary from due north, and discharge into San Pedro Bay to the southeast. The LARE federal channel serves the Queens Way Marina and the Catalina Ferry Terminal, as well as Rainbow Harbor, within the City of Long Beach and the city South Shore Boat launch Ramp that has 10,000 launches per year. The flood control channel was constructed between 1919 and 1923. Soon after the construction of the flood control channel, the City of Long Beach constructed recreational small-craft facilities and ferry landings along the banks of the estuary. Persistent shoaling creates a navigation hazard for recreational and commercial vessels using facilities along the estuary. Sediments dredged as recently as 2008 were considered to be unsuitable for open water disposal/placement due to the presence of various contaminants. Aggressive cleanup of point and non-point sources in the Los Angeles River drainage have resulted in a substantial cleanup of sediments entering the LARE. The most recent dredging in 2014 had sediments that were suitable for ocean disposal, with the exception of a single elevated hot spot.

The POLB encompasses the eastern part of the San Pedro Bay, located in the southwestern portion of the city of Long Beach, in southern Los Angeles County, approximately 20 miles south of downtown Los Angeles. The POLB is the second-busiest port in the United States. The POLB federal entrance channel is the gateway for commercial vessels transiting into and out of the POLB. The general area of the POLB and adjacent portions of the cities of Long Beach and Los Angeles are characterized by diverse industrial and commercial land uses, including marine cargo terminals; light manufacturing and industry; recreational destinations; and commercial operations including sport fishing concessions, hotels, retail shops, and a public boat launch. The Entrance Channel area is the section of the federal channel by which vessels enter into San Pedro Bay. All vessels proceeding to the POLB must enter via this channel, including the very large tankers. For this reason, removal of high spots is a high priority project to allow the continued, uninterrupted, safe flow of commerce into the POLB. Sediments in this area tend to be clean sediments consisting of fine sands and silts.

1.3 Project Authorization

The Los Angeles and Long Beach Harbors are authorized by the 1896 River and Harbor Act. Maintenance dredging of the LARE and POLB federal channels are authorized by the Rivers and Harbors Act (RHA) of 1954 (House Document 362, 83rd Congress, 2nd Session).The authorized and maintained channel features are displayed in Table 1 below.

Table 1. Los Angeles River Estuary and POLB Project Features Authorized Dimensions

Project Features	Depth (feet MLLW)	
	Authorized	Maintained
Sand Trap	-25	-25
Area 1	-25	-25
Area 2	-21	-21
POLB	-76	-76

1.4 Project Area

The LARE federal channel consists of the Sand Trap, Area 1 and Area 2 (see Figure 2 below). The Sand Trap and Area 1 of the federal channel are authorized to be dredged to design depths of -25 feet mean lower low water (MLLW), and Area 2 has a design depth of -21 feet mean lower low water (MLLW). Shoaling in the federal channel has reached a controlling depth of -10 feet MLLW, and as a result there is a need to dredge to maintain safe recreational and commercial navigation. At this depth, sections of the federal channel may become impassable for larger recreational and commercial vessels. The POLB entrance channel (Figure 3) has a design depth of -76 feet MLLW. Shoaling has occurred on the western side of the channel between Stations 306 + 00 to 321 + 00 creating a shoal depth of -66 feet MLLW.

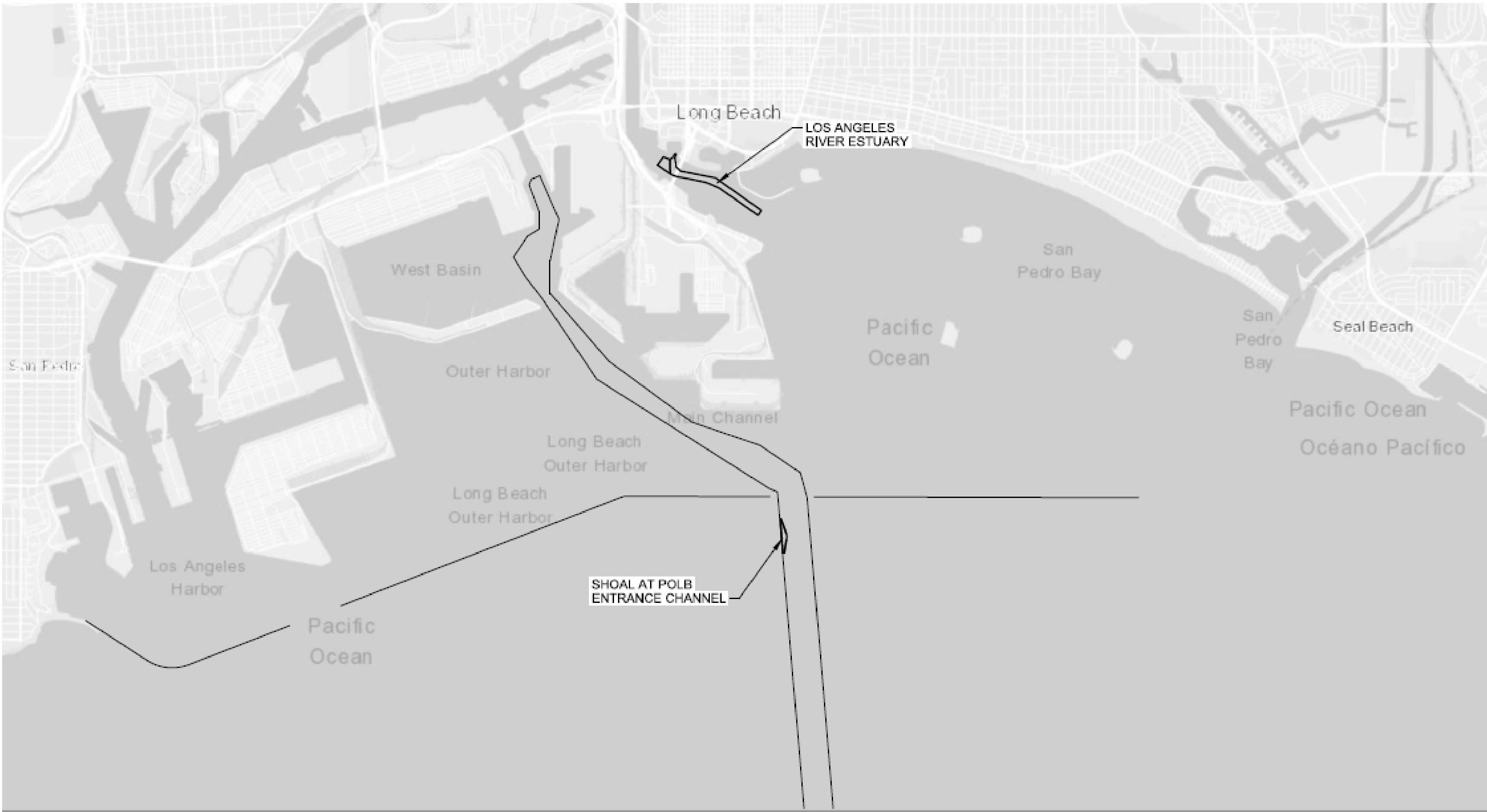


Figure 1. Los Angeles River Estuary and Port of Long Beach federal channel location

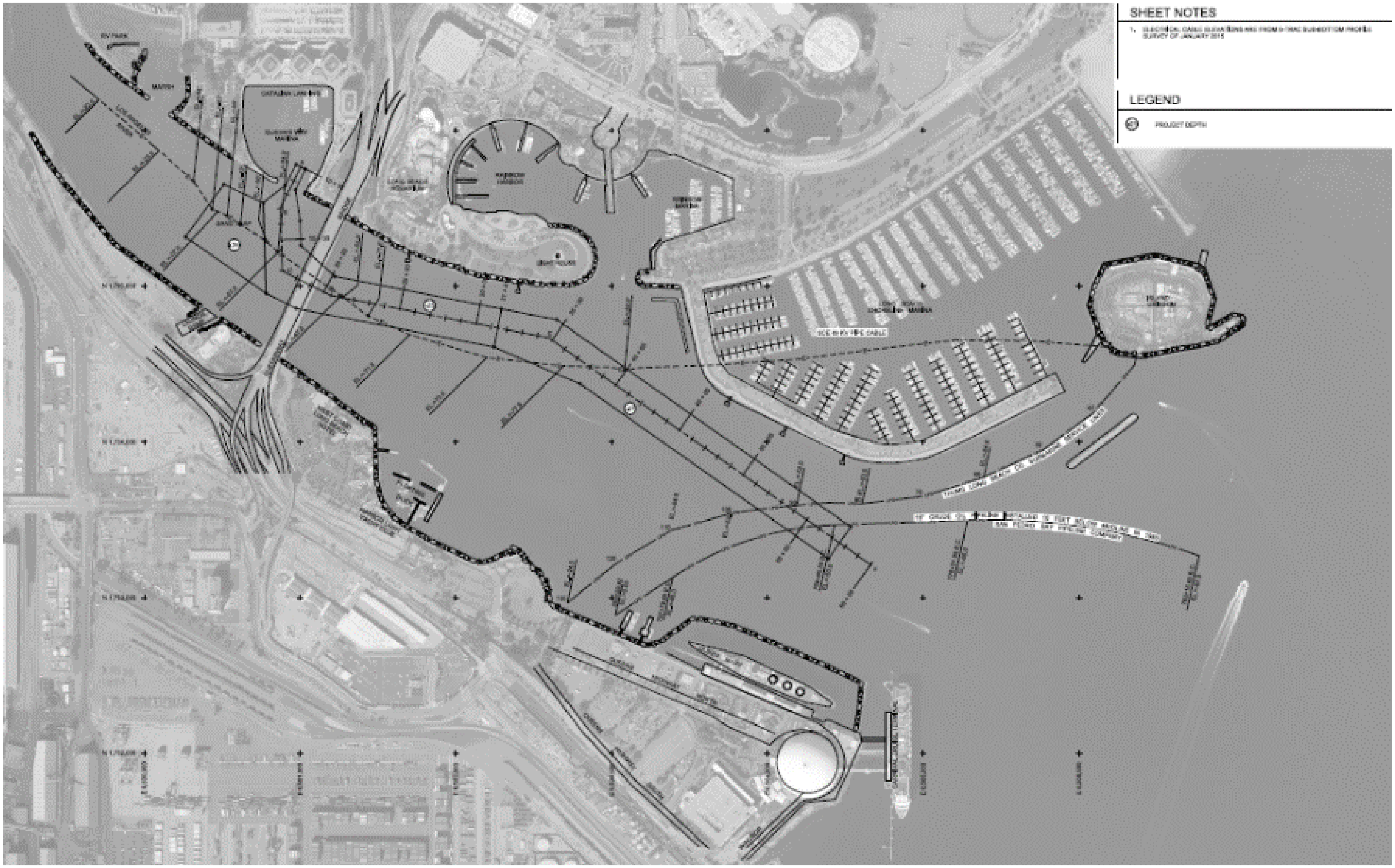


Figure 2. Los Angeles River Estuary federal channel features proposed for dredging

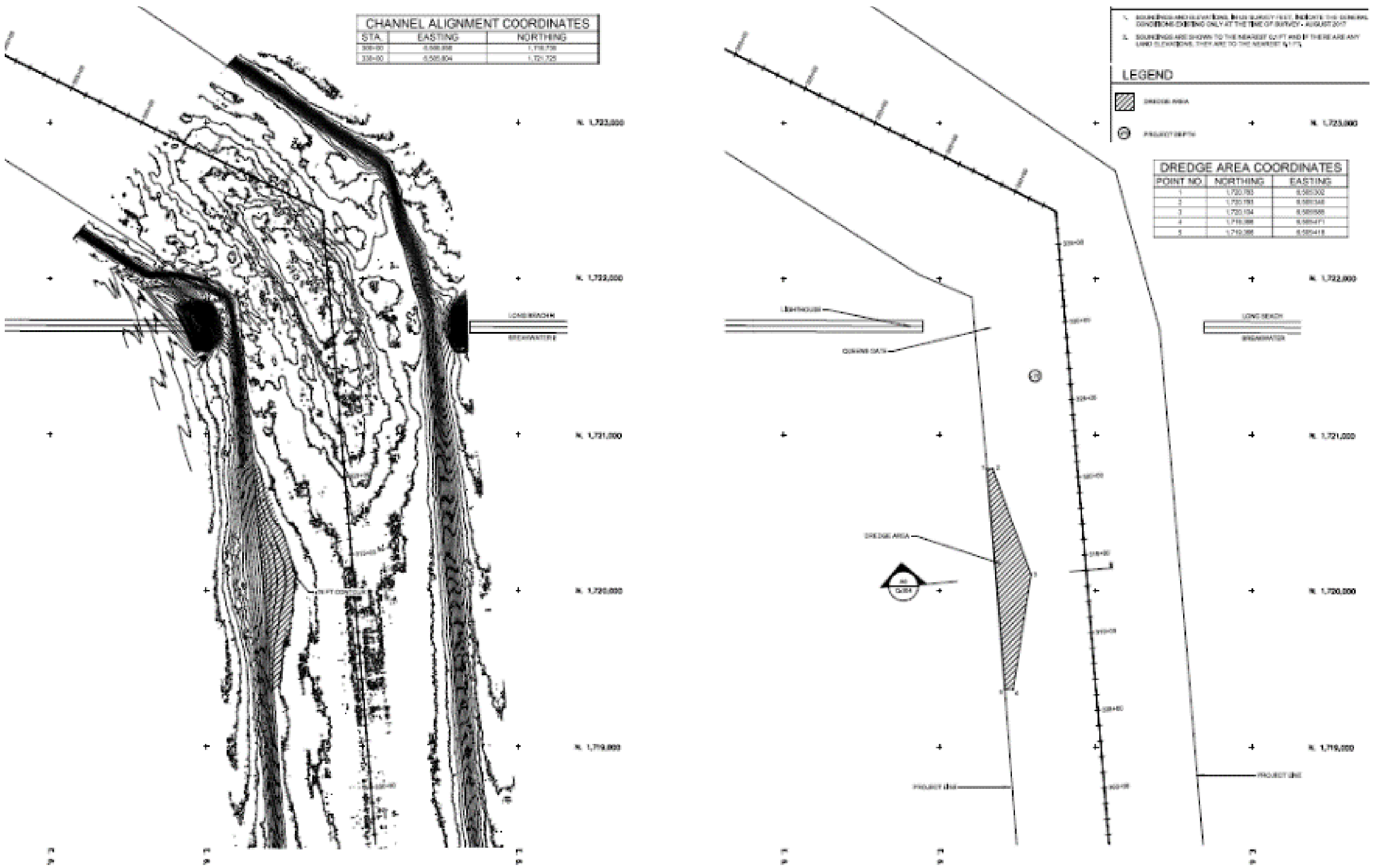


Figure 3. Port of Long Beach federal entrance channel shoal proposed for dredging

1.5 Previous Projects

The LARE has been silted in with sediments delivered from the Los Angeles River Watershed since the creation of the Los Angeles River Flood Control Channel. The flood control channel was constructed between 1919 and 1923. Soon after the construction of the flood control channel, the City of Long Beach constructed recreational small-craft facilities and ferry landings along the banks of the estuary. Persistent shoaling creates a navigation hazard for recreational and commercial vessels using facilities along the estuary.

To remain a safe and navigable channel, the LARE must maintain accessibility of its navigation channels for a variety of vessels, especially larger commercial vessels. Dredging of the LARE has been conducted under the U.S. Army Corps of Engineers (USACE) Operations and Maintenance (O&M) program since 1980. The quantity and quality of sediments in the federal channel is related to winter storms in the Los Angeles River watershed. Large storm events bring vast amounts of sediment into the estuary with sandy materials remaining in the upper estuary (in the sand trap area) and finer materials being transported by storm water flows into San Pedro Bay. In 2008 however, materials from the sand trap were clean enough and coarse enough to be used for near shore placement at Long Beach. This also reflects recent trends towards cleaner sediments, with most dredging events requiring confined disposal for contaminated sediments. Recent smaller storm events have resulted in finer-grained sediments accumulating in the estuary rather than being pushed out into San Pedro Bay. Dredged sediments for this dredging event are clean enough (with two localized exceptions) for unconfined ocean disposal but are too fine-grained for beneficial uses such as beach nourishment. Previous dredging events are displayed in Table 2.

Table 2. Los Angeles River Estuary Dredging History – 1980 – 2019

Dredge Date/Type	Volume (cubic yards)	Placement Location
1980	350,000	Used as dike material at Downtown Marina (Shoreline Harbor Marina)
1980	1,800,000	City of Long Beach dredge project. Material used as landfill at Downtown Marina
1991	122,000	POLB Pier J
1995	300,000	In Bay placement at mouth of LARE
1997	98,000	In Bay placement at mouth of LARE
1999	125,000	POLB Slip E (Confined disposal)
	41,000	LA-2
2001	135,000	North Energy Island Borrow Pit - Aquatic Capping Pilot Study.
2001		POLB channel deepening to -76 feet MLLW
2005	15,000	Sidecasting
2008	155,000	LA-2
2008	79,000	POLB Slip G (Confined disposal)
2008	181,000	Nearshore at Long Beach
2010	163,000	POLB Slip 1 (Confined disposal)
2015	640,000	LA-2

Dredging in the POLB Entrance Channel is on a much longer time period. From November 1998 to December 2000, the POLB Approach Channel was deepened from -60 feet MLLW to -76 feet MLLW. There has been no maintenance dredging conducted there since the deepening. The POLB navigation channels require infrequent maintenance dredging due to the fact that there are no sediment supply sources such as rivers in the Port. The nearest freshwater source is Dominguez Channel that flows into the adjoining Port of Los Angeles without contributing sediment into the POLB.

1.6 Project Schedule

The duration of the maintenance dredging project is approximately three months, with an estimated start date of March 2020 and completion by May 2020. Dredging will be conducted under a single contract for the LARE and shoal in the POLB entrance channel.

1.7 Anticipated Volumes

Volumes of the proposed dredging locations are included in Table 3 based on condition surveys for LARE and POLB in January 2019 and LARE in April 2019.

Table 3. Condition Surveys for the Proposed Project

Area	Depth of Dredging (feet MLLW)	Volume (cy)	
		Anticipated Volume	Anticipated Volumes with 2-foot Overdepth
Sand Trap	-25	41,000	46,000
LARE - 1	-25	145,000	183,000
LARE - 2	-21	57,000	102,000
LARE subtotal		**243,000**	**331,000**
POLB Shoal	-76	17,000	37,000
POLB subtotal		**17,000**	**37,000**
Total		**260,000**	**368,000**

1.8 Relationship to Environmental Protection Statutes, Plans, and other Requirements

The USACE is required to comply with all pertinent federal and state policies; project compliance is summarized in Table 4.

Table 4. Summary of Environmental Compliance

Statute	Status of Compliance
National Environmental Policy Act (NEPA) of 1969, 42 U.S.C., as amended Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the NEPA (40 CFR 1500-1508) dated July 1986	The EA will be completed and submitted for public review. Upon review of the Final EA, the District Engineer will issue a FONSI or require preparation of an EIS and a ROD will be issued for this project.
Clean Air Act, 42 U.S.C. 740B	A permit to construct will be obtained by contractor, if necessary.
Clean Water Act, 33 U.S.C. 1344 Rivers and Harbors Act of 1899, 33 U.S.C. 403 Section 103 of the Marine Protection, Research and Sanctuaries Act	A section 404(b)(1) analysis will not be needed for the recommended plan as there will be no placement of dredged or fill material within waters of the U.S.; a Section 401 Water Quality Certification will not be required. Not applicable. Ocean placement of dredged material associated with the Proposed Action would be at LA-2. Compliance with the Marine Protection, Research and Sanctuaries Act has been established through USEPA's permitting of this site.
National Oceanic and Atmospheric Administration Federal Consistency Regulation (15 CFR 930) Coastal Zone Management Act of 1972, 16 U.S.C. 1451 et seq California Coastal Act of 1976	A Negative Determination has been prepared by the Los Angeles District for concurrence by the California Coastal Commission
Joint Regulations (U.S. Fish and Wildlife Service and National Marine Fisheries Service) Endangered Species Committee Regulations, 50 CFR 402 Interagency Cooperation Endangered Species Act of 1973, 16 U.S.C. 1531, as amended Magnuson-Stevens Fishery Conservation and Management Act Fish and Wildlife Coordination Act, 16 U.S.C. 661-666c	An analysis of potential effects has been conducted and coordination efforts are underway with the U. S. Fish and Wildlife Service and the National Marine Fisheries Service. The USACE has determined that formal coordination pursuant to the Endangered Species Act is not required as the project would have no effect on any listed species or their designated critical habitat. An EFH Assessment will be submitted to NMFS for consultation along with this Draft EA. In the EFH assessment, USACE determined that the Proposed Action may adversely affect EFH for the fisheries present in the project area, but would not result in substantial adverse impacts. The NMFS will be requested to comment and to make conservation recommendations. An analysis of potential effects has been conducted and coordination efforts are underway with the U. S. Fish and Wildlife Service.

Migratory Bird Treaty Act, 16 U.S.C. 703-711 Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 33 U.S.C. 1413 Marine Mammal Protection Act, 16 U.S.C. 1361 et seq	The USACE has determined that no species protected by the Migratory Bird Treaty Act will be impacted. Sediments were tested for ocean disposal in accordance with provisions of this act. The USACE has determined that no species of marine mammal will be impacted.
National Historic Preservation Act, 16 U.S.C. 470 and 36 CFR 800: Protection of Historic Properties Executive Order 11593: Protection and Enhancement of the Cultural Environment, May 13, 1971 Executive Order 12898, Environmental Justice in Minority and Low-Income Populations	Per 36 CFR 800.3(a)(1), the proposed project has no potential to cause effects, and therefore the agency official has no further obligations under Section 106 of the Act. A memorandum of record is included in Appendix D. Not applicable. The minority population in the project area is significantly smaller than the minority population in the County. Therefore, the dredging would not result in disproportionate impacts to minority populations.

2 Alternatives

A set of near-term alternative plans for the 2020 maintenance dredging episode were formulated. The no action alternative and proposed alternative are described in section 2.1 and 2.2, respectively. Alternatives considered but eliminated from further analysis in this environmental assessment are described in section 2.3.

2.1 No Action Alternative

Under the No Action Alternative it is assumed that no federal maintenance dredging would take place, and shoaling would continue in the federally maintained channels. This would contribute towards unsafe navigation conditions in the federal channels.

2.2 Proposed Action

The Proposed Action consists of: 1) mechanically (clamshell) dredging approximately 331,000 cubic yards of sandy material from the LARE and transporting it 6 miles by barge for disposal at LA-2 ODMDS; and 2) either using the same clamshell and scow or hydraulically (hopper) dredging approximately 37,000 cubic yards of silty material from the POLB Entrance Channel shoal and disposal at LA-2 ODMDS, approximately 9 miles.

Maintenance dredging of the LARE Channel and shoal removal from POLB with disposal in the LA-2 ODMDS is the only practicable alternative that meets the project objectives.

2.2.1 Proposed Dredging and Placement Methodologies

Dredging LARE Channel will most likely involve the use of a clamshell dredge with disposal of dredged material at the LA-2 ODMDS by barge. While considered unlikely, a hydraulic dredge could also be used to dredge sediments from POLB only and transport to the LA-2 ODMDS, therefore, both types of equipment will be evaluated in this EA.

2.2.1.1 Mechanical (Clamshell) Dredging

Finer-grained sediment from the LARE channel (and possibly the POLB shoal) would be dredged by an approximately 500 horsepower mechanical dredge. A typical mechanical dredge consists of a crane mounted on a floating flat deck barge, with a dredging bucket (clamshell) on the end of the crane boom. The barge would have 2 to 4 spud piles to anchor the dredge, likely located at the corners. The mechanical dredge would move along the channel self-propelled by walking with its spuds or controlled by a tugboat. A crew would maintain and operate the dredging equipment at all times.

Once the dredge is positioned, the spud piles would be anchored vertically into the seafloor. The mechanical dredge, typically powered by a diesel generator, would then lower and raise the dredge bucket through the water column using a series of cables and winches. The weight of the dredge bucket allows it to sink into the sediment, with the cables restricting the clamshell from falling too deep or beyond the maximum allowable overdepth. The dredge bucket is then closed, raised up through the water column, and dredged materials are placed on a separate barge for transport to the disposal site. Unlike hydraulic cutterhead dredging, little additional water is entrained by mechanical dredging equipment. The dredging duration would be approximately 6 weeks.

When all the material within the swing reach of the mechanical dredge is removed, the spud piles would be raised and the tug (approximately 500 horsepower) would tow the barge to the disposal site and back. Approximately 3,000 to 8,000 cubic yards of sediment can be removed and transported to the disposal site per day using a clamshell dredge. Additional construction equipment typically required to support dredging activities are: three support boats (two tugboats to move the barge and/or reposition the dredge, and a crew boat).

2.2.1.2 Hydraulic (Hopper) Dredge

The hopper dredge, or trailing suction dredge, is a self-propelled ocean-going vessel with a section of the hull compartmented into one or more hoppers. Fitted with powerful pumps, the dredges suck sediment from the channel bottom through long intake pipes, called dragarms, and store it in the hoppers. Normal hopper dredge configuration has two dragarms, one on each side of the vessel. A dragarm is a pipe suspended over the side of the vessel with a suction opening called a draghead for contact with the bottom. Depending on the hopper dredge, a slurry of water and sediment is generated from the plowing of the draghead “teeth,” the use of high pressure water jets, and the suction velocity of the pumps. The dredged slurry is distributed within the vessels hopper allowing for solids to settle out and the water portion of the slurry to be discharged from the vessel during operations through its overflow system. When the hopper attains a full load, dredging stops and the ship travels to a designated in-water disposal site. The dredged material is then discharged through the bottom of the ship by splitting the hull, or opening doors in the bottom of the hull. If a shore placement site is utilized, a hopper dredge can hook up to an in-water pipeline, where the dredged material is transported to a shore placement site (e.g., beach nourishment). The hopper could also transit to an ocean disposal site operating in a manner similar to the nearshore placement site. However, this is an inefficient operation due to the time and distance involved in transiting to and from the ocean disposal site during which o dredging is occurring. Hopper dredges are well suited to dredging heavy sands. They can work in relatively rough seas but safety, effectiveness, and costs are a concern. Because they are mobile, they can be used in high-traffic areas. They are often used at ocean entrances and offshore, but cannot be used in confined or shallow areas due to their size and draft. Hopper dredges can move quickly to disposal sites under their own power (maximum speed unloaded ≤ 17 knots; maximum loaded ≤ 16 knots), but since the dredging stops during the transit to and from the disposal area, the operation loses efficiency if the haul distance is too far. Approximately 6,000 cubic yards of sediment can be removed and transported to the disposal site per day using a hopper dredge. Additional construction equipment typically required to support dredging activities are a crew boat.

A hydraulic hopper dredge would not be used for dredging of the LARE because the LARE 1 portion of the proposed project crosses under the Queensbay Bridge, which has insufficient clearance.

A hydraulic (cutterhead) dredge would likely not be used for dredging of the POLB portion of the project. Hydraulic dredges do not pair well with disposal barges for transport of sediments offshore for unconfined ocean disposal due to fuel use inefficiencies associated with hauling the dredge slurry the approximately 6 mile distance between the project dredge site and the ocean disposal site (LA-2).

2.2.1.3 LA-2 ODMDS

LA-2 disposal site is located on the outer continental shelf margin of the Pacific Ocean, at the upper southern wall of San Pedro Sea Valley, at depths from 380-1060 ft (110 to 320 m), about 6.8 miles (11 km) south-southwest of the Queens Gate entrance to the Los Angeles/Long Beach Harbor (Figure 2). The site is centered at 33º37'6" N and 118º17'24" W with an overall radius of 3000 ft (915 meters). However, disposal vessels must be fully within the smaller 1,000 ft (305 m) radius Surface Disposal Zone (SDZ), centered at the same coordinates, when discharging dredged material. The LA-2 site was officially designated as a permanent disposal site by the U.S. EPA Region IX in 1991. The disposal of dredged material at LA-2 is regulated under the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA), 33 U.S.C. § 1401.

2.2.1.4 Alternatives Eliminated from Consideration

Because the proposed project seeks to return the LARE Channel back to authorized dimensions no other alternative dredge plan is considered viable. Therefore, no other alternative dredging sites are analyzed. Alternative disposal alternatives evaluated included placement in a nearshore site for the purposes of beach nourishment. However, sediment testing conducted in 2018 indicated that the proposed dredged material contains less than 80% sand; therefore does not meet grain size suitability requirements for placement at a beach nourishment site. The Southern California Dredged Material Management Team (SC-DMMT) determined that sediment grain size within the dredge footprint of the LARE and POLB is too fine to consider for nearshore placement at the Chaffey Island site and that all sediment must be placed at the LA-2 ODMDS. Other beneficial reuse alternatives, such as Port fill projects in either the POLB or the adjoining Port of Los Angeles (POLA) were considered; however these alternatives are not available in the time frame needed. In summary, none of these disposal site alternatives are considered practicable.

2.3 Determination of Consistency

As a Federal agency, the Los Angeles District, U.S. Army Corps of Engineers (Corps) is responsible for ensuring project compliance with the Federal Coastal Zone Management Act of 1972 (CZMA). Section 307 of the CZMA [Title 16, U.S. Code Section 1456(c)] states that Federal Actions must be consistent with approved state coastal management programs to the maximum extent practicable. The California Coastal Act is this state's approved coastal management program applicable to the Proposed Project. To document the degree of consistency with the state program, the CZMA requires the preparation of a Consistency Determination (CD) whenever a project could directly affect the coastal zone. This CD provides a description of the Proposed Project, discusses the proposed project's consistency, and where applicable, describes measures, which when implemented, will result in project consistency with state policies to the maximum extent practicable.

The USACE has completed a Draft EA which: 1) identifies and discusses the problems and needs related to this action, 2) evaluates alternatives, and 3) addresses the impacts of the proposed project and alternatives as part of the decision process. The determination of consistency with the California Coastal Act is based on the analysis performed for this EA. This EA was prepared in compliance with the Council on Environmental Quality (CEQ) Regulations (40 C.F.R. 1500-1508) and the procedural provisions of Section 102(2) (c) of the NEPA of 1969, 42 U.S.C. 4321, as amended. The NEPA was used as a measure for assessing the magnitude of project impacts.

The USACE has carefully evaluated this proposed Federal Action in accordance with NEPA and the CZMA. A determination of consistency with the relevant policies of the California Coastal Act for the Proposed Project has been formulated based on the following items:

- An analysis of project construction and the potential for direct adverse impacts to the resources of the coastal zone;
- The formulation and implementation of proposed measures to offset project impacts; and
- The policies of the State of California related to the Proposed Project as outlined in the findings and declarations of the California Coastal Act of 1976, as amended.

This coastal consistency determination declares that the actions that comprise the Proposed Project are activities that are consistent to the maximum extent practicable with the approved State management program, as specified in the Coastal Zone Management Act of 1972, as amended, Section 307(c)(l). The USACE has determined this project is consistent to the maximum extent practicable with the California Coastal Act of 1976, Chapter 3, Coastal Resources Planning and Management Policies as amended February 1982, for the reasons stated above and in this determination. A Negative Determination has been requested by separate correspondence in light of the previous similar maintenance dredging projects located in the LARE and POLB.

2.4 ENVIRONMENTAL ASSESSMENT PROCESS

This Environmental Assessment (EA) shall address potential impacts associated with implementing the USACE discretionary actions as they relate to USACE policies, and those of other entities.

The USACE is the lead agency for this project. This EA complies with the NEPA of 1969, 42 U.S.C. 4321, as amended. The NEPA requires federal agencies to consider the environmental effects of their actions. When those actions significantly affect the quality of the human environment, an agency must prepare environmental documentation that provides full and fair discussion of impacts.

The EA process follows a series of prescribed steps. The first, scoping, has been completed with the purpose of soliciting comments from other federal and state agencies as well as the public. This EA, the second step, is then sent out for a 30-day public review period during which written and verbal comments on the adequacy of the EA will be received. The next step requires preparation of a Final EA that incorporates and responds to comments received. The Final EA will be furnished to all who commented on the Draft and will be made available to others upon request. The final step is preparing a Finding of no Significant Impact (FONSI); if it is determined the project will not have a significant impact upon the existing environment or the quality of the human environment. This is a concise summary of the decision made by the Corps from among the alternatives presented in the Final EA. If it is determined the project will have a significant impact upon the existing environment or the quality of the human environment, an Environmental Impact Statement (EIS) would be required.

2.5 Mitigation

No effects from the proposed action will cause significant impacts to resources including threatened and endangered species. No compensatory mitigation is required and no mitigation is planned. Water quality monitoring will be conducted during the proposed dredging operations to ensure that water quality parameters are not exceeded. Surveys for *Caulerpa taxifolia* will be conducted before the proposed dredging operations commences in the LARE.

3 Affected Environment

3.1 Water Quality

3.1.1 Affected Environment

This section discusses water quality conditions in the study area. It includes a discussion of the upland watershed and drainages, tides and currents, and water quality standards for the study area.

The LARE is primarily estuarine and is tidally influenced. It is primarily influenced by the southern California coastal marine environment and its waters are predominantly marine in nature. Tides in the study area are mixed semi-diurnal with two unequally low and high tides per day. The mean tide range is 3.8 feet (MLLW), the mean diurnal range is 5.6 feet (MLLW). The main freshwater influx is the Los Angeles River, which drains approximately 834 square miles of urban and industrial areas and carries the largest storm flow of any river in southern California. The California Current and Southern California Counter Current are the primary influences on circulation, along with winds and bottom topography, in the study area.

Water quality is typically characterized by salinity, pH, temperature, clarity, and dissolved oxygen (DO). The LARE is listed as an impaired water body by the State Water Resources Control Board in accordance with Section 303(d) of the Clean Water Act. The listing identifies the LARE as an estuarine system impacted by chlordane, polychlorinated biphenyl (PCB), and Dichlorodiphenyltrichloroethane (DDT) in the sediments, sediment toxicity, and trash.

Table 5 characterizes the overall water quality parameters for the project site. The water is generally turbid, dissolved oxygen can vary tremendously as can salinity with fresh water lenses frequently forming following rain events in the watershed.

The POLB Entrance Channel is located in the outer portion of the POLB Harbor and experiences a more stable water quality environment with reduced levels of turbidity, salinity at 32-33 ppt, dissolved oxygen levels generally above 5.0 mg/l, and a similar range of sea surface temperatures.

Table 5. Water Quality Characteristics for LARE

Table 5	
Water Quality Characteristics	
Parameters	**Project Site**
Salinity (ppt)	16.0 to 33.0
Surface Temperature (F)	55.8 to 62.5
pH	7.6 to 8.4
Clarity (ft.)	13 to 15
D.O. (mg/l)	2.0 to 20.0

Table 5A: Water Quality Characteristics for POLB

Table 5a Water Quality Characteristics	
Parameters	**Project Site**
Salinity (ppt)	33.5
Surface Temperature (F)	59.4 to 70.1
pH	7.7 to 8.2
Clarity (ft.)	28 to 82
D.O. (mg/l)	6.0 to 10.0

3.1.2 Environmental Consequences

An impact to Water Quality will be considered significant if:

1. The project results in the release of toxic substances that would be deleterious to human, fish, or plant life;
2. The project results in substantial impairment of beneficial recreational use of the project site; or
3. Discharges create a pollution, contamination, or nuisance as defined in Section 13050 of the California Water Code.

3.1.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore, no effects resulting from dredging operations on water quality would occur.

3.1.2.2 Proposed Action

In the short term, construction impacts from dredging on water quality can include temporary, localized increases in turbidity; the potential for increased concentrations of dissolved chemicals and metals; lowered dissolved oxygen levels; or changes in temperature or pH due to resuspension of sediment and sediment-bound organic material. Such impacts associated with the Proposed Action would be temporary, generally confined to the dredging area, and would return relatively quickly to background levels following construction. Disposal impacts at LA-2 ODMDS were addressed in the USEPA authorization of the LA-2 ODMDS and are hereby incorporated by reference (EPA and USACE 2005). The proposed dredged material was tested for unconfined ocean disposal and beach nourishment and reviewed by the SC-DMMT, see Section 3.2.1. The DMMT determined that the proposed dredged material from both the LARE and POLB dredge footprints is suitable for unconfined aquatic disposal at LA-2; therefore the proposed dredging and disposal activities will not have a significant adverse effect on water quality, see Appendix B.

The USACE will conduct periodic monitoring of the water column during dredging to show that turbidity increases and/or decreases in dissolved oxygen do not result in significant impacts.

Water quality monitoring will be conducted during dredging operations at four stations positioned 100' upcurrent of the dredge, 100' downcurrent of the dredge, 300' downcurrent of the dredge, and a control station located outside of any dredge plume. Weekly monitoring of the following parameters shall be collected;

- pH
- Dissolved oxygen
- Temperature
- Turbidity

Twice monthly water samples will be taken from the station 300' downcurrent of the dredge for analysis of total suspended solids. Water samples taken from dredging in the LARE would also be analyzed for total PCBs. Should water quality monitoring show an increase in turbidity or a decrease in dissolved oxygen, BMPs would be implemented to reduce the impacts. These measures include:

- Slowing the dredge cycle
- Ensuring that the bucket is completely emptied over the disposal barge
- The use of silt curtains to control turbidity or other BMPs as appropriate.

Additional requirements to avoid impacts to water quality include standard spill prevention and response measures in and around the proposed project area. The contractor responsible for operating the dredging equipment would be responsible for ensuring that such measures are adhered to. Any floating debris will be removed from the water and disposed of properly. All dredged material will be handled and transported such that it does not re-enter surface waters outside of the protected immediate work area. Dredging at each project location will continue to be limited to the approved project depth plus overdepth.

Vessels would be operated in compliance with all applicable regulations related to the prevention of water pollution by fuel, harmful substances, and accidental discharges. For mechanical dredging, the dredged material would be secured during transport, with precautions in place to minimize any risk of spills.

The Proposed Action is unlikely to result in significant water quality impacts from turbidity, release of contaminants into the water column, and would follow BMPs and monitoring protocols to protect water quality. Therefore, impacts to water quality from the Proposed Action are expected to be less than significant.

3.2 Sediments

3.2.1 Affected Environment

The project area was sampled in June 2010 (USACE 2019) and tested for unconfined ocean disposal, and beach nourishment.

Sediment Physical Characteristics

The USACE conducted sampling and testing of dredged material in the LARE and POLB dredge footprints in June 2018. The sediment testing results were published in August 2019. The August 2019 Sampling and Analysis Report is included in Appendix B.

LARE: In general, the dredged material in the LARE footprint contains a high percentage of fine grained material. The upper sediment layer from most LARE locations is characterized as either sandy silt or silt with sand. This silt layer extended anywhere from one foot below the mudline to the entire core length. Material below the silt layer varied from either fat clay, silty sand, or poorly graded sand with silt.

Several areas within the LARE dredge footprint, such as the Sand Trap, were characterized by a larger percentage of silty sand. Several locations within the sampling footprint had large amounts of vegetative debris as well as occasional trash, and had a distinct odor of decomposing plant material. This vegetative debris was quite extensive in sediments along the south and west sides of the Sand Trap. As such, approximately 55,700 cy of sediments from the sand trap will be left in place.

POLB: In general, the dredged material in the POLB footprint contains a high percentage of fine grained material. Dredged material in the POLB Approach Channel was characterized as being mostly silty sand. Other than a few seashells, there was no odor, trash or other debris noted in material from the POLB dredge footprint.

Sediment Chemical Characteristics

LARE: Compared to NOAA effects based screening levels (Long et. al., 1995 and Long and Morgan, 1991) and LA-2 disposal site reference data, contaminant concentrations were elevated for some inorganic contaminants in the LARE composite samples. Cadmium, copper, lead, and nickel exceeded corresponding Effects Range-Low (ERL) values in all three composite samples, and zinc exceeded the corresponding Effects Range-Medium (ERM) value in all three composite samples. Similar levels of sediment concentrations have been previously found in the LARE sediments in 2014. Elevated total PCB concentration, from core location LAREVC-18-15 (see Appendix B), was evaluated and sediments from this sample were not included in the composite sample for Tier III testing. Currently, there is approximately 5,000 cy of sediments in the vicinity of this core location that would be left in place. The remaining dredged material within the LARE footprint was determined to be suitable for unconfined aquatic disposal at the LA-2 ODMDS by the Southern California Dredge Material Management Team (SC-DMMT).

POLB: Except for arsenic, all detected concentrations in the POLB Approach Channel composite sample were well below Regional Screening Level (RSLs) and California Human Health Screening Level (CHHSLs) for residential soils developed for human protection. Overall analyte concentrations in the POLB Approach Channel area were below detection limits or low compared to NOAA effects based screening values and LA-2 reference concentrations. The only constituents detected above NOAA ERL values were total DDT and 4,4'-DDE, which were also elevated above ERL values in the LA-2 reference sample but at concentrations about a third less. There were no sample values that exceeded a NOAA ERM value. Low levels of metals and some PAH compounds were the only other constituents reported above a laboratory reporting limit. Phthalate compounds were also detected in both the composite sample and LA-2 reference sample but at levels below the RL or method blank detections negated the results. The remaining dredged material within the LARE footprint was determined to be suitable for unconfined aquatic disposal at the LA-2 ODMDS by the SC-DMMT.

Sediment Bioassay Results

As discussed above, the LARE and POLB Approach Channel sediments showed moderate chemical contamination. Chemical data for several constituents that were above NOAA effects levels and human health objectives. In terms of ecological effects, cadmium, copper, lead, nickel, zinc, Chlordane, 4,4' DDE, total DDTs, total low molecular weight PAHs, PCBs, and perhaps pyrethroid pesticides were the major contaminants of concern in in the LARE composite and individual core samples. Total DDT and 4,4' DDE were the only contaminants of concern in the POLB Approach Channel composite sample. Despite the observed sediment concentrations, none of the sediments from any of the composite areas were toxic to *Ampelisca* and *Neanthes*. Although, water column toxicity was evident for bivalve larvae, mysids and fish exposed to the LARE composite samples. Due to the lack of benthic toxicity, the fact that the water column limiting permissible concentration (LPC) after initial dilution was not exceeded, and the fact that critical body residues compared to Food and Drug Administration (FDA) action levels, Toxicity Reference Value (TRVs), and fish advisory levels indicate that all contaminant concentrations in tissues of organisms exposed to LARE and POLB Approach Channel sediments were below corresponding published levels, it was recommended by the SC-DMMT that all sediments from LARE and the Port of Long Beach Approach Channel be environmentally suitable for placement at the LA-2 ODMDS.

3.2.2 Environmental Consequences

Impacts to sediment would be considered significant if the proposed project would:

1. Result in exposing concentrations of constituents of concern in underlain sediment above ambient sediment quality conditions within the LARE or POLB dredge footprints.
2. Place sediment with concentrations of constituents of concern above ambient concentrations at LA-2.

3.2.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore no effects resulting from dredging operations on sediments would occur.

3.2.2.2 Proposed Action

The Proposed Action includes maintenance dredging of the federal channels, which would restore shoaled areas to their design depths. As described above, the Corps conducted sediment testing to characterize the proposed dredged material to determine the suitability of the dredge material for disposal. Approximately 55,700 cubic yards of sediments from the LARE sand trap will be left in place. Approximately 1,600 cy of sediments in the vicinity of core LAREVC-18-15 will be left in places. The SC-DMMT determined that all sediments from LARE, excluding the 55,700 cubic yards of sediment from the LARE sand trap and 1,600 cubic yards of sediments in the vicinity of core CAREVC-18-15, and the Port of Long Beach Approach Channel are suitable for unconfined aquatic disposal at the LA-2 ODMDS. The Proposed Action would not have the potential to expose people or structures to substantial adverse geological effects therefore, impacts of the Proposed Action on sediments would be less than significant.

3.3 Marine Resources)

3.3.1 Affected Environment.

Marine Resources: Marine habitat in the area includes natural open water and sandy-bottom benthic habitats, as well as artificial habitats created by harbor structures. The navigation channels within the LARE do not support vegetation due to factors such as channel depth, turbidity, and lack of suitable substrate. The breakwaters and jetties within the harbor complex support algal growth typical of rocky subtidal and intertidal communities. Breakwaters and jetties characteristically are populated by green algae (*Ulva sp*. and *Enteromorpha sp*.), several species of red algae, and some kelp species.

Wetlands: There are no wetlands within the POLB dredge footprint. There are no wetlands within the LARE dredge footprint.

Fish. Seven fish species tend to dominate in abundance: white croaker (*Genyonemus lineatus*), queenfish (*Seriphus politus*), white seaperch (*Phanerodon furcatus*), northern anchovy (*Engraulis mordax*), shiner perch (*Cymatogaster aggregata*), tonguefish (*Symphurus atricauda*), and speckled sanddab (*Citharichthys stigmaeus*). Other less abundant but ecologically-important species present are: California halibut (*Paralichthys californicus*), barred sandbass (*Paralabrax nebulifer*), kelp bass (*Paralabrax clathratus*), California corbina (M*enticirrhus undulatus*), Pacific bonito (*Sarda chiliensis)*, Pacific barracuda (*Sphyraena argentea*), white seabass (*Cynoscion nobilis*), jacksmelt (*Atherinopsis californiensis*), and several species of rockfish, sharks, and rays. Fish populations are characterized by seasonal fluctuations in numbers and composition. Adult and juvenile individuals of most species are more abundant during the summer than in the winter.

Birds. Coastal water birds, shorebirds, and waterfowl dominate the migratory bird community. The LARE and adjacent harbor habitats are used during annual migrations and for overwintering. Some have also become year-round residents. The diverse bird community is made up of about 150 species. The inner harbor is a major resting area for water birds while the deeper, open water areas of the outer harbor are rarely used. Birds using sheltered waters within the harbor for feeding and resting include loons (*Gavia spp.*), grebes (e.g., *Aechmophorus occidentalis*), surf scoters (*Melanitta perspicillata*), and lesser scaup (*Aythya affinis*). The sheltered waters offer mollusks and fish that are preyed upon by these species. Riprap shoreline is preferred by spotted sandpipers, surfbirds, willets, and pelagic cormorants. The small intertidal mudflat at the Shoreline Aquatic Park adjacent to the LARE is important foraging habitat for western sandpipers (*Calidris mauri*), semi-palmated plovers (*Charadrius semipalmatus*), and marbled godwits (*Limosa fedoa*). This habitat is also used extensively as a resting area by mew (*Larus canus*), ring-billed gulls (*Larus delawarensis*), and California gulls (*Larus californicus*). Buoys, barges, and pilings are primary roosting sites for double-crested cormorants (*Phalacrocorax auritus*), gulls, and brown pelicans (*Pelecanus occidentalis*).

Marine mammals. Several species of marine mammals have been observed inside the breakwaters and in the general vicinity of San Pedro Bay. They include California sea lions (*Zalophus californianus*), harbor seals (*Phoca vitulina*), Pacific bottlenose dolphins (*Tursiops truncatus*), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), and common dolphins (*Delphinus delphis*). Sea lions can be found year-round in the harbor, particularly on the outer harbor breakwaters. The only marine mammals expected in the dredging area would be California sea lions (*Zalophus caliornianus*) and harbor seals (*Phoca vitulina*). Harbor seals and sea lions are expected to forage in the harbor and rest on the entrance jetties, and navigational buoys.

Threatened and endangered species which may occur at the project site is the California least tern (*Sternula antillarum browni*).

California least tern. The California least tern is present in small numbers from April to September. A nesting colony is located at Pier 400; 2-3/4 miles from the nearest dredge location.

Essential Fish Habitat (EFH). In accordance with the 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act, an assessment of Essential Fish Habitat (EFH) has been conducted for the proposed project. The project is located within an area designated as EFH for two Fishery Management Plans (FMPs): Coastal Pelagics Plan and Pacific Groundfish Management Plan. There are 19 managed fish species that have been observed within the LARE including four managed coastal pelagic fish species (northern anchovy, Pacific sardine, Pacific (chub) mackerel, and jack mackerel) and fifteen managed Pacific coast groundfish species (*Table 6.*).

Table 6. Managed Fish Species Within Habitats of the Long Beach and Los Angeles Harbors

Coastal Pelagics Fishery Management Plan		
Common Name	*Scientific Name*	*Notes*
Northern anchovy	*Engraulis mordax*	Abundant throughout harbor in 2000[1]
Pacific sardine	*Sardinops sagax*	Common throughout in harbor in 2000[1]
Pacific (chub) mackerel	*Scomber japonicus*	Common throughout harbor in 2000[1]
Jack mackerel	*Trachurus symmetricus*	Common in inner to middle harbor and uncommon in Outer Harbor, primarily in deep water[1]
Pacific Coast Groundfish Fishery Management Plan		
Common Name	*Scientific Name*	*Notes*
English sole	*Parophrys vetulus*	Rare, 2 collected in Outer Harbor in 2000[1]
Pacific sanddab	*Citharichthys sordidus*	Common, primarily Outer Harbor deep water areas in 2000[1]
Leopard shark	*Triakis semifasciata*	Rare, 3 collected, all in shallow water[1]
California skate	*Raja inornata*	Uncommon, Outer Harbor in shallow water[1]
Big skate	*Raja binoculata*	Uncommon, primarily in shallow water[1]
Black rockfish	*Sebastes melanops*	Uncommon, primarily in Cabrillo Shallow Water Habitat[1]
Kelp rockfish	*Sebastes atrovirens*	Rare, in kelp along breakwater[2]
Calico rockfish	*Sebastes dalli*	Rare, 1 collected in Long Beach Harbor[3]

Vermillion rockfish	*Sebastes miniatus*	Rare, 4 collected in deep inner to middle harbor waters[1]
California scorpionfish	*Scorpena guttatta*	Common in rock dikes and breakwaters, also on soft bottom at night[1-3]
Grass rockfish	*Sebastes rastrelliger*	Rare, 2 collected in Pier 300 Shallow Water Habitat and 1 in Long Beach Harbor[1]
Olive rockfish	*Sebastes serranoides*	Common, juveniles in kelp around breakwater[2]
Bocaccio	*Sebastes paucispinis*	Uncommon, juveniles in kelp around breakwater[2]
Cabezon	*Scorpaenichthys marmoratus*	Rare, shallow water[1]
Lingcod	*Ophiodon elongatus*	Rare, shallow water[1]
Source 1. MEC 2002; 2. MEC 1999; 3. MEC 1988;		

3.3.2 Environmental Consequences

Criteria. An impact to Marine Resources will be considered significant if:

1. The population of a threatened, endangered, or candidate species is directly affected, or its habitat lost or disturbed;
2. If there is a net loss in value of a sensitive biological habitat including a marine mammal haul out site or breeding area, seabird rookery, or Area of Special Biological Significance (ASBS);
3. If the movement or migration of fish is impeded; and/or
4. If there is a substantial loss in the population or habitat of any native fish, wildlife, or vegetation (a substantial loss is defined as any change in a population which is detectable over natural variability for a period of 5 years or longer).

3.3.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore, no effects resulting from dredging operations would occur on marine resources.

3.3.2.2 Proposed Action

The Proposed Action includes maintenance dredging of the federal channels, which would restore shoaled areas to their design depths. The Proposed Action would have temporary and localized impacts on marine resources due to dredging operations. Temporary increase in turbidity and suspended solids may decrease the amount of dissolved oxygen near the dredge site, thus affecting fish and other marine life within the area. Motile species are expected to relocate out of the immediate area until dredging activities are finished. Some benthic marine populations will be destroyed by dredging but are expected to recolonize the area once dredging has ceased.

Disposal impacts were addressed in the USEPA authorization of the LA-2 ODMDS and are hereby incorporated by reference (EPA and USACE 2005).

The only marine mammals expected to occur in the project area are California sea lions and harbor seals. These species are highly mobile and would be able to avoid the project area. The noise generated by the dredge is unlikely to impact these species given the noisy background resulting from existing commercial, recreational, and safety vessels. Project activities would not adversely affect marine mammals. Furthermore, the project area would represent a small percentage of available resources, and project activities are considered short-term and localized.

Threatened or Endangered Species. The USACE has determined that the proposed project would not affect the California least tern. This determination is based primarily on the absence of this species during the proposed dredging period (February to April 2020). Dredging of the LARE channel shall be conducted first prior to the start of least tern nesting season. Should dredging occur during least tern nesting season (April 15 to September 15) the same determination applies based on the small area rendered unavailable for foraging during construction over a short time period and the long distance between the nest site and the project area. Terns tend to forage within one mile from the nest site, particularly during sensitive periods when chicks are on the nest. California least terns will be able to forage in the general area having to avoid only the immediate dredge area. Additionally, least terns from the Pier 400 nest site typically forage over the nearby Seaplane Lagoon shallow water habitat, outer harbor areas, and offshore areas outside the breakwater and not in the LARE or POLB Entrance Channel.

Formal consultation pursuant to Section 7 of the Endangered Species Act will not be required.

Essential Fish Habitat (EFH). The USACE has determined that the proposed project will not have a substantial, adverse impact to any species on the Fishery Management Plan or to their habitat. Impacts, such as turbidity associated with dredging and disposal of dredged materials would be temporary and insignificant. Pre-construction surveys for *Caulerpa taxifolia* will be conducted at the LARE dredge site. Dredging shall not begin should *Caulerpa taxifolia* be identified until cleared to do so by the National Marine Fisheries Service.

3.4 Air Quality

3.4.1 Affected Environment

Based on the federal Clean Air Act (CAA) passed in 1970, the USEPA has identified six criteria air pollutants (Table 7) that are pervasive in urban areas and for which state and national health-based ambient air quality standards have been established. The air pollutants for which Federal standards have been promulgated via the National Ambient Air Quality Standards (NAAQS) include ozone (O_3), carbon monoxide (CO), suspended particulate matter (PM), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and lead (Pb). PM emissions are regulated in two size classes: Particulates up to 10 microns in diameter (PM10) and particulates up to 2.5 microns in diameter (PM2.5). These pollutants can injure health, harm the environment, and cause property damage. USEPA has developed science-based guidelines as the basis for setting permissible levels of these criteria pollutants.

The USEPA is responsible for implementing most aspects of the CAA. Basic elements of the act include the National Ambient Air Quality Standards (NAAQS or "national standards") for major air pollutants, hazardous air pollutant standards, attainment plans, motor vehicle emission standards, stationary source emission standards and permits, acid rain control measures, stratospheric ozone protection, and enforcement provisions.

NAAQS apply to the concentration of a pollutant in outdoor air. If the air quality in a geographic area meets or does better than the national standard, it is referred to as an attainment area. Areas that do not meet the national standard are referred to as nonattainment areas.

The California Air Resources Board (CARB) has established air quality standards for California similar to the NAAQS. The California Ambient Air Quality Standards (CAAQS) are either the same as, or more restrictive than the NAAQS. These legal limits on outdoor air pollution are designed to protect the health and welfare of Californians.

Table 7. National and California Ambient Air Quality Standards

Pollutant	Averaging Time	National Standard	California Standard
Carbon Monoxide (CO)	8 hours	9 ppm	9 ppm
	1 hour	35 ppm	20 ppm
Lead (Pb)	Rolling 3 month	0.15 µg/m^3	1.2x10^{-5}µg/m^3
Nitrogen Dioxide (NO_2)	1 hour	100 ppb	180 ppb
	1 year	53 ppb	30 ppb
Ozone (O_3)	8 hours	0.07 ppm	0.07 ppm
Particulate matter (PM)	1 year	12 ug/m^3	12 ug/m^3
	24 hours	150 ug/m^3	50 ug/m^3
Sulfur Dioxide ($S0_2$)	1 hour	75 ppb	25 ppb
	3 hours	0.5 ppb	-

The CAA requires each state to prepare an air quality control plan referred to as the State Implementation Plan (SIP) for areas that are not compliant with the NAAQS (i.e., nonattainment areas). The CAA amendments added requirements for states containing areas that violate the NAAQS to revise their SIPs to incorporate additional control measures to reduce air pollution. The SIP is a living document that is modified periodically to reflect the latest emissions inventories, planning documents, and rules and regulations of air basins as reported by the agencies with jurisdiction over them.

The USEPA has responsibility to review all SIPs to determine if they conform to the mandates of the CAA amendments and will achieve air quality goals when implemented. If the USEPA determines a SIP to be inadequate, it may prepare a Federal Implementation Plan for the nonattainment area and may impose additional control measures. Failure to submit an approvable SIP or to implement the plan within mandated timeframes can result in sanctions being applied to transportation funding and stationary air pollution sources in the air basin.

California's air quality is monitored and regulated at the state level by CARB and at the local and regional level by air pollution control authorities known as Air Quality Management Districts (AQMD). The air districts' roles include developing clean air plans to manage local attainment, which feed into the State's SIP. The proposed project is located in the South Coast Air Basin under the jurisdiction of the South Coast Unified Air Quality Management District (SQAQMD).

3.4.2 Environmental Consequences

Section 176(c) of the CAA states that a federal agency cannot issue a permit for or support an activity unless the agency determines it will conform to the most recent USEPA approved SIP. General conformity requirements were adopted by Congress as part of the CAA and were implemented by USEPA regulations in the November 30, 1993, Federal Register (40 Code of Federal Regulations [CFR] Sections 6, 51, and 93: "Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule"). General conformity requires that all federal actions conform to the SIP as approved or promulgated by the USEPA by determining that the action is either exempt from the General Conformity Rule requirements or subject to a formal conformity determination. General Conformity applies to areas designated as nonattainment or maintenance for NAAQS and in such areas, a project is exempt from the conformity rule if the total net project-related emissions (construction and operation) are less than the applicability rates thresholds established by the conformity rule. A project that produces any of the 10 emissions that exceed conformity thresholds shown in the table of *de minimis* emission levels is required to mitigate or offset these impacts (USEPA, 2016). The conformity thresholds are instead used here as a reference for the level of significance of the impacts on air quality Table 8

Table 8. General Conformity Applicability Rates Thresholds for Construction Emissions

Pollutant	Applicability Rates Thresholds (tons/year)
O_3 (ROG, VOC, or NOx)	100
CO	100
NO_2	100
SO_2	100
$PM_{2.5}$	100
PM_{10}	100
Pb	25

Source: (40 CFR 93.153)

Furthermore, in accordance with 40 CFR § 51.853(c)(2)(ix), USACE has determined the proposed agency action is exempt from the requirement to prepare a conformity determination because the project consists of maintenance dredging, no new depths are required, and placement would be at an approved placement site.

General Conformity Applicability Rates as NEPA Significance Threshold

Although the proposed maintenance action is exempt from the General Conformity Rule, the applicability rates associated with the rule are used evaluate significance of impacts for the purpose of disclosure of the impact under NEPA.

3.4.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore, no effects resulting from dredging operations would impact Air Quality.

3.4.2.2 Proposed Action

Dredge impacts. Emissions associated with the proposed dredging activities will come mainly from the dredge motor drive. This operation will cause some minor air quality impacts. Because of the temporary nature of the emissions and the offshore location of the dredge operation, it is not expected to have a significant impact on air quality in the area.

Dredge operations are expected to be conducted by a clamshell dredge. Barges will be used to collect and transport sediment with the assistance of a tug. A crew boat will be used to ferry crew out to the tug and for miscellaneous transport of personnel and equipment on an as-needed basis.

Air emissions calculations for this project are provided in Appendix C. Results are provided in Table 9. Only one dredge type will be used in a given dredge event. While the hopper dredge exceeds daily significance thresholds for NOx and SOx, the impacts are considered to be insignificant due to the short duration of the dredging and the mobile nature of a hopper dredge that will operate offshore moving between the dredge and disposal sites throughout the day. Use of a hopper dredge is highly unlikely and is considered only as a contingency.

Table 9a. Estimated Daily Emissions from Construction Activities Using a Clamshell Dredge[1]

	Pounds per day				
Construction Activity/Equipment Type	**ROG**	**CO**	**NOx**	**SOx**	**PM10**
Clamshell dredge	23.8	6.6	24.0	20.9	15.2
Tug boat-clamshell dredge					
Idling	1.5	4.6	33.5	6.0	0.7
Towing sediment barge	1.5	4.6	33.5	6.0	0.7
Shifting dredge barge	0.3	0.9	6.7	1.2	0.1
Crew boat (3)	0.9	0.4	0.8	0.1	0.1
Worker Vehicles (3)	0.1	1.2	0.9	0.1	0.1
Peak Daily Emissions	**28.0**	**18.2**	**99.4**	**34.3**	**16.9**
SCAQMD Daily Significance Thresholds	**75**	**550**	**100**	**150**	**150**

[1]SEE APPENDIX C for Calculations

Table 10b. Estimated Daily Emissions from Construction Activities Using a Hopper Dredge[1]

	Pounds per day				
Construction Activity/Equipment Type	**ROG**	**CO**	**NOx**	**SOx**	**PM10**
Hopper dredge-dredging	2.0	111.8	264.2	164.4	14.2
Hopper dredge-transit loaded	0.2	9.4	22.2	13.8	1.2
Hopper dredge-transit unloaded	0.0	1.8	4.1	2.6	0.2
Crew boat (3)	0.4	0.3	0.8	0.1	0.1
Worker Vehicles (3)	0.2	2.1	1.0	0.1	0.2
Peak Daily Emissions	**2.8**	**125.3**	**292.4**	**181.1**	**15.9**
SCAQMD Daily Significance Thresholds	**75**	**550**	**100**	**150**	**150**

[1]SEE APPENDIX C for Calculations

The contractor will be required to obtain all necessary air quality permits and comply with the SCAQMD Guidelines. Construction equipment will be properly maintained to reduce emissions. Emissions associated with the proposed dredging activities derive almost exclusively from the dredge's motor drive. Compared to the hundreds of tons of pollutants emitted in the County each day, the limited levels of dredge drive exhaust pollutants are small, but still adverse. Impacts, however, will be temporary and will be further reduced by measures required by the Corps. Such measures may include:

(1) retarding injection timing of diesel-powered equipment for nitrogen oxide (NOx) control, and (2) using reformulated diesel fuel to reduce reactive organic compounds (ROC) and SO_2.

Project emissions are not expected to exceed applicability rates levels established as a criteria for a finding of conformity (Table 9). Therefore, the project is consistent with the SIP and meets the requirements of Section 176(c).

Currently there are no federal standards for greenhouse gas (GHG) emissions. The Council on Environmental Quality (CEQ) has published draft guidance on how NEPA analysis and documentation should address GHG emissions. This Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions, if finalized, would replace the final guidance CEQ issued on August 1, 2016, titled "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews," which was withdrawn effective April 5, 2017, for further consideration pursuant to Executive Order 13783 of March 28, 2017, "Promoting Energy Independence and Economic Growth."

In light of no final guidance on GHG emissions the USACE has established the following position under NEPA;

In the absence of an adopted GHG standard, the USACE will not propose a new GHG standard or make a NEPA impact determination for GHG emissions anticipated to result from any of the actions identified under the proposed project. Rather, in compliance with the NEPA implementing regulations, the anticipated GHG emissions will be disclosed without expressing a judgment as to their significance.

GHG emissions were estimated for the project. GHG emissions are provided in Table 11. Calculations are shown in Appendix C.

Table 11. Total GHG Emissions

	Total Equivalent CO_2	
	Clamshell	Hopper
Daily emissions (lbs/day)	53.4	9.7
Total project emissions (tons)	4.8	0.9

Disposal site. Impacts were addressed in the USEPA authorization of the LA-2 ODMDS and are hereby incorporated by reference.

3.5 Noise

Criteria. An impact to Noise will be considered significant if:

1. Fish and/or marine mammals are directly affected.

3.5.1 Affected Environment

Noise from dredging and placement activities has the potential to effect aquatic and terrestrial receptors. Sensitive aquatic receptors can include species of fish and marine mammals. Ambient underwater noise levels in harbors with vessel traffic generally range around 130 decibels (dB) peak referenced to 1 micro-Pascal (re 1 µPa) (SAIC, 2007). Fish and marine mammals that occur in the Harbor are mobile, but may occasionally be found in the vicinity of project dredging and placement areas.

3.5.2 Environmental Consequences

3.5.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore, no effects resulting from noise associated with dredging operations would occur.

3.5.2.2 Proposed Action

Dredge impacts. Project noise sources are limited to the dredge and its associated support vessels. Because of the temporary nature of the dredging and the location of the dredge operation within the LARE and POLB, it is not expected to have a significant impact on sensitive resources in the area. Given the general background noise levels, including those from existing boat and vehicular traffic, project noise impacts are not expected to be discernible.

Disposal site. Impacts were addressed in the USEPA authorization of the LA-2 ODMDS and are hereby incorporated by reference (EPA and USACE 2005).

Project specification will require utilization of engine shrouds to reduce noise and a public awareness program to educate and notify the public about the benefits and impacts of the proposed project.

3.6 Cultural Resources

The following definitions are common terms used to discuss the regulatory requirements and treatment of cultural resources:

Cultural resources is the term used to describe several different types of properties: prehistoric and historical archaeological sites; architectural properties such as buildings, bridges, and infrastructure; and resources of importance to Native Americans or other groups of people.

Historic properties is a term defined by the National Historic Preservation Act (NHPA) as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register of Historic Places (NRHP), including artifacts, records, and material remains related to such a property.

Historical resources as described in the California Environmental Quality Act (CEQA) includes buildings, sites, structures, objects, or districts, each of which may have historical, prehistoric, architectural, archaeological, cultural, or scientific importance, and is eligible for listing or is listed in the California Register of Historical Resources (CRHR) or a local register of historical resources. The CRHR includes resources listed in, or formally determined eligible for listing in the NRHP, as well as some California State Landmarks and Points of Historical Interest.

Paleontological resources include fossilized remains of vertebrate and invertebrate organisms, fossil tracks and trackways, and plant fossils. A unique paleontological site would include a known area of fossil-bearing rock strata.

3.6.1 Affected Environment

The Area of Potential Effects (APE) is defined as the geographic areas of an undertaking where changes to historic properties may occur, if such properties are present. The APE would include the areas subjected to dredging and the placement areas. The APE consists of the horizontal and vertical limits of the project site, and includes the area within which adverse effects to Historic Properties could occur as a result of the undertaking. The horizontal APE consists of all areas where activities associated with the undertaking are proposed. The vertical APE is described as the maximum depth below the surface to which excavations will extend. The vertical APE includes all subsurface areas where archaeological deposits could be affected. Also included in the APE are the dredged material placement sites.

3.6.2 Environmental Consequences

Criteria. An impact to Cultural Resources will be considered significant if:

> 1. The proposed action would disturb, remove from original context, or introduce incompatible elements out of character with any property considered eligible for the National Register of Historic Places.

3.6.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore no effects to cultural resources associated with dredging operations would occur.

3.6.2.2 Proposed Action

The proposed action would have a significant effect on cultural resources if it will disturb, remove from original context, or introduce incompatible elements out of character with any property considered eligible for the National Register of Historic Places. No impacts to cultural resources are anticipated. Determination was made that the proposed project would not involve National Register eligible or listed properties. The APE is entirely within areas that have been dredged intermittently over time, including the 1920's for the POLB and the LARE since 1980. Because there will be no properties involved, consultation with the State Historic Preservation Officer (SHPO) is not required. The current project will be in compliance with Section 106 of the National Historic Preservation Act pursuant to 36 CFR 800.3(1), *No potential to cause effect*. Therefore, impacts to cultural resources from the Proposed Action are expected to be less than significant. Refer to Appendix D for an MFR supporting this conclusion.

3.7 Vessel Transportation and Safety

3.7.1 Affected Environment

The LARE federal channel serves the Queens Way Marina and the Catalina Ferry Terminal, as well as Rainbow Harbor, and the city boat ramp launch. The area of Queensway Bay receives predominately recreational boaters, dinner and harbor cruise ships, and the Catalina Island Expressway, which berths in the adjacent marinas. Vessels in Queensway Bay must adhere to the speed limit of 4 knots per hour. Peak traffic from the Catalina Ferry service is during summer between Memorial and Labor Days.

The POLB federal entrance channel is the gateway for commercial vessels transiting into and out of the POLB. The POLB is the second-busiest port in the United States. The Port of Long Beach handles approximately 3,000 vessel calls per year.

3.7.2 Environmental Consequences

Criteria. An impact to vessel transportation and safety will be considered significant if:

1. The proposed project results in a substantial reduction of current safety levels for vessels in the Port and if activities present a navigational hazard to boat traffic or interfere with any emergency response or evacuation plans.

3.7.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Shoaling is likely to continue and vessel restrictions are likely.

3.7.2.2 Proposed Action

Shoaling is a navigational hazard and removal of shoaling would improve safety levels; therefore, the proposed project would improve safety levels in the LARE and POLB.

Construction impacts related to vessel safety would be temporary and minimal in the LARE and POLB. Both the LARE and POLB channels are generally wide enough to accommodate dredge equipment and allow passage of other vessel traffic, and dredges would move out of the way to allow passage of larger vessels. However, the dredging activities may occasionally delay or temporarily impede some vessels. Hopper dredges generally have less impact on navigation because they are continually moving, while clamshell-bucket dredges and cutterhead-pipeline dredges are stationary during operation, and may need to temporarily cease dredging activities to move out of the way of larger passing vessels. Transport of dredged material to the LA-2 disposal site would add vessel movement within the study area; however, this increase would be negligible considering the existing volume of vessel movement in the study area. During construction, all construction vessels will be marked and lighted in accordance with U.S. Coast Guard (USCG) regulations and notices will be published in Local Notice to Mariners warning boat users about times, durations, and locations of construction activities. Therefore, impacts to vessel transportation and safety from the Proposed Action are expected to be less than significant.

3.8 Recreation Uses

3.8.1 Affected Environment

Recreational uses of the LARE channel are primarily navigation oriented. Recreational boaters navigate the channel to reach nearby marinas, including the Queensway Marina, Rainbow Harbor, and Shoreline Marina. The Catalina Ferry transits the channel to and from Catalina Island. There is a small volume of recreational fishing along the shore line, including one fishing pier across from the Queen Mary. Other Commercial, recreational, and retail areas include the Queensway Bay Development, Aquarium of the Pacific, Shoreline Village, and the Queen Mary tour vessel. Recreational uses of the POLB Entrance Channel are also primarily navigation oriented. The area is heavily used as it is one of two entrances through the breakwater structures protecting San Pedro Bay. Due to heavy commercial and recreational boat traffic other recreational uses, including fishing and scuba diving, are non-existent in the channel.

3.8.2 Environmental Consequences

Criteria. An impact to recreation uses will be considered significant if:

1. The proposed project results in a permanent loss of existing recreational uses.

3.8.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore, there would be no impacts to recreation resulting from dredging operations.

3.8.2.2 Proposed Action

Impacts to recreational boaters will be negligible and limited to the period of time when dredging occurs. The project would not impact shoreline recreational uses in the area other than from an aesthetic aspect. Results of the project would increase recreational boat access and safety by returning the channel to its authorized dimensions. Therefore, the proposed project would not have a significant effect on recreational uses.

3.9 Aesthetics

3.9.1 Affected Environment

The overall aesthetic character of the project area is composed of a riprap-lined channel opening to San Pedro Bay. Open space, in the form of parks and walkways provide viewing locations for the public although the focus is on the Queen Mary rather than the river itself. Shoreline Village provides shopping and dining with view of the estuary. The aesthetic of the POLB Entrance Channel is an entrance through the existing breakwater at Queens Gate.

3.9.2 Environmental Consequences

Criteria: An impact to aesthetics would be considered significant if:

1. The project would significantly impact the aesthetics if a landscape is changed in a manner that permanently and significantly degrades an existing view shed or alters the character of a view shed by adding incompatible structures.

3.9.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore there would be no impacts to aesthetics from dredging operations.

3.9.2.2 Proposed Action

The presence of dredging will result in mixed impacts depending on the opinion of the viewer. Many viewers will consider the presence of the dredge to be an adverse impact, interrupting viewpoints from local land points and from boats. Many other viewers will consider the presence of the dredge to be a beneficial impact providing an interesting feature to the existing view. Aesthetic impacts will be insignificant.

3.10 Land and Water Uses

3.10.1 Affected Environment

The LARE is surrounded by industrial, commercial, and recreational facilities. Industrial facilities include manufacturing. Commercial, recreational, and retail areas include the Queensway Bay Development, Queensway Marina, Rainbow Harbor, Aquarium of the Pacific, Shoreline Village, Shoreline Marina, and the Queen Mary tour vessel. The POLB is a very large commercial port with facilities dedicated to the safe and efficient transport of cargo of various types and volumes.

3.10.2 Environmental Consequences

Criteria: An impact to land and water uses would be considered significant if:

1. Impacts would be considered significant if access to existing land and water uses is substantially restricted or eliminated.

3.10.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore there would be no impacts to land or water uses from dredging operations.

3.10.2.2 Proposed Action

The project would be characterized as a compatible use with the existing land use classification for both the LARE and POLB. Restoring authorized depths would provide safer navigation conditions given that the channel is authorized for navigation purposes. Local changes to bathymetry would result due to dredging of marine sediments.

Dredging would have a long-term benefit to navigation, particularly to the vessels using Queensway Marina, by reducing the sediment load in the navigation channel.

The dredging operation would be conducted such that obstruction to navigating vessels is minimized. The operation would be bounded by buoys and other markers to ensure that navigators are aware of the operation and can safely avoid the area. The dredge operator would move the dredge for law enforcement and rescue vessels whenever necessary.

3.11 Ground Transportation

3.11.1 Affected Environment

LARE and POLB is accessed by several major routes. Traffic impacts would be limited to worker commutes.

3.11.2 Environmental Consequences

Criteria: An impact to ground transportation would be considered significant if:

1. Significant impacts would occur if the proposed project results in inadequate parking facilities, the creation of hazardous traffic conditions, or inadequate access or on-site circulation systems.

3.11.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore there would be no impacts to ground transportation from dredging operations.

3.11.2.2 Proposed Action

Construction will require the use of marine equipment with no impacts to ground transportation. Traffic will be generated by crews associated with operations of dredge and support equipment. The equipment crew is anticipated at approximately 18 people. This small staff will not significantly add to the local traffic levels. Additional vehicular traffic is not anticipated as result of completion of this project.

3.12 Climate Change Analysis

3.12.1 Affected Environment

Changes in atmospheric concentrations of GHG have altered the energy balance of the climate system (IPCC, 2007) resulting in a global temperature increase. Global mean sea level is expected to rise by 0.35 ± 0.12 meters from the 1980 to 1999 period to the 2090 to 2099 period (Field, et. al. 2007). This level of sea level rise is not expected to directly impact operations within the LARE and POLB. Sea level rise will actually result in a "deepening" of the channels resulting in a reduced level of maintenance dredging.

Predictions for future winter storms are for fewer, larger storm events that could produce coastal flooding in unprotected areas. However, the LARE is well protected from such increased storms by a series of structural barriers (i.e. the riprap-armored banks of the LARE). POLB facilities are designed to withstand severe storm events, including associated storm surge from storms as large as tropical typhoons. Minor sea level rise would not adversely affect the capability of the POLB infrastructure to withstand future storm events.

3.12.2 Environmental Consequences

Criteria: An impact to ground transportation would be considered significant if:

1. Significant impacts would occur if the proposed project results in the production of GHGs that may have a significant impact on the environment or conflict with an applicable plan, policy, or regulatory adopted for the purpose of reducing the emissions of greenhouse gases.

3.12.2.1 No Action Alternative

The No Action Alternative would consist of no federal maintenance dredging. Therefore there would be no impacts to climate change from dredging operations.

3.12.2.2 Proposed Action

Given that there is no threshold to determine significance for the emission of GHGs and given the reduction measures proposed by the USACE, the production of GHGs resulting from project construction will likely not contribute to cumulative impacts to global climate conditions. Additionally, the project will not result in the ongoing production of GHGs and once complete the project's potential contribution to global climate change ends. Therefore, the proposed action would have no significant impacts to climate change.

4 Cumulative Impacts

NEPA requires that cumulative impacts of the proposed action be analyzed and disclosed. Cumulative impacts are effects on the environment that are caused by the Proposed Action in combination with past, current, or future activities. Individually, each activity may have impacts that are less than significant, but collectively, the cumulative effects could be significant. This analysis evaluates the potential for cumulative impacts of the Proposed Action in combination with other past, present, or future activities.

Past activities that have occurred in the LARE vicinity include prior dredging of federal and privately owned areas within the harbor. Maintenance dredging of nearby marinas is permitted under a regional dredging permit, no work is planned under that permit for the period encompassing the scheduled dredging of the federal channel. Other future foreseeable activities that might have a cumulative effect in combination with the Proposed Action would be future maintenance dredging of the federal channels, deepening of the federal channel, and non-federal maintenance of berthing areas. Maintenance dredging of channels and berths in the POLB occasionally occurs with other areas of the harbor. No work is planned during the expected duration of maintenance dredging in the Entrance Channel.

In the context of these past and foreseeable future actions in the vicinity of the proposed project, the Proposed Action is not expected to have significant incremental cumulative effects.

5 Environmental Compliance

5.1 National Environmental Policy Act

Under NEPA, federal agencies must consider the environmental consequences of proposed federal actions. The spirit and intent of NEPA is to protect and enhance the environment through well-informed federal decisions, based on sound science. When it is determined that a proposed action could result in significant environmental effects, an EIS is prepared. NEPA is premised on the assumption that providing timely information to the decision maker and the public about the potential environmental consequences of proposed actions would improve the quality of federal decisions.

This EA has been prepared pursuant to NEPA and Council on Environmental Quality (CEQ) regulations. Impacts on the human environment as a result of the proposed maintenance dredging of the federal channels at LARE and POLB and disposal of dredged material at the LA-2 ODMDS are anticipated to be less than significant. A Draft Finding of No Significant Impact (FONSI) is included. This Draft EA is being released to agencies and the public for comment. All agency and public comments will be considered and evaluated. If appropriate, a Finding of No Significant Impact (FONSI) will be signed with a conclusion of no significant impacts from this Proposed Action.

5.2 Clean Water Act of 1972 (33 USC 1251 et seq.)

The Clean Water Act (CWA) was passed to restore and maintain chemical, physical, and biological integrity of the Nation's waters. Specific sections of the CWA control the discharge of pollutants and wastes into aquatic and marine environments. The proposed project consists of maintenance dredging with ocean disposal. This does not include the discharge of dredged or fill materials if a clamshell dredge is employed for all work. As such, provisions of the CWA do not apply to the proposed project. The USACE is not required to apply for a Water Quality Certification under Section 401 of the CWA. However, in the unlikely event that a hopper dredge is employed, provisions of the CWA would apply, including Sections 401 and 404. Although Sections 401 and 404(b)(1) of the CWA apply, by their own terms, only to applications for Federal permits, the USACE has made a policy decision to apply them to their own projects. This policy is set out in USACE regulations at 33 CFR Part 336. Section 336.1(a) of that regulation states, "Although the USACE does not process and issue permits for its own activities, the USACE authorizes its own discharges of dredge or fill material by applying all applicable substantive legal requirements, including public notice, opportunity for public hearing, and application of the Section 404(b)(1) guidelines." The USACE would prepare supplemental NEPA documentation should a hopper dredge be selected for the POLB work, including application for a 401 Water Quality Certification.

5.3 Section 103 of the Marine Protection, Research and Sanctuaries Act

The MPRSA of 1972, or Ocean Dumping Act, regulates intentional ocean placement of materials, authorizes related research, and provides for the designation and regulation of marine sanctuaries. The act regulates the ocean dumping of all material beyond the territorial limit (3 miles from shore) and prevents or limits dumping material that "would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities."

Ocean placement of dredged material associated with the Proposed Action would be at LA-2. Compliance with the Marine Protection, Research and Sanctuaries Act has been established through USEPA's permitting of this site.

5.4 Endangered Species Act of 1973 (16 USC 1531 et seq.)

The Endangered Species Act (ESA) protects threatened and endangered species by prohibiting federal actions that would jeopardize continued existence of such species or result in destruction or adverse modification of any critical habitat of such species. Section 7 of the Act requires consultation regarding protection of such species be conducted with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS) prior to project implementation. During the planning process, the USFWS and the NMFS evaluate potential impacts of all aspects of the project on threatened or endangered species. Their findings are contained in letters that provide an opinion on whether a project will jeopardize the continued existence of endangered species or modify critical habitat. If a jeopardy opinion is issued, the resource agency will provide reasonable and prudent alternatives, if any, that will avoid jeopardy. A non-jeopardy opinion may be accompanied by reasonable and prudent measures to minimize incidental take caused by the project.

Under the proposed construction scenario, construction impacts would not affect the Federally-listed California least tern. The project would not affect any designated critical habitat. The project would, therefore, not affect any listed species or their designated critical habitat.

5.5 Coastal Zone Management Act of 1976 (PL 92-582; 16 USC 1456 et seq.)

Under the Coastal Zone Management Act (CZMA), any federal agency conducting or supporting activities directly affecting the coastal zone must demonstrate that the activity is, and proceed in a manner, consistent with approved State's Coastal Zone Management Program, to the maximum extent practicable. As no federal agency activities are categorically exempt from this requirement, the USACE will obtain concurrence from the California Coastal Commission for the necessary consistency determination. Coastal Commission staff has been requested to concur in USACE preliminary finding that a Negative Determination is appropriate for the proposed project submitted under separate cover. Concurrence from the Coastal Commission will be documented in the Final EA.

5.6 Clean Air Act of 1969 (42USC7401 et seq.); CAA Amendments of 1990 (PL101-549)

Air quality regulations were first promulgated with the Clean Air Act (CAA). The CAA is intended to protect the Nation's air quality by regulating emissions of air pollutants. Section 118 of the CAA requires that all Federal agencies engaged in activities that may result in the discharge of air pollutants comply with state and local air pollution control requirements. Section 176 of the CAA prohibits federal agencies from engaging in any activity that does not conform to an approved State Implementation Plan.

The CAA established the NAAQS and delegated enforcement of air pollution control to the states. In California, the Air Resources Board (ARB) has been designated as the state agency responsible for regulating air pollution sources at the state level. The ARB, in turn, has delegated the responsibility of regulating stationary emission sources to local air pollution control or management districts which, for the proposed project, is the South Coast Air Quality Management District (SCAQMD).

The CAA states that all applicable federal and state ambient air quality standards must be maintained during the operation of any emission source. The CAA also delegates to each state the authority to establish air quality rules and regulations. State adopted rules and regulations must be at least as stringent as the mandated federal requirements. In states where the NAAQS are exceeded, the CAA requires preparation of a State Implementation Plan (SIP) that identifies how the state will meet standards within timeframes mandated by the CAA.

The USEPA, in conjunction with the U.S. Department of Transportation, established the General Conformity Rule on 30 November 1993. The rule implements the CAA conformity provision, which requires federal agencies to identify, analyze, and quantify emission impacts of an action and mandates that the federal government not engage, support, or provide financial assistance for licensing or permitting, or approve any activity not conforming to an approved CAA implementation plan.

The project area meets NAAQS for criteria pollutants and therefore, no conformity analysis was required. This EA evaluates air emissions resulting from the Proposed Action and concludes that there will not be a significant impact on air quality. Project emissions are not expected to exceed applicability rates levels established as a criteria for a finding of conformity. Therefore, the project is consistent with the SIP and meets the requirements of Section 176(c).

5.7 National Historic Preservation Act of 1966 (16 USC 470 et seq.)

The NHPA (16 USC 470 et seq.) provides direction in preserving, restoring, and maintaining the historic and cultural environment of the nation. Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on cultural resources listed or determined eligible for listing in the NRHP. The Section 106 implementing regulations are codified in 36 CFR 800, which describe the procedures that federal agencies follow to consult with the State Historic Preservation Office (SHPO), the Advisory Council on Historic Preservation, Native American tribes, and interested parties. No prehistoric or historic cultural resources/historic properties were identified within the project APE and no shipwrecks were identified as existing in an area that would be affected by the project. The APE is entirely within areas that have been dredged intermittently over time, including the 1920's for the POLB and the LARE since 1980.

USACE has determined that the Proposed Action would have no effect on historic and cultural resources. No further project coordination with respect to Section 106 of the NHPA (36 CFR 800) will be required (see Memorandum for the Record in Appendix D of this EA).

If previously unknown cultural resources are identified during project implementation, all activity will cease until requirements of 36 CFR 800.11, *Discovery of Properties during Implementation of an Undertaking*, are met.

5.8 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) requires the USACE to consult with the U. S. Fish and Wildlife Service whenever the waters of any stream or other body of water are proposed to be impounded, diverted, or otherwise modified. Coordination efforts will continue in order to fulfill the requirements of the FWCA; at this time, we are in full compliance with its provisions.

5.9 Magnuson-Stevens Fishery Management and Conservation Act, as amended.

This Draft EA contained an EFH Assessment as required by the Magnuson-Stevens Act. Although construction will occur within Essential Fish Habitat, the USACE has determined that the proposed project would not result in a substantial, adverse impact. In compliance with the coordination and consultation requirements of the Act, the Draft EA will be sent to the NMFS for their review and comment.

5.10 Executive Order 12898 (Environmental Justice)

Executive Order 12898 (59 FR 7629, February 16, 1994) requires all federal agencies to "…make achieving environmental justice part of [their] mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." No minorities or economically disadvantaged individuals are expected to be disproportionately impacted by the proposed project.

5.11 Environmental Compliance Commitments

Following is a proposed summary of future commitments (no mitigation is proposed or required):

1. It is the Contractor's responsibility to obtain all applicable air permits and comply with federal, state, and local air and noise regulations.

2. If cultural resources are discovered prior to or during work and cannot be avoided, work will be suspended in that area until resources are evaluated for eligibility for listing in the NRHP after consultation with the SHPO. If resources are deemed eligible for the NRHP, the effects of the project will be taken into consideration in consultation with the SHPO. The Advisory Council on Historic Preservation (ACHP) will be provided an opportunity to comment in accordance with 36 CFR 800.11.

3. The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters.

4. The Contractor shall implement a Water Quality Monitoring Plan at the dredge site.

5. All dredging and fill activities will remain within the boundaries specified in the plans. There will be no dumping of fill or material outside of the project area or within any adjacent aquatic community.

6. The Contractor shall keep construction activities under surveillance, management, and control to minimize interference with, disturbance to, and damage of fish and wildlife.

7. The contractor shall mark the dredge and all associated equipment in accordance with U.S. Coast Guard regulations. The contractor must contact the U.S. Coast Guard two weeks prior to the commencement of dredging. The following information shall be provided: the size and type of equipment to be used; names and radio call signs for all working vessels; telephone number for on-site contact with the project engineer; the schedule for completing the project; and any hazards to navigation. Notices shall be published in Local Notice to Mariners warning boat users about times, durations, and locations of construction activities.

8. The contractor shall move equipment upon request by the U.S. Coast Guard and Harbor Patrol law enforcement and rescue vessels.

9. Construction equipment shall be properly maintained in order to minimize emissions of air pollutants.

10. Retarding injection timing of diesel-powered equipment to reduce NOx emissions will be implemented where practicable. Use reformulated diesel fuel to reduce reactive organic compounds (ROC) and SO_2.

11. Equip all internal combustion engines with properly operating mufflers.

12. Pre-construction surveys for *Caulerpa taxifolia* will be conducted at the LARE dredge site. Construction shall not begin should *Caulerpa taxifolia* be identified until cleared to do so by the National Marine Fisheries Service.

5.12 Summary of Environmental Compliance

The proposed project is a navigation maintenance project designed and scheduled to avoid and/or minimize probable effects on the environment while maximizing ecosystem restoration. It is determined the proposed project will not have a significant impact upon the existing environment or the quality of the human environment, as documented in this EA. As a result, preparation of an EIS is not required.

6 Public Involvement

The Draft EA is being distributed for a 30-day public and agency review. All comments will be documented and addressed in the Final EA. The following agencies have been notified of the availability of this EA for review and comment, along with members of the interested public and local organizations.

A. Federal agencies:
1) U.S. Environmental Protection Agency (EPA Region 9)
2) U.S. Coast Guard (USCG)
3) U.S. Fish and Wildlife Service
4) National Marine Fisheries Service

B. State agencies:
1) California Coastal Commission
2) State Lands Commission
3) State Historic Preservation Officer
4) Los Angeles Regional Water Quality Control Board
7) South Coast Air Quality Management District
8) California Department of Fish and Wildlife
9) California State Clearinghouse

6.1 COORDINATION

The principle agencies with which this project has been, and will continue to be coordinated, include: the Los Angeles Regional Contaminated Sediment Task Force (CSTF), the Southern California Dredged Material Management Team (SC-DMMT), US Environmental Protection Agency (USEPA), the Los Angeles Regional Water Quality Control Board (LA RWQCB), and the California Coastal Commission (CCC).

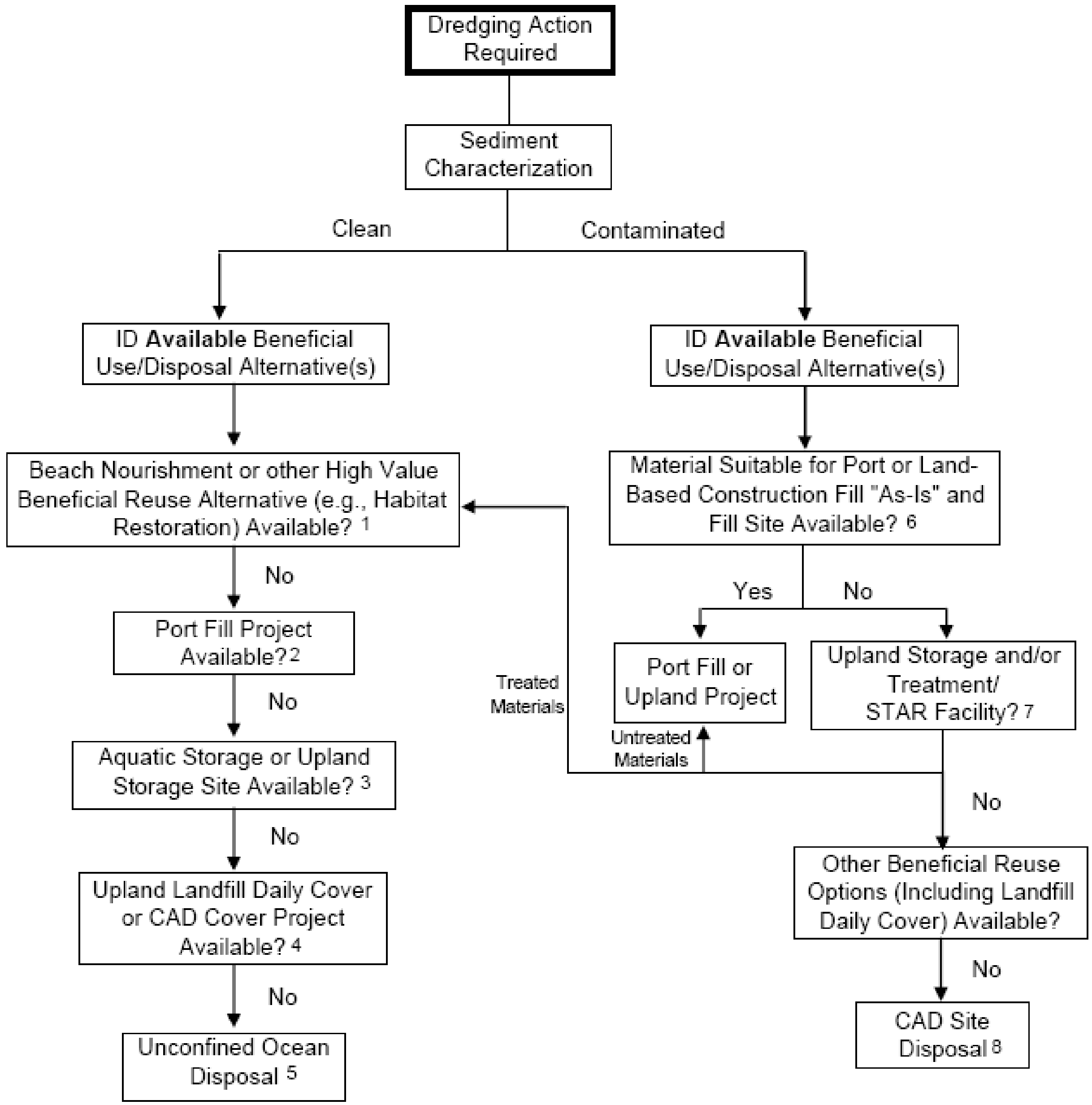
6.1.1 Contaminated Sediments Task Force.

The Contaminated Sediments Task Force (CSTF) is a multi-agency task force in the Los Angeles Region responsible for the coordination of projects involving the dredging and disposal of contaminated sediments. Sediment characterization studies conducted in 2018 showed the sediments to be relatively free of contaminants (see discussion in Section 3.2.1 and Appendix B for details). Going through the decisions tree, the first decision point is for high value beneficial reuse. The sediments have high fines content (see discussion in Section 3.2.1 below and Appendix B for details) and are not suitable for beach nourishment. As discussed in Section 3.2, approximately 55,700 cubic yards of sediments from the LARE sand trap will be left in place. Approximately 1,600 cy of sediment in the vicinity of core LAREVC-18-15 will be left in place. The remaining 368,000 cy of accumulated sediment in the LARE federal channel and all 37,000 cy of accumulated sediment from the POLB Entrance Channel is composed of primarily sandy silt that was deemed suitable for placement in the LA-2 Ocean Dredged Material Disposal Site. There are no known restoration projects that could use the sediments at this time.

The next decision point is the availability of Port fill. There are no known Port fill projects that could use the sediments at this time.

Formal coordination was conducted with the CSTF during joint meetings with the SC-DMMT while conducting and evaluating sediment sampling and analysis. The CSTF concurred with the finding of suitability of the sediments for disposal at the LA-2 ODMDS. Individual members of the CSTF will receive copies of this Draft EA for review and comment. Meeting notes are in Appendix B.

Figure 4. Los Angeles CSTF Sediment Management Decision Tree



6.1.2 Southern California Dredged Material Management Team.

The Southern California Dredged Material Management Team (SC-DMMT) is a multi-agency management team recently set up jointly by the USACE and the U.S. Environmental Protection Agency (USEPA). The SC-DMMT initially consisted of the Corps and USEPA, but has expanded to include participation by the various Regional Water Quality Control Boards and the Coastal Commission as well as by staff from the National Marine Fisheries Service and California Department of Fish and Wildlife. The SC-DMMT differs from the CSTF in that the SC-DMMT deals with all dredging-related projects across the entire Los Angeles District, not just those dealing with contaminated sediments. The SC-DMMT currently meets monthly.

The Sampling and Analysis Plan was discussed at a joint meeting of the SC-DMMT/CSTF held on April 25, 2018, and May 23, 2018. Minor adjustments were made to the plan, which was then implemented. The Sampling and Analysis Plan Report (Appendix C) was discussed at a joint meeting of the SC-DMMT/CSTF held August 28, 2019. The consensus was that the proposed disposal of sediments at the LA-2 ODMDS was a suitable use of the sediments with the exception of Areas within the Sand Trap and in the vicinity of core LAREVC-18-15 and that the 2018 sediment test results were adequate for determining suitability for unconfined, ocean disposal.

6.1.3 U.S. Environmental Protection Agency.

The USEPA, in consultation with the Corps, reviewed and approved the Sampling and Analysis Plan (SAP) used in 2018 to conduct sediment sampling and analysis from the Main Channels. Results were provided to them for review.

Formal USEPA concurrence with the suitability determination made by the Corps that these materials with the exception of Areas within the Sand Trap and in the vicinity of core LAREVC-18-15 are suitable for unconfined, ocean disposal at the LA-2 ODMDS was made as part of the joint meeting of the SC-DMMT/CSTF held August 28, 2019. See Appendix C for meeting notes.

6.1.4 Los Angeles Regional Water Quality Control Board.

The Los Angeles Regional Water Quality Control Board (LA RWQCB) is requested to review the Draft EA, including the determination that a Section 401 Water Quality Certification for the proposed project is not required.

6.1.5 California Coastal Commission.

A copy of the Draft EA was provided to the Coastal Commission staff concurrently with public review. A request has been provided with this Draft EA to initiate review for a Negative Determination for the proposed project. Please refer to Section 5.5 of this EA for a discussion of project compliance with the Coastal Zone Management Act (CZMA).

7 List of Preparers

Laurence Smith, USACE Los Angeles District

Margaret Chang, USACE San Francisco District

Ellie Covington, USACE San Francisco District

8 References

EPA and USACE (U.S. Environmental Protection Agency and U.S. Army Corps of Engineers). 2005. Final Environmental Impact Statement (EIS) Site Designation of the LA-3 Ocean Dredged Material Disposal Site off Newport Bay Orange County, California. July.

USACE (U.S. Army Corps of Engineers). 2019. Sampling and Analysis Plan Report Dredge Material Evaluation 2018 Los Angeles River Estuary and Queens Gate Geotechnical and Environmental Investigation Project. August 6, 2019.

USACE (U.S. Army Corps of Engineers). 2014. Final Environmental Assessment Los Angeles River Estuary Maintenance Dredging Project, Los Angeles County. August.

Appendix A

Mailing List

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Appendix B

Notes for August 28, 2019
Southern California Dredged Material Management Team (SC-DMMT) Meeting
US Army Corps of Engineers - Los Angeles District (3 Pages)

Attendance (*phone):
Stephen Estes (Corps Regulatory)
Amanda Wagner (Corps Regulatory)
Gerry Salas (Corps Regulatory)
Joe Ryan (Corps Coastal)
Natalie Martinez (Corps Planning)
Chris Hayward (Corps Engineering)
Jeff Devine (Corps Engineering)
Melissa Scianni (USEPA)
Chris Miller (City of Newport Beach)
Adam Gale (Anchor QEA)
Chris Osuch* (Anchor QEA)
Steve Cappellino (Anchor QEA)
Theresa Stevens* (Corps Regulatory)
Robert Smith* (Corps Regulatory)
Larry Smith* (Corps Planning)
Alan Ota* (USEPA)
Larry Simon* (CCC)
L.B. Nye* (RWQCB)
Cris Morris* (RWQCB)
Jason Freshwater* (RWQCB)
Kat Prickett* (POLA)
Hugo Cisneros* (POLA)
Barry Snyder* (Wood Environment & Infrastructure Solutions)
Kimbrie Gobbi* (Wood Environment & Infrastructure Solutions)
Ken Kronschnabl* (Kinnetic Labs)

Announcements: None

Oceanside Harbor Maintenance Dredging Project

The U.S. Army Corps of Engineers Los Angeles District (Corps) is seeking approval from the Corps South Pacific Division to conduct advance maintenance dredging in the Approach Channel and Advance Maintenance Areas of Oceanside Harbor down to a depth of -30 feet Mean Lower Low Water (MLLW) from the current -25 feet MLLW. Prior sediment testing in these areas was down to -30 feet MLLW to allow the Corps the flexibility to dredge deeper, if warranted. Shallow water and groundings just prior to annual maintenance dredging makes this desirable from a safety point. It is estimated that an additional 80,000 cubic yards of material would need to be dredged in the first year, anticipated to be in 2020. Subsequent years would revert back to the same volumes as before as deepening would not result in any changes to sediment transport, so the infill would be the same for -30 feet MLLW as it was for -25 feet MLLW.

The Corps proposed that sediments down to -30 feet MLLW are suitable for beach placement. The U.S. Environmental Protection Agency (USEPA), California Coastal Commission (CCC), and Regional Water Quality Control Board (RWQCB) concurred.

Los Angeles River Estuary (LARE) Dredging Project/Port of Long Beach (POLB) Queens Gate Dredging Project

A combined Sampling and Analysis Plan Report (SAPR) was prepared for both the LARE and POLB dredge sediments evaluation.

The SC-DMMT agreed with the revised final SAPR for LARE. The SAPR was revised to state that the Corps would be disposing of all sediment dredged from the next dredge event for LARE and Queen's Gate footprints at the offshore LA-2 Ocean Dredged Material Disposal Site (ODMDS). The SC-DMMT determined that sediment grain size was too fine to consider further for nearshore placement at the Chaffey Island site and that all sediment would need to be placed offshore at the LA-2 ODMDS.

Sediment along the South and West sides of the LARE Sand Trap contained mostly vegetative debris. As such, sediments from the area identified on Figure 12 and Figure 24 of the SAPR (55,700 cubic yards) would be left in place. Sediments in the vicinity of core LAREVC-18-15, also shown on Figure 24 of the SAPR (approximately 1,600 cubic yards), were not included in the composite sample for Tier III testing. These sediments are considered to be unsuitable for ocean disposal as well.

The USEPA, CCC, and RWQCB concurred with the suitability determination for ocean disposal with the above exceptions for the LARE.

The SC-DMMT agreed with the final SAPR for Queens Gate. The SAPR was revised to state that the Corps would be disposing of all sediment dredged from the next dredge event for LARE and Queen's Gate footprints at the offshore LA-2 ODMDS. The SC-DMMT determined that sediment grain size was too fine to consider further for nearshore placement at Chaffey Island site and that all sediment would need to be placed offshore at the LA-2 ODMDS.

The USEPA, CCC, and RWQCB concurred with the suitability determination for ocean disposal for the Queens Gate sediments.

Newport Harbor Federal Channel Dredging Project

The City of Newport Beach, in conjunction with the Corps, presented the proposed suitability determination for the federal channels project in Newport Harbor. Mr. Larry Smith (Corps) noted that although the Corps Planning Division supports the project and the proposed plan as presented, the Corps is still working with the USEPA on a separate track to further refine the sediment suitability for the LA-3 ODMDS. However, those discussions would not preclude any direction given by the SC-DMMT at this meeting.

The City and Corps presented a plan whereby sediment with an approximate range of 1.5 ppm Hg could be disposed at the LA-3 ODMDS based on the recent sediment characterization performed by the City. The remaining material would be disposed at an in-harbor Confined Aquatic Disposal (CAD) site at a location to be finalized by the City but likely between Lido Isle and Bay Island. The City would also propose a Newport Harbor Sediment Management Plan, which would offer harbor-wide solutions for other non-federal sediment that may have future disposal needs.

All composite areas with the exception of NC1 were determined suitable for ocean disposal with the Entrance Channel also suitable for nearshore placement.

The USEPA concurred with the plan, including the Sediment Management Plan component, but noted that the City could contribute (some or all) to future, incremental LA-3 ODMDS sediment testing for Hg in the coming years. The RWQCB agreed with the proposed approach, and the CCC also agreed but inquired about the future project details such as depth, interim cap for CAD, source material, etc.

Wilmington Waterfront Pile Jetting Project

- Presentation given on the SAPR

- Questions:
    1) Corps – Where is the hole in the piling located?
        a. Port of Los Angeles (POLA) – Confirmed with their engineering group that the hole is in the center and exits the bottom center of the pile. The 2-3 inch pile jetting hose has a nozzle that directs the stream directly under the pile.
    2) USEPA – Need better understanding of the concentrations found in the sediment - are they the same and/or representative of the entire Wilmington Waterfront area?
        a. POLA would research this information.
    3) USEPA – A lot of turbidity is generated from the removal of piles and not jetting activities. The action of removing them causes resuspension. USEPA's understanding is that when the piles are pulled there is some liquefaction of the sediments and this causes resuspension. What is the potential for resuspension during jetting vs. extraction? Is there more of an issue with extraction vs. jetting?
    4) USACE – liquefaction of piles as driven is a big concern for projects. Best Management Practices (BMPs) for extraction may need to be implemented.
    5) CCC – Leaning towards requiring silt curtains during project activities.
    6) Wood Environment & Infrastructure – Jetting only occurs when necessary. If POLA can install without jetting, they would do so. At depth, resuspension of sediments is less likely (too far down in the substrate).
    7) RWQCB – How long does sediment stay resuspended during jetting?
        a. POLA – The time required for jetting changes with each site, but they can ask their engineering group. It is unlikely to be more than a few hours.
        b. Corps – It is probable that the smallest number of piles is put into place at one time so the impact would be reduced. 10 piles can be installed in a day or less during daylight hours. 34 may take a couple of days. Piles to be penetrated approximately 5 feet down. Worst case scenario is 100+ piles to install. Short term impacts are probably a few hours on any given day during installation.
    8) Corps – Number of piles to be removed is 244 – is there a way that the sediments would be contained during removal?
        a. POLA Engineering – Silt curtains would be set up around the entire project limits of in-water work. They would be placed around timber piles and decks and would also be installed during jetting and driving activities.

    b. Silt curtain plan can be provided to Corps and RWQCB. POLA would prepare the plan.

9) USEPA – In regards to a suitability determination, what is proposed is adequate, with the caveat that the Corps and RWQCB get more information about boom and silt curtain BMPs.
10) Corps – Silt curtains catch surface turbidity and not much is anticipated.
11) USEPA – It would be beneficial to have a summary of what the sediments are surrounding the project area. It would also be helpful to know if adjacent sediments are of similarly high COCs.
    a. POLA can provide prior sediment characterization results for landside investigations but there have not been many offshore.
    b. USEPA – Element of 404 permit that includes a section for historical information
12) To Do Items:
    a. Summarize available sediment data in area.
    b. Provide plan on how silt curtains would be implemented during project.

SAMPLING AND ANALYSIS PLAN REPORT

DREDGE MATERIAL EVALUATION
2018 LOS ANGELES RIVER ESTUARY AND QUEENS GATE GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION PROJECT

USACE Contract No. W912PL-17-D-0003, Task Order No. 008

Prepared for:

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT
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August 6, 2019

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Sampling and Analysis Plan Report

DREGE MATERIAL EVALUATION
2018 LOS ANGELES RIVER ESTUARY AND QUEENS GATE
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION PROJECT

August 6, 2019

Table of Contents

Page No.

APPENDICES

List of Tables

Page No.

List of Figures

<u>Page No.</u>

LIST OF ACRONYMS

ADDAMS	Automated Dredging and Disposal Alternatives Modeling System	**NA**	Not Applicable
ASTM	American Society for Testing and Materials	**ND**	Not Detected
ANOVA	Analysis of Variance	**NEIBP**	North Energy Island Burrow Pit
CAD	Confined Aquatic Disposal	**NOAA**	National Oceanic and Atmospheric Administration
CCC	Criteria Continuous Concentration	**NOEC**	No Observable Effects Concentration
CAL/EPA	California Environmental Protection Agency	**NMFS**	National Marine Fishery Service
CD	Compact Disc	**ODMDS**	Ocean dredge Material Disposal Site
CDF	Confined Disposal Facility	**OEHHA**	Office of Environmental Hazard Assessment
CDFW	California Department of Fish and Wildlife	**OTM**	Ocean Testing Manual
CESPD	Corps of Engineers South Pacific Division	**PAH**	Polycyclic Aromatic Hydrocarbon
CHHSL	California Human Health Screening Level	**PDS**	Post-Digestion Spike
CMC	Criteria Maximum Concentration	**PCB**	Polychlorinated biphenyl
COC	Chain of Custody	**PEL**	Probable Effects Level
CSLC	California State Lands Commission	**POLA**	Port of Los Angeles
Csp	Concentration of Suspended Particulate	**POLB**	Port of Long Beach
CSTF	Contaminated Sediment Task Force	**PRG**	Preliminary Remediation Goal
CV	Coefficient of Variation	**QA/QC**	Quality Assurance/Quality Control
CWA	Clean Water Act	**RCRA**	Resource Conservation Recovery Act
CY	Cubic Yards	**RL**	Reporting Limit
DDD	Dichlorodiphenyldichloroethane	**RPD**	Relative Percent Difference
DDE	Dichlorodiphenyldichloroethylene	**RSL**	Regional Screening Level
DDT	Dichlorodiphenyltrichloroethane	**SAP**	Sampling and Analysis Plan
DGPS	Differential Global Positioning Satellite	**SAPR**	Sampling and Analysis Plan Report
EC_{50}	50% of the Time Effects Concentration	**SC-DMMT**	So. Cal. Dredge Material Management Team
ERED	Environmental Residue Effects Database	**SET**	Standard Elutriate Test
ERL	Effects Range-Low	**SOP**	Standard Operating Procedure
ERM	Effects Range-Medium	**SP**	Solid Phase
ERMq	Effects Range-Medium Quotient	**SPP**	Suspended Particulate Phase
FDA	Food and Drug Administration	**SURR**	Surrogate Analysis
HHMSSL	Human Health Medium – Specific Screening Level	**TEL**	Threshold Effects Level
ITM	Inland Testing Manual	**TMDL**	Total Maximum Daily Load
LARE	Los Angeles River Estuary	**TOC**	Total Organic Carbon
LARWQCB	Los Angeles Regional Water Quality Control Board	**TRPH**	Total Recoverable Hydrocarbons
LC_{50}	50% of the Time Lethal Concentration	**TRV**	Toxicity Reference Value
LCS	Laboratory Control Spike	**TSS**	Total Suspended Solids
LDPE	Low Density Polyethylene	**TVS**	Total Volatile Solids
LOEC	Lowest Observable Effects Concentration	**USACE**	U.S. Army Corps of Engineers
LPC	Limiting Permissible Concentration	**USCG**	U.S. Coast Guard
MDL	Method Detection Limit	**USEPA**	U.S. Environmental Protection Agency
MET	Modified Elutriate Extract	**USNMFS**	U.S. National Marine Fisheries Service
MLLW	Mean Lower Low Water	**USFWS**	U.S. Fish and Wildlife Service
MDL or DL	Detection Limit	**UTM**	Upland Testing Manual
MS	Matrix Spike	**QA**	Quality Assurance
MSD	Matrix Spike Duplicate	**QC**	Quality Control
NAD83	North American Datum of 1983	**WLA**	Waste Load Allocation

Sampling and Analysis Plan Report

DREGE MATERIAL EVALUATION
2018 LOS ANGELES RIVER ESTUARY AND QUEENS GATE GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION PROJECT

August 6, 2019

1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) needs to conduct maintenance dredging of the Los Angeles River Estuary (LARE) federal channels and associated Sand Trap and in a shoaled area of the Port of Long Beach (POLB) federal Approach Channel near the Queens Gate Entrance (Figure 1) to restore the channels to their design depths and to facilitate navigation. The LARE federal channel serves the Queens Way Marina and the Catalina Ferry Terminal, as well as Rainbow Harbor, all within the City of Long Beach. The channel also support access to the City Boat Launch Ramp and the Harborlight Yacht Club. The POLB Approach Channel serves vessel traffic coming into and out of the Port of Long Beach.

1.1 Project Summary

Including a two foot overdepth allowance, there was approximately 282,000 cubic yards (cy) of shoaling in the LARE federal channels and adjacent sand trap and approximately 39,000 cy of shoaling in the POLB Approach Channel near Queens Gate at the time of the last condition surveys conducted in May 2018 and August 2017, respectively. It is anticipated that the channels will not be dredged until sometime in the middle of 2019, and it is estimated that these volumes could increase by 75,000 cy per year for the LARE channels and 8,000 cy per year for the POLB Approach Channel shoaled area. Therefore, the volumes of material at the time of dredging will probably be closer to 430,000 cy for the LARE channels and 55,000 cy for the Queens Gate shoaled area.

The overall LARE dredge area was sectioned off into three main dredge units based on design depths, purpose, and composite testing. Shoaling in the POLB Approach Channel is restricted to a single dredge area. Design depths and May 2018 dredge volumes for each of these dredge units are summarized in Table 1. The Sand Trap was built upstream of the LARE federal channel and was designed to intercept sediments before they can reach the federal channel. The design depth of the Sand Trap (Area ST-1) is -25 feet Mean Lower Low Water (MLLW) and is the same as the design depth of the upper federal channel (Area LARE-1). The design depth of the lower LARE federal channel (Area LARE-2) is -21 feet MLLW. The design depth of the POLB Approach Channel is -76 feet MLLW. Figure 2 shows the boundary limits for each LARE dredge unit and Figure 3 shows the boundary limits for the POLB Approach Channel shoaled area.

Placement alternatives considered in this SAPR for the LARE and Queens Gate sediments are as follows:

- Beach nourishment at a nearshore placement area near Chaffee Island (Figure 1);
- LA-2 Ocean Dredge Material Disposal Site (ODMDS);

Final construction methods for dredging will be determined by the construction contractor. As in past maintenance dredging episodes, mechanical dredging utilizing a clamshell and scows to remove sediment from shoaled areas may be used. Alternatively, dredging could possibly be performed by a hopper dredge, dependent upon the final placement site. Material designated for placement at LA-2 ODMDS would be loaded onto bottom-dump ocean scows and transported to the LA-2 site and dumped, or a hopper dredge may be used.

Table 1. Preliminary Dredge Quantities and Composite Testing Areas.

Testing Areas	Dredge Areas	Design Depth (ft MLLW)	Total Volume with 2 feet Overdepth (cy)*
ST-1	Sand Trap Area.	-25	75,600
LARE-1	Upper Main Channel	-25	132,700
LARE-2	Lower Main Channel	-21	73,700
QG-1	POLB Entrance Channel	-76	39,000
Total 2017 Project Volume (cy)			***321,000***

*These quantities are based on a May 2018 and August 2017 condition surveys and can be expected to increase by the actual time dredging takes place.

1.2 Purpose

The purpose of this project was to sample and test sediments from within the LARE and POLB Approach Channel areas proposed for maintenance dredging to provide physical, chemical and biological data necessary to evaluate environmental effects of dredging and of reuse/placement options. This Sampling and Analysis Plan Report (SAPR) is to fulfill requirements of CESPD Regulation No. 1110-1-8 (CESPD, 2000), the ocean testing manual (OTM) (USEPA/USACE, 1991), the Inland Testing Manual (ITM) (USEPA/USACE, 1998), the Clean Water Act (CWA), and the Southern California Dredge Material Management Team (SC-DMMT) and Contaminated Sediment Task Force (CSTF) draft guidelines. Sampling and testing of this project was conducted according to the project Sampling and Analysis Plan (SAP) (AECOM and Kinnetic Laboratories, 2018a).

Grab sampling of sediments and geotechnical testing of the nearshore placement site off Chaffee Island (Figures 1 and 4) was also carried out in order to assist in determining if the LARE and POLB Approach Channel dredged sediments are suitable to be beneficially reused for beach nourishment. Furthermore, sediments were collected from the USEPA designated LA-2 reference area in order to assist in determining if the LARE and Queens Gate dredged sediments are suitable for placement at the LA-2 ODMDS.

1.3 Site Location

The LARE and POLB Approach Channel dredging sites are located along the Southern California Coast in Long Beach (Figure 1). Geographic coordinates (NAD 83) for the entrance to the LARE federal channel are 33° 45' 16.76" N and 118° 11' 15.79" W, and geographic coordinates in the vicinity of the POLB Approach Channel shoaled area are 33° 43' 16" N and 118° 11' 12" W. Coordinates for the Chaffee Island reuse site are provided on Figure 4.

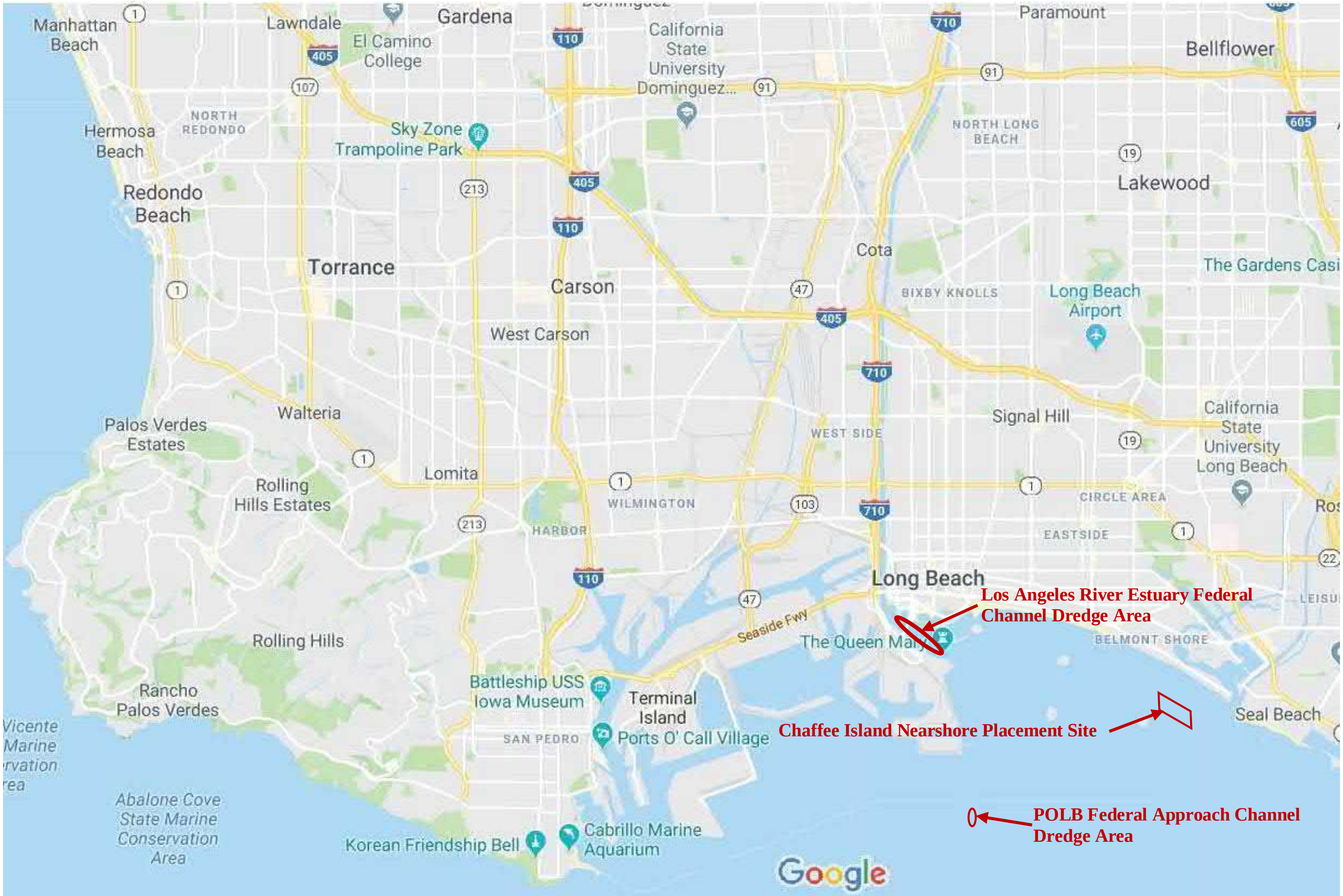


Figure 1. Vicinity of the Los Angeles River Estuary and POLB Federal Channels Dredge Areas and the Chaffee Island Nearshore Placement Site.

LARE ESTUARY ASBUILT VIBRACORE COORDINATES		
VIBRACORE No.	NORTHING	EASTING
LAREVC-18-01	1,735,587	6,500,489
LAREVC-18-02	1,735,332	6,500,407
LAREVC-18-03	1,735,166	6,500,548
LAREVC-18-04	1,735,332	6,500,620
LAREVC-18-05	1,735,513	6,500,711
LAREVC-18-06	1,735,622	6,500,939
LAREVC-18-07	1,735,426	6,500,772
LAREVC-18-08	1,735,046	6,500,710
LAREVC-18-09	1,734,985	6,500,933
LAREVC-18-10	1,735,131	6,500,876
LAREVC-18-11	1,735,234	6,501,005
LAREVC-18-12	1,735,033	6,501,242
LAREVC-18-13	1,734,815	6,501,353
LAREVC-18-14	1,734,990	6,501,516
LAREVC-18-15	1,734,747	6,501,883
LAREVC-18-16	1,734,771	6,501,779
LAREVC-18-17	1,734,765	1,501,880
LAREVC-18-18	1,734,704	6,501,961
LAREVC-18-19	1,734,795	6,502,096
LAREVC-18-20	1,734,661	6,502,235
LAREVC-18-21	1,734,594	6,502,381
LAREVC-18-22	1,734,648	6,502,604
LAREVC-18-23	1,734,363	6,502,893
LAREVC-18-24	1,735,550	6,500,549
LAREVC-18-25	1,734,180	6,503,176
LAREVC-18-26	1,735,198	6,500,670
LAREVC-18-27	1,733,889	6,503,515
LAREVC-18-28	1,733,749	6,503,763
LAREVC-18-29	1,733,645	6,503,904
LAREVC-18-30	1,733,785	6,503,991
LAREVC-18-31	1,733,645	6,503,986
LAREVC-18-32	1,733,554	6,504,026
LAREVC-18-33	1,733,621	6,504,082
LAREVC-18-34*	1,735,296	6,500,523
LAREVC-18-35*	1,735,453	6,500,478
LAREVC-18-36*	1,735,574	6,500,559
LAREVC-18-37*	1,735,393	6,500,412
LAREVC-18-38*	1,735,328	6,500,336
LAREVC-18-39*	1,735,259	6,500,442
LAREVC-18-40*	1,735,119	6,500,824

*ADDED VIBRACORE LOCATIONS

LEGEND

ELEVATIONS ARE IN FEET REFERENCED TO MLLW

ELEVATIONS IN BLUE, ARE FROM ORIGINAL USACE 1979 DREDGE CONTRACT DRAWINGS

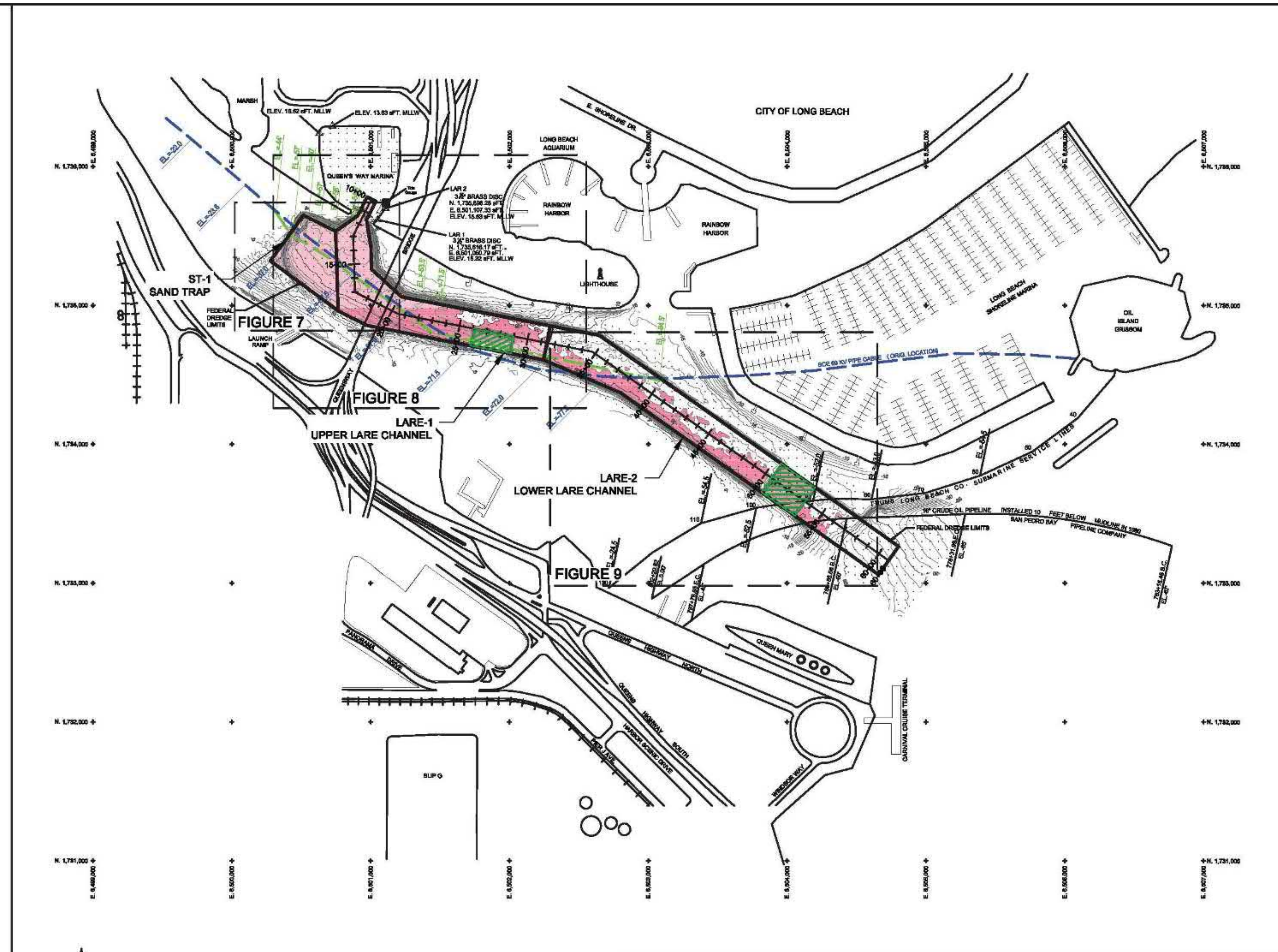
ELEVATIONS IN GREEN ARE FROM E-TRAC SUB-BOTTOM PROFILE SURVEY OF JANUARY 2015

AREAS AT PROJECT DESIGN DEPTH AND ABOVE

AREA FOUND TO BE UNSUITABLE FOR LA-2 PLACEMENT DURING 2015 DREDGING EPISODE

NOTES

1. SOUNDINGS AND ELEVATIONS, INDICATE THE GENERAL CONDITIONS EXISTING ONLY AT THE TIME OF SURVEY - MAY 23-24, 2018.
2. COORDINATES ARE CALIFORNIA LAMBERT ZONE V, (NAD 1983) .
3. MLLW ESTABLISHED FROM LOS ANGELES HARBOR, STATION ID 9410660.
4. MEAN LOWER LOW WATER (MLLW) IS BASED ON MONUMENT 941 0660 TIDAL 8 (PID DY1083) , WITH AN ELEV OF 13.76 US FEET, EPOCH 1983-2001.
5. CONTOURS ARE BASED ON THE AVERAGE DEPTH OF SOUNDINGS WITHIN A 3ft GRID CELL AND ARE GIVEN THE COORDINATES OF THE CENTER OF THAT CELL. THE PLOTTED DEPTHS ARE FROM THE SOUNDING NEAREST THE CENTER OF A 60 FOOT GRID CELL.
6. SOUNDINGS ARE SHOWN TO THE NEAREST 0.1 FOOT AND IF THERE ARE ANY NON-WATER ELEVATIONS, THEY ARE TO THE NEAREST 0.1 FOOT.
7. SOUNDINGS LOCATED BY DGPS (CG BEACON 302 - PT. LOMA) . DEPTHS MEASURED BY A MULTI-BEAM ECHO SOUNDER PROVIDING NEAR FULL BOTTOM COVERAGE.
8. ALL STRUCTURES SHOWN ARE APPROXIMATE.



750' 0 750' 1500'

SCALE: 1"=750'

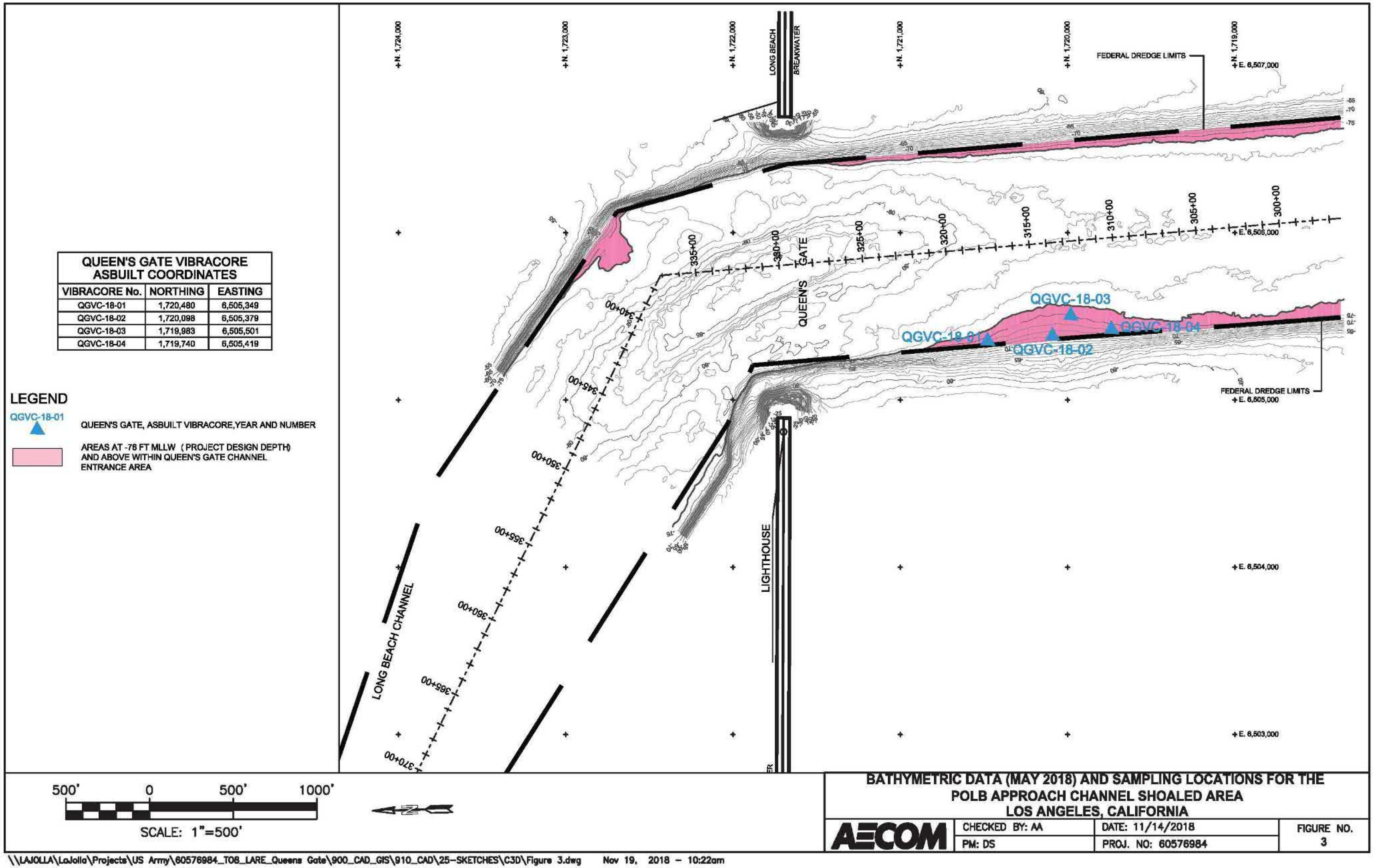
N

LOCATION OF THE THREE LARE CHANNEL DREDGE UNITS
ACTUAL SAMPLING LOCATIONS AND MAY 2018 BATHYMETRIC DATA
LOS ANGELES, CALIFORNIA

AECOM	CHECKED BY: AA	DATE: 11/14/2018	FIGURE NO.
	PM: DS	PROJ. NO: 60576984	2

\\LAJOLLA\LaJolla\Projects\US Army\60576984_TO8_LARE_Queens Gate\900_CAD_GIS\910_CAD\25-SKETCHES\C3D\Figure 2.dwg Nov 19, 2018 - 11:54am

Figure 2. Location of the Three LARE Channel Dredge Units, Actual Sampling Locations and May 2018 Bathymetric Data.



QUEEN'S GATE VIBRACORE ASBUILT COORDINATES

VIBRACORE No.	NORTHING	EASTING
QGVC-18-01	1,720,480	6,505,349
QGVC-18-02	1,720,098	6,505,379
QGVC-18-03	1,719,983	6,505,501
QGVC-18-04	1,719,740	6,505,419

Figure 3. Location of the POLB Approach Channel Dredge Unit, Sampling Locations and 2017 Bathymetric Data.

Figure 4. Location of the Chaffee Island Nearshore Placement Site.

1.4 Roles and Responsibilities

Key responsibilities for elements of this program are tabulated in Table 2. Key contacts for this sediment characterization program are listed as follows:

James Field USACE Project Manager PPMD Navigation & Coastal Projects Branch 901 Wilshire Blvd. Los Angeles, CA 90017 213-452-3403 James.A.Fields@usace.army.mil	Jeffrey Devine USACE Project Technical Mgr. Geotechnical Branch 901 Wilshire Blvd. Los Angeles, CA 90017 213-452-3579 Jeffrey.D.Devine@usace.army.mil	Larry Smith USACE Environmental Coordinator U.S. Army Corps of Engineers, Los Angeles District 915 Wilshire Blvd. Los Angeles, CA 90017 213-452-3846 Lawrence.J.Smith@usace.army.mil
Ken Kronschnabl Kinnetic Laboratories, Inc. 307 Washington St. Santa Cruz, CA 95060 831- 457-3950 kkronsch@kinneticlabs.net	David Schug, CEG, CHG Senior Principal Geologist AECOM 401 West A Street, Suite 1200 San Diego, CA 92101 619-610-7600 david.schug@aecom.com	Jeffrey Cotsifas Pacific EcoRisk 2250 Cordelia Road Fairfield, CA 94534 707-207-7761 cotsifas@pacificecorisk.com,
Michael Smith, PE, GE, AECOM Project Manager 999 Town and Country Road Orange, CA 92868 1-714-567-2791 michael.g.smith@aecom.com	Michele Castro Eurofins Calscience Environmental Lab 7440 Lincoln Way Garden Grove, CA 92841 949-870-8766 MicheleCastro@eurofinsus.com	Amy Howk KLI QA/QC Officer Kinnetic Laboratories, Inc. 307 Washington St. Santa Cruz, CA 95060 Tel. (831) 457-3950 ahowk@kinneticlabs.net

1.5 Data Users

Principal users of data produced by this project are the following SC-DMMT and CSTF regulating agencies:

1. Los Angeles District, U.S. Army Corps of Engineers (USACE);
2. California Regional Water Quality Control Board, Region 4 – Los Angeles Region (LARWQCB);
3. U.S. Environmental Protection Agency (USEPA) - Region IX;
4. California Coastal Commission;
5. California State Lands Commission (CSLC).
6. California Department of Fish and Wildlife (CDFW);
7. U.S. Fish and Wildlife Service (USFWS); and
8. U.S. National Marine Fisheries Service (NMFS).

Table 2. Project Team and Responsibilities.

Responsibility	Name	Affiliation
Project Planning and Coordination	James Field Jeffrey Devine Larry Smith David Schug Ken Kronschnabl	USACE USACE USACE AECOM Kinnetic Laboratories
Sampling and Analysis Plan (SAP) Preparation	Ken Kronschnabl David Schug Amy Howk	Kinnetic Laboratories AECOM Kinnetic Laboratories
Field Sample Collection and Transport	Spencer Johnson Tim Fleming	Kinnetic Laboratories Kinnetic Laboratories
Geotechnical Core Logging	David Schug Sabah Fanaiyan Jeffrey Devine	AECOM AECOM USACE
Health and Safety Officer and Site Safety Plan	Jon Toal	Kinnetic Laboratories
Laboratory Chemical Analyses	Kathy Burney Amy Howk	Eurofins Kinnetic Laboratories
Laboratory Biological Testing	Jeffrey Cotsifas	Pacific EcoRisk
QA/QC Management	Any Howk Danielle Gonsman Kathy Burney	Kinnetic Laboratories Kinnetic Laboratories Eurofins
Technical Review	Jeffrey Devine Larry Smith Joe Ryan James Fields	USACE USACE USACE USACE
Final Sampling and Analysis Results Report	Ken Kronschnabl David Schug	Kinnetic Laboratories AECOM
Agency Coordination	Jeffrey Devine Kirk Brus Larry Smith	USACE USACE USACE

2.0 SITE HISTORY AND HISTORICAL DATA REVIEW

This section presents a brief history of the LARE channels and POLB Approach Channel maintenance dredging, potential sources of contamination, and recent dredging history. Previous testing and sampling results are also discussed.

2.1 Site Setting and Potential Sources of Contamination

Separate from the Port of Long Beach, the local marinas near LARE are overseen by the City of Long Beach Parks, Recreation and Marine Department, and they are administered by the Marine Bureau. Long Beach Marinas are protected by a series of offshore breakwaters and by a natural south-facing bay.

Served by the present LARE federal channel, the Rainbow Harbor/Marina is located next to the Aquarium of the Pacific and has 87 slips for commercial vessels, (16) 30-foot slips and a 200-foot long dock for day guests. Rainbow Harbor also has (12) 150-foot docks for commercial vessels. Shoreline Village and The Pike surround the harbor. At the upper end of the LARE federal channel is the Queensway Marina, home to the Catalina Ferry Terminal. Locations of these facilities are shown on Figure 2.

Queens Gate is a gap between the Long Beach Break Water and the Middle Harbor Breakwater protecting the Ports of Los Angeles and Long Beach. The Approach Channel to the Port of Long Beach passes through this gap. The Approach Channel originates two miles offshore of Queens Gate and terminates at Queens Gate when it transitions to the narrower POLB Main Channel. At a depth of 76 feet, the channel can accommodate deep draft oil tankers.

Potential for contamination of sediments within the LARE federal channel and POLB Approach Channel is primarily due to pollutants originating from the Los Angeles River. Contaminants from the entire Los Angeles River Watershed can be transported as soluble contaminants, or as suspended or bed-load sediments into this area. Coagulation of suspended sediments from the fresh river water upon mixing with the harbor salt water causes sediment and associated contaminants to precipitate within these LARE channels. Local storm water discharges from the City of Long Beach and Port of Long Beach also discharge into the LARE. There is one City of Long Beach pump station located below Ocean Boulevard just at the bend of the Los Angeles River above the Sand Trap area (see Figure 5) that discharges stormwater runoff from a large section of Downtown Long Beach below Ocean Boulevard and above West Shoreline Drive. There are only a few small outfalls that discharge localized runoff into LARE that are directly adjacent to the federal channel. These outfalls are identified on Figure 5.

The channel sediments at POLB Approach Channel were expected to be sandier in nature and have a lower influence of contamination from the Los Angeles River due to its exposure to the open ocean.

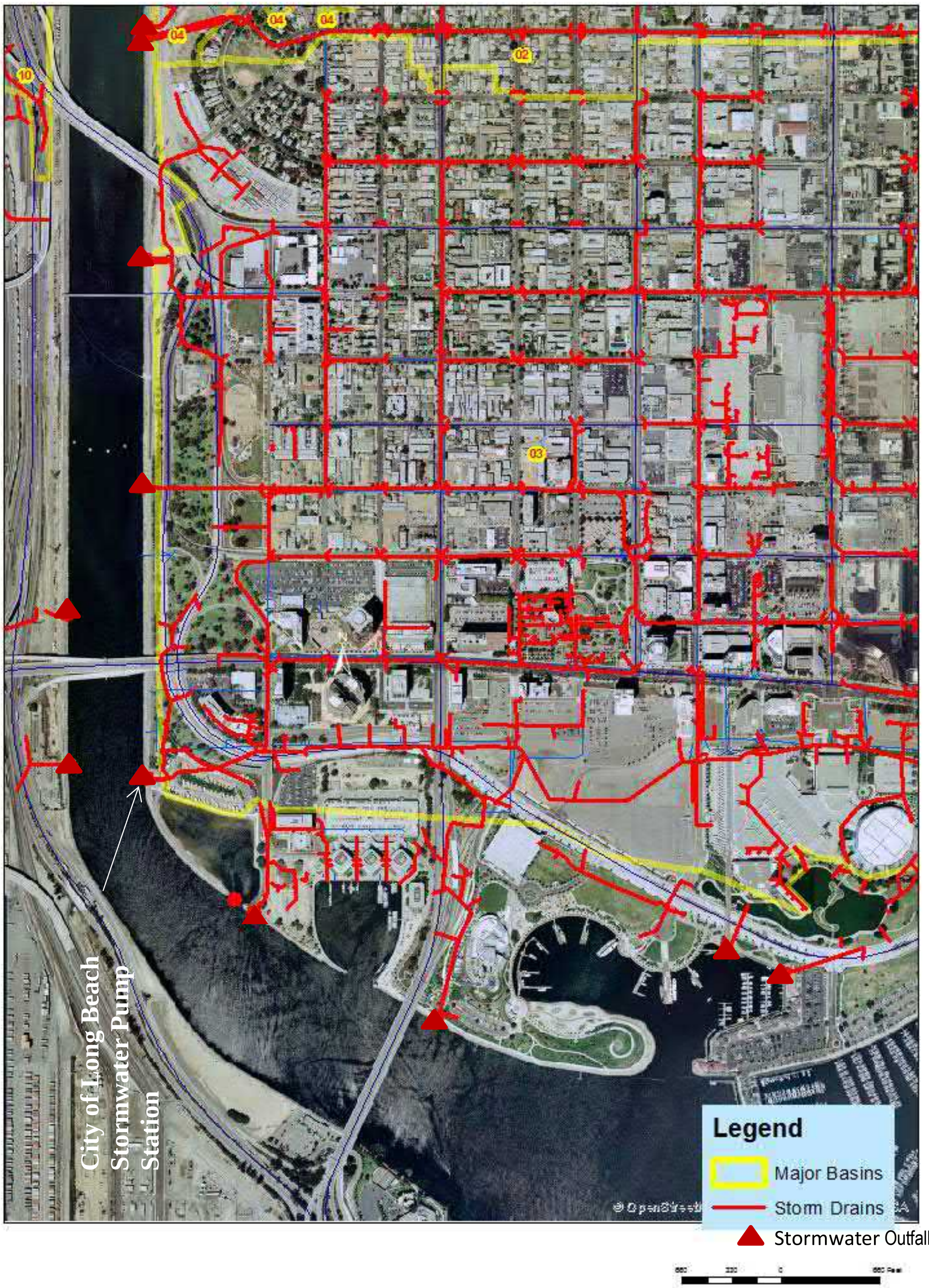


Figure 5. Storm Drain and Associated Outfall Locations near the LARE Federal Channel.

The surface water quality of the Los Angeles River is currently locally regulated by the LARWQCB. Therefore, it is subject to a river specific Total Maximum Daily Load (TMDL) regulatory action for metals (copper and lead during dry weather; cadmium, copper, lead and zinc during wet weather), trash, bacteria, and nutrients (LARWQCB, 2003, 2007a, 2007b, 2010, 2012 and LARWQCB/USEPA, 2010). TMDL compliance monitoring suggests that Waste Load Allocations (WLA) are currently being met for metals during dry weather conditions but considerable reductions will be necessary to achieve metal WLAs during storm events. More specifically, the Los Angeles River Estuary itself (Queensway Bay) has been listed as an impaired water body according to Section 303(d) of the Clean Water Act for not meeting water quality standards for chlordane, DDT, and PCBs in sediments and trash (SWRCB, 2010). More recently, the EPA added the Estuary to the City of Long Beach Bacteria TMDL based upon monitoring conducted at the Queensway Bridge by the Council for Watershed Health, a consortium of state and local agencies and other stakeholders assembled to protect local watersheds through education, research and planning. Sediment monitoring at the bridge has been incorporated into the Coordinated Compliance, Monitoring, and Reporting Plan for the Greater Los Angeles and Long Beach Harbor Waters (Anchor QEA, 2013). This has been implemented in response to the Greater Los Angeles and Long Beach Harbor Water Toxics TMDL, set by the LARWQCB in 2011, and occurs as a multi-faceted collection program that involves sampling of surface sediments. Included are bioassays, benthic community analysis, and analysis of all toxics in order to evaluate the sites based upon California's Part 1 Sediment Quality Objectives procedures. These procedures were developed by the State Water Resources Control Board and consist of sediment chemical analyses, sediment toxicity, and benthic infaunal analyses.

2.2 Previous LARE Federal Channel Dredging Episodes

Previous dredging episodes, quantities dredged and dredge material placement locations for the LARE federal channel are summarized in Table 3. Environmental studies conducted for dredging episodes since 1998 are summarized below.

2.2.1 Sampling and Testing 1998

MEC Analytical Systems, Inc. (MEC) conducted sampling and analysis of sediments from the lower LARE federal channel for the USACE-LA District in July 1998 (MEC, 1998). Physical, chemical and biological testing was conducted on representative dredged material collected from the proposed project areas to determine suitability of the material for placement at the LA-2 ODMDS. Chemical analyses of sediments from this study showed the presence of low to moderate levels of metals and organic compounds. Mercury was the only analyte that exceeded NOAA upper or median effects based (ERM) screening values (Long et. al., 1995). Results of biological testing showed material from Area 2-bottom and Area 3 (which corresponds to Area 3 and Area 4, respectively in the later 2005-2007 study summarized below) to be suitable for ocean placement at the LA-2 ODMDS. However, material from Area 1 (Area 1 & 2 in the 2005-2007 study) and Area 2-top were not suitable for ocean placement due to amphipod toxicity.

Table 3. Dredging Episodes for the LARE Federal Channel from 1980 to the Present.

Dredge Year	Volume (cubic yards)	Placement Location
1980	350,000	Used as dike material at Downtown Marina (Shoreline Harbor Marina)
1991	122,000	POLB Pier J
1995	300,000	In Bay placement at mouth of LARE
1997	98,000	In Bay placement at mouth of LARE
1999	125,000	POLB Slip E (Confined disposal)
	41,000	LA-2
2001	135,000	North Energy Island Borrow Pit - Aquatic Capping Pilot Study
2005	15,000	Side Cast
2008	155,000	LA-2
	79,000	POLB Slip G (Confined disposal)
	181,000	Nearshore at Long Beach
2010	163,000	POLB Slip 1 (Confined disposal)
2015	640,000	LA-2

2.2.2 Sampling and Testing 2001

Chemical analyses of LARE sediments were conducted by the Chambers Group in March 2001. The upper layer (13 to 16 feet below the mudline) of this contaminated sediment was comprised predominantly of sand with some finer grain material (silty sands and clay) (Chambers, 2001). Results indicated a number of metals, pesticides, total PCBs, and a few PAHs at concentrations above NOAA lower effects based (ERL) values (Long et. al., 1995). A few samples exhibited contaminant concentrations in excess of ERM values for zinc, selected pesticides, and total PCBs (Chambers, 2001).

Contaminated sediments (~105,000 m^3) from the Los Angeles River Estuary were mechanically dredged and placed in the pre-existing North Energy Island Borrow Pit (NEIBP) in the Inner Harbor in 2001 and capped with one to 1.5 meters of clean sand (ASTSWMO, 2013). This cap was monitored annually over a subsequent three-year period to evaluate the long-term stability of containment/isolation of the contaminated sediments, as well as biological re-colonization of the cap surface.

2.2.3 Sampling and Testing 2005 and 2007

Heavy rains during the winter and spring of 2005 in Southern California deposited a large volume of sediment at the LA River mouth, creating a potential navigational hazard. Due to insufficient depths in the LARE channels, the USACE, Los Angeles District issued an emergency permit in Spring 2005 to side cast 15,000 cy of material from the main navigation channel to areas immediately adjacent to the channel so that Catalina Cruise vessels could resume operations from Queensway Marina. Conditions in the navigation channel after the emergency dredging remained restrictive due to the narrow width of the existing channel and reduced depths which ranged from -0.2 m (-0.7 ft) MLLW in the upper (northwest) portion of the proposed dredge area to -5.5 m (-18.0 ft) MLLW in the lower (southeast) portion.

In February of 2005, prior to the emergency dredging, Weston Solutions, Inc. (Weston) performed a Tier III sediment sampling and analysis program to evaluate approximately 415,000 cy of LARE dredge material (Weston, 2005). The proposed dredge footprint was subdivided into four sampling areas (Area 1 & 2, Area 3, Area 4, and the Sand Trap), each containing four to six separate core locations. Following sampling, chemical, physical, and biological testing and analyses were performed on composite samples from each area. Sediments from Area 1 & 2 was divided into top and bottom composite samples. Results from the 2005 investigation are summarized in Appendix A.

Based on an evaluation of the 2005 sediments, composite sediments from Area 3 and the Sand Trap met the Limiting Permissible Concentration (LPC) requirements for ocean disposal. The remaining areas (1 & 2 Top, 1 & 2 Bottom and 4) did not meet LPC requirements based solely on poor survival in solid phase (SP) toxicity tests with the amphipod *Eohaustorius estuarius*. However, a general lack of elevated chemistry in the sediments, the predominantly sandy nature of the material, and the high survival in subsequent tests with another amphipod test species suggested that factors other than sediment associated contaminants may have affected survival in *E. estuarius*, resulting in the apparent failure of material from 1 & 2 Top, 1 & 2 Bottom and Area 4 for ocean disposal. Consequently, supplemental Tier IV testing of material from these three areas was recommended to determine whether tests with *E. estuarius* were confounded by factors other than sediment-associated contaminants and to provide for a more definitive determination of suitability of the material with regard to potential ocean disposal. The objective of this supplemental sampling and analysis program was to evaluate dredged material from Area 1, Area 2 and Area 4 in order to reach a final determination regarding the suitability of the material for placement at either the LA-2 ODMDS, the LA Borrow Pit Inland Disposal Site, and/or possible beneficial replenishment of a nearby beach. Weston conducted the supplemental study in 2006 (Weston, 2007). Summary results from the supplemental testing are provided in Appendix B.

Chemical analyses were performed on project sediments from four of the 2006 sampling areas. Chemical concentrations in sediments were relatively low with only a few ERL exceedances (metals and DDTs) and one ERM exceedance (total chlordanes); all other chemicals were below ERL values.

Side-by-side SP toxicity tests with the amphipods *E. estuarius* and *R. abronius* were conducted on 2006 project sediments from all four areas (1 & 2 Top, 1 & 2 Bottom, 4 Top, and 4 Bottom). These SP test results indicated that sediment from Areas 1 & 2 Bottom, 4 Top and 4 Bottom met the LPC requirement for ocean disposal. Results of SP tests with *E. estuarius* on sediment from Area 1 & 2 Top demonstrated that this material did not meet the LPC requirement for ocean placement.

Bioaccumulation potential tests were also conducted on the 2006 project sediments from Area 1 & 2 Top, Area 1 & 2 Bottom, Area 4 Top, and Area 4 Bottom. Based on data from the Environmental Residue-Effects Database (ERED) and critical body residues, all contaminant concentrations in tissues of organisms exposed to LARE sediments were below published relevant effects levels. In addition, none of the chemicals in project areas that were measured above reference tissue concentrations have an affinity to biomagnify in marine food webs.

Sediments were ultimately dredged in 2008. Table 3 lists the locations the material was placed. About a 155,000 cy of that dredged material was placed at LA-2.

2.2.4 Sampling and Testing 2010

LARE sediments from two areas in 2010 were evaluated for placement in POLB Slip 1 Confined Disposal Facility (CDF) by Anchor QEA (2010). Cores were collected to a project elevation of -15 feet MLLW plus two feet for overdepth testing at four locations in each area. All four cores in each area were combined into composite samples for physical and chemical testing. Summary results are provided in Appendix C. These results indicated that the sediments contained between 51.5% and 94.4% sand. Concentrations of contaminants were relatively low with no ERM value exceedances. Several metals, total PCB Aroclors, DDT compounds, and chlordane compounds exceeded ERL values. Sediments were found to be suitable for placement in POLB Slip 1 and approximately 163,000 cy were subsequently placed there.

2.2.5 Sampling and Testing 2013/2014

The LARE federal channels and Sand Trap sediments were last sampled in late 2013 in support of the last maintenance dredging episode. At the time of sampling, there was approximately 677,000 cy of shoaled sediment, assuming a two foot overdepth. Sediments from 27 locations and three composite areas (LARE-1, LARE-2 and Sand Trap) were evaluated for potential placement at a beach nourishment nearshore area near Cherry Avenue in the City of Long Beach, the North Energy Island Borrow Pit (NEIBP) Confined Aquatic Disposal (CAD) Site, the Port of Long Beaches' Middle Harbor Phase II Slip Fill CDF, and the LA-2 ODMDS.

Full Tier II and III testing was conducted on the 2013 sediments including testing of modified elutriate test (MET) extracts to evaluate potential effluent from CDF placement. The results of this investigation were detailed in a report by Diaz Yourman & Associates, GeoPentech and Kinnetic Laboratories Joint Venture (2014). Summary results for this investigation are provided in Appendix D.

As part of this study, USACE, Los Angeles District conducted a physical suitability evaluation for placing the sediments at the Cherry Avenue nearshore placement area. This evaluation indicated that most LARE sediment would not be a good candidate for reuse at the nearshore area based on grain size characteristics. The test sediments consisted primarily of loose sandy silt (ML) with occasional trash and other debris. Sand content for the 2013 samples averaged only 35% to 45% among the three composite areas. Poorly graded sand (SP) or silty sand (SM) was encountered at numerous locations many feet below the mudline but prior to the overdepth elevation. These sediments were deemed suitable if they could be isolated during dredging.

Compared to empirical effects based screening levels and LA-2 reference data, some contaminant concentrations in the 2013 LARE sediments were elevated. Contaminants exceeding ERL values in one or more composite samples included several metals including mercury, total PCB congeners, 4,4'-DDE, total DDT, and fluorene. In addition, total chlordane and bis-(2-ethylhexyl) phthalate exceeded ERM screening levels in one or more samples. Of the compounds exceeding an effects level, only 4,4'-DDE and total DDT were detected in the LA-2 reference sample at concentrations exceeding ERL values. Also worth mentioning is that a few phenolic compounds and the pyrethroid pesticides bifenthrin and cis- and trans-permethrin, for which effects based screening levels are not available, were noticeably elevated compared to LA-2 reference data.

Contamination in the 2013 sediments was not severe enough to cause any statistically significant benthic toxicity. There was, however, some water column toxicity, but initial mixing calculations showed that the LPC would not be exceeded. There was also statistically significant bioaccumulation of lead, DDTs, PCBs, and chlordane in the LARE test tissues. However, levels were determined to represent minimal threat to the marine benthic environment at LA-2 ODMDS. Therefore, the report indicated that most of the LARE sediments should be suitable for placement at the LA-2 ODMDS. There was 640,000 cy of suitable sediments that were subsequently dredged from the LARE channels and placed at the LA-2 ODMDS. However, there were two areas the USEPA identified, based on the results of the individual boring chemistry mentioned above, as being <u>not</u> suitable for placement at the LA-2 ODMDS. These areas are identified on Figures 6, 8 and 9 and sediments in these areas were left in place during dredging.

2.3 Previous Queens Gate Dredging Episodes

From November 1998 to December 2000, the POLB Approach Channel was deepened from -60 feet MLLW to -76 feet MLLW. There has been no maintenance dredging conducted there since the deepening,

In preparation for the deepening project, the Approach Channel was sampled and tested in 1994. A total of 45 vibracore borings were collected along the 1,200 ft wide and 15,000 ft long channel. Grain size analyses, in support of potential beach nourishment reuse, were conducted on all 45 cores. In addition, chemical analyses were conducted on a subset of 28 of these cores. One to four layers from each of the 28 cores were analyzed, depending on the geologic stratification. As part of determining if the Approach Channel sediments are compatible with City of Long Beach receiving beaches and various other nearshore placement areas, a series of sediment diver core samples were also collected along six beach transects and at several nearshore placement areas. The results of from all core and grab locations are provided in a report by Sea Surveyor (1994).

Vibracore locations 12, 15 and 17 from the 1994 study are the closest locations to the current shoaled area in the Approach Channel. Summary results for these locations are provided in Appendix E along with a map of locations. According to the 1994 geotechnical logs (Appendix E), the 12, 15 and 17 cores consisted primarily of sand (SP) and silty sand (SP-SM) in the top five to ten feet of sediment. Below that, the sediments were predominantly silt (ML or MH) and/or lean clay (CL) down to an elevation of about -75 feet MLLW. The weighted average sand content for these boring locations were not reported in the Sea Surveyor report.

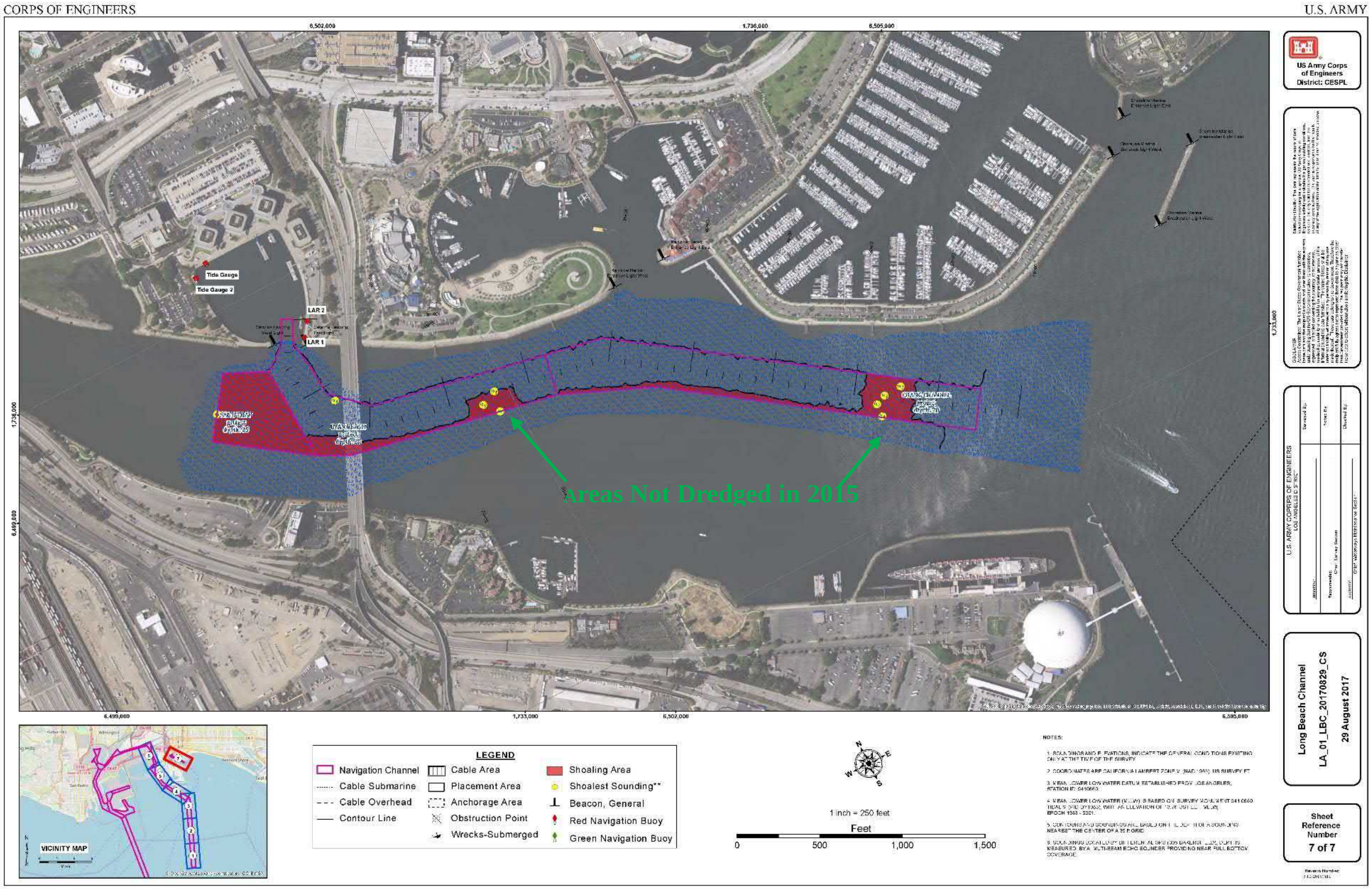


Figure 6. Location of LARE Channel Areas Unsuitable for LA-2 ODMDS Placement and not Dredged in 2015.

Chemical testing of the sediments was only conducted on the 1994 locations 12 and 17. A top and bottom layer was analyzed separately for both cores. The only organic contamination detected in the core segments were phthalate compounds and low levels of tributyltin. All detected metal concentrations were below ERL values. The report concluded that the sediments were acceptable for all placement options.

Beach compatibility analysis showed that approximately half of the core samples were physically compatible for beach nourishment at Long Beach, Surfside/Sunset Beach, and Seal Beach. These were the original placement sites chosen. However, final placement occurred at Energy Islands North (811,000 cubic meters), West Anchorage (2,924,000 cubic meters), and at the Palos Verdes Shelf (93,000 cubic meters). Placement at the Palos Verdes Shelf was part of a pilot capping program conducted for the USEPA for the Palos Verdes Shelf Superfund Site.

3.0 METHODS

This section describes dredging design, study design, and field and analytical methods for this testing program.

3.1 Dredge Design

Bathymetric data from a May 2018 condition survey are shown on Figures 7 through 9 for the LARE federal channels and for the upstream Sand Trap. August 2017 bathymetric data for the POLB Approach Channel are shown on Figure 3. Actual sampling locations are also shown on each of these figures. Dredge volumes for each dredge unit identified for dredging are provided in Table 1. These volumes are based on dredging to project elevations plus two feet for overdepth. Design depths are -25 feet MLLW for the upper LARE federal channel and sand trap area and -21 feet MLLW for the lower LARE federal channel. The design depth of the POLB Approach Channel is -76 feet MLLW.

3.2 Study Design

The study design detailed in the SAP for this project and summarized below covered data collection tasks for the LARE federal channel and Sand Trap, the POLB Approach Channel shoaled area, the Chaffee Island Nearshore Placement Site, and the LA-2 reference site. The study design is based on sediment sampling for environmental and geotechnical testing utilizing a vibracore borehole sampler for the LARE and POLB Approach Channel dredge units and grab samplers for the Chaffee Island Nearshore Placement Site and the LA-2 reference site.

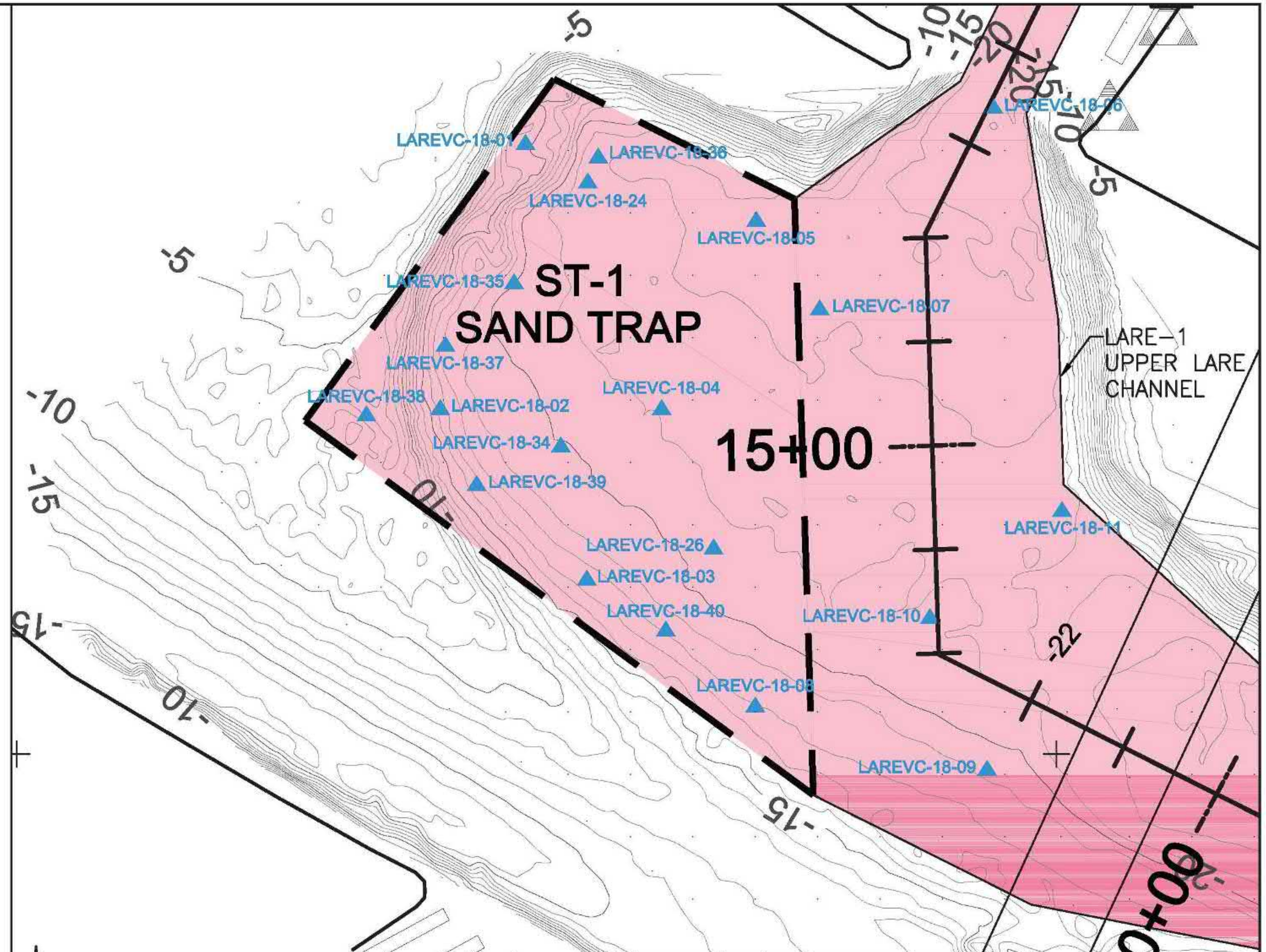
All sampling and testing followed requirements and procedures detailed in the OTM (USEPA/USACE, 1991) and ITM (USEPA/USACE, 1998) with further guidance from SC-DMMT and CSTF draft guidelines. Acceptability guidelines published in these documents were used to evaluate the suitability of the sediments to be dredged for each of the placement options.

3.2.1 Sample Identification, Sediment Collection and Composite Formation

Sediment sampling at LARE took place from June 11, 2018 through June 14, 2018. Sediment sampling in the POLB Approach Channel occurred on June 14, 2018. The sample ID prefix is "LAREVC-18-#" for all LARE locations and "QGVC-18-##" for the Queens Gate locations.

Grab sampling was also conducted at 11 locations in the Chaffee Island Nearshore Placement Site and at one location at the LA-2 reference site. Sediment sampling at the Chafee Island Nearshore Placement Site took place on June 7, 2018, and sediment sampling at the LA-2 reference site took place on June17, 2018. The sample ID prefix is "CINS-18-##" for the Chaffee Island Nearshore Placement Site locations and "LA2REF-18" for the LA-2 reference site. The Chaffee Island locations were tested individually for grain size only. Tier II and III testing was conducted on the LA-2 reference sediments.

A total of 40 locations were sampled within the LARE channels and four locations were sampled in the POLB Approach Channel. All samples were collected with an electric vibracore from the *RV DW Hood*. Core locations sampled by dredge area (actual) are depicted on Figures 7 through 9 along with the most recent bathymetric data. Date and time of sampling, final sampling coordinates, and sampling elevations for each core are summarized in Tables 4 through 7.



LARE ESTUARY ASBUILT VIBRACORE COORDINATES, SAND TRAP AREA

VIBRACORE No.	NORTHING	EASTING
LAREVC-18-01	1,735,587	6,500,489
LAREVC-18-02	1,735,332	6,500,407
LAREVC-18-03	1,735,168	6,500,548
LAREVC-18-04	1,735,332	6,500,620
LAREVC-18-05	1,735,513	6,500,711
LAREVC-18-08	1,735,046	6,500,710
LAREVC-18-24	1,735,550	6,500,549
LAREVC-18-26	1,735,198	6,500,670
LAREVC-18-34	1,735,296	6,500,523
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LAREVC-18-36	1,735,574	6,500,559
LAREVC-18-37	1,735,393	6,500,412
LAREVC-18-38	1,735,326	6,500,336
LAREVC-18-39	1,734,259	6,500,442
LAREVC-18-40	1,735,119	6,500,624

LEGEND

LAREVC-18-01 — LARE ESTUARY, ASBUILT VIBRACORE, YEAR AND NUMBER

AREAS AT -25 FT MLLW (PROJECT DESIGN DEPTH) AND ABOVE WITHIN SAND TRAP AND UPPER LARE CHANNEL AREAS

100' 0 100' 200'

SCALE: 1"=100'

N

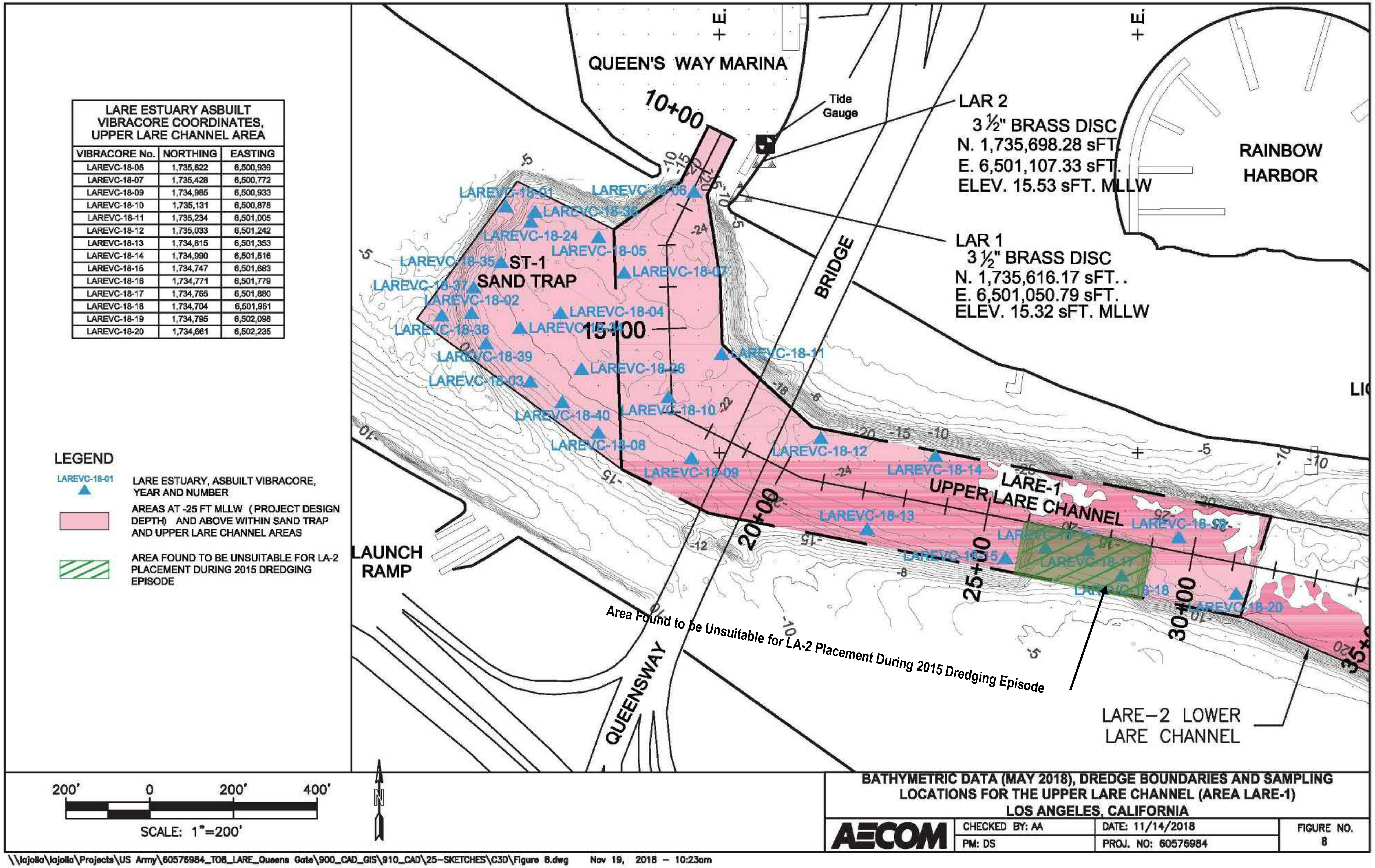
BATHYMETRIC DATA (MAY 2018), DREDGE BOUNDARIES AND SAMPLING LOCATIONS FOR THE SAND TRAP (AREA ST-1)
LOS ANGELES, CALIFORNIA

AECOM

CHECKED BY: AA	DATE: 11/14/2018	FIGURE NO.
PM: DS	PROJ. NO: 60576984	7

\\lajolla\lajolla\Projects\US Army\60576984_TO8_LARE_Queens Gate\900_CAD_GIS\910_CAD\25-SKETCHES\C3D\Figure 7.dwg Nov 19, 2018 - 10:22am

Figure 7. Bathymetric Data (May 2018), Dredge Boundaries and Sampling Locations for the Sand Trap (Area ST-1).



LARE ESTUARY ASBUILT VIBRACORE COORDINATES, UPPER LARE CHANNEL AREA

VIBRACORE No.	NORTHING	EASTING
LAREVC-18-06	1,735,622	6,500,939
LAREVC-18-07	1,735,428	6,500,772
LAREVC-18-09	1,734,985	6,500,933
LAREVC-18-10	1,735,131	6,500,878
LAREVC-18-11	1,735,234	6,501,005
LAREVC-18-12	1,735,033	6,501,242
LAREVC-18-13	1,734,815	6,501,353
LAREVC-18-14	1,734,990	6,501,516
LAREVC-18-15	1,734,747	6,501,683
LAREVC-18-16	1,734,771	6,501,779
LAREVC-18-17	1,734,765	6,501,880
LAREVC-18-18	1,734,704	6,501,961
LAREVC-18-19	1,734,795	6,502,098
LAREVC-18-20	1,734,661	6,502,235

Figure 8. Bathymetric Data (May 2018), Dredge Boundaries and Sampling Locations for the Upper LARE Channel (Area LARE-1).

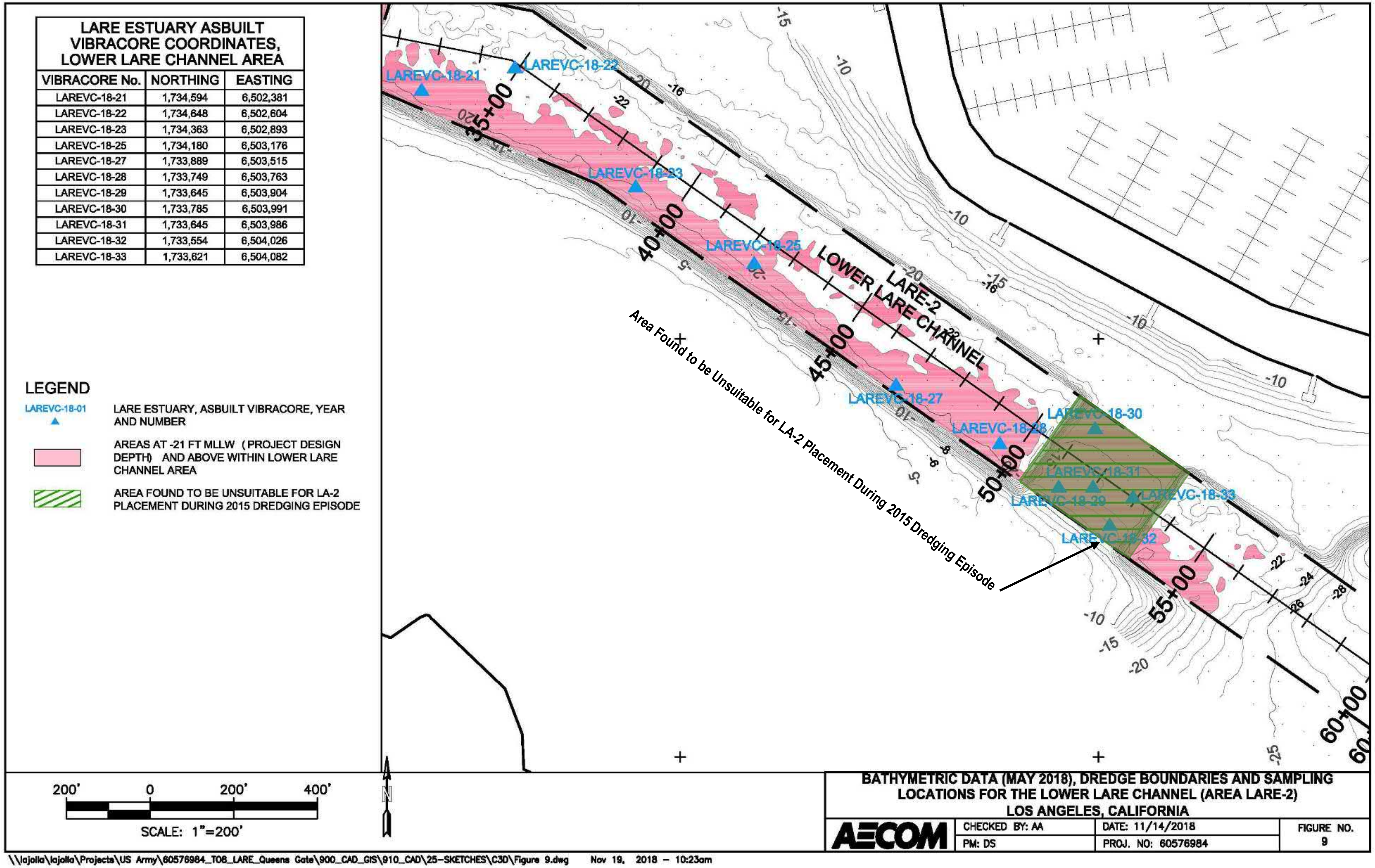
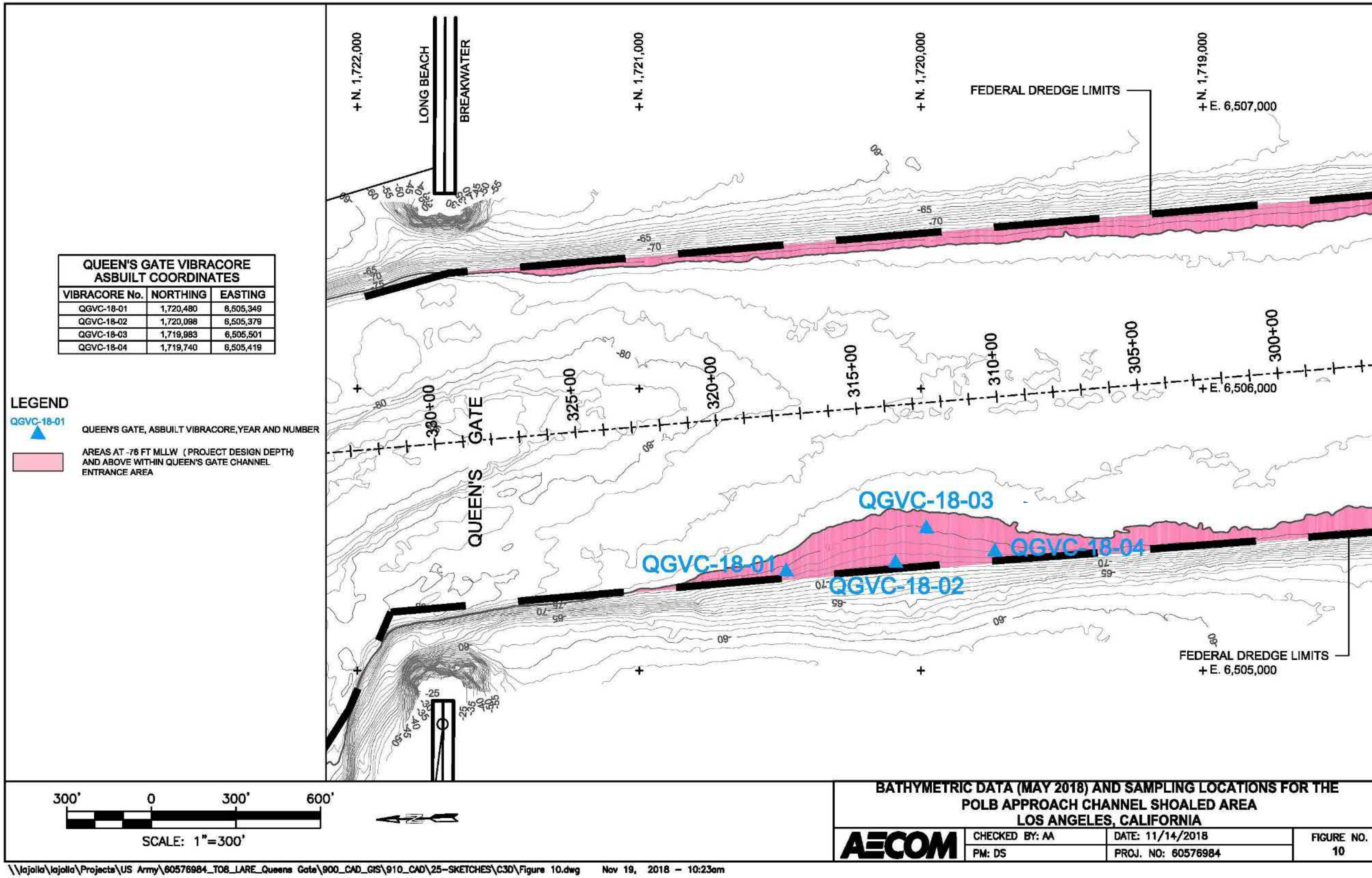


Figure 9. Bathymetric Data (May 2018), Dredge Boundaries and Sampling Locations for the Lower LARE Channel (Area LARE-2).



QUEEN'S GATE VIBRACORE ASBUILT COORDINATES

VIBRACORE No.	NORTHING	EASTING
QGVC-18-01	1,720,480	6,505,349
QGVC-18-02	1,720,098	6,505,379
QGVC-18-03	1,719,983	6,505,501
QGVC-18-04	1,719,740	6,505,419

Figure 10. Bathymetric Data (August 2017) and Sampling Locations for the POLB Approach Channel Shoaled Area.

Table 4. Actual Sampling Location Coordinates, Date and Time of Sampling, Core Depths, Mudline Elevations, and Sampling Elevations for the Los Angeles River Estuary Sand Trap Composite Area.

Core Designation (LAREVC-18-)	Date Sampled	Time Sampled	California Lambert Zone 5 (NAD 83)		Geographic Coordinates (NAD 83)		Water Depth (feet)	Actual Mudline Elevation (ft., MLLW)	Core Recovery (ft.)	Core Interval Sampled (ft., MLLW)	Multiple Cores Collected for Volume? (Y or N)
			Northing (feet)	Easting (feet)	Latitude North	Longitude West					
01[1]	6/11/2018	14:30	1735587	6500489	33º 45.680′	118º 12.076′	14.5	-13.0	7.0[1]	-13.0 to -20	N
02[2]	6/11/2018	16:08	1735332	6500407	33º 45.638′	118º 12.092′	14.7	-12.0	1.0[2]	--	N
03[3]	6/13/2018	08:45	1735168	6500548	33º 45.611′	118º 12.064′	20.4	-17.3	5.5[3]	-17.3 to -22.8	N
04	6/13/2018	13:43	1735332	6500620	33º 45.638′	118º 12.050′	22.8	-20.6	9.6	-20.6 to -27	N
05	6/13/2018	13:10	1735513	6500711	33º 45.668′	118º 12.032′	24.0	-21.4	7.9	-21.4 to -27	N
08	6/13/2018	08:10	1735046	6500710	33º 45.591′	118º 12.032′	21.2	-19.0	8.0	-19.0 to -27	N
24[4]	6/13/2018	12:36	1735550	6500549	33º 45.674′	118º 12.064′	23.5	-20.6	11.3	-20.6 to -27	N
26[4]	6/13/2018	14:10	1735198	6500670	33º 45.616′	118º 12.040′	22.5	-20.6	10.5	-20.6 to -27	N
34[5]	6/13/2018	11:11	1735296	6500523	33º 45.632′	118º 12.069′	24.0	-20.2	9.0	-20.2 to -27	N
35[5]	6/13/2018	11:43	1735453	6500478	33º 45.658′	118º 12.078′	23.5	-20.0	9.5	-20.0 to -27	N
36[6]	6/14/2018	14:14	1735574	6500559	33º 45.678′	118º 12.062′	23.7	-21.3	8.5	-21.3 to -27	N
37[6]	6/14/2018	13:43	1735393	6500412	33º 45.648′	118º 12.091′	21.1	-18.4	4.8[7]	-18.4 to -23.2	N
38[6]	6/14/2018	16:36	1735326	6500336	33º 45.637′	118º 12.106′	13.0	-9.9	1.0[7]	-9.9 to -10.9	N
39[6]	6/14/2018	15:00	1735259	6500442	33º 45.626′	118º 12.085′	18.6	-16.6	6.8[7]	-16.6 to -23.4	N
40[6]	6/14/2018	15:22	1735119	6500624	33º 45.603′	118º 12.049′	21.0	-19.1	11.2	-19.1 to -27	N

[1]Core refusal at this location due to leafy debris. Three attempts were made. Longest of three cores was kept.
[2]Core refusal at this location due to leafy debris. Three attempts were made. Only leafy debris collected. Not included in sediment composite sample.
[3]Core refusal at this location. Two attempts were made. Longest of two cores was kept.
[4]These cores were moved from the LARE-2 composite area to the Sand Trap because of the lack of shoaling in the vicinity of the LARE-2 SAP locations.
[5]Supplmental core location. Sample included in the Chemical and Tier III composite sample.
[6]Supplmental core location. Sample not included in the Chemical and Tier III composite sample. Logged and sampled for geotechnical purposes. Archive chemistry sample collected.
[7]Core refusal at these locations due to leafy debris. One attempt was made.

Table 5. Actual Sampling Location Coordinates, Date and Time of Sampling, Core Depths, Mudline Elevations, and Sampling Elevations for the Los Angeles River Estuary LARE-1 Federal Channel Composite Area.

Core Designation (LAREVC-18-)	Date Sampled	Time Sampled	California Lambert Zone 5 (NAD 83)		Geographic Coordinates (NAD 83)		Water Depth (feet)	Actual Mudline Elevation (ft., MLLW)	Core Recovery (ft.)	Core Interval Sampled (ft., MLLW)	Multiple Cores Collected for Volume? (Y or N)
			Northing (feet)	Easting (feet)	Latitude North	Longitude West					
06	6/12/2018	07:45	1735622	6500939	33º 45.686′	118º 11.987′	26.7	-23.8	10.0	-23.8 to -27	N
07	6/12/2018	08:10	1735428	6500772	33º 45.654′	118º 12.020′	25.2	-21.9	11.0	-21.9 to -27	N
09	6/12/2018	09:50	1734985	6500933	33º 45.581′	118º 11.988′	24.6	-20.8	11.5	-20.8 to -27	N
10	6/12/2018	08:38	1735131	6500878	33º 45.605′	118º 11.999′	24.5	-20.9	8.2	-20.9 to -27	N
11	6/12/2018	09:03	1735234	6501005	33º 45.622′	118º 11.974′	24.9	-21.1	10.0	-21.1 to -27	N
12	6/12/2018	10:28	1735033	6501242	33º 45.589′	118º 11.927′	26.7	-23.0	12.0	-23.0 to -27	N
13[1]	6/11/2108	18:00	1734815	6501353	33º 45.553′	118º 11.905′	25.6	-20.8	9.5	-20.8 to -27	N
14[1]	6/12/2018	10:53	1734990	6501516	33º 45.582′	118º 11.873′	27.6	-24.0	9.2	-24.0 to -27	N
15[2,3]	6/11/2018	18:55	1734747	6501683	33º 45.542′	118º 11.840′	22.6	-17.0	10.0	-17.0 to -27	N
16[2]	6/12/2018	19:30	1734771	6501779	33º 45.546′	118º 11.821′	18.8	-13.2	13.8	-13.2 to -27	N
17[2]	6/12/2018	18:35	1734765	6501880	33º 45.545′	118º 11.801′	18.0	-13.0	15.8	-13.0 to -27	N
18[2]	6/13/2018	09:52	1734704	6501961	33º 45.538′	118º 11.785′	15.9	-12.1	14.5	-12.1 to -26.6	N
19[2]	6/12/2018	12:15	1734795	6502098	33º 45.550′	118º 11.758′	27.7	-25.0	6.3	-25.0 to -27	N
20	6/12/2018	11:22	1734661	6502235	33º 45.528′	118º 11.731′	27.3	-24.0	7.5	-24.0 to -27	N

[1]Individual cores analyzed for PCBs.
[2]Individual cores analyzed for the full suite of bulk sediment chemical analyses.
[3]Excluded from the Area Tier III Composite Sample.

Table 6. Actual Sampling Location Coordinates, Date and Time of Sampling, Core Depths, Mudline Elevations, and Sampling Elevations for the Los Angeles River Estuary LARE-2 Federal Channel Composite Area.

Core Designation (LAREVC-18-)	Date Sampled	Time Sampled	California Lambert Zone 5 (NAD 83)		Geographic Coordinates (NAD 83)		Water Depth (feet)	Actual Mudline Elevation (ft., MLLW)	Core Recovery (ft.)	Core Interval Sampled (ft., MLLW)	Multiple Cores Collected for Volume? (Y or N)
			Northing (feet)	Easting (feet)	Latitude North	Longitude West					
21	6/12/2018	13:14	1734594	6502381	33º 45.517′	118º 11.702′	22.9	-20.9	6.2	-20.9 to -23	Y
22	6/12/2018	13:55	1734648	6502604	33º 45.526′	118º 11.658′	22.6	-21.0	7.0	-22.6 to -23	Y
23	6/12/2018	17:25	1734363	6502893	33º 45.479′	118º 11.601′	24.5	-20.8	6.0	-20.8 to -23	Y
25	6/12/2018	14:46	1734180	6503176	33º 45.449′	118º 11.545′	22.3	-20.8	7.0	-20.8 to -23	Y
27	6/12/2018	15:20	1733889	6503515	33º 45.401′	118º 11.478′	22.5	-20.8	5.1	-20.8 to -23	Y
28[1]	6/12/2018	15:53	1733749	6503763	33º 45.378′	118º 11.429′	22.7	-20.6	6.4	-20.6 to -23	Y
29[1]	6/13/2018	14:50	1733645	6503904	33º 45.361′	118º 11.401′	16.3	-14.6	10.0	-14.6 to -23	N
30[1]	6/13/2018	15:52	1733785	6503991	33º 45.384′	118º 11.384′	17.9	-16.2	10.5	-16.2 to -23	N
31[1]	6/13/2018	15:20	1733645	6503986	33º 45.361′	118º 11.385′	16.2	-14.6	11.0	-14.6 to -23	N
32[1]	6/13/2018	16:45	1733554	6504026	33º 45.346′	118º 11.377′	17.0	-14.8	11.2	-14.8 to -23	N
33[1]	6/13/2018	16:16	1733621	6504082	33º 45.357′	118º 11.366′	16.5	-14.5	11.2	-14.5 to -23	N

[1]Individual cores analyzed for the full suite of bulk sediment chemical analyses.

Table 7. Actual Sampling Location Coordinates, Date and Time of Sampling, Core Depths, Mudline Elevations, and Sampling Elevations for POLB Approach Channel Near Queens Gate.

Core Designation (QGVC-18-)	Date Sampled	Time Sampled	California Lambert Zone 5 (NAD 83)		Geographic Coordinates (NAD 83)		Water Depth (feet)	Actual Mudline Elevation (ft., MLLW)	Core Recovery (ft.)	Core Interval Sampled (ft., MLLW)[1]	Multiple Cores Collected for Volume? (Y or N)
			Northing (feet)	Easting (feet)	Latitude North	Longitude West					
01	6/14/2018	09:06	1720480	6505349	33º 43.188′	118º 11.109′	78.0	-75.2	6.8	-75.2 to -78	Y
02	6/14/2018	08:30	1720092	6505379	33º 43.127′	118º 11.105′	77.0	-75.0	6.8	-75.0 to -78	Y
03	6/14/2018	08:01	1719983	6505501	33º 43.109′	118º 11.087′	77.0	-75.3	4.3	-75.3 to -78	Y
04	6/14/2018	07:51	1719740	6505419	33º 43.069′	118º 11.097′	77.0	-75.7	7.0	-75.7 to -78	Y

Unusual sediment characteristics were encountered in the Sand Trap (ST-1) dredge unit that called for supplemental locations to be sampled. Core rejection was encountered at a few locations due to the presence of a dense mat of decaying vegetation and other debris. The Project SAP called for six locations to be sampled in ST-1. In order to obtain actual sediment for testing and to delineate the extent of the vegetative mat, nine additional locations were sampled in ST-1. Sediments from four of these locations, as indicated in Table 4, were included in the ST-1 sediment composite sample. Sediments in the cores for the remaining five locations were logged, submitted for grain size analyses and archived. They were not included in the sediment composite sample. Since no sediment was recovered in the core from LAREVC-18-2, this location was not part of the sediment composite sample.

Another situation was encountered in the LARE-2 area. No shoaling above design depth could be located in the vicinity of LARE-2 SAP Locations 24 and 26. Therefore, these two locations were not sampled in LARE-2 and were moved to supplement ST-1.

Continuous samples from the mudline to project depths plus two feet for overdepth testing (-27 feet MLLW for LARE-1 and ST-1, -23 feet MLLW for LARE-2 and -78 feet MLLW for QGVC-18) were collected from all core locations unless rejection was encountered. Except as noted above, these primary core intervals were homogenized and then combined with the primary core intervals from all other cores within a dredge unit to form the area composite samples. The basic approach for overdepth sampling and testing was consistent with the US Army Corps of Engineers' draft guidance document on "overdepth" allowance (USACE, 2005) and with a memorandum from the Director of Civil Works for the USACE to USACE Commanders of Major Subordinate Commands on assuring the adequacy of environmental documentation for the maintenance dredging of federal navigation projects (USACE, 2006). Sediments below overdepth elevations were not included in the sediment composite sample.

Each of the 44 cores collected were also logged for geotechnical properties and strata present and sampled for physical properties according to strata present. The basic approach was to collect a single geotechnical sample from the "fluff layer" (top six inches or so of the core) if present and for every strata six inches or greater in length. The sampling crew coordinated with the USACE Project Technical Manager on the selection of additional testing samples per borehole and archive samples. Data from all geotechnical samples collected were used to determine which sediments within the entire maintenance dredging area can be beneficially reused at the Chaffee Island nearshore site.

In addition to the geotechnical samples, at least one primary archive bulk sediment chemistry sample was collected from each core location. The LARE sediments were previously sampled and tested in 2013/2014. Subsequent to the testing, there were two areas the USEPA identified as being not suitable for placement at the LA-2 ODMDS. These areas are identified on Figures 8 and 9, and sediments in these areas were left in place during the previous dredging episode. As such, 11 locations within and adjacent to these areas were analyzed individually for bulk sediment chemistry. The primary archive and individual core samples represented a composite of the entire primary core interval (mudline to overdepth elevations). Further archiving was performed if any other suspicious potential contaminated layer exists or if there was a significant change in the stratigraphy greater than two feet. All archive samples are being stored frozen for at least six months unless directed otherwise by the USACE Technical Manager. The 11 locations that were analyzed individually are identified in Tables 5 and 6 as LAREVC-18-15 through LAREVC-18-19 and LAREVC-18-28 through LAREVC-18-33.

After the bulk sediment chemistry archives and geotechnical samples were collected, the remaining material left in each core was used for horizontal composite formation according to the compositing scheme identified in Tables 4 through 7 and with the exception noted below. These composite samples were analyzed for bulk sediment chemistry to assess all placement options. In addition, composite samples were tested for benthic and water column toxicity and bioaccumulation potential to assess open water placement. Except for water column toxicity testing, a sample of LA-2 reference material underwent the same testing.

Chemical results from the LARE composite samples and from the 11 individual core analyses conducted in the and adjacent to the 2013/2014 exclusion areas were summarized in a preliminary report (AECOM and Kinnetic Laboratories, 2018b). The USEPA reviewed this report and the results were discussed on a July 6, 2018 conference call. During this call, an agreement was made to exclude sediment from LAREVC-18-15 from the Tier III composite sample because of elevated PCBs. In addition, the USEPA requested that PCB analyses be conducted on individual archive samples for the LAREVC-18-13 and LAREVC-18-14 locations to the west of the 2013/2014 LARE-1 exclusion area (Figure 8).

3.2.2 Summary of Testing and Evaluation Sequence

The testing and evaluation sequence for LARE and the POLB Approach Channel is as follows:

- Conduct bulk sediment chemical analyses on the composite samples and eleven of the individual cores.
- Grain size physical compatibility analyses was conducted by the Los Angeles District U.S. Army Corps of Engineers Geotechnical Branch (Appendix E).
- Analytical results were evaluated using the sediment quality guidelines consisting of Effects Range Low (ERL) and Effects Range Medium (ERM) values developed by Long, *et al*. (1995) that correlate concentrations of selected contaminants with likelihood of adverse biological effects.
- Analytical results were also evaluated using the USEPA's RSL (Regional Screening Levels) (USEPA Region 9, updated 2018) and the State of California's CHHSL (California Human Health Screening Levels) for potential effects to humans (Cal/EPA, 2005 – updated 2010).
- Tier III testing on the composite samples, as prescribed by the OTM for ocean placement, comprised of elutriate bioassays with three water column species, benthic sediment bioassays with two infaunal species, and evaluation of bioaccumulation potential using two sediment-dwelling organisms. After bioassays and tissue analyses were complete, results were evaluated to determine if the sediments exceeded OTM and USEPA Region 9 criteria for open water placement.

If grain size characteristics are compatible with the beach nearshore site, contaminant levels are low compared to lower effects based screening levels and human health screening levels, and the sediments were not toxic to benthic organisms, then the sediments are suitable for nearshore placement. If the sediment contaminant levels are low, the sediments are not toxic to benthic, the sediments are not toxic to water column species after initial mixing, and the bioaccumulation potential of contaminants of concern is low, then the sediments are suitable for open water placement. Testing sequences for both placement/reuse alternatives are discussed separately in more detail in the subsections that follow.

3.2.3 Initial Sediment Testing –Physical Testing and Bulk Sediment Chemistry

Initial physical and chemical sediment testing was carried out with accelerated laboratory turnaround times so that these sediments could be evaluated early for the feasibility of placement options. This allowed decisions to be made in a timely manner, within prescribed sample holding times as to the necessity for additional bioassay/bioaccumulation tests required for ocean placement. Bulk sediment physical (individual only) and chemistry analyses for all composite samples and the 11 individual samples identified in Tables 5 and 6 included the following:

- Grain Size Analyses
- Total Organic Carbon (TOC)
- Percent Solids
- Metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Ag and Zn)
- Total Ammonia
- Total Volatile Solids (TVS)
- Oil and Grease
- Total Recoverable Petroleum Hydrocarbons (TRPH)
- Butyltins
- Chlorinated Pesticides
- Pyrethroid Pesticides
- Polychlorinated Biphenyl (PCB) congeners (41 total)
- Phenols
- Phthalate Esters
- Polycyclic Aromatic Hydrocarbons (PAHs)

3.2.4 Reuse for Beach Nourishment

Placement at the Chaffee Island nearshore site in order to replenish sand in front of Belmont Shores and along the Alamitos Peninsula is an option that was evaluated. For consideration of use of these dredged sediments for beach replenishment, coarse grain material is less likely to be a carrier of contamination. Per ITM guidance, dredged materials proposed for beach nourishment often can be excluded from chemical or biological testing and instead focus on determining physical compatibility with the candidate disposal area as measured by grain size and TOC. However, since the LARE channels and POLB Approach Channel shoaled areas are not isolated from sources of pollution, both grain size and bulk sediment chemistry testing were conducted for consideration for beach nourishment. Preliminary evaluation of sediment physical characteristics of the soils logs generated by visual examination were used to identify dredge areas where beach nourishment reuse might be feasible. Secondly, grain size, TOC, and other bulk sediment chemistry analytical results from the area composite samples were used as guidance as to whether these sediments might potentially be used for beach nourishment purposes.

To evaluate the Chaffee Island nearshore site, eleven (11) sediment surface grab samples were taken from random locations within the boundaries of the Chaffee Island Nearshore Placement Site (Figure 4) and subjected to grain size analyses. Final sampling coordinates, sampling times and water depths are provided in Table 8. The nearshore site grain size data were then evaluated by the USACE, Los Angles District for comparison with the LARE and Queens Gate dredge sediment physical properties. This evaluation is provided in Appendix E.

Table 8. Actual Sampling Location Coordinates, Date and Time of Sampling and Water Depths for the Chaffee Island Nearshore Placement Site.

Core Designation (CINS-18-)	Date Sampled	Time Sampled	California Lambert Zone 5 (NAD 83)		Geographic Coordinates (NAD 83)		Depth (feet MLLW)
			Northing (feet)	Easting (feet)	Latitude North	Longitude West	
01	6/7/2018	10:15	6520750.1	1729649.4	33º 44.7067′	118º 8.0750′	18
02	6/7/2018	10:25	6521458.7	1729061.9	33º 44.6100′	118º 7.9350′	17
03	6/7/2018	10:30	6522015.4	1728484.9	33º 44.5150′	118º 7.8250′	18
04	6/7/2018	10:35	6522462.2	1727988.8	33º 44.4333′	118º 7.7367′	16
05	6/7/2018	10:45	6522520.5	1727281.5	33º 44.3167′	118º 7.7250′	22
06	6/7/2018	10:50	6522460.5	1726735.7	33º 44.2267′	118º 7.7367′	23
07	6/7/2018	11:00	6521988.9	1727625.5	33º 44.3733′	118º 7.8300′	21
08	6/7/2018	11:05	6521525.1	1728263.0	33º 44.4783′	118º 7.9217′	20
09	6/7/2018	11:12	6521163.1	1728900.3	33º 44.5833′	118º 7.9933′	19
10	6/7/2018	11:20	6520824.7	1728567.2	33º 44.5283′	118º 8.0600′	20
11	6/7/2018	11:30	6521372.4	1727747.6	33º 44.3933′	118º 7.9517′	22

3.2.5 Placement at the LA-2 ODMDS

Chemical and biological testing requirements and procedures detailed in the OTM were used to evaluate the suitability of each testing area composite sample for unconfined aquatic (open water) placement. Tier III evaluations included statistical comparisons with sediment data collected from the LA-2 offshore reference area. As each phase of testing was completed, critical data review was performed to direct subsequent test phases. Based on initial sediment chemistry results and solid phase toxicity results, all composite samples underwent full Tier III testing.

To fully evaluate sediments for open water placement, the composite samples required the following additional testing:

- Whole sediment (SP) bioassays using amphipods and polychaete worms.
- Water column suspended particulate phase (SPP) bioassays using mysids, juvenile teleost fish, and bivalve larvae.
- Bioaccumulation exposures using clams and polychaete worms.
- Tissue analyses were based on sediment contaminant concentrations and recommendations summarized in the preliminary data report (AECOM and Kinnetic Laboratories, 2018b).

After consultation with the USEPA during the July 6 conference call, it was agreed to follow the recommendations in the preliminary data report, which recommended the analysis of cadmium, copper, lead, zinc, chlordane compounds, DDT compounds and PCB congeners as well as lipids for each tissue replicate.

Except for the SPP bioassays, these same tests were performed on the sample collected from the LA-2 reference area.

3.2.6 Sediment Chemistry Evaluation Guidelines

As mentioned above, to aid in the evaluation of sediment test data, chemical concentrations of contaminants found within the sediments were compared to sediment quality guidelines (Long et. al., 1995) developed by NOAA. These guidelines were used to screen sediments for contaminant concentrations that might cause biological effects and to identify sediments for further toxicity testing. For any given contaminant, ERL guidelines represent the 10^{th} percentile concentration value in the NOAA database that might be expected to cause adverse biological effects and ERM guidelines reflect the 50^{th} percentile value in the database. Note that ERLs and ERMs were only used as a screening tool. They were not used to determine suitability.

Since gama-BHC (lindane) and bis-(2-Ethylhexyl) phthalate do not have associated ERL and ERM values, EPA derived Threshold Effects Levels (TELs) and Probable Effects Levels (PELs) (MacDonald, 1994) were used for these contaminants. TELs are the 15th percentile concentration from a dataset of toxic effects data and the median of a no-effect dataset. PELs are the 50th percentile of impacted toxic samples and the 85 percentile of non-impacted samples.

As an additional measure of potential toxicity, the mean ERM quotient (ERMq) for the composite samples was calculated according to Long et al. (1998a) and Hyland et al. (1999). ERMq is calculated by dividing each contaminant concentration by its respective ERM value and then summing the results and dividing through by the number of contaminants as shown in the following equation:

$$ERMQuotient = \frac{1}{24}\sum \frac{SampleConcentration}{ERM}$$

In cases where concentrations of measured contaminants was below the method detection limit (MDL), a value of ½ the MDL was used for the ERMq calculations. For a general overall indication of toxicity, a quotient less than 0.1 is indicative of a low probability (<12%) of a highly toxic response to marine amphipods (Long and MacDonald, 1998b). If there are no ERL exceedances in a sample, there is less than a 10% probability of a highly toxic response to marine amphipods. The probability of a highly toxic response increases to 71% for quotients greater than 1.0.

The dredge material was also assessed to whether or not it is suitable for human contact. To do so, the chemical results were compared to “Regional Screening Levels for Chemical Contaminants at Superfund Sites" (USEPA Region 9, updated 2018), formerly known as Preliminary Remediation Goals (PRGs). These screening levels (RSLs) were developed for Superfund/RCRA programs and are a consortium of USEPA Region 9 Preliminary Remediation Goals (PRGs), USEPA Region 3 Risked-Based Concentrations (RBCs) and EPA Region 6 Human Health Medium – Specific Screening Levels (HHMSSLs). RSLs are risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. RSLs used were based on a target hazard quotient of 0.1.

Human health risks from sediment exposure were also evaluated using California Human Health Screening Levels (CHHSLs). CHHSLs (Cal/EPA, updated 2010) are concentrations of 54 hazardous chemicals in soil or soil gas that are considered to be protective of human health. The CHHSLs were developed by the Office of Environmental Health Hazard Assessment (OEHHA) on behalf of California Environmental Protection Agency (Cal/EPA). CHHSLs were developed using standard exposure assumptions and chemical toxicity values published by the USEPA and Cal/EPA. CHHSLs used were developed separately for industrial/commercial settings and for residential settings.

3.2.7 Tier III Evaluation Guidelines

The SPP bioassays were conducted on the sediment composite samples in order to evaluate water quality effects from dumping dredged sediment through the water column at the LA-2 ODMDS. Standard elutriates were prepared with site water, and water used to make the dilutions was clean open-coast seawater. Concurrent bioassays were performed on 100%, 50%, 10% and 1% elutriate concentrations and laboratory control water. Results of elutriate bioassays were statistically compared with control water bioassays. Elutriates which produced significantly greater toxicity than control water have been identified. OTM guidelines for interpretation of suspended particulate-phase bioassays require that initial mixing calculations be performed to determine the concentration of liquid and suspended particulate material at edge of the mixing zone after dumping and within the mixing zone four hours after dumping for any sample producing toxicity sufficient to generate an LC_{50} or EC_{50} less than 100% elutriate. The statistical calculations to determine LC_{50}s and EC_{50}s were through interpolations. If the concentration at the edge of the mixing zone or within the mixing zone four hours after dumping did not exceed 1% of the LC_{50} or EC_{50}, the sediment is judged to comply with water column toxicity criteria.

Solid phase (SP or benthic) bioassay results were statistically compared with bioassay results from reference sediments collected in the vicinity of LA-2 ODMDS and with control sediments collected from the organisms' home environment. Guidelines for interpretation of benthic bioassay results are published in the OTM. If survival responses in test sediment were statistically lower than those in reference sediment and if the difference in mean survival between groups is greater than 10% (20% for amphipods), then the test sediment is considered to have the potential to significantly degrade the marine environment.

Twenty-eight-day bioaccumulation exposures were performed on five replicates of each composite sample. Composite sediment exposures were run concurrently with five replicate exposures to LA-2 reference sediments and five replicate exposures to control sediments. As mentioned previously, tissue samples generated were analyzed for cadmium, copper, lead, zinc, chlordane compounds, DDT compounds and PCB congeners.

Concentrations of metal and/or organic contaminants in tissues of organisms exposed to reference sediments were compared with concentrations in organisms exposed to test sediments. Constituents that showed statistically elevated concentrations in test tissues were considered to be potentially bioaccumulative and were then evaluated to determine if the tissue concentrations are important in terms of biological effects and human health concerns. This included comparisons of residue levels to Food and Drug Administration (FDA) Action Levels and relevant (lowest or no observable effects concentrations for whole body effects) Toxicity Reference Values (TRVs) from USACE's Environmental Residue-Effects Database (ERED) (https://ered.el.erdc.dren.mil/).

3.3 Field Sampling Protocols

Vibracore sampling, grab sampling, decontamination, sample processing and documentation procedures are discussed in this section.

3.3.1 Sediment Sampling

Vibratory borehole sampling was conducted from Kinnetic Laboratories' research vessel *DW HOOD*. This vessel is suitably equipped with winches and superstructure to handle the coring equipment. Positioning at the coring locations was accomplished using a Differential GPS (DGPS) navigation system. The accuracy of the DGPS was checked against a known benchmark daily. Water depths were measured with a graduated lead line and corrected to MLLW. Tidal stage was determined using NOAA tide prediction software checked against a local tide gauge, and was used to calculate the seafloor elevation/mudline for each site.

Kinnetic Laboratories' vibratory sampler consists of a 4-inch diameter aluminum coring tube, a stainless steel cutting tip, and a stainless-steel core catcher. Inserted into the core tubes were new, food-grade clean polyethylene liners. The vibrating unit has two counter-rotating motors encased in a waterproof aluminum housing. A three-phase, 240-volt generator powers the motors. The vibratory head and tube were lowered overboard using the ***DW Hood***'s A-frame and winch. If possible, the core tube was allowed to penetrate the surficial materials below the mudline as far as possible under the static weight of the vibratory unit. The unit was then vibrated until it reached beyond the project depth plus two feet for overdredge allowance or until the vibratory sampler was rejected from further penetration. The depth of refusal is defined as the depth at which the average rate of penetration is less than 1/10th (0.10 feet) of a foot/minute for a two-minute period. At sites where the depth of refusal was reached prior to the sample depth, at least one (1) additional attempt was made at nearby locations to reach the sample depth if there was a reasonable chance of obtaining better results. If refusal was encountered again, any material obtained from the longest of the cores was used for testing and the reason for refusal was be noted on the field log.

When penetration of the vibratory borehole sampler was complete, power was shut off to the vibra-head, and the vibratory sampler was brought aboard the vessel. A check valve located on top of the core tube reduced or prevented sediment loss during pull-out. The length of sediment recovered was noted by measuring down the interior of the core tube to the top of the sediment. The core tube was then detached from the vibra-head and the core cutter and catcher were removed. Afterwards, the core liners were removed and sealed on both ends until processed.

All sample contact surfaces were stainless steel, polyethylene, or Teflon® coated. Compositing tools were stainless steel. Except for the liners, all contact surfaces of the sampling devices and the coring tubes were cleaned for each sampling area. The cleaning protocol consisted of a site water rinse, a Micro-90® soap wash followed by a tap or site water rinse, and then finished with three deionized water rinses. The polyethylene core liners used were new and of food grade quality. All rinseate was collected in containers and disposed of properly.

3.3.2 Core Processing

Individual core strata were analyzed individually for grain size distribution. A composite sample was also formed from all cores in a dredge unit. The composite samples tested following the sequence outlined in Section 3.2. Archive samples were also obtained from each core as described earlier.

Whole cores were processed on a nearby dock. Cores were placed in a PVC core rack that was cleaned between cores. After placement in the core rack, core liners were split lengthwise to expose the recovered sediment. Once exposed, sediment that came in contact with the core liner were removed by scraping with a pre-cleaned, stainless steel spoon. Each core was photographed, measured, and lithologically logged in accordance with the Unified Soil Classification System (USCS) as outlined in ASTM Standards D-2488 (2006a) and D-2487 (2006b). Additional observations, such as the presence of trash and oil sheens, was also recorded. A geologist from AECOM did the lithologic logging along with collection of sample splits for geotechnical testing.

Photographs were taken of each core (each photograph covered a maximum two-foot interval) prior to sample processing and of sampling equipment and procedures. These pictures are provided in Appendix F with captions describing the subject and date.

Following logging, vertical composite subsamples were formed from each core by combining and homogenizing a representative sample from each core, as described in Section 3.2, in a pre-cleaned stainless steel tray. A 0.5-liter portion of each primary vertical composite subsample and significant core strata were placed in a pre-cleaned and certified glass jar with a Teflon®-lined for archived material. An additional 0.5-liter portion of the vertical composite samples from the 11 cores identified in Tables 5 and 6 were placed in another certified jar and chemically analyzed individually. Other portions representing each geologic stratum greater than six inches were placed in Ziploc bags for geotechnical testing. The remaining portion of each primary vertical composite subsample within each sampling interval identified for composite sample formation was placed in another pre-cleaned tray for area compositing with other cores from the same dredge unit. This composited material was placed in a one-liter jar with a Teflon®-lined lid for chemical analyses. The remaining portion of each core or an equally weighted portion of each core based on the length of the core was placed in pre-cleaned 3.5 gallon buckets with food grade LDPE liners. Horizontal compositing of these samples for Tier III testing took place at Kinnetic Laboratories' facility in Santa Cruz, CA on July 9, 2018 after review of the sediment chemistry results. As mentioned previously, sediment from the core collected at the LAREVC-18-15 location was not included in the LARE-1 composite sample.

During archive and composite sample formation, any visible rocks larger than small gravel were removed from the samples and not included in testing. Large trash and leafy debris were also removed.

All sediment samples were placed in a refrigerated truck immediately following sampling and maintained at 2 to 4°C until analyzed. The archive samples were initially refrigerated and then transferred to a freezer once they reached Kinnetic Laboratories'. A small amount of headspace will be allowed for the archive samples to prevent container breakage during freezing. All samples were handled under Chain of Custody (COC) protocols beginning at the time of collection. Redundant sampling data were also recorded on field log sheets.

3.3.3 Beach Nearshore Site Grab Samples

The top six inches of sand or sediment were collected at each Chaffee Island nearshore site sampling location. Sampling was conducted from the ***DW Hood*** using a Smith-McIntyre Grab. Positioning was accomplished using a DGPS navigation system. Water depths were measured with an onboard fathometer. The grab sampler was deployed at each location, and upon retrieval, the grab was visually inspected to ensure the sample was acceptable according to SOPs. Subsamples of each grab were collected using a plastic sampling scoop. One subsample was collected for grain size analyses from each sampling location. All samples for grain size analyses were transferred to pre-labeled sample containers (sealed plastic bags) and stored appropriately until they are ultimately transferred to AECOM's geotechnical laboratory for analysis.

3.3.4 LA-2 Reference and Control Sediments

A sample of reference sediments was collected for physical, chemical and biological testing. Samples were collected from the designated reference site in the vicinity of 33º 33.4′ and -118º 10.8′ (Figure 11). The LA-2 reference sample was obtained using a protocol cleaned, chain-rigged pipe dredge deployed from the *DW Hood*. Navigation, sample compositing, recording, and preservation procedures followed those described for vibracore sampling.

Samples of control sediment were collected for biological testing. Control sediment for the solid phase bioassays and bioaccumulation exposures were the "home sediment" from the areas where the animals were collected.

3.3.5 Water Sampling

Water was collected from the Queens Gate area for use in preparing elutriates for chemical analyses and bioassays. A sample of background water was also be collected to assess ambient aquatic metals chemistry. Water was pumped from mid-depth using protocol cleaned sample tubing. Water for background chemistry was placed in a one-liter, laboratory supplied plastic jar. Water for elutriate preparation was placed in QC grade (certified) cubitainers. Water samples were placed in a refrigerated truck and shipped to the analytical and bioassay laboratories, where they were held at 4°C ± 2º until used.

Figure 11. Location of LA-2 Reference Site.

3.3.6 Detailed Soils Log

A detailed soils log was prepared for each sampling location. At a minimum, this log included the project name, location designation, date, time, location, water depth, estimated tide, mudline elevation, type and size of sampling device used, depth of penetration, length of recovery, name of person(s) taking samples, depths below mudline of samples, and a description and condition of the sediment. Sediment descriptions were made in accordance with ASTM D 2488 (2006a), and included as a minimum: grain size, color, maximum particle size, estimation of density (sand) or consistency (silts and clays), odor (if present), and description of amount and types of organics and trash present. Completed sediment logs are provided in Appendix G.

3.3.7 Documentation and Sample Custody

All samples had their containers physically marked as to sample location. All samples were handled under COC protocols beginning at the time of collection. Redundant sampling data were also recorded on field data log sheets along with sampling coordinates, weather conditions, sea state and any deviations from the sampling plan and reasons for those deviations. A copy of the field data logs will be included in the Draft and Final Reports. Copies of these logs are included in this report as Appendix H. An inventory was made of all samples taken and delivered.

Standard COC procedures were used for all samples collected, transferred, and analyzed as part of this project, including archive samples. COC forms were used to identify the samples, custodians, and dates of transfer. Except if a shipping company is used, each person who had custody of the samples signed the COC form and ensure samples were stored properly and not left unattended unless properly secured.

Standard information on COC forms includes:

- Sample Identification;
- Sample Collection Date and Time;
- Sample Matrices (e.g., marine sediment);
- Analyses to be Performed;
- Container Types;
- Preservation Method;
- Sampler Identification;
- Dates of Transfer; and
- Names of Persons with Custody.

Copies of the COC records are included with the testing laboratory reports in Appendix I (chemistry) and Appendix J (bioassay).

A daily field activity log was maintained listing the beginning and ending time for every and all phases of operation, the names and responsibilities of all field personnel present, description and length of any delays, and weather and sea conditions. This log included DGPS and water depth calibration/verification notes.

As described in Sections 3.3.6, a detailed sediment log was prepared for each sampling location, including nearshore locations. These logs are provided in Appendix G.

3.4 Laboratory Testing Methods

Chemical analyses were initiated as soon as practical after the collection of samples and analyzed on a quick turnaround basis. Biological analyses were initiated after initial review of the sediment physical characteristics. Chemical analyses and biological testing of sediments for this project were carried out by Calscience Laboratories (Cal-ELAP No. 2944CA) and Pacific EcoRisk (NELAP No. 04225CA), respectively, using USEPA and USACE approved methodologies. Grain size analyses were carried out by AECOM.

3.4.1 Geotechnical Testing

Sieve analyses were performed according to ASTM D 422 (1963) on every individual core stratum, each nearshore site grab and on the LA-2 reference sediments. Required U.S. standard sieve sizes used included No. 4, 7, 10, 14, 18, 25, 35, 45, 60, 80, 120, 170, 200, and 230 sieves. In addition to the mechanical grain size samples, ten (10) hydrometer tests were run according to ASTM D 422 and ten (10) Atterberg Limits tests were run according to ASTM D 4318 (2005). The hydrometer and Atterberg tests were run on representative samples of fine grained material collected from the 43 successful sediment cores (sediment was not obtained from LAREVC-18-01). All sediment samples were classified in accordance with the Unified Soil Classification System (ASTM D 2487-06 and ASTM D 2488-06), as described earlier. Grain size compatibility of the proposed dredge material with the Chaffee Island reuse site was evaluated by USACE, Los Angeles District. This evaluation is attached as Appendix K.

3.4.2 Bulk Sediment and Tissue Chemical Analyses

The LARE and POLB Approach Channel sediment composite samples and the LA-2 reference sample were analyzed for the parameters, methods and quantification limits specified in Table 9. The results were reported in dry weight unless noted otherwise. As such, actual reporting limits in Table 9 have been dry weight adjusted. All analyses were conducted in a manner consistent with guidelines for dredge material testing methods in the USEPA/USACE OTM and ITM. Samples were extracted and analyzed within specified USEPA holding times, and all analyses were accomplished with appropriate quality control measures.

Discrete chemistry samples from each location have been archived frozen. If requested, additional direction will be provided for analysis.

Table 9. Sediment Analytical Methods and Quantitation Limits Achieved.

Analyte	Method	Method Detection Limits (Dry Weight)	Laboratory Reporting Limits (Dry Weight)	SAP Reporting Limits (Wet Weight)
CONVENTIONALS (mg/kg except where noted)				
Ammonia	SM 4500-NH3 B/C (M)	0.15-0.25	0.28-0.45	0.2
Percent Solids (%)	SM 2540 B	0.100	0.100	0.1
Total Organic Carbon (%)	EPA 9060A	0.024-0.039	0.069-0.11	0.05
Total Volatile Solids (%)	EPA 160.4M	0.10	0.10	0.1
Oil & Grease	EPA 1664A (M) HEM	11-18	14-23	10
TRPH	EPA 1664A (M) HEM-SGT	11-18	14-23	10
METALS (mg/kg)				
Arsenic	EPA 6020	0.120-0.197	0.138-0.226	0.1
Cadmium	EPA 6020	0.0788-0.129	0.138-0.226	0.1
Chromium	EPA 6020	0.0855-0.140	0.138-0.226	0.1
Copper	EPA 6020	0.0577-0.0946	0.138-0.226	0.1
Lead	EPA 6020	0.0908-0.149	0.138-0.226	0.1
Mercury	EPA 7471A	0.0082-0.0130	0.0279-0.0444	0.02
Nickel	EPA 6020	0.0697-0.114	0.138-0.226	0.1
Selenium	EPA 6020	0.101-0.165	0.138-0.226	0.1
Silver	EPA 6020	0.0431-0.0707	0.138-0.226	0.1
Zinc	EPA 6020	1.09-1.79	1.38-2.26	1.0
ORGANICS-CHLORINATED PESTICIDES (µg/kg)				
2,4' DDD	EPA 8270C (SIM)	0.11-0.86	0.28-2.3	0.2
2,4' DDE	EPA 8270C (SIM)	0.05-0.40	0.28-2.3	0.2
2,4' DDT	EPA 8270C (SIM)	0.088-0.70	0.28-2.3	0.2
4,4' DDD	EPA 8270C (SIM)	0.057-0.45	0.28-2.3	0.2
4,4' DDE	EPA 8270C (SIM)	0.058-0.46	0.28-2.3	0.2
4,4' DDT	EPA 8270C (SIM)	0.075-0.59	0.28-2.3	0.2
Total DDT	EPA 8270C (SIM)			0.2
Aldrin	EPA 8270C (SIM)	0.054-0.43	0.28-2.3	0.2
BHC-alpha	EPA 8270C (SIM)	0.082-0.65	0.28-2.3	0.2
BHC-beta	EPA 8270C (SIM)	0.096-0.76	0.28-2.3	0.2
BHC-delta	EPA 8270C (SIM)	0.13-1.0	0.28-2.3	0.2
BHC-gamma (Lindane)	EPA 8270C (SIM)	0.049-0.39	0.28-2.3	0.2
Chlordane-alpha	EPA 8270C (SIM)	0.095-0.75	0.28-2.3	0.2
Chlordane-gamma	EPA 8270C (SIM)	0.076-0.60	0.28-2.3	0.2
Oxychlordane	EPA 8270C (SIM)	0.10-0.82	0.28-2.3	0.2
Chlordane (Technical)	EPA 8081A	7.3-12	14-22	10
Cis-Nonachlor	EPA 8270C (SIM)	0.072-0.57	0.28-2.3	0.2
Dieldrin	EPA 8270C (SIM)	0.15-1.2	0.28-2.3	0.2
Endosulfan sulfate	EPA 8270C (SIM)	0.15-1.2	0.28-2.3	0.2
Endosulfan I	EPA 8270C (SIM)	0.082-0.65	0.28-2.3	0.2
Endosulfan II	EPA 8270C (SIM)	0.13-1.0	0.28-2.3	0.2
Endrin	EPA 8270C (SIM)	0.08-0.64	0.28-2.3	0.2
Endrin aldehyde	EPA 8270C (SIM)	0.14-1.1	0.28-2.3	0.2
Endrin ketone	EPA 8270C (SIM)	0.079-0.63	0.28-2.3	0.2
Heptachlor	EPA 8270C (SIM)	0.073-0.58	0.28-2.3	0.2
Heptachlor epoxide	EPA 8270C (SIM)	0.063-0.50	0.28-2.3	0.2
Methoxychlor	EPA 8270C (SIM)	0.096-0.76	0.28-2.3	0.2
Mirex	EPA 8270C (SIM)	0.056-0.44	0.28-2.3	0.2
Toxaphene	EPA 8081A	12-20	28-44	20
trans-Nonachlor	EPA 8270C (SIM)	0.061-0.48	0.28-2.3	0.2

Table 9. Sediment Analytical Methods and Quantitation Limits Achieved (Continued).

Analyte	Method	Method Detection Limits (Dry Weight)	Laboratory Reporting Limits (Dry Weight)	SAP Reporting Limits (Wet Weight)
ORGANICS-Pyrethroid Pesticides (µg/kg)				
Allethrin (Bioallethrin)	EPA 8270D (M)/TQ/EI	0.34-1.1	0.68-2.1	0.5
Bifenthrin	EPA 8270D (M)/TQ/EI	0.41-1.3	0.68-2.1	0.5
Cyfluthrin-beta (Baythroid)	EPA 8270D (M)/TQ/EI	0.34-1.1	0.68-2.1	0.5
Cyhalothrin-Lamba	EPA 8270D (M)/TQ/EI	0.34-1.1	0.68-2.1	0.5
Cypermethrin	EPA 8270D (M)/TQ/EI	0.34-1.1	0.68-2.1	0.5
Deltamethrin (Decamethrin)	EPA 8270D (M)/TQ/EI	0.34-1.1	0.68-2.1	0.5
Esfenvalerate/ Fenvalerate	EPA 8270D (M)/TQ/EI	0.34-1.1	0.68-2.1	0.5
Fenpropathrin (Danitol)	EPA 8270D (M)/TQ/EI	0.34-1.1	0.68-2.1	0.5
Fluvalinate	EPA 8270D (M)/TQ/EI	0.34-1.1	0.68-2.1	0.5
Permethrin (cis and trans)	EPA 8270D (M)/TQ/EI	0.68-2.1	1.4-4.2	1.0
Resmethrin/Bioresmethrin	EPA 8270D (M)/TQ/EI	0.57-1.8	0.68-2.1	0.5
Sumithrin (Phenothrin)	EPA 8270D (M)/TQ/EI	0.34-1.1	0.68-2.1	0.5
Tetramethrin	EPA 8270D (M)/TQ/EI	0.41-1.3	0.68-2.1	0.5
Tralomethrin	EPA 8270D (M)/TQ/EI	0.34-1.1	0.68-2.1	0.5
ORGANICS-BUTYLTINS (µg/kg)				
Monobutyltin	Krone et al., 1989	1.9-3.1	4.1-6.8	3.0
Dibutyltin	Krone et al., 1989	1.0-1.6	4.1-6.8	3.0
Tributyltin	Krone et al., 1989	2.0-3.4	4.1-6.8	3.0
Tetrabutyltin	Krone et al., 1989	1.0-1.7	4.1-6.8	3.0
ORGANICS-PHTHALATES (µg/kg)				
bis(2-ethylhexyl) phthalate	EPA 8270C (SIM)	2.1-25	69-830	10
Butyl benzyl phthalate	EPA 8270C (SIM)	2.7-33	69-830	10
Diethyl Phthalate	EPA 8270C (SIM)	2.2-27	69-830	10
Dimethyl Phthalate	EPA 8270C (SIM)	2.8-33	69-830	10
Di-n-butyl Phthalate	EPA 8270C (SIM)	2.6-32	69-830	500
Di-n-octyl Phthalate	EPA 8270C (SIM)	2.6-31	69-830	10
ORGANICS-PHENOLS (µg/kg)				
2,3,4,6-Tetrachlorophenol	EPA 8270C (SIM)	5.4-65	14-170	10
2,4,5-Trichlorophenol	EPA 8270C (SIM)	1.7-20	14-170	10
2,4,6-Trichlorophenol	EPA 8270C (SIM)	1.8-22	14-170	10
2,4-Dichlorophenol	EPA 8270C (SIM)	2.3-28	14-170	10
2,4-Dimethylphenol	EPA 8270C (SIM)	3.6-43	690-8300	500
2,4-Dinitrophenol	EPA 8270C (SIM)	83-990	690-8300	500
2,6-Dichlorophenol	EPA 8270C (SIM)	2.9-35	14-170	10
2-Chlorophenol	EPA 8270C (SIM)	2.6-31	14-170	10
2-Methyl-4,6-dinitrophenol	EPA 8270C (SIM)	91-1100	690-8300	500
2-Methylphenol	EPA 8270C (SIM)	2.7-33	14-170	10
2-Nitrophenol	EPA 8270C (SIM)	2.3-28	690-8300	500
3+4-Methylphenol	EPA 8270C (SIM)	5.0-60	14-170	10
4-Chloro-3-methylphenol	EPA 8270C (SIM)	2.8-34	14-170	10
4-Nitrophenol	EPA 8270C (SIM)	110-1300	690-8300	500
Bisphenol A	EPA 8270C (SIM)	2.8-9.1	14-44	10
Pentachlorophenol	EPA 8270C (SIM)	1.8-22	690-8300	500
Phenol	EPA 8270C (SIM)	3.2-38	14-170	10

Table 9. Sediment Analytical Methods and Quantitation Limits Achieved (Continued).

Analyte	Method	Method Detection Limits (Dry Weight)	Laboratory Reporting Limits (Dry Weight)	SAP Reporting Limits (Wet Weight)
ORGANICS-PCBs (µg/kg) PCB congeners of: 018, 028, 037, 044, 049, 052, 066, 070, 074, 077, 081, 087, 099, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138/158, 149, 151, 153, 156, 157, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.	EPA 8270C (SIM)	0.046-0.80	0.27-0.90	0.5
Total PCBs as sum of all individual PCB congeners.	EPA 8270C (SIM)			0.5
ORGANICS-PAHs (µg/kg dry)				
1-Methylnaphthalene	EPA 8270C (SIM)	1.5-18	14-170	10
1-Methylphenanthrene	EPA 8270C (SIM)	2.7-32	14-44	10
1,6,7-Trimethylnaphthalene	EPA 8270C (SIM)	2.4-29	14-170	10
2,6-Dimethylnaphthalene	EPA 8270C (SIM)	2.9-35	14-170	10
2-Methylnaphthalene	EPA 8270C (SIM)	2.3-27	14-170	10
Acenaphthene	EPA 8270C (SIM)	2.1-25	14-170	10
Acenaphthylene	EPA 8270C (SIM)	2.3-28	14-170	10
Anthracene	EPA 8270C (SIM)	2.7-32	14-170	10
Benzo[a]anthracene	EPA 8270C (SIM)	2.0-24	14-170	10
Benzo[a]pyrene	EPA 8270C (SIM)	1.9-23	14-170	10
Benzo[b]fluoranthene	EPA 8270C (SIM)	2.0-24	14-170	10
Benzo[e]pyrene	EPA 8270C (SIM)	2.3-28	14-170	10
Benzo[g,h,i]perylene	EPA 8270C (SIM)	2.1-25	14-170	10
Benzo[k]fluoranthene	EPA 8270C (SIM)	2.0-25	14-170	10
Biphenyl	EPA 8270C (SIM)	2.6-31	14-170	10
Chrysene	EPA 8270C (SIM)	1.9-23	14-170	10
Dibenzo[a,h]anthracene	EPA 8270C (SIM)	2.0-24	14-170	10
Dibenzothiophene	EPA 8270C (SIM)	1.9-22	14-170	10
Fluoranthene	EPA 8270C (SIM)	2.4-29	14-170	10
Fluorene	EPA 8270C (SIM)	2.3-27	14-170	10
Indeno[1,2,3-c,d]pyrene	EPA 8270C (SIM)	1.8-22	14-170	10
Naphthalene	EPA 8270C (SIM)	2.1-26	14-170	10
Perylene	EPA 8270C (SIM)	1.6-19	14-170	10
Phenanthrene	EPA 8270C (SIM)	2.4-29	14-170	10
Pyrene	EPA 8270C (SIM)	2.2-27	14-170	10
Total Low Weight PAHs	EPA 8270C (SIM)	--	14-170	10
Total High Weight PAHs	EPA 8270C (SIM)	--	14-170	10
Total Detectable PAHs	EPA 8270C (SIM)	--	14-170	10

Green shaded analyses indicate elevated reporting limits due to necessary dilutions.

3.4.3 Elutriate Preparation Methods and Chemical Analysis

Standard elutriate test (SET) samples for the SPP tests were prepared according to OTM methods. Composite sediment was mixed with dredge site water in a 1:4 volumetric ratio. Vigorous mixing proceeded for 30 minutes, and the mixture was allowed to settle undisturbed for one hour. The supernatant (100% elutriate) was then siphoned off for bioassay testing without disturbing the settled material.

3.4.4 Tier III Biological Testing

For Tier III testing for open water placement, the composite sediments along with control sediments were tested for toxicity and for bioaccumulation potential. Bioassay protocols followed ITM and OTM protocols for both SPP and SP bioassays. Species, methods and endpoints used for the bioassays and bioaccumulation exposures are listed in Table 10. All species used in this testing program complied with ITM and OTM recommendations and guidelines for bioassay and bioaccumulation tests.

Table 10. Species, Methods, and End-Points for Biological Testing.

Test Type	Species	Method	End Points
SPP Bioassays:			
Bivalve Larvae	*Mytilus galloprovincialis*	ASTM E 724-98 (1998)	48 hr. survival and normal development
Mysid	*Americamysis bahia*	USEPA/USACE 823-B-98-004 (1998) USEPA 821-R-02-012 (2002)	96 Hour Survival
Teleost Fish	*Menidia beryllina*	USEPA/USACE 823-B-98-004 (1998) USEPA 821-R-02-012 (2002)	96 Hour Survival
Solid Phase Bioassays:			
Amphipod	*Ampelisca abdita*	ASTM E 1367-99 (1999) USEPA (1994)	10 day survival
Polychaete worm	*Neanthes arenaceodentata*	ASTM E 1611-00 (2007)	10 day survival
BIOACCUMULATION EXPOSURES:			
Clam	*Macoma nasuta*	USEPA/USACE 823/B-98/004, ASTM E-1168-00a (2000)	28 day benthic exposure
Worm	*Neris virens*	USEPA/USACE 823/B-98/004, ASTM E-1168-00a (2000)	28 day benthic exposure

Upon arrival at Pacific EcoRisk, the temperatures of the sediments and routine water quality parameters (i.e. dissolved oxygen, salinity, pH, sulfides and ammonia) of the porewaters were measured. Sediment porewater was collected by centrifuging samples at 2,500g for 15 minutes. All samples were then refrigerated at 4° Celsius (C) until tests were initiated.

The initial sediment porewater ammonia concentrations were elevated (82 to 192 mg/L N) in the LARE-1, LARE-2 and ST-1 composite samples and exceeded the USACE recommended guideline of 15 mg/l for the solid phase amphipod test. As such, ammonia purging took place prior to test initiation. This involved aeration and twice daily overlying water replacements with seawater until the porewater ammonia levels dropped to below 15 mg/L.

Water used for bioassay dilutions and bioaccumulation exposures was filtered natural seawater obtained from UC Davis Granite Canyon Marine Laboratory. This seawater was 1-µm filtered and then adjusted to the desired test salinity using Type 1 lab water (reverse osmosis, de-ionized water) prior to use in these tests. Dilution water salinity for the water column bioassays was 28 ppt and overlying water salinity for the benthic bioassays was 28 ppt.

Bioassays

Multiple dilutions of elutriates for the SPP bioassays were prepared for testing. Testing was initiated on August 2, 2018 for *M. galloprovincialis*, July 18, 2018 for M. *beryllina* and July 19, 2018 for *A. bahia*. All three species used were exposed to 100%, 50%, 10%, and 1% elutriate concentrations along with a 0% control concentration. As the sediment porewater concentrations of ammonia exceeded 25 mg/L (Table 22) for the LAREVC-18-ST-1, LAREVC-18-LARE-1, and LAREVC-18-LARE-2 site sediments, an additional test treatment of 25% elutriate was also prepared and tested for these samples to add better resolution to the calculation of 50% effects concentrations.

The SP bioassays were initiated on August 1, 2018 for *Ampelisca abdita* and August 3, 2018 for *Neanthes arenaceodentata*.

For all tests, water quality parameters (pH, temperature, salinity and dissolved oxygen) were monitored on a daily basis. Water samples from test chambers were also collected at specified intervals to monitor ammonia concentrations. For the 48- and 96-hr SPP tests, water samples for ammonia analysis were collected at test initiation. For the 10-day solid-phase sediment tests, porewater samples were collected through centrifugation and tested for ammonia and sulfides before test initiation and at test termination. Overlying water was analyzed for ammonia at test initiation and termination. All water quality monitoring data are provided in the bioassay laboratory report included as Appendix J.

Reference Toxicant Tests using potassium chloride (KCl) as the toxicant were also run for all bioassays. This was done by determining key dose response point estimates (e.g. EC_{50}) and comparing these to a typical response range by the mean plus or minus two standard deviations of point estimates generated from the 20 most recent reference toxicant tests for the organisms used.

Bioaccumulation Exposures

Prior to tissue analyses, the OTM and ITM requires a 28-day exposure period of two benthic species to test, reference, and control sediments following the method listed in Table 10. Test species, which conform to OTM and ITM recommendations, were as follows:

Nereis virens (worm) *Macoma nasuta* (clam)

Water quality parameters (pH, temperature, salinity, dissolved oxygen, and ammonia) were monitored on overlying composite water samples each day of the 28 days of exposures. Twenty randomly selected clams and ten randomly selected worms were added to the replicate test tanks at day zero, which began approximately 24 hours after the sediments and water were allowed to equilibrate. Water changes in the test aquaria were conducted approximately three times a week by siphoning off approximately 80% of water in each aquaria and replacing it with new water.

Following exposure of the organisms to the test sediments, they were placed in a clean, non-stressful environment to purge their systems of sediment. The purge time was sufficiently long enough to purge sediment, but not long enough to allow them to depurate accumulated toxicants. Generally, 24 hours is deemed to be sufficient. Once purging of the sediment is complete, whole animals were packaged according to composite and replicate IDs and frozen. The frozen animals were delivered overnight to Eurofins Calscience Laboratories on dry ice where they were placed in the freezer until analyzed. These animals were later shucked (clams only) and homogenized in a clean laboratory at Eurofins Calscience Laboratories prior to analysis of lipids, cadmium, copper, lead, zinc, PCB congeners, chlordane compounds and DDT compounds. Methods, detection limits and reporting limits for the tissue analyses are provided in Table 11.

Statistical Evaluations

Statistical analysis of experimental data was performed for each of the bioassay and bioaccumulation assessments. Tests of fundamental data assumptions (e.g., normality and variance homogeneity) were performed followed by the appropriate parametric or non-parametric analyses in accordance with the ITM and OTM.

Experiment-wide survival data from species bioassays were analyzed using one-way analysis of variance (ANOVA). Multiple comparison t-tests were then used to compare survival in each of the test sediments against survival in control sediment and reference sediment. Prior to analyses, normality was evaluated with the Shapiro-Wilk test and homogeneity of variance was assessed with either Bartlett's Test or the F-Test. When necessary to satisfy these assumptions, proportional survival data were arcsine square-root transformed. Solid-phase statistical analyses were performed with CETIS® Version 1.9.2 statistical software.

Statistical analyses of all bioassay species and reference toxicant data were also performed using CETIS® Version 1.9.2 software. Comparisons between the dilution water and each test concentration were performed using either the equal variance two sample t-test or the Dunnett's Multiple Comparison test if data displayed homogenous variance and a normal distribution. Data with heterogeneous variance, or non-normal distributions were analyzed using Steel's Many-One

Rank Sum test. Normality was evaluated with the Shapiro-Wilk test and homogeneity of variance was assessed with the Bartlett test, the F-Test or the Levene test.

Table 11. Analytical Methods and Quantitation Limits Achieved for the Tissue Samples.

Analyte	Method	Method Detection Limits	Laboratory Reporting Limits
Percent Solids (%)	SM 2540 B	0.1	0.1
Lipids (% wet weight)[2]	$MeCl_2$ Extraction	0.1	0.1
Metals (mg/L, Wet)			
Cadmium	EPA 6020	0.029 – 0.143	0.1 – 0.5
Copper	EPA 6020	0.021 – 0.105	0.1 – 0.5
Lead	EPA 6020	0.033 – 0.165	0.1 – 0.5
Zinc	EPA 6020	0.937 – 1.99	1.0 – 5.0
OC Pesticides (µg/L, Wet)			
2,4'-DDD	EPA 8270C PEST-SIM	0.075 – 0.38	0.2 – 1.0
2,4'-DDE	EPA 8270C PEST-SIM	0.035 – 0.18	0.2 – 0.4
2,4'-DDT	EPA 8270C PEST-SIM	0.061 – 0.31	0.2 – 1.0
4,4'-DDD	EPA 8270C PEST-SIM	0.039 – 0.20	0.2 – 1.0
4,4'-DDE	EPA 8270C PEST-SIM	0.040 – 0.20	0.2 – 1.0
4,4'-DDT	EPA 8270C PEST-SIM	0.052 – 0.26	0.2 – 1.0
Total DDTs	EPA 8270C PEST-SIM	0.38	0.2 – 1.0
Alpha Chlordane	EPA 8270C PEST-SIM	0.066 – 0.33	0.2 – 1.0
Cis-nonachlor	EPA 8270C PEST-SIM	0.05 – 0.25	0.2 – 1.0
Gamma Chlordane	EPA 8270C PEST-SIM	0.053 – 0.27	0.2 – 1.0
Heptachlor	EPA 8270C PEST-SIM	0.051 – 0.26	0.2 – 1.0
Heptachlor Epoxide	EPA 8270C PEST-SIM	0.044 – 0.22	0.2 – 1.0
Methoxychlor	EPA 8270C PEST-SIM	0.066 – 0.34	0.2 – 1.0
Oxychlordane	EPA 8270C PEST-SIM	0.072 – 0.36	0.2 – 1.0
Trans-nonachlor	EPA 8270C PEST-SIM	0.042 - 0.21	0.2 – 1.0
Chlordane (Technical)	EPA 8081A	7.3-12	14-22
Total Chlordane	EPA 8270C PEST-SIM	0.38	0.2 – 1.0
PCBs (µg/kg, Wet) PCB congeners of: 018, 028, 037, 044, 049, 052, 066, 070, 074, 077, 081, 087, 099, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138/158, 149, 151, 153, 156, 157, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.	EPA 8270C (SIM)	0.033 – 0.19	0.2 – 0.4
Total PCBs as sum of all individual PCB congeners.	EPA 8270C (SIM)	--	0.2 – 0.4

Bioaccumulation assessment of tissues for two species and eight analytes were analyzed statistically. Cadmium, copper, lead, zinc, total DDTs, technical and total chlordane, and total PCBs were analyzed in *Macoma* and *Nereis* tissues for four dredge test sites against the LA-2 reference site and a control if the test site means were below the reference. If the control mean was higher than the test site means, no analysis was conducted.

Analysis of the bioaccumulation data from this set of tissues generally followed the recommendations outlined in the OTM Section 13, Statistical Analysis for the 28-day dredged sediments vs. “reference” scenario. The statistical program NCSS version 12 (http://www.ncss.com) was used to find test site vs. reference differences. The procedure for Two-Sample T-Tests was used on data without non-detected (ND) concentrations. This NCSS module produces both parametric and non-parametric output that includes normality, variance homogeneity, and distribution testing along with the hypothesis results in a single report. The null hypothesis in this case assumes that the test sites are not significantly greater than the reference category, so it is a one-way probability layout ($p \leq 0.05$). In cases where non-detected data occurred in 50% or less of the samples, the logrank test with equal weighting could be used. Where more than 50% of the samples were NDs, hypothesis testing could not be performed because results are considered to be unreliable. The logrank test compares parametrically or by randomization techniques to survival curves generated by nonparametric Kaplan-Meier methods.

When NDs were absent, the reported results were used, this also includes “J” flagged values. Non-detected or left-censored tissue data occurred for all parameters except copper and zinc for *Macoma*. NDs were less prevalent for *Nereis* occurring only in cadmium, DDTs, technical and total chlordane, and total PCBs.

Dealing with left-censored values in a tissue data set requires special handling procedures (see: Helsel, 2005, 2006, 2012, Singh et al., 2006). Initially the detection limit (MDLs) is applied to all data marked as NDs. The goal with censored data analysis is to avoid analyzing substituted data with the applied MDLs. To do this, a new variable is created where data are separately coded with a detection indicator value of ones and zeros so that detected data (1s) can be clearly distinguished from NDs (0s). Hypothesis testing of censored data is based on the use of the new indicator variable and the Kaplan-Meier cumulative proportion data that are created. No analyses were disqualified due to the logrank test being only valid for data with NDs less than or equal to 50%.

The USEPA-sponsored statistical software package, ProUCL Version 5.2 for Environmental Applications for Datasets with and without ND observations (https://www.epa.gov/land-research/proucl-software) was used to generate the 95% confidence limits (LCLs & UCLs) for each parameter mean for all sites. ProUCL also derived estimated confidence limits for tissue with 60% NDs present but these limits are questionable due to only two detected values being present. Reliable confidence limits for *Macoma* reference data could not be estimated for technical and total chlordane because only ND data existed. Reliable confidence limits for *Macoma* control data also could not be generated for DDTs and both chlordanes. Reliable reference confidence limits for *Nereis* could not be generated for cadmium and the chlordanes and for the control just the chlordanes.

Determining reliable 95% confidence limits allows the UCLs of the test sites to be statistically compared with the LCLs of the reference and control for overlap and to an Action Level (as suggested by the OTM).

4.0 RESULTS

Physical, chemical and biological testing results of the LARE and POLB Approach Channel sediments are summarized in Tables 12 through 32 below. Tables do not include analytical quality assurance/quality control (QA/QC) data. Complete analytical results including all associated QA/QC data are provided in Appendix I. All biological QA/QC data are provided in Appendix J, and a complete set of physical results with grain size plots are included in Appendix L.

4.1 Sediment Physical Results

Grain Size analyses were performed on multiple layers from each of 42 cores collected. Sieve and analysis data for each core and each individual layer are provided in Tables 12 through 15 along with calculated weighted averages for the composite samples. Atterberg Limits for a select number of samples are also provided in Tables 12 through 15. Sieve analysis data for the Chaffee Island nearshore placement site and the LA-2 reference site samples are provided in Table 16. Individual grain size distribution curves for each individual grain size sample are provided in Appendix L along with plasticity index plots and hydrometer data for a select number of samples.

4.2 Sediment Chemistry Results

A summary of the sediment chemical testing results for the LARE composite samples and LA-2 reference sample are provided in Table 17. A summary of the sediment chemical testing results for seven individual sample locations in LARE-1 and six individual sample locations in LARE-2 are provided in Table 18. A summary of the sediment chemical testing results for the POLB Approach Channel composite sample are provided in Table 19. Included in Tables 17 through 19 are screening values consisting of NOAA ERL and ERM values and human health criteria for residential and industrial settings consisting of RSLs and CHHSLs (see Section 3.2.7). Any testing values that exceed any of these screening values are highlighted. Concentrations that exceed ERL values are bolded red. Concentrations that exceed ERM values are bolded red and underlined. Table cells shaded in orange are for data that exceed one or more human health screening values. Estimated values between the method detection limits and reporting limits were considered real values for the purpose of these comparisons.

Data contained in Tables 17 through 19 are often coded. Values that were not detected above the method detection limit were assigned a “<” prefix symbol. Values estimated between the MDL and RL were tagged with a “J”. A “J” code may also indicate an estimated value due to QC data for that value being outside of certain QC objectives. Definitions of all other symbols are described in the QA/QC report in Appendix M and in table footnotes.

4.3 Solid Phase Bioassay Results

Replicate and mean survival for the 10-day acute solid phase bioassays conducted on the LARE and POLB Approach Channel composite samples as well as the LA-2 reference sample are provided in Table 20 for *Ampelisca abdita* and Table 21 for *Neanthes arenaceodentata.* Initial sediment porewater measurements for the reference and composite samples are provided in Table 22. Initial ammonia levels were above levels expected to cause toxicity.

4.4 Suspended Particulate Phase (SPP) Bioassay Results

Standard elutriate SPP bioassay results for the LARE and POLB Approach Channel composite samples are summarized in Tables 23 through 25. Mean percent survival and normal development data and supporting replicate data for the 48-hour bivalve larvae SPP bioassays using the larvae of *Mytilus galloprovincialis* are provided in Table 23 along with estimated 50% effects point estimate 50^{th} percentile (EC_{50}) and lethal point estimate 50^{th} percentile (LC_{50}) values. Mean survival results and supporting replicate data for the mysid shrimp (*Americamysis bahia*) 96-hour acute SPP bioassays along with estimated LC_{50} values are presented in Table 24. Mean survival results and supporting replicate data for the juvenile fish (*Menidia beryllina)* 96-hour acute SPP bioassays along with estimated LC_{50} values are presented in Table 25. All tables for all three species include results for each replicate exposure to 100%, 50%, 10%, and 1% elutriate concentrations along with a 0% site water concentration. A 25% dilution was also run on the LARE composite samples (not the POLB Approach Channel composite sample) as an additional measure to address elevated ammonia concentrations.

4.5 Bioaccumulation Results

Survival data for the 28-day bioaccumulation exposures are presented in Table 26. Replicate results of the *Macoma nasuta* tissue analyses are presented in Tables 27 and 28, and replicate results of the *Nereis virens* tissue analyses are presented in Tables 29 and 30. Mean values were determined by substituting non-detected values according to the Kaplan-Meier cumulative proportion method. Tissue qualification codes are the same as those for the sediment samples.

Tissue burden statistical results are summarized in Table 31 for *Macoma* and and Table 32 for *Nereis* for those analytes detected in the tissues. Lipid normalized results were used in statistical testing if a positive relationship could be found beween lipid and contaminant concentration as suggested by Herbert and Keenleyside (1995). This was only evident for total chlordane in *Macoma* tissues and technical chlordane in *Nereis* tissues. Mean concentrations in cells shaded green indicate statistically significant ($p \leq 0.05$) differences with mean reference tissue concentrations. Mean concentrations in cells shaded blue indicate statistically significant ($p \leq 0.05$) differences with both mean reference and mean control tissue concentrations.

Table 12. Los Angeles river Estuary Area ST-1 Sieve Analysis Data.

Boring ID	Elevation (ft MLLW)		Fine Gravel					Coarse Sand		Medium Sand				Fine Sand						Silt	Atterberg Limits		Soil Classification
			Sieve No./Sieve Size/% Passing																				
			1"	3/4"	1/2"	3/8"	4	7	10	14	18	25	35	45	60	80	120	170	200	230			
	Top	Bottom	25.4 mm	19 mm	12.5mm	9.5 mm	4.75 mm	2.38 mm	2 mm	1.41 mm	1.0 mm	0.71 mm	0.50 mm	0.35 mm	0.25 mm	0.18 mm	0.125 mm	0.09 mm	0.075 mm	0.063 mm	LL	PL	
Sand Trap (Area ST-1)																							
LAREVC-18-01	-13.0	-16.0	100	100	100	100	100	100	100	100	100	100	100	96	87	75	64	56	52	50			SANDY SILT (MH)
LAREVC-18-01	-16.0	-17.2	100	100	100	99	99	98	97	97	96	95	92	85	48	21	8	5	4	4			POORLY GRADED SAND (SP)
LAREVC-18-01	-17.2	-20.0	100	100	100	100	100	100	100	100	100	96	90	82	65	51	43	39	37	35			SILTY SAND (SM)
LAREVC-18-03	-17.3	-18.3	100	100	100	99	97	94	92	89	87	85	82	78	68	58	47	40	36	33			SILTY SAND (SM)
LAREVC-18-03	-18.3	-21.5	100	100	100	100	100	100	100	99	99	98	96	87	56	32	20	16	15	15			SILTY SAND (SM)
LAREVC-18-03	-21.5	-22.8	100	100	100	100	100	100	99	99	98	97	95	93	88	79	63	53	48	46			SILTY SAND (SM)
LAREVC-18-04	-20.6	-22.6	100	100	100	100	100	100	100	100	99	99	99	98	94	89	82	76	72	70			SANDY SILT (MH)
LAREVC-18-04	-22.6	-27.0	100	100	100	100	100	100	100	100	100	99	99	98	97	95	89	82	76	72	78	74	SILT WITH SAND (MH)
LAREVC-18-05	-21.4	-22.9	100	100	100	100	100	100	100	99	99	98	97	96	91	83	75	70	66	64			SANDY SILT (MH)
LAREVC-18-05	-22.9	-27.0	100	100	100	100	100	100	100	100	100	99	98	95	92	90	86	81	77	75			SANDY SILT (MH)
LAREVC-18-08	-19.0	-19.5	100	100	100	100	99	98	97	96	95	94	93	91	83	74	64	57	53	51			SANDY SILT (MH)
LAREVC-18-08	-21.0	-22.3	100	100	100	100	99	98	97	96	95	93	90	83	49	22	9	6	6	5			POORLY GRADED SAND WITH SILT (SP-SM)
LAREVC-18-08	-22.3	-26.0	100	100	100	100	100	100	100	100	100	99	98	96	91	83	71	63	58	56	76	39	SILT WITH SAND (MH)
LAREVC-18-24	-20.6	-22.6	100	100	100	100	100	100	100	99	99	99	98	97	90	83	76	71	68	66			SANDY SILT (MH)
LAREVC-18-24	-22.6	-27.0	100	100	100	100	100	100	100	100	99	99	98	98	97	96	94	92	89	87			SANDY SILT (MH)
LAREVC-18-26	-20.6	-22.1	100	100	100	100	100	100	100	100	99	99	99	98	97	96	93	91	88	86			FAT CLAY (CH)
LAREVC-18-26	-22.1	-27.0	100	100	100	100	100	100	100	99	99	98	97	96	94	91	84	78	73	70			SANDY SILT (MH)
LAREVC-18-34	-20.2	-21.7	100	100	100	100	100	100	100	100	99	99	98	96	90	83	75	69	65	63			SANDY SILT (MH)
LAREVC-18-34	-21.7	-26.3	100	100	100	100	100	100	100	100	99	99	98	96	94	90	81	75	70	68			SANDY SILT (MH)
LAREVC-18-34	-26.3	-27.0	100	100	100	100	100	100	100	99	98	95	91	88	84	72	56	42	35	32			SILTY SAND (SM)
LAREVC-18-35	-20.0	-21.5	100	100	100	100	100	100	100	99	99	98	97	95	89	83	75	69	66	63			SANDY SILT (MH)
LAREVC-18-35	-21.5	-25.7	100	100	100	100	100	100	100	99	99	98	97	96	93	91	84	77	73	69			SANDY SILT (MH)
LAREVC-18-35	-25.7	-27.0	100	100	100	100	100	100	100	100	100	99	99	98	97	96	94	90	84	80			SILT WITH SAND (MH)
LAREVC-18-36	-21.3	-24.3	100	100	100	100	100	100	99	99	98	98	97	95	92	88	83	79	75	73			SANDY SILT (MH)
LAREVC-18-36	-24.3	-26.7	100	100	100	100	100	100	100	100	99	99	99	98	97	96	94	92	90	88			SANDY SILT (MH)
LAREVC-18-37	-18.4	-19.8	100	100	100	100	99	99	99	98	97	95	93	89	78	70	59	52	47	45			SILTY SAND (SM)
LAREVC-18-37	-19.8	-20.7	100	100	100	99	98	98	98	98	97	95	90	76	40	23	14	10	9	8			POORLY GRADED SAND WITH SILT (SP-SM)
LAREVC-18-37	-20.7	-23.2	100	100	100	100	100	99	99	99	99	98	95	92	81	70	59	53	50	48			SILTY SAND (SM)
LAREVC-18-39	-16.6	-18.5	100	100	100	99	98	98	97	97	96	96	94	91	85	80	75	69	65	62			SANDY SILT (MH)
LAREVC-18-39	-18.5	-19.8	100	100	100	100	100	100	99	99	99	98	94	79	43	24	13	9	8	7			POORLY GRADED SAND WITH SILT (SP-SM)
LAREVC-18-39	-19.8	-22.2	100	100	100	100	100	100	100	100	99	98	95	84	41	14	5	3	2	2			POORLY GRADED SAND (SP)
LAREVC-18-40	-19.1	-21.0	100	100	100	100	100	100	100	100	99	99	98	96	93	91	87	83	79	75			SANDY SILT (MH)
LAREVC-18-40	-21.0	-22.1	100	100	100	100	100	100	100	100	99	99	97	90	51	20	7	4	3	3			POORLY GRADED SAND (SP)
LAREVC-18-40	-22.1	-27.0	100	100	100	100	100	100	100	100	99	99	99	98	96	93	88	83	79	77			FAT CLAY (CH)
Area ST-1 Weighted Average**			100	100	100	100	100	100	100	99	99	98	97	94	85	77	69	64	60	58			

** Weighted average calculated by factoring in the length of each core interval contributing to the composite sample.

Table 13. Los Angeles river Estuary Area LARE-1 Sieve Analysis Data.

Boring ID	Elevation (ft MLLW)		Fine Gravel					Coarse Sand		Medium Sand				Fine Sand						Silt	Atterberg Limits		Soil Classification
			Sieve No./Sieve Size/% Passing																				
			1"	3/4"	1/2"	3/8"	4	7	10	14	18	25	35	45	60	80	120	170	200	230			
	Top	Bottom	25.4 mm	19 mm	12.5mm	9.5 mm	4.75 mm	2.38 mm	2 mm	1.41 mm	1.0 mm	0.71 mm	0.50 mm	0.35 mm	0.25 mm	0.18 mm	0.125 mm	0.09 mm	0.075 mm	0.063 mm	LL	PL	
LARE Upper Channel (LARE-1)																							
LAREVC-18-06	-23.8	-25.8	100	100	100	100	100	100	100	100	99	99	99	99	98	98	97	97	96	95			SANDY SILT (MH)
LAREVC-18-06	-25.8	-27.0	100	100	100	100	100	100	100	100	100	99	99	99	98	96	93	90	88	86	107	65	FAT CLAY (CH)
LAREVE-18-07	-21.9	-23.9	100	100	100	100	100	100	100	100	99	99	99	98	98	97	96	94	92	90			SANDY SILT (MH)
LAREVE-18-07	-23.9	-27.0	100	100	100	100	100	100	100	100	100	99	99	98	96	93	89	84	81	79			SANDY SILT (MH)
LAREVC-18-09	-20.8	-21.8	100	100	100	100	100	100	100	100	100	99	98	97	93	87	76	65	58	55			SANDY SILT (MH)
LAREVC-18-09	-21.8	-24.3	100	100	100	100	100	100	100	100	99	99	98	97	95	91	81	70	64	61			SANDY SILT (MH)
LAREVC-18-09	-24.3	-26.3	100	100	100	100	100	100	100	100	99	98	94	88	80	70	55	44	38	35			SILTY SAND (SM)
LAREVC-18-09	-26.3	-27.0	100	100	100	100	100	100	100	100	99	99	97	95	92	88	79	69	64	60			SANDY SILT (MH)
LAREVC-18-10	-20.9	-22.9	100	100	100	100	100	100	100	100	100	100	99	98	97	95	90	84	80	77	102	57	SILT WITH SAND (MH)
LAREVC-18-10	-22.9	-27.0	100	100	100	100	100	100	100	100	99	99	98	97	95	91	82	75	71	68			SANDY SILT (MH)
LAREVC-18-11	-21.1	-22.9	100	100	100	100	100	100	100	100	100	100	99	99	97	92	84	78	74	72			SANDY SILT (MH)
LAREVC-18-11	-22.9	-27.0	100	100	100	100	100	100	100	100	100	100	99	99	98	96	91	86	82	80			SANDY SILT (MH)
LAREVC-18-12	-23.0	-25.6	100	100	100	100	100	100	100	100	100	100	100	99	98	96	90	82	76	72	73	36	SILT WITH SAND (MH)
LAREVC-18-12	-25.6	-27.0	100	100	100	100	100	100	100	100	100	100	100	99	99	98	96	93	90	88			SANDY SILT (MH)
LAREVC-18-13	-20.8	-22.8	100	100	100	100	100	100	100	100	99	99	99	98	94	87	78	72	69	67			SANDY SILT (MH)
LAREVC-18-13	-22.8	-25.0	100	100	100	100	100	100	100	99	99	98	98	97	91	80	67	58	54	51			SANDY SILT (MH)
LAREVC-18-13	-25.0	-27.0	100	100	100	100	100	100	100	100	100	100	100	99	99	97	94	90	87	85			SANDY SILT (MH)
LAREVC-18-14	-24.0	-26.0	100	100	100	100	100	100	100	100	99	99	99	98	97	95	90	83	79	76			SANDY SILT (MH)
LAREVC-18-14	-26.0	-27.0	100	100	100	100	100	100	100	100	100	100	100	99	99	98	96	92	89	87			SANDY SILT (MH)
LAREVC-18-15	-17.0	-18.5	100	100	100	100	100	100	100	100	100	99	99	98	96	92	81	71	66	63			SANDY SILT (MH)
LAREVC-18-15	-18.5	-19.1	100	100	100	100	100	100	100	100	100	99	99	96	77	44	22	15	13	12			SILTY SAND (SM)
LAREVC-18-15	-19.1	-20.3	100	100	100	100	100	100	100	99	98	96	91	86	83	79	66	55	50	47			SILTY SAND (SM)
LAREVC-18-15	-20.3	-23.8	100	100	100	100	100	100	99	98	96	87	71	62	57	53	45	38	35	33			SILTY SAND (SM)
LAREVC-18-15	-23.8	-24.4	100	100	100	100	100	100	99	98	95	83	64	46	29	20	11	8	7	6			POORLY GRADED SAND WITH SILT (SP-SM)
LAREVC-18-15	-24.4	-27.0	100	100	100	100	100	100	100	100	99	99	98	97	95	92	81	70	64	61			SANDY SILT (MH)
LAREVC-18-16	-13.2	-15.2	100	100	100	100	100	100	100	100	99	99	99	98	97	93	81	71	64	60			SANDY SILT (MH)
LAREVC-18-16	-15.2	-20.2	100	100	100	100	100	100	100	99	99	98	97	95	90	85	77	66	60	56			SANDY SILT (MH)
LAREVC-18-16	-20.2	-24.4	100	100	100	100	100	100	100	99	99	99	99	97	93	86	78	71	67	64			SANDY SILT (MH)
LAREVC-18-16	-24.4	-25.7	100	100	100	100	100	100	100	100	99	99	98	95	87	74	48	35	31	28			SILTY SAND (SM)
LAREVC-18-16	-25.7	-27.0	100	100	100	100	100	100	100	100	100	100	99	99	98	94	86	78	74	72			SANDY SILT (MH)
LAREVC-18-17	-13.0	-13.4	100	100	100	100	100	100	100	100	100	100	100	99	96	87	65	51	45	42			SILTY SAND (SM)
LAREVC-18-17	-13.4	-13.7	100	100	100	100	100	100	100	100	100	100	99	98	88	58	25	15	12	11			POORLY GRADED SAND WITH SILT (SP-SM)
LAREVC-18-17	-13.7	-17.5	100	100	100	100	100	100	100	100	100	99	99	98	96	94	83	69	61	56			SANDY SILT (MH)
LAREVC-18-17	-17.5	-18.6	100	100	100	100	100	99	99	99	98	97	93	87	75	64	52	44	40	38			SILTY SAND (SM)
LAREVC-18-17	-18.6	-19.7	100	100	100	100	100	100	100	100	99	97	88	76	55	40	30	26	24	23			SILTY SAND (SM)
LAREVC-18-17	-19.7	-24.0	100	100	100	100	100	100	100	100	99	99	99	97	93	86	77	71	66	64			SANDY SILT (MH)

Table 13 (Continued). Los Angeles river Estuary Area LARE-1 Sieve Analysis Data.

Boring ID	Elevation (ft MLLW)		Fine Gravel*					Coarse Sand		Medium Sand				Fine Sand						Silt	Atterberg Limits		Soil Classification
			Sieve No./Sieve Size/% Passing																				
			1"	3/4"	1/2"	3/8"	4	7	10	14	18	25	35	45	60	80	120	170	200	230			
	Top	Bottom	25.4 mm	19 mm	12.5mm	9.5 mm	4.75 mm	2.38 mm	2 mm	1.41 mm	1.0 mm	0.71 mm	0.50 mm	0.35 mm	0.25 mm	0.18 mm	0.125 mm	0.09 mm	0.075 mm	0.063 mm	LL	PL	
LAREVC-18-18	-12.1	-12.6	100	100	100	100	100	100	100	100	100	100	99	98	93	77	50	39	36	33			SILTY SAND (SM)
LAREVC-18-18	-12.6	-15.1	100	100	100	100	100	100	100	100	100	99	98	97	95	89	73	59	52	48			SANDY SILT (MH)
LAREVC-18-18	-15.1	-19.4	100	100	100	100	100	100	100	99	98	95	86	74	64	59	50	41	37	35			SILTY SAND (SM)
LAREVC-18-18	-19.4	-20.6	100	100	100	100	100	99	99	99	98	95	85	61	35	24	18	15	14	13			SILTY SAND (SM)
LAREVC-18-18	-20.6	-21.9	100	100	100	100	100	100	100	100	100	99	98	97	94	90	84	76	71	67			SANDY SILT (MH)
LAREVC-18-18	-21.9	-23.5	100	100	100	100	100	99	99	98	98	97	95	88	69	51	35	27	24	22			SILTY SAND (SM)
LAREVC-18-18	-23.5	-26.6	100	100	100	100	100	100	100	100	99	99	98	96	89	74	48	33	27	24			SILTY SAND (SM)
LAREVC-18-19	-25.0	-26.0	100	100	100	100	100	100	100	100	100	100	100	99	99	97	92	85	80	77			SANDY SILT (MH)
LAREVC-18-19	-26.0	-27.0	100	100	100	100	100	100	100	100	100	100	100	99	99	97	93	87	83	80			SANDY SILT (MH)
LAREVC-18-20	-24.0	-25.5	100	100	100	100	100	100	100	100	100	100	99	99	97	93	79	67	61	58			SANDY SILT (MH)
LAREVC-18-20	-25.5	-27.0	100	100	100	100	100	100	100	100	100	100	99	99	99	98	95	91	87	85	92	54	FAT CLAY (CH)
Area LARE-1Weighted Average**			100	100	100	100	100	100	100	100	99	98	96	94	89	84	75	66	62	59			

** Weighted average calculated by factoring in the length of each core interval contributing to the composite sample.

Table 14. Los Angeles river Estuary Area LARE-2 Sieve Analysis Data.

Boring ID	Elevation (ft MLLW)		Fine Gravel					Coarse Sand		Medium Sand				Fine Sand						Silt	Atterberg Limits		Soil Classification
			Sieve No./Sieve Size/% Passing																				
			1"	3/4"	1/2"	3/8"	4	7	10	14	18	25	35	45	60	80	120	170	200	230			
	Top	Bottom	25.4 mm	19 mm	12.5mm	9.5 mm	4.75 mm	2.38 mm	2 mm	1.41 mm	1.0 mm	0.71 mm	0.50 mm	0.35 mm	0.25 mm	0.18 mm	0.125 mm	0.09 mm	0.075 mm	0.063 mm	LL	PL	
LARE Lower Channel (LARE-2)																							
LAREVC-18-21	-20.9	-23.0	100	100	100	100	100	100	100	100	100	100	99	99	98	97	91	85	80	77	93	51	SILT WITH SAND (MH)
LAREVC-18-22	-21.0	-22.7	100	100	100	100	100	100	100	100	100	100	99	99	97	94	87	80	75	72			SANDY SILT (MH)
LAREVC-18-22	-22.7	-23.0	100	100	100	100	100	100	100	99	99	99	98	97	94	79	49	32	26	23			SILTY SAND (SM)
LAREVC-18-22	-23.0	-23.3	100	100	100	100	100	100	100	100	100	99	99	98	93	73	41	26	20	18			SILTY SAND (SM)
LAREVC-18-23	-20.8	-23.0	100	100	100	100	100	100	100	100	100	100	100	99	99	98	93	87	83	80			SANDY SILT (MH)
LAREVC-18-25	-20.8	-23.0	100	100	100	100	100	100	100	100	100	100	100	99	99	97	92	86	83	80			SANDY SILT (MH)
LAREVC-18-27	-20.8	-23.0	100	100	100	100	100	100	100	100	100	100	100	99	99	98	95	89	85	83			SANDY SILT (MH)
LAREVC-18-28	-20.6	-23.0	100	100	100	100	100	100	100	100	100	100	99	99	98	96	90	81	75	72			SANDY SILT (MH)
LAREVC-18-29	-14.6	-16.6	100	100	100	100	100	100	100	100	100	99	99	98	97	95	88	77	69	64			SANDY SILT (MH)
LAREVC-18-29	-16.6	-23.0	100	100	100	100	100	100	100	100	100	99	99	99	98	95	87	78	71	67	55	24	SILT WITH SAND (MH)
LAREVC-18-30	-16.2	-18.3	100	100	100	100	100	100	100	100	100	99	98	97	92	81	63	53	48	45			SILTY SAND (SM)
LAREVC-18-30	-18.3	-19.0	100	100	100	100	100	100	100	100	100	99	95	83	52	25	11	7	6	6			POORLY GRADED SAND WITH SILT (SP-SM)
LAREVC-18-30	-19.0	-23.0	100	100	100	100	100	100	100	100	100	100	100	99	99	96	84	72	64	60			SANDY FAT CLAY (CH)
LAREVC-18-31	-14.6	-18.0	100	100	100	100	100	100	100	100	100	99	99	99	98	95	89	80	73	68			SANDY SILT (MH)
LAREVC-18-31	-18.0	-23.0	100	100	100	100	100	100	100	100	100	99	99	99	97	93	79	67	60	56			SANDY SILT (MH)
LAREVC-18-32	-14.8	-17.7	100	100	100	100	100	100	100	100	100	99	99	99	98	96	89	78	70	65			SANDY SILT (MH)
LAREVC-18-32	-17.7	-21.6	100	100	100	100	100	100	100	100	99	99	98	97	96	93	82	70	63	58			SANDY SILT (MH)
LAREVC-18-32	-21.6	-23.0	100	100	100	100	100	100	100	100	100	100	99	99	98	94	78	64	57	53			SANDY SILT (MH)
LAREVC-18-33	-14.5	-16.5	100	100	100	100	100	100	100	100	99	99	99	98	97	95	88	79	72	67			SANDY SILT (MH)
LAREVC-18-33	-16.5	-23.0	100	100	100	100	100	100	100	99	99	99	98	97	96	91	76	64	56	52	50	21	SILT WITH SAND (MH)
Area LARE-2 Weighted Average**			100	100	100	100	100	100	100	100	100	99	99	98	97	93	83	73	67	63			

** Weighted average calculated by factoring in the length of each core interval contributing to the composite sample.

Table 15. Long Beach Approach Channel (Queens Gate) Sieve Analysis Data.

Boring ID	Elevation (ft MLLW)		Fine Gravel					Coarse Sand		Medium Sand				Fine Sand						Silt	Atterberg Limits		Soil Classification
			Sieve No./Sieve Size/% Passing																				
			1"	3/4"	1/2"	3/8"	4	7	10	14	18	25	35	45	60	80	120	170	200	230			
	Top	Bottom	25.4 mm	19 mm	12.5mm	9.5 mm	4.75 mm	2.38 mm	2 mm	1.41 mm	1.0 mm	0.71 mm	0.50 mm	0.35 mm	0.25 mm	0.18 mm	0.125 mm	0.09 mm	0.075 mm	0.063 mm	LL	PL	
Long Beach Federal Approach Channel Near Queens Gate																							
QGVC-18-01	-75.2	-76.7	100	100	100	100	100	100	99	99	99	99	97	94	89	86	76	57	38	28			SILTY SAND (SM)
QGVC-18-01	-76.7	-78.0	100	100	100	100	100	99	99	99	99	99	98	98	95	88	68	43	29	23			SILTY SAND (SM)
QGVC-18-02	-75.0	-76.3	100	100	100	100	100	100	100	100	100	100	100	100	98	96	92	64	45	33			SILTY SAND (SM)
QGVC-18-02	-76.3	-77.2	100	100	100	100	100	100	100	100	100	100	100	99	98	95	85	68	53	44			SANDY SILT (ML)
QGVC-18-02	-77.2	-78.0	100	100	100	100	100	100	99	99	99	99	99	99	98	95	74	40	21	12			SILTY SAND (SM)
QGVC-18-03	-75.3	-77.3	100	100	100	100	100	100	100	100	100	100	100	100	100	98	94	79	59	48			SANDY SILT (ML)
QGVC-18-03	-77.3	-78.0	100	100	100	100	100	100	100	100	100	100	100	99	98	95	86	71	56	47	29	2	SANDY SILT (ML)
QGVC-18-04	-75.7	-78.0	100	100	100	100	100	100	100	100	100	100	100	100	99	97	90	72	53	44			SANDY SILT (ML)
QGVC-18-04	-78.0	-79.1	100	100	100	100	100	100	100	100	100	100	100	99	93	83	65	44	31	24			SILTY SAND (SM)
Long Beach Approach Weighted Average**			100	100	100	100	100	100	100	100	100	100	99	99	97	93	83	63	45	36			

** Weighted average calculated by factoring in the length of each core interval contributing to the composite sample.

Table 16. Chaffee Island Nearshore Site and LA-2 Reference Site Sieve Analysis Data.

Grab ID	Depth (ft)	Fine Gravel					Coarse Sand		Medium Sand				Fine Sand						Silt	Atterberg Limits		Soil Classification
		Sieve No./Sieve Size/% Passing																				
		1.5"	1"	3/4"	3/8"	4	7	10	14	18	25	35	45	60	80	120	170	200	230			
		38.1 mm	25.4 mm	19 mm	9.5 mm	4.75 mm	2.38 mm	2 mm	1.41 mm	1.0 mm	0.71 mm	0.50 mm	0.35 mm	0.25 mm	0.18 mm	0.125 mm	0.09 mm	0.075 mm	0.063 mm	LL	PL	
Chaffee Island Nearshore Site Reference Samples																						
CINS-18-1	0.5	100	100	100	100	100	100	100	100	100	100	100	100	99	99	96	81	65	51			SANDY SILT (ML)
CINS-18-2	0.5	100	100	100	100	100	100	100	100	100	100	100	100	99	99	96	79	60	49			SANDY SILT (ML)
CINS-18-3	0.5	100	100	100	100	100	100	100	100	100	100	100	100	99	99	95	55	36	26			SILTY SAND (SM)
CINS-18-4	0.5	100	100	100	100	100	100	100	100	100	100	100	100	99	97	93	53	32	21			SILTY SAND (SM)
CINS-18-5	0.5	100	100	100	100	100	100	100	100	100	100	100	99	96	95	90	53	36	27			SILTY SAND (SM)
CINS-18-6	0.5	100	100	100	100	100	100	100	100	100	99	99	96	92	88	83	52	35	27			SILTY SAND (SM)
CINS-18-7	0.5	100	100	100	100	100	100	100	100	100	100	100	100	99	98	95	68	46	35			SILTY SAND (SM)
CINS-18-8	0.5	100	100	100	100	100	100	100	100	100	100	100	100	100	99	97	77	55	44			SANDY SILT (ML)
CINS-18-9	0.5	100	100	100	100	100	100	100	100	100	100	100	100	99	98	96	81	65	53			SANDY SILT (ML)
CINS-18-10	0.5	100	100	100	100	100	100	100	100	100	100	100	100	99	98	95	79	64	53			SANDY SILT (ML)
CINS-18-11	0.5	100	100	100	100	100	100	100	100	100	100	100	100	99	98	96	74	54	42			SANDY SILT (ML)
Chaffee Island Nearshore Average		100	100	100	100	100	100	100	100	100	100	100	100	98	97	94	68	50	39			
LA-2 Reference Sample																						
LA2REF-18	1.0	100	100	100	100	100	100	100	100	100	100	100	100	100	99	97	71	49	39			SILTY SAND (SM)

Table 17. 2018 Los Angeles River Estuary Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	LARE Composite Samples (LAREVC-18-)			LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
		ST-1	LARE-1	LARE-2		Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
CONVENTIONAL CONSTITUENTS											
Percent Solids	%	47.9	47	54.4	70.4						
Total Volatile Solids	%	2	2.6		3.1						
Total Organic Carbon	%	5.3	4.4	4	0.41						
Oil and Grease	mg/kg dry	1100	1100	1600	19						
TRPH	mg/kg dry	560	550	810	<11						
Total Ammonia	mg/kg dry	23	16	8.2	1.4						
METALS											
Arsenic	mg/kg dry	6.42	7.76	6.04	2.29	8.2	70	0.68	3.0	0.07	0.24
Cadmium	mg/kg dry	**2.35**	**2.68**	**2.59**	0.178	1.2	9.6	7.1	98	1.7	7.5
Chromium	mg/kg dry	32	38.4	36.4	23.4	81	370			100,000	1,000,000
Copper	mg/kg dry	**88.5**	**91.2**	**77.9**	16.4	34	270	310	4,700	3,000	38,000
Lead	mg/kg dry	**75.5**	**81.6**	**87.6**	5.01	46.7	218	400	800	150	3,500
Mercury	mg/kg dry	0.0748	0.111	**0.224**	0.0250J	0.15	0.71	1.1	4.6	18	180
Nickel	mg/kg dry	**31**	**35.9**	**35.5**	11.8	20.9	51.6	150	2,200	1,600	16,000
Selenium	mg/kg dry	2.28	1.4	1.34	<0.104			39	580	380	4,800
Silver	mg/kg dry	0.423	0.643	0.769	0.177	1	3.7	39	580	380	4,800
Zinc	mg/kg dry	**480**	**478**	**404**	45.5	150	410	2,300	35,000	23,000	100,000
BUTYLTINS											
Monobutyltin	µg/kg dry	<2.8	<2.9	<2.5	1.6J						
Dibutyltin	µg/kg dry	8	<1.6	<1.3	<1.9			1,900	25,000		
Tributyltin	µg/kg dry	<3	<3.2	<2.7	<1.0			1,900	25,000		
Tetrabutyltin	µg/kg dry	<1.5	<1.6	<1.3	<2.0						
PAH's											
1-Methylnaphthalene	µg/kg dry	11J	10J	8.6J	<1.5			18,000	73,000		
1-Methylphenanthrene	µg/kg dry	<8.1	<8.3	<7.1	<2.7						
1,6,7-Trimethylnaphthalene	µg/kg dry	<7.3	<7.5	<6.4	<2.5						
2,6-Dimethylnaphthalene	µg/kg dry	440	410	250	4.5J						
2-Methylnaphthalene	µg/kg dry	16J	15J	12J	<2.3	70	670	24,000	300,000		
Acenaphthene	µg/kg dry	11J	8.6J	6.8J	<2.1	16	500	360,000	4,500,000		
Acenaphthylene	µg/kg dry	<7	9.8J	7.6J	<2.3	44	640				
Anthracene	µg/kg dry	31J	29J	30J	<2.7	85.3	1100	1,800,000	23,000,000		

Table 17 (Continued). 2018 Los Angeles River Estuary Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	LARE Composite Samples (LAREVC-18-)			LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
		ST-1	LARE-1	LARE-2		Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
Benzo (a) Anthracene	µg/kg dry	100	97	110	<2.0	261	1600	1,100	21,000		
Benzo (a) Pyrene	µg/kg dry	81	84	96	<1.9	430	1600	110	2,100	38	130
Benzo (b) Fluoranthene	µg/kg dry	86	93	110	<2.0			1,100	21,000		
Benzo (e) Pyrene	µg/kg dry	120	97	110	2.5J						
Benzo (g,h,i) Perylene	µg/kg dry	74	63	73	3.2J						
Benzo (k) Fluoranthene	µg/kg dry	110	87	120	<2.1			11,000	210,000		
Biphenyl	µg/kg dry	28J	28J	24J	<2.7			4,700	20,000		
Chrysene	µg/kg dry	220	230	200	<1.9	384	2800	110,000	2,100,000		
Dibenz (a,h) Anthracene	µg/kg dry	<6	<6.1	<5.3	<2.0	63.4	260	110	2,100		
Dibenzothiophene	µg/kg dry	16J	16J	12J	<1.9			78,000	1,200,000		
Fluoranthene	µg/kg dry	290	280	280	<2.5	600	5100	240,000	3,000,000		
Fluorene	µg/kg dry	<6.8	<7	<6	<2.3	19	540	240,000	3,000,000		
Indeno (1,2,3-c,d) Pyrene	µg/kg dry	62	52	64	<1.8			1,100	21,000		
Naphthalene	µg/kg dry	20J	21J	18J	<2.2	160	2100	3,800	17,000		
Perylene	µg/kg dry	73	73	99	3.4J						
Phenanthrene	µg/kg dry	150	120	110	<2.4	240	1500				
Pyrene	µg/kg dry	300	280	310	2.3J	665	2600	180,000	2,300,000		
Total Low Weight PAHs	µg/kg dry	**723**	**667**	479	4.5J	552	3160				
Total High Weight PAHs	µg/kg dry	1516	1436	1572	11.4J	1700	9600				
Total PAHs	µg/kg dry	2239	2103	2051	15.9J	4022	44792				
PHTHALATES											
Benzyl butyl phthalate	µg/kg dry	120J	150J	160J	7.8J			290,000	1,200,000		
bis-(2-Ethylhexyl)phthalate	µg/kg dry	3500	3400	3400	21J	*182*[4]	*2646*[4]	39,000	160,000		
Diethyl phthalate	µg/kg dry	83J	<6.9	<5.9	<2.3			5,100,000	66,000,000		
Dimethyl phthalate	µg/kg dry	<8.3	30J	<7.3	<2.8			780,000	12,000,000		
Di-n-butyl phthalate	µg/kg dry	<7.9	210U	180U	70U			630,000	8,200,000		
Di-n-octyl phthalate	µg/kg dry	<7.8	<8	<6.9	<2.6			63,000	820,000		
PHENOLS											
2,3,4,6-Tetrachlorophenol	µg/kg dry	<16	<17	<14	<5.5			190,000	2,500,000		
2,4,5-Trichlorophenol	µg/kg dry	<5	<5.2	<4.4	<1.7			630,000	8,200,000		
2,4,6-Trichlorophenol	µg/kg dry	<5.4	<5.6	<4.8	<1.8			6,300	82,000		
2,4-Dichlorophenol	µg/kg dry	<7.1	<7.2	<6.2	<2.4			19,000	250,000		
2,4-Dimethylphenol	µg/kg dry	<11	<11	<9.5	<3.6			130,000	1,600,000		
2,4-Dinitrophenol	µg/kg dry	<250	<260	<220	<84			13,000	160,000		
2,6-Dichlorophenol	µg/kg dry	<8.9	<9.1	<7.8	<3.0						

Table 17 (Continued). 2018 Los Angeles River Estuary Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	LARE Composite Samples (LAREVC-18-)			LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
		ST-1	LARE-1	LARE-2		Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
2-Chlorophenol	µg/kg dry	<7.7	<7.9	<6.8	<2.6			39,000	580,000		
2-Methylphenol	µg/kg dry	<8.2	<8.4	<7.1	<2.7			320,000	4,100,000		
2-Nitrophenol	µg/kg dry	<7	<7.1	<6.1	<2.3						
3/4-Methylphenol	µg/kg dry	650	220	73	<5.1						
4,6-Dinitro-2-Methylphenol	µg/kg dry	<280	<280	<240	<93						
4-Chloro-3-Methylphenol	µg/kg dry	<8.6	<8.8	<7.5	<2.9						
4-Nitrophenol	µg/kg dry	<340	<350	<300	<110						
Bisphenol A	µg/kg dry	130	660	120	<2.9			320,000	4,100,000		
Pentachlorophenol	µg/kg dry	<5.5	<5.6	<4.8	<1.8			1,000	4,000	4,400	13,000
Phenol	µg/kg dry	<9.6	<9.9	<8.4	<3.2			1,900,000	25,000,000		
CHLORINATED PESTICIDES											
2,4'-DDD	µg/kg dry	<0.79	<0.8	<0.69	<0.11						
2,4'-DDE	µg/kg dry	<0.37	<0.37	<0.32	<0.050						
2,4'-DDT	µg/kg dry	<0.65	<0.65	<0.57	<0.088						
4,4'-DDD	µg/kg dry	<0.42	<0.42	<0.36	0.34	2	20	190	2,500	2,300	9,000
4,4'-DDE	µg/kg dry	**18**	**17**	**16**	**4.5**	2.2	27	2,000	9,300	1,600	6,300
4,4'-DDT	µg/kg dry	0.55UJ	0.55UJ	0.48UJ	<0.075	1	7	1,900	8,500	1,600	6,300
Total DDT	µg/kg dry	**18**	**17**	**16**	**4.8**	1.58	46.1				
Aldrin	µg/kg dry	0.4UJ-	0.4UJ-	0.34UJ-	<0.054			39	180	33	130
BHC-alpha	µg/kg dry	<0.6	<0.61	<0.52	<0.082			86	360		
BHC-beta	µg/kg dry	<0.7	<0.71	<0.61	<0.096			300	1,300		
BHC-delta	µg/kg dry	<0.97	<0.98	<0.84	<0.13						
BHC-gamma	µg/kg dry	<0.36	<0.36	<0.31	<0.049	*0.32*[4]	*0.99*[4]	570	2,500		
Chlordane-alpha	µg/kg dry	7.1	5.3	5.3	<0.095						
Chlordane-gamma	µg/kg dry	9.5	8	6.2	<0.076						
Chlordane (Technical)	µg/kg dry	110	110	80	<7.3			1,700	7,700	430	1,700
Cis-nonachlor	µg/kg dry	5.2	1.8J	2	<0.072						
Dieldrin	µg/kg dry	1.1UJ	1.1UJ	0.97UJ	<0.15	0.02	8	34	140	35	130
Endosulfan Sulfate	µg/kg dry	1.1UJ	1.1UJ	0.95UJ	<0.15						
Endosulfan I	µg/kg dry	0.6UJ	0.61UJ	0.53UJ	<0.082			47,000	700,000		
Endosulfan II	µg/kg dry	<0.95	<0.95	<0.82	<0.13						
Endrin	µg/kg dry	<0.59	<0.6	<0.51	<0.080			1,900	25,000	21,000	230,000
Endrin Aldehyde	µg/kg dry	<1	<1	<0.9	<0.14						
Endrin Ketone	µg/kg dry	0.58UJ	0.58UJ	0.5UJ	<0.079						
Heptachlor	µg/kg dry	0.54UJ-	0.54UJ-	0.47UJ-	<0.073			130	630	130	520

Table 17 (Continued). 2018 Los Angeles River Estuary Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	LARE Composite Samples (LAREVC-18-)			LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
		ST-1	LARE-1	LARE-2		Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
Heptachlor Epoxide	µg/kg dry	<0.46	<0.47	<0.4	<0.063			70	330		
Methoxychlor	µg/kg dry	<0.7	<0.71	<0.61	<0.096			32,000	410,000	340,000	3,800,000
Mirex	µg/kg dry	<0.41	<0.41	<0.36	<0.056			36	170	31	120
Oxychlordane	µg/kg dry	<0.76	<0.77	<0.66	<0.10						
Toxaphene	µg/kg dry	<19	<19	<16	<12			490	2,100	460	1,800
Trans-nonachlor	µg/kg dry	10J	5.1J	3.5J	<0.061						
Total Chlordane	µg/kg dry	**31.8**	**20.2**	**17**	ND	0.5	6	1,700	7,700		
PCB CONGENERS											
PCB018	µg/kg dry	<0.14	3	<0.12	<0.092						
PCB028	µg/kg dry	<0.14	2	<0.13	<0.099						
PCB037	µg/kg dry	<0.13	<0.13	<0.11	<0.086						
PCB044	µg/kg dry	<0.32	2.6	2.2	<0.22						
PCB049	µg/kg dry	0.97	1.6	1.2	<0.070						
PCB052	µg/kg dry	3.4	3.3	2.8	<0.27						
PCB066	µg/kg dry	2.4	3.2	2.2	<0.18						
PCB070	µg/kg dry	2.9	2.8	2.4	<0.10						
PCB074	µg/kg dry	<0.19	1.6	1.4	<0.13						
PCB077	µg/kg dry	<0.24	<0.24	<0.21	<0.16			38	160		
PCB081	µg/kg dry	<0.19	<0.19	<0.16	<0.13			12	48		
PCB087	µg/kg dry	<0.23	2	1.7	<0.16						
PCB099	µg/kg dry	1.6	1.3	1.5	<0.067						
PCB101	µg/kg dry	5.3	4.6	3.6	<0.063						
PCB105	µg/kg dry	2.9	2.8	<0.097	<0.076			120	490		
PCB110	µg/kg dry	4.6	4.3	4.4	<0.048						
PCB114	µg/kg dry	<0.15	<0.16	<0.13	<0.11			120	500		
PCB118	µg/kg dry	4.3	3.7	3.9	<0.049			120	490		
PCB119	µg/kg dry	<0.13	<0.13	<0.11	<0.089						
PCB123	µg/kg dry	<0.15	<0.15	<0.13	<0.10			120	490		
PCB126	µg/kg dry	<0.11	<0.12	<0.1	<0.078			0.036	0.15		
PCB128	µg/kg dry	<0.25	<0.25	<0.22	<0.17						
PCB132/153	µg/kg dry	12	7.2	6.9	<0.23						
PCB138/158	µg/kg dry	10	6.1	5.8	<0.50						
PCB149	µg/kg dry	7.6	4	3.5	<0.17						
PCB151	µg/kg dry	3	1.4	1.1	<0.12						
PCB156	µg/kg dry	<0.16	<0.16	<0.14	<0.11			120	500		

Table 17 (Continued). 2018 Los Angeles River Estuary Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	LARE Composite Samples (LAREVC-18-)			LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
		ST-1	LARE-1	LARE-2		Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
PCB157	µg/kg dry	<0.18	<0.18	<0.15	<0.12			120	500		
PCB167	µg/kg dry	<0.28	<0.28	<0.24	<0.19			120	510		
PCB168	µg/kg dry	<0.3	<0.3	<0.26	<0.20						
PCB169	µg/kg dry	<0.14	<0.14	<0.12	<0.092			0.12	0.51		
PCB170	µg/kg dry	4	2.1	1.7	<0.16						
PCB177	µg/kg dry	2.5	1.3	<0.21	<0.17						
PCB180	µg/kg dry	9.7	4.6	3.8	<0.13						
PCB183	µg/kg dry	2.4	1.2	0.89	<0.13						
PCB187	µg/kg dry	4.7	2.7	2.5	<0.15						
PCB189	µg/kg dry	<0.13	<0.14	<0.12	<0.091			130	520		
PCB194	µg/kg dry	2.4	<0.16	1.3	<0.11						
PCB201	µg/kg dry	<0.071	<0.072	<0.062	<0.048						
PCB206	µg/kg dry	1.4	1.5	1.8	<0.16						
Total PCB Congeners	µg/kg dry	**88.1**	**70.9**	**56.6**	ND	22.7	180	230	940	89	300
PYRETHROIDS											
Allethrin	µg/kg dry	<1	<1.1	<0.45	<0.36			95,000	1,200,000		
Bifenthrin	µg/kg dry	13J-	12J-	3.6J-	<0.43			160,000	2,100,000		
cis-/trans-Permethrin	µg/kg dry	19J-	18J-	4.8J-	<0.71			6,300	82,000		
Cyfluthrin	µg/kg dry	5.7	7.1	1.3	<0.36			380,000	4,900,000		
Cypermethrin	µg/kg dry	6.1	6.4	1.1	<0.36			47,000	620,000		
Deltamethrin:Tralomethrin	µg/kg dry	3.5	4.1	0.73J	<0.36			160,000	2,100,000		
Esfenvalerate:Fenvalerate	µg/kg dry	4.1	3.2	2.5	<0.36			160,000	2,100,000		
Fenpropathrin	µg/kg dry	<1	<1.1	<0.45	<0.36			63,000	820,000		
Fluvalinate	µg/kg dry	<1	<1.1	<0.45	<0.36						
Lambda-Cyhalothrin	µg/kg dry	<1	<1.1	<0.45	<0.36			320,000	4,100,000		
Phenothrin	µg/kg dry	<1	<1.1	<0.45	<0.36			190,000	2,500,000		
Resmethrin:Bioresmethrin	µg/kg dry	<1.7	<1.8	<0.77	<0.60						
Tetramethrin	µg/kg dry	<1.2	<1.3	<0.54	<0.43						
ERM Quotient		0.19	0.19	0.18							

1. Effects Range Low (ERL) and Effects Range Median (ERM) sediment quality objectives from Long *et al.* (1995).
2. Regional Screening Levels for Chemical Contaminants at Superfund Sites" (USEPA Region 9, updated 2018).
3. California Human Health Screening Levels for Soil (Cal/EPA, 2005).
4. TELs and PELs were used when ERLs and ERMs were not available.

Bolded values exceed ERL values. **Bolded and underlined** values exceed ERM values. Shaded values exceed one or more of the corresponding human health values.
< = Not detected at the corresponding Method Detection Limit. J = Estimated between the Reporting Limit and the Method Detection Limit. J-=Possible underestimation of a value. ND= Not Detected

Table 18. LARE Individual Core Chemistry Results.

Valid Analyte Name	Units	LARE-1 Locations (LAREVC-18-)							LARE-2 Locations (LAREVC-18-)						NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
		13	14	15	16*	17*	18*	19	28	29*	30*	31*	32*	33*	Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
CONVENTIONAL CONSTITUENTS																				
Percent Solids	%	47.1	43.6	54.8	63.1	60.2	66.6	44.3	46.6	57.9	59.4	57.2	58.4	51.7						
Total Volatile Solids	%	--	--	2.8	1.6	3	1.8	2.9	2.3	2.6	1.8	3.4	2.4	2.8						
Total Organic Carbon	%	--	--	3.6	3.2	2.7	2.4	4.2	4.6	3.9	2.8	3.9	4	3.6						
Oil and Grease	mg/kg dry	--	--	940	1900	1500	1400	650	1300	1300	1100	1900	1200	930						
TRPH	mg/kg dry	--	--	490	1200	960	810	360	670	790	530	1100	600	530						
Total Ammonia	mg/kg dry	--	--	10	22	16	13	2.5	12	10	4	7.6	7.2	7						
METALS																				
Arsenic	mg/kg dry	--	--	5.95	6.77	4.81	4.14	6.71	5.47	5.61	5.52	6.8	5.91	8.63	8.2	70	0.68	3.0	0.07	0.24
Cadmium	mg/kg dry	--	--	**2.03**	**1.99**	**1.55**	**1.39**	**2.4**	**2.15**	**1.52**	**1.73**	**2.31**	**1.89**	**2.6**	1.2	9.6	7.1	98	1.7	7.5
Chromium	mg/kg dry	--	--	30	29.8	26.5	22.1	33.5	28.7	27	27.6	34.2	29.3	39.2	81	370			100,000	1,000,000
Copper	mg/kg dry	--	--	**70.2**	**71.2**	**54.6**	**46.6**	**82.1**	**71.6**	**57.1**	**59.1**	**77.9**	**65**	**85.8**	34	270	310	4,700	3,000	38,000
Lead	mg/kg dry	--	--	**68.6**	**75.2**	**75.7**	**68.3**	**68.7**	**47.4**	**58.9**	**68.5**	**88.6**	**74.7**	**98.6**	46.7	218	400	800	150	3,500
Mercury	mg/kg dry	--	--	0.138	**0.253**	0.116	0.0798	0.114	0.1	**0.166**	0.13	**0.138**	0.111	0.109	0.15	0.71	1.1	4.6	18	180
Nickel	mg/kg dry	--	--	**30.7**	**31.5**	**28.2**	**22.2**	**32.8**	**31.7**	**25.7**	**27.5**	**34.5**	**29.9**	**39.3**	20.9	51.6	150	2,200	1,600	16,000
Selenium	mg/kg dry	--	--	1.41	1.13	0.964	1.03	2.05	2.14	1.26	1.35	1.39	1.43	1.81			39	580	380	4,800
Silver	mg/kg dry	--	--	0.487	0.681	0.453	0.47	0.447	0.347	0.421	0.542	0.658	0.545	0.691	1	3.7	39	580	380	4,800
Zinc	mg/kg dry	--	--	**347**	**352**	**268**	**226**	**411**	**344**	**278**	**299**	**394**	**325**	**420**	150	410	2,300	35,000	23,000	100,000
BUTYLTINS																				
Monobutyltin	µg/kg dry	--	--	<2.4	<2.2	<2.2	<2.1	<3.1	<2.8	<2.3	<2.2	<2.3	<2.3	<2.6						
Dibutyltin	µg/kg dry	--	--	6	<1.2	15	15	20	11	4.4J	16	12	<1.2	11			1,900	25,000		
Tributyltin	µg/kg dry	--	--	<2.6	<2.4	<2.4	<2.2	<3.4	<3	<2.4	<2.4	<2.5	<2.5	<2.8			1,900	25,000		
Tetrabutyltin	µg/kg dry	--	--	<1.3	<1.2	<1.2	<1.1	<1.7	<1.5	<1.2	<1.2	<1.3	<1.3	<1.4						
PAH's																				
1-Methylnaphthalene	µg/kg dry	--	--	9.1J	8.4J	7.8J	4.1J	7.2J	6.2J	11J	<18	11J	9.4J	12J			18,000	73,000		
1-Methylphenanthrene	µg/kg dry	--	--	<7	<6.2	<6.4	<2.9	<8.7	<8.2	<6.6	<32	<6.7	<3.3	<3.8						
1,6,7-Trimethylnaphthalene	µg/kg dry	--	--	<6.3	<5.6	<5.8	<2.6	<7.8	<7.4	<5.9	<29	<6	<3	<3.4						
2,6-Dimethylnaphthalene	µg/kg dry	--	--	250	250	270	56	240	190	260	160J	290	130	160						
2-Methylnaphthalene	µg/kg dry	--	--	17J	12J	11J	6.8J	11J	9.6J	19J	<27	17J	16J	15J	70	670	24,000	300,000		
Acenaphthene	µg/kg dry	--	--	<5.5	9.4J	9.5J	7.8J	<6.7	7J	**31J**	<25	10J	13J	11J	16	500	360,000	4,500,000		
Acenaphthylene	µg/kg dry	--	--	7.7J	6.3J	7.6J	3.7J	9.5J	9J	8.6J	<28	10J	8.6J	8.1J	44	640				
Anthracene	µg/kg dry	--	--	30J	28J	31J	24	30J	30J	68	<32	44	38	31	85.3	1100	1,800,000	23,000,000		
Benzo (a) Anthracene	µg/kg dry	--	--	95	75	110	78	110	88	170	77J	150	140	94	261	1600	1,100	21,000		
Benzo (a) Pyrene	µg/kg dry	--	--	79	63	92	93	110	82	140	94J	110	140	100	430	1600	110	2,100	38	130
Benzo (b) Fluoranthene	µg/kg dry	--	--	95	90	110	91	170	130	140	<24	120	180	120			1,100	21,000		
Benzo (e) Pyrene	µg/kg dry	--	--	95	84	91	88	130	110	150	100J	130	140	96						
Benzo (g,h,i) Perylene	µg/kg dry	--	--	65	51	66	68	97	70	87	120J	83	120	66						
Benzo (k) Fluoranthene	µg/kg dry	--	--	110	88	110	98	120	99	160	<25	150	140	110			11,000	210,000		
Biphenyl	µg/kg dry	--	--	24J	19J	18J	17	41J	28J	28J	<31	31J	16J	23						
Chrysene	µg/kg dry	--	--	190	170	210	140	200	200	270	120J	250	230	180	384	2800	110,000	2,100,000		
Dibenz (a,h) Anthracene	µg/kg dry	--	--	<5.2	<4.6	<4.7	<2.1	45	<6	33J	27J	<4.9	28	<2.8	63.4	260	110	2,100		
Dibenzothiophene	µg/kg dry	--	--	<4.9	<4.3	<4.4	<2	15J	14J	23J	<22	17J	<2.3	<2.6			78,000	1,200,000		
Fluoranthene	µg/kg dry	--	--	240	260	310	210	270	300	480	190	390	260	250	600	5100	240,000	3,000,000		
Fluorene	µg/kg dry	--	--	<5.9	<5.2	<5.4	22	<7.3	<6.9	<5.5	<27	<5.6	<2.8	24	19	540	240,000	3,000,000		
Indeno (1,2,3-c,d) Pyrene	µg/kg dry	--	--	54	43	55	64	76	51	81	69J	71	89	56			1,100	21,000		
Naphthalene	µg/kg dry	--	--	16J	20J	15J	10J	20J	15J	25J	<26	25J	20	20	160	2100	3,800	17,000		
Perylene	µg/kg dry	--	--	79	70	91	60	86	89	120	92J	140	150	98						

Table 18 (Continued). LARE Individual Core Chemistry Results.

Valid Analyte Name	Units	LARE-1 Locations (LAREVC-18-)							LARE-2 Locations (LAREVC-18-)						NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
		13	14	15	16*	17*	18*	19	28	29*	30*	31*	32*	33*	Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
Phenanthrene	µg/kg dry	--	--	130	160	170	140	93	130	**310**	110J	170	140	140	240	1500				
Pyrene	µg/kg dry	--	--	280	300	340	210	280	280	450	210	380	340	300	665	2600	180,000	2,300,000		
Total Low Weight PAHs	µg/kg dry	--	--	484	513	540	291	467	439	**784**	270	**625**	391	444	552	3160				
Total High Weight PAHs	µg/kg dry	--	--	1382	1294	1585	1200	1694	1499	**2281**	1099	**1974**	**1957**	1470	1700	9600				
Total PAHs	µg/kg dry	--	--	1866	1807	2125	1491	2161	1938	3065	1369	2599	2348	1914	4022	44792				
PHTHALATES																				
Benzyl butyl phthalate	µg/kg dry	--	--	190	150J	140J	350	140J	100J	160J	<33	160J	<3.3	150			290,000	1,200,000		
bis-(2-Ethylhexyl)phthalate	µg/kg dry	--	--	5200	3700	4100	2100	3100	2500	3900	12000	4100	3600	3400	*182*[4]	*2646*[4]	39,000	160,000		
Diethyl phthalate	µg/kg dry	--	--	<5.8	110J	<5.3	<2.4	<7.1	<6.7	<5.4	<27	<5.5	<2.7	<3.1			5,100,000	66,000,000		
Dimethyl phthalate	µg/kg dry	--	--	<7.2	<6.3	<6.6	13J	<8.9	33J	19J	<33	<6.8	<3.4	<3.9			780,000	12,000,000		
Di-n-butyl phthalate	µg/kg dry	--	--	180U	160U	160U	74U	220U	210U	170U	830U	170U	94	<3.7			630,000	8,200,000		
Di-n-octyl phthalate	µg/kg dry	--	--	<6.8	<5.9	<6.2	<2.8	<8.3	<7.9	<6.4	<31	<6.4	<3.2	<3.6			63,000	820,000		
PHENOLS																				
2,3,4,6-Tetrachlorophenol	µg/kg dry	--	--	<14	<12	<13	<5.8	<17	<16	<13	<65	<13	<6.6	<7.5			190,000	2,500,000		
2,4,5-Trichlorophenol	µg/kg dry	--	--	<4.4	<3.8	<4	<1.8	<5.4	<5.1	<4.1	<20	<4.1	<2	<2.3			630,000	8,200,000		
2,4,6-Trichlorophenol	µg/kg dry	--	--	<4.7	<4.1	<4.3	<1.9	<5.8	<5.5	<4.4	<22	<4.5	<2.2	<2.5			6,300	82,000		
2,4-Dichlorophenol	µg/kg dry	--	--	<6.1	<5.4	<5.6	<2.5	<7.5	<7.1	<5.7	<28	<5.8	<2.9	<3.3			19,000	250,000		
2,4-Dimethylphenol	µg/kg dry	--	--	<9.4	<8.2	<8.5	<3.9	<12	<11	<8.8	<43	<8.9	<4.4	<5			130,000	1,600,000		
2,4-Dinitrophenol	µg/kg dry	--	--	<220	<190	<200	<89	<270	<250	<200	<990	<200	<100	<120			13,000	160,000		
2,6-Dichlorophenol	µg/kg dry	--	--	<7.7	<6.7	<7	<3.2	<9.5	<8.9	<7.2	<35	<7.3	<3.6	<4.1						
2-Chlorophenol	µg/kg dry	--	--	<6.7	<5.9	<6.1	<2.8	<8.2	<7.8	<6.3	<31	<6.3	<3.1	<3.6			39,000	580,000		
2-Methylphenol	µg/kg dry	--	--	<7.1	<6.2	<6.4	<2.9	<8.7	<8.2	<6.6	<33	<6.7	<3.3	<3.8						
2-Nitrophenol	µg/kg dry	--	--	<6	<5.3	<5.5	<2.5	<7.4	<7	<5.6	<28	<5.7	<2.8	<3.2						
3/4-Methylphenol	µg/kg dry	--	--	72	86	64	69	73	150	86	87J	96	92	80						
4,6-Dinitro-2-Methylphenol	µg/kg dry	--	--	<240	<210	<220	<98	<290	<280	<220	<1100	<230	<110	<130						
4-Chloro-3-Methylphenol	µg/kg dry	--	--	<7.4	<6.5	<6.7	<3.1	<9.1	<8.6	<6.9	<34	<7	<3.5	<4						
4-Nitrophenol	µg/kg dry	--	--	<290	<260	<270	<120	<360	<340	<270	<1300	<280	<140	<160						
Bisphenol A	µg/kg dry	--	--	88	200	79	46	150	110	100	62	50	90	110			320,000	4,100,000		
Pentachlorophenol	µg/kg dry	--	--	<4.8	<4.2	<4.3	<2	<5.8	<5.5	<4.5	<22	<4.5	<2.2	<2.5			1,000	4,000	4,400	13,000
Phenol	µg/kg dry	--	--	<8.3	<7.3	<7.6	<3.4	<10	<9.7	<7.8	<38	<7.9	<3.9	<4.5			1,900,000	25,000,000		
CHLORINATED PESTICIDES																				
2,4'-DDD	µg/kg dry	--	--	<0.68	<0.59	<0.63	<0.56	<0.86	<0.8	<0.64	<0.63	<0.65	<0.64	<0.74						
2,4'-DDE	µg/kg dry	--	--	<0.32	<0.27	<0.29	<0.26	<0.4	<0.37	<0.3	<0.29	<0.3	<0.3	<0.34						
2,4'-DDT	µg/kg dry	--	--	<0.56	<0.49	<0.51	<0.46	<0.7	<0.65	<0.52	<0.51	<0.53	<0.52	<0.6						
4,4'-DDD	µg/kg dry	--	--	<0.36	<0.31	<0.33	<0.29	<0.45	<0.42	<0.34	<0.33	<0.34	<0.33	<0.39	2	20	2,300	9,600	2,300	9,000
4,4'-DDE	µg/kg dry	--	--	**19**	**12**	**18**	**12**	**22**	**17**	**19**	**20**	**18**	**15**	**16**	2.2	27	2,000	9,300	1,600	6,300
4,4'-DDT	µg/kg dry	--	--	0.47UJ	0.41UJ	0.43UJ	0.39UJ	0.59UJ	0.55UJ	0.44UJ	0.43UJ	0.45UJ	0.44UJ	0.51UJ	1	7	1,900	8,500	1,600	6,300
Total DDT	µg/kg dry	--	--	**19**	**12**	**18**	**12**	**22**	**17**	**19**	**20**	**18**	**15**	**16**	1.58	46.1				
Aldrin	µg/kg dry	--	--	0.34UJ-	0.3UJ-	0.31UJ-	0.28UJ-	0.43UJ-	0.4UJ-	0.32UJ-	0.31UJ-	0.32UJ-	0.32UJ-	0.37UJ-			39	180	33	130
BHC-alpha	µg/kg dry	--	--	<0.52	<0.45	<0.47	<0.42	<0.65	<0.6	<0.48	<0.47	<0.49	<0.48	<0.56			86	360		
BHC-beta	µg/kg dry	--	--	<0.61	<0.53	<0.55	<0.49	<0.76	<0.71	<0.57	<0.56	<0.58	<0.57	<0.65			300	1,300		
BHC-delta	µg/kg dry	--	--	<0.83	<0.72	<0.76	<0.68	<1	<0.98	<0.78	<0.77	<0.79	<0.78	<0.9						
BHC-gamma	µg/kg dry	--	--	<0.31	<0.27	<0.28	<0.25	<0.39	<0.36	<0.29	<0.28	<0.29	<0.29	<0.33	*0.32*[4]	*0.994*	570	2,500		
Chlordane-alpha	µg/kg dry	--	--	11	6.4	6.4	6.2	6.6	5.6	6.7	5.7	6.4	4.6	4.8						
Chlordane-gamma	µg/kg dry	--	--	15	7.6	8.6	7	9.6	5.6	6.8	6.3	8.2	6.6	6.3						
Chlordane (Technical)	µg/kg dry	--	--	100	81	98	66	69	77	83	46	61	78	66			1,700	7,700	430	1,700
Cis-nonachlor	µg/kg dry	--	--	6.9	<0.4	2.9	3	4	2.4	2.3	2.5	4.6	3.4	3.7						
Dieldrin	µg/kg dry	--	--	0.95UJ	0.83UJ	0.87UJ	0.78UJ	1.2UJ	1.1UJ	0.89UJ	0.88UJ	0.91UJ	0.89UJ	1UJ			34	140	35	130

Table 18 (Continued). LARE Individual Core Chemistry Results.

Valid Analyte Name	Units	LARE-1 Locations (LAREVC-18-)							LARE-2 Locations (LAREVC-18-)						NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
		13	14	15	16*	17*	18*	19	28	29*	30*	31*	32*	33*	Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
Endosulfan Sulfate	µg/kg dry	--	--	0.94UJ	0.81UJ	0.86UJ	0.76UJ	1.2UJ	1.1UJ	0.88UJ	0.86UJ	0.89UJ	0.87UJ	1UJ						
Endosulfan I	µg/kg dry	--	--	0.52UJ	0.45UJ	0.48UJ	0.42UJ	0.65UJ	0.61UJ	0.49UJ	0.48UJ	0.49UJ	0.49UJ	0.56UJ			47,000	700,000		
Endosulfan II	µg/kg dry	--	--	<0.81	<0.71	<0.74	<0.66	<1	<0.95	<0.76	<0.75	<0.77	<0.76	<0.88						
Endrin	µg/kg dry	--	--	<0.51	<0.44	<0.47	<0.41	<0.64	<0.59	<0.48	<0.47	<0.48	<0.47	<0.55			1,900	25,000	21,000	230,000
Endrin Aldehyde	µg/kg dry	--	--	<0.89	<0.78	<0.82	<0.73	<1.1	<1	<0.84	<0.82	<0.85	<0.83	<0.96						
Endrin Ketone	µg/kg dry	--	--	0.5UJ	0.43UJ	0.46UJ	0.41UJ	0.63UJ	0.58UJ	0.47UJ	0.46UJ	0.47UJ	0.47UJ	0.54UJ						
Heptachlor	µg/kg dry	--	--	0.46UJ-	0.4UJ-	0.42UJ-	0.38UJ-	0.58UJ-	0.54UJ-	0.43UJ-	0.42UJ-	0.44UJ-	0.43UJ-	0.5UJ-			130	630	130	520
Heptachlor Epoxide	µg/kg dry	--	--	<0.4	<0.35	<0.36	<0.32	<0.5	<0.47	<0.37	<0.37	<0.38	<0.37	<0.43			70	330		
Methoxychlor	µg/kg dry	--	--	<0.61	<0.53	<0.55	<0.49	<0.76	<0.71	<0.57	<0.56	<0.57	<0.57	<0.65			32,000	410,000	340,000	3,800,000
Mirex	µg/kg dry	--	--	<0.35	<0.31	<0.32	<0.29	<0.44	<0.41	<0.33	<0.32	<0.33	<0.33	<0.38			36	170	31	120
Oxychlordane	µg/kg dry	--	--	<0.66	<0.57	<0.6	<0.53	<0.82	<0.77	<0.61	<0.6	<0.62	<0.61	<0.71						
Toxaphene	µg/kg dry	--	--	<16	<14	<15	<13	<20	<19	<15	<15	<15	<15	<17			490	2,100	460	1,800
Trans-nonachlor	µg/kg dry	--	--	10J	6J	8.7J	10J	6.8J	12J	5.7J	6.5J	15J	5.2J	8J						
Total Chlordane	µg/kg dry	--	--	**42.9**	**20**	**26.6**	**26.2**	**27**	**25.6**	**21.5**	**21**	**34.2**	**19.8**	**22.8**	0.5	6	1,700	7,700		
PCB CONGENERS																				
PCB018	µg/kg dry	<0.13	<0.15	<0.12	<0.1	<0.11	<0.095	5.7	<0.14	<0.11	<0.11	<0.11	<0.11	3.7						
PCB028	µg/kg dry	<0.14	<0.16	<0.12	<0.11	<0.11	<0.1	3.6	<0.15	<0.12	<0.11	<0.12	<0.12	2.5						
PCB037	µg/kg dry	<0.13	<0.14	<0.11	<0.095	<0.1	<0.089	<0.14	<0.13	<0.1	<0.1	<0.1	<0.1	<0.12						
PCB044	µg/kg dry	2.9	2.4	3.7	2.6	3.9	3.6	4.5	<0.32	1.6	3.1	3.1	3.5	2.5						
PCB049	µg/kg dry	1.4	1.7	3.2	1.4	2.3	2.2	3.2	<0.1	1.4	0.95	1.7	1.7	2.3						
PCB052	µg/kg dry	1.9	2.7	6.9	2.5	3.8	3.8	5.3	2.8	2.9	2.8	3.7	3.4	2.9						
PCB066	µg/kg dry	2	2.1	2.8	2.7	3.5	2.5	4.3	1.5	2.6	2.3	2.3	2.5	2.3						
PCB070	µg/kg dry	2.5	2.5	4.7	2.5	4.1	3.2	5.4	1.4	3	2.5	3.1	3	3.1						
PCB074	µg/kg dry	1.2	1.8	3.5	1.4	2	1.6	2.4	<0.19	1.3	1.3	1.7	1.3	1.4						
PCB077	µg/kg dry	<0.24	<0.26	<0.21	<0.18	<0.19	<0.17	<0.26	<0.24	<0.2	<0.19	<0.2	<0.19	<0.22			38	160		
PCB081	µg/kg dry	<0.19	<0.2	<0.16	<0.14	<0.15	<0.13	<0.2	<0.19	<0.15	<0.15	<0.15	<0.15	<0.17			12	48		
PCB087	µg/kg dry	3.4	3.4	4	1.4	2.9	1.5	2.5	<0.23	2.8	2.1	2.6	2.3	1.7						
PCB099	µg/kg dry	1.5	3.8	3.6	1.7	2.3	2.1	2.7	1.9	1.6	1.7	2.4	1.9	1.6						
PCB101	µg/kg dry	2.3	4.4	8.3	4.2	5.4	4.1	6.1	3.6	7.3	4.3	4.7	5.2	3.3						
PCB105	µg/kg dry	<0.11	<0.12	7.7	2.6	3.4	<0.078	4.4	<0.11	<0.09	<0.088	4.5	<0.09	<0.1			120	490		
PCB110	µg/kg dry	3.7	4.3	9.7	5.4	6.3	4	5.5	2.9	5.4	4.2	5.9	5.3	4.4						
PCB114	µg/kg dry	<0.15	<0.17	<0.13	<0.12	<0.12	<0.11	<0.17	<0.16	<0.12	<0.12	<0.13	<0.12	<0.14			120	500		
PCB118	µg/kg dry	4.2	6.6	8.6	3.5	5.1	3.1	6.6	2.4	6.5	3.9	5.1	5.4	3.5			120	490		
PCB119	µg/kg dry	<0.13	<0.14	<0.11	<0.098	<0.1	<0.092	<0.14	<0.13	<0.11	<0.1	<0.11	<0.1	<0.12						
PCB123	µg/kg dry	<0.15	<0.16	<0.13	<0.11	<0.12	<0.11	<0.16	<0.15	<0.12	<0.12	<0.12	<0.12	<0.14			120	490		
PCB126	µg/kg dry	<0.11	<0.12	<0.099	<0.086	<0.09	<0.08	<0.12	<0.12	<0.093	<0.091	<0.094	<0.092	<0.11			0.036	0.15		
PCB128	µg/kg dry	<0.25	<0.27	<0.22	1.8	<0.2	<0.18	<0.27	<0.25	<0.2	<0.2	<0.2	<0.2	<0.23						
PCB132/153	µg/kg dry	4.7	7.7	16	7.7	9.2	6.1	7.1	4.7	7.2	6.8	9.1	8.4	5.7						
PCB138/158	µg/kg dry	7.9	8.3	14	7	7.6	5.3	8.1	5.5	7.6	7.2	7.9	8.2	5.7						
PCB149	µg/kg dry	2.9	4.5	9.7	4.2	5.3	3.5	4.4	3.1	4.9	3.8	4.9	5.3	3.6						
PCB151	µg/kg dry	2.7	2.1	3.3	1.5	1.5	1.1	1.6	1.3	1.4	1.2	1.7	1.7	1.2						
PCB156	µg/kg dry	<0.16	<0.17	<0.14	<0.12	<0.13	<0.11	<0.17	<0.16	<0.13	<0.13	<0.13	<0.13	<0.15			120	500		
PCB157	µg/kg dry	<0.18	<0.19	<0.15	<0.13	<0.14	<0.12	<0.19	<0.18	<0.14	<0.14	<0.14	<0.14	<0.16			120	500		
PCB167	µg/kg dry	<0.28	<0.3	<0.24	<0.21	<0.22	<0.19	<0.3	<0.28	<0.22	<0.22	<0.23	<0.22	<0.26			120	510		
PCB168	µg/kg dry	<0.3	<0.32	<0.26	<0.22	<0.23	<0.21	<0.32	<0.3	<0.24	<0.24	<0.24	<0.24	<0.28						
PCB169	µg/kg dry	<0.13	<0.15	<0.12	<0.1	<0.11	<0.095	<0.15	<0.14	<0.11	<0.11	<0.11	<0.11	<0.13			0.12	0.51		
PCB170	µg/kg dry	1.4	1.3	4.4	2	2.9	2	<0.25	<0.23	1.9	2.3	2.3	2	1.5						
PCB177	µg/kg dry	<0.24	<0.26	2.3	0.91	<0.19	<0.17	<0.26	1.2	<0.2	0.85	<0.2	<0.2	1.7						

Table 18 (Continued). LARE Individual Core Chemistry Results.

Valid Analyte Name	Units	LARE-1 Locations (LAREVC-18-)							LARE-2 Locations (LAREVC-18-)						NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
		13	14	15	16*	17*	18*	19	28	29*	30*	31*	32*	33*	Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
PCB180	µg/kg dry	4.4	4.9	11	4.9	5.4	3.5	4.8	3.9	5.2	4.5	5.5	5.4	4						
PCB183	µg/kg dry	1.2	1.5	2.7	0.95	1.9	1.8	1.8	<0.2	<0.16	1.2	1.6	1.4	1.2						
PCB187	µg/kg dry	2.6	2.3	5.7	2.3	2.9	2.4	3	<0.22	2.3	2.3	2.9	3	2.1						
PCB189	µg/kg dry	<0.13	<0.14	<0.12	<0.1	<0.11	<0.094	<0.14	<0.13	<0.11	<0.11	<0.11	<0.11	<0.12			130	520		
PCB194	µg/kg dry	<0.15	<0.17	2.2	1.2	<0.12	<0.11	<0.17	<0.16	<0.12	<0.12	<0.13	<0.12	<0.14						
PCB201	µg/kg dry	<0.07	<0.077	<0.061	0.26J	<0.056	<0.05	<0.077	<0.072	<0.057	<0.056	<0.058	<0.057	<0.066						
PCB206	µg/kg dry	2.3	1.9	3.7	1.4	2	1.4	1.9	<0.24	2.2	1.9	1.9	1.5	1.5						
Total PCB Congeners	µg/kg dry	**57.1**	**70.2**	**142**	**68.0**	**83.7**	**58.8**	**94.9**	**36.2**	**69.1**	**61.2**	**78.6**	**72.4**	**63.4**	22.7	180	230	940	89	300
PYRETHROIDS																				
Allethrin	µg/kg dry	--	--	<0.89	<0.79	<0.42	<0.37	<0.56	<1	<0.43	<0.41	<0.86	<0.43	<0.47						
Bifenthrin	µg/kg dry	--	--	3.8J-	4.2J-	3.1J-	2.5J-	9J-	15J-	2.7J-	4.7J-	6.4J-	3J-	3.9J-						
cis-/trans-Permethrin	µg/kg dry	--	--	8.2J-	8.3J-	4.7J-	4.5J-	8.5J-	20J-	4.1J-	4.8J-	12J-	8J-	7.1J-						
Cyfluthrin	µg/kg dry	--	--	1.7J	2.1	0.84	0.89	4.3	6.6	1	0.86	1.7J	0.91	0.54J						
Cypermethrin	µg/kg dry	--	--	1.7J	1.8	0.95	1	2.5	6.3	0.82J	0.73J	1J	1.1	0.69J						
Deltamethrin:Tralomethrin	µg/kg dry	--	--	<0.89	1.9	<0.42	0.69J	1.8	3.7	<0.43	1	1.6J	0.54J	0.72J						
Esfenvalerate:Fenvalerate	µg/kg dry	--	--	2.2	<0.79	1.1	1.2	2.4	3	<0.43	<0.41	<0.86	0.64J	0.79J						
Fenpropathrin	µg/kg dry	--	--	<0.89	<0.79	<0.42	<0.37	<0.56	<1	<0.43	<0.41	<0.86	<0.43	<0.47						
Fluvalinate	µg/kg dry	--	--	<0.89	<0.79	<0.42	<0.37	<0.56	<1	<0.43	<0.41	<0.86	<0.43	<0.47						
Lambda-Cyhalothrin	µg/kg dry	--	--	<0.89	<0.79	<0.42	<0.37	<0.56	<1	<0.43	<0.41	<0.86	<0.43	<0.47						
Phenothrin	µg/kg dry	--	--	<0.89	<0.79	<0.42	<0.37	<0.56	<1	<0.43	<0.41	<0.86	<0.43	<0.47						
Resmethrin:Bioresmethrin	µg/kg dry	--	--	<1.5	<1.3	<0.71	<0.63	<0.95	<1.8	<0.73	<0.7	<1.5	<0.73	<0.81						
Tetramethrin	µg/kg dry	--	--	<1.1	<0.95	<0.5	<0.45	<0.67	<1.3	<0.52	<0.5	<1	<0.51	<0.57						
ERM Quotient		--	--	0.18	0.16	0.16	0.12	0.19	0.15	0.18	0.16	0.19	0.16	0.18						

*Locations within areas not dredged in 2014 and suitable for placement at the LA-2 ODMDS.

1. Effects Range Low (ERL) and Effects Range Median (ERM) sediment quality objectives from Long *et al.* (1995).
2. Regional Screening Levels for Chemical Contaminants at Superfund Sites" (USEPA Region 9, updated 2017).
3. California Human Health Screening Levels for Soil (Cal/EPA, 2005).
4. TELs and PELs were used when ERLs and ERMs were not available.

Bolded values exceed ERL values. **Bolded and underlined** values exceed ERM values. Shaded values exceed one or more of the corresponding human health values.

< = Not detected at the corresponding Method Detection Limit. J = Estimated between the Reporting Limit and the Method Detection Limit. J-=Possible underestimation of a value.

ND= Not Detected

Table 19. 2018 Long Beach Federal Approach Channel Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	QGVC-18	LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
				Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
CONVENTIONAL CONSTITUENTS									
Percent Solids	%	72.6	70.4						
Total Volatile Solids	%	2.2	3.1						
Total Organic Carbon	%	0.41	0.41						
Oil and Grease	mg/kg dry	64	19						
TRPH	mg/kg dry	50	<11						
Total Ammonia	mg/kg dry	1.9	1.4						
METALS									
Arsenic	mg/kg dry	3.32	2.29	8.2	70	0.68	3.0	0.07	0.24
Cadmium	mg/kg dry	0.247	0.178	1.2	9.6	7.1	98	1.7	7.5
Chromium	mg/kg dry	20.3	23.4	81	370			100,000	1,000,000
Copper	mg/kg dry	12.4	16.4	34	270	310	4,700	3,000	38,000
Lead	mg/kg dry	8.1	5.01	46.7	218	400	800	150	3,500
Mercury	mg/kg dry	0.0445	0.0250J	0.15	0.71	1.1	4.6	18	180
Nickel	mg/kg dry	13.7	11.8	20.9	51.6	150	2,200	1,600	16,000
Selenium	mg/kg dry	0.42	<0.104			39	580	380	4,800
Silver	mg/kg dry	0.138U	0.177	1	3.7	39	580	380	4,800
Zinc	mg/kg dry	55.3	45.5	150	410	2,300	35,000	23,000	100,000
BUTYLTINS									
Monobutyltin	µg/kg dry	<1.9	1.6J						
Dibutyltin	µg/kg dry	<1	<1.9			1,900	25,000		
Tributyltin	µg/kg dry	<2	<1.0			1,900	25,000		
Tetrabutyltin	µg/kg dry	<1	<2.0						
PAH's									
1-Methylnaphthalene	µg/kg dry	<1.5	<1.5			18,000	73,000		
1-Methylphenanthrene	µg/kg dry	<2.7	<2.7						
1,6,7-Trimethylnaphthalene	µg/kg dry	<2.4	<2.5						
2,6-Dimethylnaphthalene	µg/kg dry	9.4J	4.5J						
2-Methylnaphthalene	µg/kg dry	<2.3	<2.3	70	670	24,000	300,000		
Acenaphthene	µg/kg dry	<2.1	<2.1	16	500	360,000	4,500,000		
Acenaphthylene	µg/kg dry	<2.3	<2.3	44	640				
Anthracene	µg/kg dry	<2.7	<2.7	85.3	1100	1,800,000	23,000,000		

Table 19 (Continued). 2018 Long Beach Approach Channel Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	QGVC-18	LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
				Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
Benzo (a) Anthracene	µg/kg dry	7.3J	<2.0	261	1600	1,100	21,000		
Benzo (a) Pyrene	µg/kg dry	6.7J	<1.9	430	1600	110	2,100	38	130
Benzo (b) Fluoranthene	µg/kg dry	5.9J	<2.0			1,100	21,000		
Benzo (e) Pyrene	µg/kg dry	5.4J	2.5J						
Benzo (g,h,i) Perylene	µg/kg dry	2.3J	3.2J						
Benzo (k) Fluoranthene	µg/kg dry	7.2J	<2.1			11,000	210,000		
Biphenyl	µg/kg dry	<2.6	<2.7						
Chrysene	µg/kg dry	6.3J	<1.9	384	2800	110,000	2,100,000		
Dibenz (a,h) Anthracene	µg/kg dry	<2	<2.0	63.4	260	110	2,100		
Dibenzothiophene	µg/kg dry	<1.9	<1.9			78,000	1,200,000		
Fluoranthene	µg/kg dry	10J	<2.5	600	5100	240,000	3,000,000		
Fluorene	µg/kg dry	<2.3	<2.3	19	540	240,000	3,000,000		
Indeno (1,2,3-c,d) Pyrene	µg/kg dry	2.1J	<1.8			1,100	21,000		
Naphthalene	µg/kg dry	<2.1	<2.2	160	2100	3,800	17,000		
Perylene	µg/kg dry	11J	3.4J						
Phenanthrene	µg/kg dry	3.6J	<2.4	240	1500				
Pyrene	µg/kg dry	14	2.3J	665	2600	180,000	2,300,000		
Total Low Weight PAHs	µg/kg dry	13.0	4.5J	552	3160				
Total High Weight PAHs	µg/kg dry	78.2	11.4J	1700	9600				
Total PAHs	µg/kg dry	91.2	15.9J	4022	44792				
PHTHALATES									
Benzyl butyl phthalate	µg/kg dry	11J	7.8J			290,000	1,200,000		
bis-(2-Ethylhexyl)phthalate	µg/kg dry	32J	21J	*182*[4]	*2646*[4]	39,000	160,000		
Diethyl phthalate	µg/kg dry	<2.2	<2.3			5,100,000	66,000,000		
Dimethyl phthalate	µg/kg dry	<2.8	<2.8			780,000	12,000,000		
Di-n-butyl phthalate	µg/kg dry	69U	70U			630,000	8,200,000		
Di-n-octyl phthalate	µg/kg dry	<2.6	<2.6			63,000	820,000		
PHENOLS									
2,3,4,6-Tetrachlorophenol	µg/kg dry	<5.4	<5.5			190,000	2,500,000		
2,4,5-Trichlorophenol	µg/kg dry	<1.7	<1.7			630,000	8,200,000		
2,4,6-Trichlorophenol	µg/kg dry	<1.8	<1.8			6,300	82,000		
2,4-Dichlorophenol	µg/kg dry	<2.3	<2.4			19,000	250,000		

Table 19 (Continued). 2018 Long Beach Approach Channel Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	QGVC-18	LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
				Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
2,4-Dimethylphenol	µg/kg dry	<3.6	<3.6			130,000	1,600,000		
2,4-Dinitrophenol	µg/kg dry	<83	<84			13,000	160,000		
2,6-Dichlorophenol	µg/kg dry	<2.9	<3.0						
2-Chlorophenol	µg/kg dry	<2.6	<2.6			39,000	580,000		
2-Methylphenol	µg/kg dry	<2.7	<2.7						
2-Nitrophenol	µg/kg dry	<2.3	<2.3						
3/4-Methylphenol	µg/kg dry	<5	<5.1						
4,6-Dinitro-2-Methylphenol	µg/kg dry	<91	<93						
4-Chloro-3-Methylphenol	µg/kg dry	<2.8	<2.9						
4-Nitrophenol	µg/kg dry	<110	<110						
Bisphenol A	µg/kg dry	53	<2.9			320,000	4,100,000		
Pentachlorophenol	µg/kg dry	<1.8	<1.8			1,000	4,000	4,400	13,000
Phenol	µg/kg dry	<3.2	<3.2			1,900,000	25,000,000		
CHLORINATED PESTICIDES									
2,4'-DDD	µg/kg dry	<0.52	<0.11						
2,4'-DDE	µg/kg dry	<0.24	<0.050						
2,4'-DDT	µg/kg dry	<0.42	<0.088						
4,4'-DDD	µg/kg dry	<0.27	0.34	2	20	2,300	9,600	2,300	9,000
4,4'-DDE	µg/kg dry	**16**	**4.5**	2.2	27	2,000	9,300	1,600	6,300
4,4'-DDT	µg/kg dry	0.36UJ	0.075UJ	1	7	1,900	8,500	1,600	6,300
Total DDT	µg/kg dry	**16**	**4.8**	1.58	46.1				
Aldrin	µg/kg dry	0.26UJ-	<0.054			39	180	33	130
BHC-alpha	µg/kg dry	<0.39	<0.082			86	360		
BHC-beta	µg/kg dry	<0.46	0.096UJ			300	1,300		
BHC-delta	µg/kg dry	<0.63	<0.13						
BHC-gamma	µg/kg dry	<0.23	<0.049	*0.32*[4]	*0.99*[4]	570	2,500		
Chlordane-alpha	µg/kg dry	<0.46	<0.095						
Chlordane-gamma	µg/kg dry	<0.36	<0.076						
Chlordane (Technical)	µg/kg dry	<7.3	<7.3			1,700	7,700	430	1,700
Cis-nonachlor	µg/kg dry	<0.35	<0.072						
Dieldrin	µg/kg dry	0.72UJ	<0.15			34	140	35	130
Endosulfan Sulfate	µg/kg dry	0.71UJ	0.15UJ						

Table 19 (Continued). 2018 Long Beach Approach Channel Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	QGVC-18	LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
				Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
Endosulfan I	µg/kg dry	0.39UJ	<0.082			47,000	700,000		
Endosulfan II	µg/kg dry	<0.62	<0.13						
Endrin	µg/kg dry	<0.39	<0.080			1,900	25,000	21,000	230,000
Endrin Aldehyde	µg/kg dry	<0.68	<0.14						
Endrin Ketone	µg/kg dry	0.38UJ	<0.079						
Heptachlor	µg/kg dry	0.35UJ-	<0.073			130	630	130	520
Heptachlor Epoxide	µg/kg dry	<0.3	<0.063			70	330		
Methoxychlor	µg/kg dry	<0.46	0.096UJ			32,000	410,000	340,000	3,800,000
Mirex	µg/kg dry	<0.27	<0.056			36	170	31	120
Oxychlordane	µg/kg dry	<0.5	<0.10						
Toxaphene	µg/kg dry	<12	12UJ			490	2,100	460	1,800
Trans-nonachlor	µg/kg dry	0.29UJ	<0.061						
Total Chlordane	µg/kg dry	ND	ND	0.5	6	1,700	7,700		
PCB CONGENERS									
PCB018	µg/kg dry	<0.089	<0.092						
PCB028	µg/kg dry	<0.095	<0.099						
PCB037	µg/kg dry	<0.083	<0.086						
PCB044	µg/kg dry	<0.21	<0.22						
PCB049	µg/kg dry	<0.068	<0.070						
PCB052	µg/kg dry	<0.26	<0.27						
PCB066	µg/kg dry	<0.17	<0.18						
PCB070	µg/kg dry	<0.098	<0.10						
PCB074	µg/kg dry	<0.12	<0.13						
PCB077	µg/kg dry	<0.16	<0.16			38	160		
PCB081	µg/kg dry	<0.12	<0.13			12	48		
PCB087	µg/kg dry	<0.15	<0.16						
PCB099	µg/kg dry	<0.065	<0.067						
PCB101	µg/kg dry	<0.06	<0.063						
PCB105	µg/kg dry	<0.073	<0.076			120	490		
PCB110	µg/kg dry	<0.046	<0.048						
PCB114	µg/kg dry	<0.1	<0.11			120	500		
PCB118	µg/kg dry	<0.047	<0.049			120	490		

Table 19 (Continued). 2018 Long Beach Approach Channel Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	QGVC-18	LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
				Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
PCB119	µg/kg dry	<0.085	<0.089						
PCB123	µg/kg dry	<0.099	<0.10			120	490		
PCB126	µg/kg dry	<0.075	<0.078			0.036	0.15		
PCB128	µg/kg dry	<0.16	<0.17						
PCB132/153	µg/kg dry	<0.22	<0.23						
PCB138/158	µg/kg dry	<0.48	<0.50						
PCB149	µg/kg dry	<0.16	<0.17						
PCB151	µg/kg dry	<0.12	<0.12						
PCB156	µg/kg dry	<0.11	<0.11			120	500		
PCB157	µg/kg dry	<0.12	<0.12			120	500		
PCB167	µg/kg dry	<0.18	<0.19			120	510		
PCB168	µg/kg dry	<0.19	<0.20						
PCB169	µg/kg dry	<0.089	<0.092			0.12	0.51		
PCB170	µg/kg dry	<0.15	<0.16						
PCB177	µg/kg dry	<0.16	<0.17						
PCB180	µg/kg dry	<0.13	<0.13						
PCB183	µg/kg dry	<0.13	<0.13						
PCB187	µg/kg dry	<0.14	<0.15						
PCB189	µg/kg dry	<0.087	<0.091			130	520		
PCB194	µg/kg dry	<0.1	<0.11						
PCB201	µg/kg dry	<0.046	<0.048						
PCB206	µg/kg dry	<0.16	<0.16						
Total PCB Congeners	µg/kg dry	ND	ND	22.7	180	230	940	89	300
PYRETHROIDS									
Allethrin	µg/kg dry	<0.34	<0.36						
Bifenthrin	µg/kg dry	0.41UJ-	<0.43						
cis-/trans-Permethrin	µg/kg dry	0.68UJ-	<0.71						
Cyfluthrin	µg/kg dry	<0.34	<0.36						
Cypermethrin	µg/kg dry	<0.34	<0.36						
Deltamethrin:Tralomethrin	µg/kg dry	<0.34	<0.36						
Esfenvalerate:Fenvalerate	µg/kg dry	<0.34	<0.36						
Fenpropathrin	µg/kg dry	<0.34	<0.36						

Table 19 (Continued). 2018 Long Beach Approach Channel Composite Bulk Sediment Chemistry Results.

Valid Analyte Name	Units	QGVC-18	LA-2 Ref.	NOAA Screening		Human RSLs[2] (HQ = 0.1)		Human CHHSLs[3]	
				Salt ERL[1]	Salt ERM[1]	Residential	Industrial	Residential	Commercial Industrial
Fluvalinate	µg/kg dry	<0.34	<0.36						
Lambda-Cyhalothrin	µg/kg dry	<0.34	<0.36						
Phenothrin	µg/kg dry	<0.34	<0.36						
Resmethrin:Bioresmethrin	µg/kg dry	<0.57	<0.60						
Tetramethrin	µg/kg dry	<0.41	<0.43						
ERM Quotient		0.06							

1. Effects Range Low (ERL) and Effects Range Median (ERM) sediment quality objectives from Long *et al*. (1995).
2. Regional Screening Levels for Chemical Contaminants at Superfund Sites" (USEPA Region 9, updated 2017).
3. California Human Health Screening Levels for Soil (Cal/EPA, 2005).
4. TELs and PELs were used when ERLs and ERMs were not available.

Bolded values exceed ERL values. **Bolded and underlined** values exceed ERM values. Shaded values exceed one or more of the corresponding human health values.

< = Not detected at the corresponding Method Detection Limit. J = Estimated between the Reporting Limit and the Method Detection Limit. J- = Possible underestimation of a value.

ND= Not Detected

Table 20. Survival Results for the 10-day *Ampelisca abdita* Bioassays.

Sample ID	Rep	# Alive Out of 20	% Survival	Mean % Survival
Lab Control	A	19	95	97
	B	20	100	
	C	19	95	
	D	20	100	
	E	19	95	
LA-2 REF	A	18	90	**92***
	B	19	95	
	C	18	90	
	D	18	90	
	E	19	95	
LAREVC-18-ST-1	A	17	85	95
	B	19	95	
	C	20	100	
	D	20	100	
	E	19	95	
LAREVC-18-LARE-1	A	20	100	99
	B	20	100	
	C	20	100	
	D	20	100	
	E	19	95	
LAREVC-18-LARE-2	A	20	100	98
	B	18	90	
	C	20	100	
	D	20	100	
	E	20	100	
QGVC-18	A	20	100	100
	B	20	100	
	C	20	100	
	D	20	100	
	E	20	100	

* The survival response at this treatment was significantly less than the Lab Control response at $p < 0.05$.

Table 21. Survival Results for the 10-day *Neanthes arenaceodentata* Bioassays.

Sample ID	Rep	# Alive Out of 10	% Survival	Mean % Survival
Lab Control	A	10	100	100
	B	10	100	
	C	10	100	
	D	10	100	
	E	10	100	
LA-2 REF	A	10	100	100
	B	10	100	
	C	10	100	
	D	10	100	
	E	10	100	
LAREVC-18-ST-1	A	10	100	100
	B	10	100	
	C	10	100	
	D	10	100	
	E	10	100	
LAREVC-18-LARE-1	A	10	100	100
	B	10	100	
	C	10	100	
	D	10	100	
	E	10	100	
LAREVC-18-LARE-2	A	10	100	100
	B	10	100	
	C	10	100	
	D	10	100	
	E	10	100	
QGVC-18	A	10	100	100
	B	10	100	
	C	10	100	
	D	10	100	
	E	10	100	

Reference toxicant bioassay results show that the test organisms responded to toxic stress in a typical fashion (see Section 6.3).

Table 22. Sediment Porewater Initial Water Quality Characteristics for the Bioassay Test Sediments.

Sample ID	pH	Salinity (ppt)	Total Ammonia (mg/L N)	Total Sulfide (mg/L)
LA-2 REF	7.97	26.5	4.2	0.335
LAREVC-18-ST-1	7.69	33.8	192	0.178
LAREVC-18-LARE-1	7.75	33.5	175	1.692
LAREVC-18-LARE-2	7.75	34.0	81.8	0.154
QGVC-18	8.05	33.4	9.8	0.750

Table 23. Replicate and Mean Survival and Normal Development Results and Median Effective and Lethal Concentrations for the Suspended Particulate-Phase 48-Hour Toxicity Tests Using *Mytilus galloprovincialis* Larvae.

Elutriate Concentrations	Percent Survival at 48 Hours						LC$_{50}$ (%)	Percent Normal Development at 48 Hours						EC$_{50}$ (%)
	Rep A	Rep B	Rep C	Rep D	Rep E	Mean		Rep A	Rep B	Rep C	Rep D	Rep E	Mean	
LARE Sand Trap (ST-1)														
Lab Control	100	100	100	100	100	100	17.5	95.3	96.3	97.4	94.9	94.2	95.6	17.3
Salt Control	100	100	100	98.1	100	99.6		94.8	97.4	95.9	95.6	97.5	96.2	
Site Water	100	71.7	90.3	87.7	100	89.7		91.2	61.9	75.5	80.8	91.9	80.3	
1%	100	100	100	100	100	100		97.1	97.6	95.4	97.4	98.0	97.1	
10%	100	100	100	100	100	100		94.9	93.3	93.8	95.5	92.8	94.1	
25%	0	0	0	0	0	**0***		0	0	0	0	0	**0***	
50%	0	0	0	0	0	**0***		0	0	0	0	0	**0***	
100%	0	0	0	0	0	**0***		0	0	0	0	0	**0***	
LARE Upper Channel (LARE-1)														
Lab Control	100	100	100	100	100	100	17.5	96.7	96.6	94.8	94.4	96.7	95.8	17.3
Salt Control	100	100	100	98.1	100	99.6		94.8	97.4	95.9	95.6	97.5	96.2	
Site Water	100	71.7	90.3	87.7	100	89.7		91.2	61.9	75.5	80.8	91.9	80.3	
1%	100	100	100	100	100	100		97.0	96.4	96.3	96.0	95.5	96.2	
10%	100	100	100	100	100	100		92.7	93.0	94.3	93.8	93.7	93.5	
25%	0	0	0	0	0	**0***		0	0	0	0	0	**0***	
50%	0	0	0	0	0	**0***		0	0	0	0	0	**0***	
100%	0	0	0	0	0	**0***		0	0	0	0	0	**0***	
LARE Lower Channel (LARE-2)														
Lab Control	100	100	100	100	100	100	37.5	99.5	100	100	98.5	98.0	99.2	37.5
Salt Control	100	100	100	98.1	100	99.6		94.8	97.4	95.9	95.6	97.5	96.2	
Site Water	100	71.7	90.3	87.7	100	89.7		91.2	61.9	75.5	80.8	91.9	80.3	
1%	100	100	100	100	100	100		99.5	98.8	99.0	99.5	98.6	99.1	
10%	100	100	100	100	100	100		99.5	100	99.1	99.4	99.0	99.4	
25%	100	100	100	100	100	100		98.3	99.0	100	100	99.6	99.4	
50%	0	0	0	0	0	**0***		0	0	0	0	0	**0***	
100%	0	0	0	0	0	**0***		0	0	0	0	0	**0***	

Table 23 (Continued). Replicate and Mean Survival and Normal Development Results and Median Effective and Lethal Concentrations for the Suspended Particulate-Phase 48-Hour Toxicity Tests Using *M. galloprovincialis*.

Elutriate Concentrations	Percent Survival at 48 Hours						LC_{50} (%)	Percent Normal Development at 48 Hours						EC_{50} (%)
	Rep A	Rep B	Rep C	Rep D	Rep E	Mean		Rep A	Rep B	Rep C	Rep D	Rep E	Mean	
POLB Approach Channel Near Queens Gate (QGVC-18)														
Lab Control	100	100	100	100	100	100		97.6	97.3	94.9	95.6	97.7	96.6	
Salt Control	100	100	100	98.1	100	99.6		94.8	97.4	95.9	95.6	97.5	96.2	
Site Water	100	71.7	90.3	87.7	100	89.7		91.2	61.9	75.5	80.8	91.9	80.3	
1%	100	100	100	100	100	100	>100[1]	94.8	98.0	98.1	96.5	95.7	96.6	>100[1]
10%	100	100	100	100	100	100		97.7	95.7	98.6	98.5	97.6	97.6	
50%	100	100	100	100	100	100		96.9	97.4	94.7	97.6	96.6	98.6	
100%	100	100	100	100	100	100		97.1	98.6	99.0	97.9	97.3	98.0	

Reference toxicant bioassay results show that the test organisms responded to toxic stress in a typical fashion (see Section 6.3).

* The survival response at this treatment was significantly less than the Lab Control response at $p < 0.05$.

[1] Due to the absence of significant impairment, the LC_{50} and EC_{50} could not be calculated but can be determined by inspection to be >100% elutriate.

Table 24. Replicate and Mean Survival Results and Median Lethal Concentrations for the 96-Hour Acute Suspended Particulate-Phase Toxicity Tests Using *Americamysis bahia*.

Elutriate Concentrations	Percent Survival at 96 Hours						LC_{50} (%)
	Rep A	Rep B	Rep C	Rep D	Rep E	Mean	
LARE Sand Trap (ST-1)							
Lab Control	100	90	100	100	100	98	62.3
Site Water	100	100	100	100	100	100	
1%	100	100	100	100	100	100	
10%	100	90	100	80	100	94	
25%	100	100	100	100	100	100	
50%	80	100	90	80	90	**88***	
100%	0	0	0	0	0	**0***	
LARE Upper Channel (LARE-1)							
Lab Control	100	100	100	100	100	100	68.3
Site Water	100	100	100	100	100	100	
1%	100	90	100	100	100	98	
10%	100	100	100	100	90[2]	100	
25%	100	100	100	80	100	96	
50%	90[2]	100	100	100	100	100	
100%	0	0	0	0	0	**0***	
LARE Lower Channel (LARE-2)							
Lab Control	100	100	100	100	100	100	>100[1]
Site Water	100	100	100	100	100	100	
1%	90	100	90	100	90	96	
10%	90	90	100	100	90	94	
25%	100	100	100	100	100	100	
50%	60	100	100	100	100	92	
100%	100	100	100	90	100	100	
POLB Approach Channel Near Queens Gate (QGVC-18)							
Lab Control							>100[1]
Site Water	100	100	100	100	100	100	
1%	100	100	100	100	90	98	
10%	100	100	100	100	100	100	
50%	100	100	100	100	100	100	
100%	100	100	100	90	100	98	

Reference toxicant bioassay results show that the test organisms responded to toxic stress in a typical fashion (see Section 6.3).

* The survival response at this treatment was significantly less than the Lab Control response at $p < 0.05$.

[1] Due to the absence of significant impairment, the LC_{50} could not be calculated but can be determined by inspection to be >100% elutriate.

[2] Organism found dead and dried on side of beaker above water. Removed from statistical analysis.

Table 25. Replicate and Mean Survival Results and Median Lethal Concentrations for the 96-Hour Acute Suspended Particulate-Phase Toxicity Tests Using *Menidia beryllina.*

Elutriate Concentrations	Percent Survival at 96 Hours						LC_{50} (%)
	Rep A	Rep B	Rep C	Rep D	Rep E	Mean	
LARE Sand Trap (ST-1)							
Lab Control	100	100	90	100	90	96	47.4
Site Water	80	100	100	90	100	94	
1%	100	100	100	80	100	96	
10%	100	100	100	90	100	98	
25%	100	100	90	100	80	94	
50%	60	20	20	70	50	**44***	
100%	0	0	0	0	0	**0***	
LARE Upper Channel (LARE-1)							
Lab Control	80	9	100	90	100	92	65
Site Water	80	100	100	90	100	94	
1%	100	70	100	100	100	94	
10%	100	90	100	100	90	96	
25%	100	100	100	100	100	100	
50%	90	90	70	90	80	94	
100%	0	0	0	0	0	**0***	
LARE Lower Channel (LARE-2)							
Lab Control	90	100	80	100	90	92	77.4
Site Water	80	100	100	90	100	94	
1%	90	100	90	100	90	94	
10%	100	90	90	70	100	90	
25%	90	100	100	80	100	94	
50%	90	70	100	100	90	90	
100%	30	0	0	10	20	**12***	
POLB Approach Channel Near Queens Gate (QGVC-18)							
Lab Control	90	90	90	100	100	94	>100[1]
Site Water	80	100	100	90	100	94	
1%	90	100	80	100	100	94	
10%	100	80	100	90	90	92	
50%	80	100	100	70	90	88	
100%	100	90	100	90	100	96	

* The survival response at this treatment was significantly less than the Lab Control response at $p < 0.05$.

Reference toxicant bioassay results show that the test organisms responded to toxic stress in a typical fashion (see Section 6.3).

[1] Due to the absence of significant impairment, the LC_{50} could not be calculated but can be determined by inspection to be >100% elutriate.

Table 26. Clam and Polychaete Survival for the Anaheim Bay Harbor Bioaccumulation Exposures.

Site	*Macoma nasuta*		*Nereis virens*	
	% Survival/Rep	Mean % Survival	% Survival/Rep	Mean % Survival
Lab Control	95	99	100	100
	100		100	
	100		100	
	100		100	
	100		100	
LA-2 REF	95	97	100	100
	100		100	
	95		100	
	95		100	
	100		100	
LAREVC-18-ST-1	100	95	100	100
	95		100	
	90		100	
	95		100	
	95		100	
LAREVC-18-LARE-1	100	95	100	95
	100		100	
	90		90	
	90		100	
	95		100	
LAREVC-18-LARE-2	85	93	100	100
	95		100	
	100		100	
	100		100	
	85		100	
QGVC-18	95	98	100	98
	100		100	
	100		100	
	95		90	
	100		100	

Table 27. Bioaccumulation Potential Replicate and Mean Tissue Results for *Macoma nasuta* Exposed to the ST-1, LARE-1, LARE-2 and Control Sediments.

Analyte	Composite Replicate and Mean Concentrations for *Macoma nasuta* Tissues																								
	LAREVC-18-ST-1						LAREVC-18-LARE-1						LAREVC-18-LARE-2						CONTROL						T0
	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	
Percent Lipids	0.58	0.44	0.57	0.47	0.28	0.468	0.54	0.52	0.55	0.45	0.45	0.502	0.50	0.40	0.50	0.55	0.42	0.474	0.40	0.38	0.41	0.34	0.32	0.370	0.59
Metals (mg/kg, wet)																									
Cadmium	0.0359J	0.0388J	<0.0286	<0.0286	<0.0286	*0.321*	0.0361J	0.0428J	0.0334J	0.0332J	0.0428J	0.038	<0.0286	0.0547J	0.0354J	0.037J	0.03J	0.037	0.0288J	0.0356J	<0.114	<0.0286	0.037J	0.0325	0.034J
Copper	1.53	1.2	1.33	0.822	0.845	*1.15*	1.54	1.82	1.47	1.6	1.96	*1.68*	1.4	1.99	1.49	1.56	1.24	*1.54*	1.57	1.67	2.82	1.64	1.49	1.84	1.25
Lead	0.547	0.259	0.504	0.195	0.238	0.349	0.559	0.746	0.555	0.588	0.649	**0.619**	0.527	0.776	0.548	0.483	0.528	**0.572**	0.0918J	0.135	<0.132	0.143	0.124	0.120	0.0909J
Zinc	16.1	11.2	12.2	10.2	9.06	11.8	37.5	17	15.4	15.4	15.6	**20.2**	14.3	21.6	16.2	15.5	13.8	**16.3**	10.5	15.9	11.3	12.8	11.3	12.4	14.3
OC Pesticides (μg/kg, wet)																									
2,4'-DDD	<0.075	<0.076	<0.076	<0.075	<0.076		<0.076	<0.076	<0.076	<0.076	<0.076		<0.076	<0.075	<0.076	<0.075	<0.076		<0.076	<0.076	<0.15	<0.15	<0.076		<0.076
2,4'-DDE	<0.035	<0.035	<0.035	<0.035	<0.035		<0.035	<0.035	<0.035	<0.035	<0.035		<0.035	<0.035	<0.035	<0.035	<0.035		<0.035	<0.035	<0.07	<0.07	<0.035		<0.035
2,4'-DDT	<0.062	<0.062	<0.062	<0.061	<0.062		<0.062	<0.062	<0.062	<0.062	<0.062		<0.062	<0.062	<0.062	<0.061	<0.062		<0.062	<0.062	<0.12	<0.12	<0.062		<0.062
4,4'-DDD	<0.039	<0.04	<0.04	<0.039	<0.04		<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	<0.039	<0.04	<0.039	<0.04		<0.04	<0.04	<0.079	<0.08	<0.04		<0.04
4,4'-DDE	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	<0.04	<0.081	<0.081	<0.04		<0.04
4,4'-DDT	0.052UJ	0.052UJ	0.052UJ	0.052UJ	0.053UJ		0.053UJ	0.053UJ	0.052UJ	0.052UJ	0.053UJ		0.053UJ	0.052UJ	0.052UJ	0.052UJ	0.053UJ		<0.053	<0.052	<0.1	<0.11	<0.053		<0.053
Total DDT's	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha Chlordane	0.51	0.37	0.69	0.29	0.28		0.57	0.65	0.56	0.48	0.59		0.47	0.53	0.73	0.43	0.56		<0.067	<0.067	<0.13	<0.13	<0.067		<0.067
Cis-nonachlor	0.27	0.23	0.32	0.13J	0.2J		0.29	0.38	0.34	0.28	0.23		0.27	0.49	0.38	0.23	0.23		<0.051	<0.051	<0.1	<0.1	<0.051		<0.051
Gamma Chlordane	0.63	0.42	0.81	0.43	0.26		0.68	0.69	0.68	0.48	0.64		0.53	0.56	0.78	0.57	0.63		<0.053	<0.053	<0.11	<0.11	<0.053		<0.053
Heptachlor	<0.051	<0.051	<0.051	<0.051	<0.051		<0.051	<0.051	<0.051	<0.051	<0.051		<0.051	<0.051	<0.051	<0.051	<0.051		<0.051	<0.051	<0.1	<0.1	<0.051		<0.051
Heptachlor Epox.	<0.044	<0.044	<0.044	<0.044	<0.044		<0.044	<0.044	<0.044	<0.044	<0.044		<0.044	<0.044	<0.044	<0.044	<0.044		<0.044	<0.044	<0.088	<0.089	<0.044		<0.044
Methoxychlor	0.067UJ	0.067UJ	0.067UJ	0.066UJ	0.067UJ		0.067UJ	0.067UJ	0.067UJ	0.067UJ	0.067UJ		0.067UJ	0.067UJ	0.067UJ	0.066UJ	0.067UJ		<0.067	<0.067	<0.13	<0.13	<0.067		<0.067
Oxychlordane	<0.072	<0.073	<0.073	<0.072	<0.073		<0.073	<0.073	<0.073	<0.073	<0.073		<0.073	<0.072	<0.073	<0.072	<0.073		<0.073	<0.073	<0.15	<0.15	<0.073		<0.073
Tech. Chlordane	6.5J	<5.2	7.7J	<5.2	<5.3	*5.96*	7.7J	8.2J	7.7J	8.9J	12	*8.90*	5.6J	7.6J	8.4J	8.5J	6.8J	*7.38*	<5.3	<5.2	<5.2	<5.3	<5.3		<5.3
Trans-nonachlor	0.4	0.29	0.49	0.25	0.18J		0.39	0.41	0.42	0.31	0.45		0.39	0.46	0.5	0.32	0.42		<0.043	<0.043	<0.085	<0.086	<0.043		<0.043
Total Chlordane	1.81	1.31	2.31	1.1	0.92	*1.49*	1.93	2.13	2	1.55	1.91	*1.90*	1.66	2.04	2.39	1.55	1.84	*1.90*	ND	ND	ND	ND	ND	ND	ND
PCB Congeners (μg/kg, wet)																									
PCB018	<0.07	<0.071	<0.071	<0.07	<0.071		<0.071	0.23	<0.071	<0.071	<0.071		<0.071	0.16J	0.2	<0.07	0.19J		<0.071	<0.071	<0.071	<0.071	<0.071		<0.071
PCB028	<0.033	<0.033	<0.033	<0.033	<0.034		0.24	0.23	0.24	0.2J	0.21		0.21	0.22	0.26	0.15J	0.22		<0.034	<0.033	<0.033	<0.034	<0.034		<0.033
PCB037	<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06		<0.06
PCB044	<0.086	<0.086	<0.086	<0.086	<0.087		<0.087	<0.087	<0.086	0.2	<0.087		<0.087	<0.086	0.15J	<0.086	<0.087		<0.087	<0.086	<0.086	<0.087	<0.087		<0.086
PCB049	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	0.17J	<0.11	<0.11	0.17J		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB052	<0.062	<0.062	<0.062	<0.062	<0.063		0.24	0.32	0.3	0.29	0.29		0.23	0.22	<0.062	<0.062	0.2J		<0.063	<0.062	<0.062	<0.063	<0.063		<0.062
PCB066	<0.1	<0.1	0.21	<0.1	<0.1		0.27	0.35	0.31	0.24	0.28		0.25	0.2	0.32	0.18J	0.25		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
PCB070	<0.059	<0.059	0.22	<0.059	<0.06		0.25	0.41	0.32	0.32	0.34		0.24	0.33	0.37	0.19J	0.26		<0.06	<0.059	<0.059	<0.06	<0.06		<0.059
PCB074	<0.086	<0.086	<0.086	<0.086	<0.087		<0.087	0.23	0.22	0.15J	0.18J		0.15J	0.2J	0.18J	<0.086	0.2		<0.087	<0.086	<0.086	<0.087	<0.087		<0.086
PCB077	<0.077	<0.077	<0.077	<0.076	<0.078		<0.078	<0.078	<0.077	<0.077	<0.078		<0.078	<0.077	<0.077	<0.076	<0.078		<0.078	<0.077	<0.077	<0.078	<0.078		<0.077
PCB081	<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12
PCB087	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	0.18J		<0.11	0.21	0.32	0.2	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB099	<0.06	<0.06	<0.06	<0.06	<0.061		<0.061	0.22	0.21	<0.06	<0.061		<0.061	<0.06	0.24	<0.06	<0.061		<0.061	<0.06	<0.06	<0.061	<0.061		<0.06
PCB101	<0.097	<0.097	<0.097	<0.096	<0.098		0.2	0.38	0.3	0.27	0.31		0.28	0.26	0.27	0.25	0.28		<0.098	<0.097	<0.097	<0.098	<0.098		<0.097
PCB105	<0.054	<0.054	<0.054	<0.054	<0.055		<0.055	0.33	0.3	0.24	0.18J		<0.055	0.18J	0.21	<0.054	<0.055		<0.055	<0.054	<0.054	<0.055	<0.055		<0.054
PCB110	<0.045	<0.046	0.23	<0.045	<0.046		0.27	0.44	0.4	0.32	0.33		0.29	0.37	0.44	0.27	0.35		<0.046	<0.046	<0.046	<0.046	<0.046		<0.046
PCB114	<0.081	<0.082	<0.082	<0.081	<0.082		<0.082	<0.082	<0.082	<0.082	<0.082		<0.082	<0.081	<0.082	<0.081	<0.082		<0.082	<0.082	<0.082	<0.082	<0.082		<0.082
PCB118	<0.083	<0.084	<0.084	<0.083	<0.084		0.23	0.42	0.41	0.28	0.32		0.31	0.39	0.4	0.3	0.25		<0.084	<0.084	<0.084	<0.084	<0.084		<0.084
PCB119	<0.094	<0.094	<0.094	<0.093	<0.094		<0.094	<0.094	<0.094	<0.094	<0.094		<0.094	<0.094	<0.094	<0.093	<0.094		<0.094	<0.094	<0.094	<0.094	<0.094		<0.094
PCB123	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
PCB126	<0.079	<0.08	<0.08	<0.079	<0.08		<0.08	<0.08	<0.08	<0.08	<0.08		<0.08	<0.079	<0.08	<0.079	<0.08		<0.08	<0.08	<0.08	<0.08	<0.08		<0.08
PCB128	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
PCB132/153	0.25J	0.23J	0.26J	<0.17	<0.17		0.32J	0.49	0.44	0.34J	0.34J		0.35J	0.4	0.42	0.36J	0.35J		0.25J	0.22J	0.24J	<0.17	0.22J		<0.17
PCB138/158	<0.093	<0.094	0.22J	<0.093	<0.094		0.3J	0.39J	0.33J	0.22J	0.26J		0.26J	0.34J	0.36J	0.28J	<0.094		<0.094	<0.094	<0.094	<0.094	<0.094		<0.094

Table 27 (Continued). Bioaccumulation Potential Replicate and Mean Tissue Results for *Macoma nasuta* Exposed to the Long Beach Federal Approach Channel, LA-2 Reference and Control Sediments.

Analyte	Composite Replicate and Mean Concentrations for *Macoma nasuta* Tissues																								
	LAREVC-18-ST-1						LAREVC-18-LARE-1						LAREVC-18-LARE-2						CONTROL						T0
	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	
PCB149	<0.097	<0.097	<0.097	<0.096	<0.098		<0.098	0.28	0.26	0.18J	0.17J		0.25	0.25	0.21	0.2	0.25		<0.098	<0.097	<0.097	<0.098	<0.098		<0.097
PCB151	<0.067	<0.067	<0.067	<0.066	<0.067		<0.067	<0.067	<0.067	<0.067	<0.067		<0.067	<0.067	<0.067	<0.066	<0.067		<0.067	<0.067	<0.067	<0.067	<0.067		<0.067
PCB156	<0.057	<0.057	<0.057	<0.057	<0.058		<0.058	<0.058	<0.057	<0.057	<0.058		<0.058	<0.057	<0.057	<0.057	<0.058		<0.058	<0.057	<0.057	<0.058	<0.058		<0.057
PCB157	<0.052	<0.052	<0.052	<0.051	<0.052		<0.052	<0.052	<0.052	<0.052	<0.052		<0.052	<0.052	<0.052	<0.051	<0.052		<0.052	<0.052	<0.052	<0.052	<0.052		<0.052
PCB167	<0.061	<0.061	<0.061	<0.061	<0.062		<0.062	<0.062	<0.061	<0.061	<0.062		<0.062	<0.061	<0.061	<0.061	<0.062		<0.062	<0.061	<0.061	<0.062	<0.062		<0.061
PCB168	<0.048	<0.048	<0.048	<0.048	<0.049		<0.049	<0.049	<0.048	<0.048	<0.049		<0.049	<0.048	<0.048	<0.048	<0.049		<0.049	<0.048	<0.048	<0.049	<0.049		<0.048
PCB169	<0.06	<0.061	<0.061	<0.06	<0.061		<0.061	<0.061	<0.061	<0.061	<0.061		<0.061	<0.06	<0.061	<0.06	<0.061		<0.061	<0.061	<0.061	<0.061	<0.061		<0.061
PCB170	<0.063	<0.063	<0.063	<0.062	<0.063		<0.063	<0.063	<0.063	<0.063	<0.063		<0.063	<0.063	<0.063	<0.062	<0.063		<0.063	<0.063	<0.063	<0.063	<0.063		<0.063
PCB177	<0.086	<0.087	<0.087	<0.086	<0.087		<0.087	<0.087	<0.087	<0.087	<0.087		<0.087	<0.086	<0.087	<0.086	<0.087		<0.087	<0.087	<0.087	<0.087	<0.087		<0.087
PCB180	<0.042	<0.042	<0.042	<0.041	<0.042		<0.042	<0.042	<0.042	<0.042	<0.042		<0.042	<0.042	<0.042	<0.041	<0.042		<0.042	<0.042	<0.042	<0.042	<0.042		<0.042
PCB183	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB187	<0.083	<0.084	<0.084	<0.083	<0.084		<0.084	<0.084	<0.084	<0.084	<0.084		<0.084	<0.083	<0.084	<0.083	<0.084		<0.084	<0.084	<0.084	<0.084	<0.084		<0.084
PCB189	<0.06	<0.061	<0.061	<0.06	<0.061		<0.061	<0.061	<0.061	<0.061	<0.061		<0.061	<0.06	<0.061	<0.06	<0.061		<0.061	<0.061	<0.061	<0.061	<0.061		<0.061
PCB194	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB201	<0.096	<0.096	<0.096	<0.095	<0.097		<0.097	<0.097	<0.096	<0.096	<0.097		<0.097	<0.096	<0.096	<0.095	<0.097		<0.097	<0.096	<0.096	<0.097	<0.097		<0.096
PCB206	<0.19	<0.19	<0.19	<0.19	<0.19		<0.19	<0.19	<0.19	<0.19	<0.19		<0.19	<0.19	<0.19	<0.19	<0.19		<0.19	<0.19	<0.19	<0.19	<0.19		<0.19
Total PCBs	0.250	0.230	1.14	ND	ND	0.337	2.32	4.72	4.04	3.25	3.39	**3.54**	2.82	3.9	4.35	2.38	2.97	**3.28**	0.25	0.22	0.24	ND	0.22	0.193	ND

Notes:

Values in grey shaded cells represent detected replicate concentrations.

Bolded Values and Blue shaded cells indicate statistically significant differences in mean concentrations between test and LA-5 reference tissues.

Mean values in *italics* could not be statistically evaluated for significance because reference or control were greater than test tissues or one or both sets of tissue replicates are all ND.

J = Estimated value between the method detection limit and reporting limit. A "J" value may also indicate an estimated value due to that value not meeting certain QC objectives.

J+ = A high-biased estimate.

< = Not detected at the method detection limit.

ND = not detected.

"U" = not detected at the reporting limit.

Table 28. Bioaccumulation Potential Replicate and Mean Tissue Results for *Macoma nasuta* Exposed to the Long Beach Federal Approach Channel, LA-2 Reference and Control Sediments.

Analyte	Composite Replicate and Mean Concentrations for *Macoma nasuta* Tissues																		
	QGVC-18						LA-2 REF						CONTROL						T0
	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	
Percent Lipids	0.41	0.67	0.50	0.43	0.45	0.492	0.44	0.57	0.42	0.41	0.43	0.454	0.40	0.38	0.41	0.34	0.32	0.37	0.59
Metals (mg/kg, wet)																			
Cadmium	0.0291J	<0.0286	0.0376J	<0.0286	0.0416J	0.033	0.0412J	0.0431J	<0.114	0.0287J	0.0313J	0.036	0.0288J	0.0356J	<0.114	<0.0286	0.037J	0.033	0.034J
Copper	1.02	1.54	1.68	1.36	1.34	*1.15*	1.65	1.67	3.14	1.49	1.13	1.82	1.57	1.67	2.82	1.64	1.49	1.84	1.25
Lead	0.306	0.359	0.374	0.239	0.309	**0.317**	0.146	0.122	0.18J	0.0866J	0.174	0.142	0.0918J	0.135	<0.132	0.143	0.124	0.120	0.0909J
Zinc	13.6	14.8	16	15.4	17.1	**15.4**	12.2	13	14.3	11.2	11.7	12.48	10.5	15.9	11.3	12.8	11.3	12.4	14.3
OC Pesticides (µg/kg, wet)																			
2,4'-DDD	<0.076	<0.076	<0.075	<0.076	<0.076		<0.075	<0.076	<0.076	<0.076	<0.076		<0.076	<0.076	<0.15	<0.15	<0.076		<0.076
2,4'-DDE	1.7	1.7	1.7	1.5	1.2	1.56	<0.035	0.72	0.3	0.35	0.24	0.402	<0.035	<0.035	<0.07	<0.07	<0.035		<0.035
2,4'-DDT	<0.062	<0.062	<0.062	<0.062	<0.062		<0.062	<0.062	<0.062	<0.062	<0.062		<0.062	<0.062	<0.12	<0.12	<0.062		<0.062
4,4'-DDD	<0.04	<0.04	<0.039	<0.04	<0.04		<0.039	<0.04	<0.04	<0.04	<0.04		<0.04	<0.04	<0.079	<0.08	<0.04		<0.04
4,4'-DDE	13	19	20	19	20	18.2	5.2	7.6	5.2	5.5	5.1	5.72	<0.04	<0.04	<0.081	<0.081	<0.04		<0.04
4,4'-DDT	0.052UJ	0.052UJ	0.052UJ	0.052UJ	<0.052		<0.052	<0.053	<0.053	<0.052	<0.052		<0.053	<0.052	<0.1	<0.11	<0.053		<0.053
Total DDT's	14.7	20.7	21.7	20.5	21.2	**19.8**	5.2	8.32	5.5	5.85	5.34	6.04	ND	ND	ND	ND	ND	ND	ND
Alpha Chlordane	<0.067	<0.067	<0.066	<0.067	<0.067		<0.066	<0.067	<0.067	<0.067	<0.067		<0.067	<0.067	<0.13	<0.13	<0.067		<0.067
Cis-nonachlor	<0.051	<0.051	<0.05	<0.051	<0.051		<0.05	<0.051	<0.051	<0.051	<0.051		<0.051	<0.051	<0.1	<0.1	<0.051		<0.051
Gamma Chlordane	<0.053	<0.053	<0.053	<0.053	<0.053		<0.053	<0.053	<0.053	<0.053	<0.053		<0.053	<0.053	<0.11	<0.11	<0.053		<0.053
Heptachlor	<0.051	<0.051	<0.051	<0.051	<0.051		<0.051	<0.051	<0.051	<0.051	<0.051		<0.051	<0.051	<0.1	<0.1	<0.051		<0.051
Heptachlor Epox.	<0.044	<0.044	<0.044	<0.044	<0.044		<0.044	<0.044	<0.044	<0.044	<0.044		<0.044	<0.044	<0.088	<0.089	<0.044		<0.044
Methoxychlor	0.067UJ	0.067UJ	0.067UJ	0.067UJ	<0.067		<0.067	<0.067	<0.067	<0.067	<0.067		<0.067	<0.067	<0.13	<0.13	<0.067		<0.067
Oxychlordane	<0.073	<0.073	<0.072	<0.073	<0.073		<0.072	<0.073	<0.073	<0.073	<0.073		<0.073	<0.073	<0.15	<0.15	<0.073		<0.073
Tech. Chlordane	<5.2	<5.2	<5.2	<5.2	<5.2	ND	<5.2	<5.3	<5.3	<5.2	<5.2	ND	<5.3	<5.2	<5.2	<5.3	<5.3	ND	<5.3
Trans-nonachlor	<0.043	<0.043	<0.043	<0.043	<0.043		<0.043	<0.043	<0.043	<0.043	<0.043		<0.043	<0.043	<0.085	<0.086	<0.043		<0.043
Total Chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB Congeners (µg/kg, wet)																			
PCB018	<0.071	<0.071	<0.07	<0.071	<0.071		<0.07	<0.071	<0.071	<0.071	<0.071		<0.071	<0.071	<0.071	<0.071	<0.071		<0.071
PCB028	<0.033	<0.033	<0.033	0.17J	<0.034		<0.033	<0.034	<0.034	<0.033	<0.033		<0.034	<0.033	<0.033	<0.034	<0.034		<0.033
PCB037	<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06		<0.06
PCB044	<0.086	<0.086	<0.086	<0.086	<0.087		<0.086	<0.087	<0.087	<0.086	<0.086		<0.087	<0.086	<0.086	<0.087	<0.087		<0.086
PCB049	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB052	<0.062	<0.062	<0.062	<0.062	<0.063		<0.062	<0.063	<0.063	<0.062	<0.062		<0.063	<0.062	<0.062	<0.063	<0.063		<0.062
PCB066	<0.1	0.22	0.19J	0.17J	0.17J		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
PCB070	<0.059	0.19J	0.16J	<0.059	<0.06		<0.059	<0.06	<0.06	<0.059	<0.059		<0.06	<0.059	<0.059	<0.06	<0.06		<0.059
PCB074	<0.086	<0.086	<0.086	<0.086	<0.087		<0.086	<0.087	<0.087	<0.086	<0.086		<0.087	<0.086	<0.086	<0.087	<0.087		<0.086
PCB077	<0.077	<0.077	<0.077	<0.077	<0.078		<0.077	<0.078	<0.078	<0.077	<0.077		<0.078	<0.077	<0.077	<0.078	<0.078		<0.077
PCB081	<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12
PCB087	0.22	0.27	0.27	0.2	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB099	<0.06	0.2	0.21	0.23	0.21		<0.06	<0.061	<0.061	<0.06	<0.06		<0.061	<0.06	<0.06	<0.061	<0.061		<0.06
PCB101	0.31	0.29	0.26	0.25	0.31		<0.097	<0.098	<0.098	<0.097	<0.097		<0.098	<0.097	<0.097	<0.098	<0.098		<0.097
PCB105	<0.054	<0.054	<0.054	<0.054	<0.055		<0.054	<0.055	<0.055	<0.054	<0.054		<0.055	<0.054	<0.054	<0.055	<0.055		<0.054
PCB110	0.22	0.28	0.22	0.21	0.26		<0.045	<0.046	<0.046	<0.046	<0.046		<0.046	<0.046	<0.046	<0.046	<0.046		<0.046
PCB114	<0.082	<0.082	<0.081	<0.082	<0.082		<0.081	<0.082	<0.082	<0.082	<0.082		<0.082	<0.082	<0.082	<0.082	<0.082		<0.082
PCB118	0.23	0.3	0.29	0.31	0.25		<0.083	<0.084	<0.084	<0.084	<0.084		<0.084	<0.084	<0.084	<0.084	<0.084		<0.084
PCB119	<0.094	<0.094	<0.094	<0.094	<0.094		<0.094	<0.094	<0.094	<0.094	<0.094		<0.094	<0.094	<0.094	<0.094	<0.094		<0.094
PCB123	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
PCB126	<0.08	<0.08	<0.079	<0.08	<0.08		<0.079	<0.08	<0.08	<0.08	<0.08		<0.08	<0.08	<0.08	<0.08	<0.08		<0.08
PCB128	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
PCB132/153	0.37J	0.5	0.51	0.39J	0.51		0.21J	0.32J	0.24J	<0.17	0.21J		0.25J	0.22J	0.24J	<0.17	0.22J		<0.17
PCB138/158	0.24J	0.34J	0.26J	0.25J	0.37J		<0.093	<0.094	<0.094	<0.094	<0.094		<0.094	<0.094	<0.094	<0.094	<0.094		<0.094

Table 28 (Continued). Bioaccumulation Potential Replicate and Mean Tissue Results for *Macoma nasuta* Exposed to the Long Beach Federal Approach Channel, LA-2 Reference and Control Sediments.

Analyte	Composite Replicate and Mean Concentrations for *Macoma nasuta* Tissues																		
	QGVC-18						LA-2 REF						CONTROL						T0
	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	
PCB149	0.21	0.21	0.22	0.2	0.23		<0.097	<0.098	<0.098	<0.097	<0.097		<0.098	<0.097	<0.097	<0.098	<0.098		<0.097
PCB151	<0.067	<0.067	<0.067	<0.067	<0.067		<0.067	<0.067	<0.067	<0.067	<0.067		<0.067	<0.067	<0.067	<0.067	<0.067		<0.067
PCB156	<0.057	<0.057	<0.057	<0.057	<0.058		<0.057	<0.058	<0.058	<0.057	<0.057		<0.058	<0.057	<0.057	<0.058	<0.058		<0.057
PCB157	<0.052	<0.052	<0.052	<0.052	<0.052		<0.052	<0.052	<0.052	<0.052	<0.052		<0.052	<0.052	<0.052	<0.052	<0.052		<0.052
PCB167	<0.061	<0.061	<0.061	<0.061	<0.062		<0.061	<0.062	<0.062	<0.061	<0.061		<0.062	<0.061	<0.061	<0.062	<0.062		<0.061
PCB168	<0.048	<0.048	<0.048	<0.048	<0.049		<0.048	<0.049	<0.049	<0.048	<0.048		<0.049	<0.048	<0.048	<0.049	<0.049		<0.048
PCB169	<0.061	<0.061	<0.06	<0.061	<0.061		<0.06	<0.061	<0.061	<0.061	<0.061		<0.061	<0.061	<0.061	<0.061	<0.061		<0.061
PCB170	<0.063	<0.063	<0.063	<0.063	<0.063		<0.063	<0.063	<0.063	<0.063	<0.063		<0.063	<0.063	<0.063	<0.063	<0.063		<0.063
PCB177	<0.087	<0.087	<0.086	<0.087	<0.087		<0.086	<0.087	<0.087	<0.087	<0.087		<0.087	<0.087	<0.087	<0.087	<0.087		<0.087
PCB180	<0.042	<0.042	<0.042	<0.042	<0.042		<0.042	<0.042	<0.042	<0.042	<0.042		<0.042	<0.042	<0.042	<0.042	<0.042		<0.042
PCB183	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB187	<0.084	<0.084	<0.083	<0.084	<0.084		<0.083	<0.084	<0.084	<0.084	<0.084		<0.084	<0.084	<0.084	<0.084	<0.084		<0.084
PCB189	<0.061	<0.061	<0.06	<0.061	<0.061		<0.06	<0.061	<0.061	<0.061	<0.061		<0.061	<0.061	<0.061	<0.061	<0.061		<0.061
PCB194	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB201	<0.096	<0.096	<0.096	<0.096	<0.097		<0.096	<0.097	<0.097	<0.096	<0.096		<0.097	<0.096	<0.096	<0.097	<0.097		<0.096
PCB206	<0.19	<0.19	<0.19	<0.19	<0.19		<0.19	<0.19	<0.19	<0.19	<0.19		<0.19	<0.19	<0.19	<0.19	<0.19		<0.19
Total PCBs	1.8	2.8	2.59	2.38	2.31	**2.38**	0.21	0.32	0.24	ND	0.21	0.203	0.25	0.22	0.24	ND	0.22	0.193	ND

Notes:

Values in grey shaded cells represent detected replicate concentrations.

Bolded Values and Blue shaded cells indicate statistically significant differences in mean concentrations between test and LA-5 reference tissues.

Mean values in *italics* could not be statistically evaluated for significance because reference or control were greater than test tissues or one or both sets of tissue replicates are all ND.

J = Estimated value between the method detection limit and reporting limit. A "J" value may also indicate an estimated value due to that value not meeting certain QC objectives.

J+ = A high-biased estimate.

< = Not detected at the method detection limit. ND = not detected.

"U" = not detected at the reporting limit.

Table 29. Bioaccumulation Potential Replicate and Mean Tissue Results for *Nereis virens* Exposed to the ST-1, LARE-1, LARE-2 and Control Sediments.

Analyte	Composite Replicate and Mean Concentrations for *Nereis virens* Tissues																								
	LAREVC-18-ST-1						LAREVC-18-LARE-1						LAREVC-18-LARE-2						CONTROL						T0
	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	
Percent Lipids	0.98	0.96	0.74	0.78	1.0	0.89	1.1	0.80	1.0	1.1	1.0	1.0	1.7	1.1	1.1	1.0	0.89	1.2	1.3	0.82	0.86	1.5	0.89	1.1	0.94
Metals (mg/kg, wet)																									
Cadmium	<0.143	<0.143	<0.143	<0.143	<0.143	ND	<0.143	<0.143	<0.143	<0.143	<0.143	ND	0.0374J	0.034J	0.0292J	<0.0286	0.0302J	0.0319	0.0464J	0.0469J	0.0427J	0.0374J	0.0342J	0.041	0.0407J
Copper	1.39	1.56	1.76	1.23	1.57	1.50	1.3	1.04	1.4	1.32	1.45	1.30	1.59	1.7	1.69	1.91	1.78	1.73	1.8	1.73	1.77	1.77	1.88	1.79	1.34
Lead	0.209J	0.242J	0.264J	0.265J	0.206J	0.237	0.227J	0.2J	0.253J	0.21J	0.339J	0.246	0.118	0.237	0.168	0.118	0.143	0.157	0.138	0.221	0.191	0.171	0.165	0.177	0.247
Zinc	29.8J	44J	19.8J	27.9J	7.75J	25.6	8.19J	15.8J	38.5J	44J	24.6J	26.2	21.7	21.8	29.3	19	23.3	23.0	9.47J	12.7J	22.3J	14.6J	24J	16.6	13.9
OC Pesticides (µg/kg, wet)																									
2,4'-DDD	<0.15	<0.15	<0.15	<0.15	<0.15		<0.15	<0.15	<0.15	<0.15	<0.15		<0.15	<0.15	<0.15	<0.38	<0.15		<0.15	<0.15	<0.15	<0.15	<0.15		<0.076
2,4'-DDE	<0.07	<0.07	<0.07	<0.07	<0.07		<0.069	<0.07	<0.07	<0.07	<0.07		<0.069	<0.07	<0.07	<0.18	<0.07		<0.07	<0.07	<0.07	<0.07	<0.07		<0.035
2,4'-DDT	<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.31	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.062
4,4'-DDD	<0.08	<0.079	<0.08	<0.08	<0.079		<0.079	<0.079	<0.079	<0.079	<0.079		<0.079	<0.08	<0.079	<0.2	<0.08		<0.08	<0.079	<0.079	<0.079	<0.08		<0.04
4,4'-DDE	<0.081	<0.081	<0.081	<0.081	<0.08		<0.08	<0.081	<0.081	<0.081	<0.081		<0.08	<0.081	<0.081	<0.2	<0.081		<0.081	<0.08	<0.081	<0.08	<0.081		<0.04
4,4'-DDT	<0.11	<0.1	<0.11	<0.11	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.11	<0.1	<0.26	<0.11		<0.11	<0.1	<0.1	<0.1	<0.11		<0.052
Total DDT's	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha Chlordane	1.1	1.4	1.4	1.2	1.2		1.2	1.1	1.4	1.5	1.2		1.4	1.6	1.6	2.2	1.6		<0.13	<0.13	<0.13	<0.13	<0.13		<0.067
Cis-nonachlor	0.46	0.69	0.83	0.59	0.69		0.39J	0.44	0.53	0.74	0.53		0.77	1	0.53	1.2	0.52		<0.1	<0.1	<0.1	<0.1	<0.1		<0.051
Gamma Chlordane	0.86	0.93	1.1	0.81	1		0.91	0.8	1	1	0.92		0.89	1.1	1.3	1.5	1.2		<0.11	<0.11	<0.11	<0.11	<0.11		<0.053
Heptachlor	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.26	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.051
Heptachlor Epox.	<0.089	<0.088	<0.089	<0.089	<0.088		<0.087	<0.088	<0.088	<0.088	<0.088		<0.087	<0.089	<0.088	<0.22	<0.089		<0.089	<0.088	<0.088	<0.088	<0.089		<0.044
Methoxychlor	<0.13	<0.13	<0.13	<0.13	<0.13		<0.13	<0.13	<0.13	<0.13	<0.13		<0.13	<0.13	<0.13	<0.34	<0.13		<0.13	<0.13	<0.13	<0.13	<0.13		<0.067
Oxychlordane	<0.15	<0.15	<0.15	<0.15	<0.14		<0.14	<0.15	<0.15	<0.15	<0.15		<0.14	<0.15	<0.15	<0.36	<0.15		<0.15	<0.14	<0.15	<0.14	<0.15		<0.073
Tech. Chlordane	20	25	15	13	23	19	31	27	44	45	51	40	84	31	34	33	37	44	<5.3	<5.2	<5.2	<5.2	<5.3	ND	<5.2
Trans-nonachlor	1	1.2	1.7	1.2	1.1		0.98	0.91	1.3	1.4	0.88		1.2	1.6	1.4	2.3	1.4		<0.086	<0.085	<0.085	<0.085	<0.086		<0.043
Total Chlordane	3.4	4.2	5.0	3.8	4.0	4.1	3.5	3.3	4.2	4.6	3.5	3.8	4.26	5.3	4.83	7.2	4.72	5.3	ND	ND	ND	ND	ND	ND	ND
PCB Congeners (µg/kg, wet)																									
PCB018	<0.071	<0.071	<0.071	<0.071	<0.07		0.22	<0.071	<0.071	0.23	0.2		0.27	0.21	<0.071	0.27	0.21		<0.071	<0.07	<0.071	<0.07	<0.071		<0.071
PCB028	<0.034	<0.033	<0.034	<0.034	<0.033		0.2	<0.033	<0.033	0.23	<0.033		<0.033	<0.034	<0.033	0.26	0.22		<0.034	<0.033	<0.033	<0.033	<0.034		<0.033
PCB037	<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06		<0.06
PCB044	<0.087	<0.086	0.23	<0.087	<0.086		<0.086	<0.086	<0.086	<0.086	<0.086		0.28	<0.087	<0.086	0.24	<0.087		<0.087	<0.086	<0.086	<0.086	<0.087		<0.086
PCB049	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		0.2	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB052	0.28	0.3	0.37	0.21	0.37		0.35	0.31	0.32	0.5	0.36		0.45	0.32	<0.062	0.46	0.53		<0.063	<0.062	<0.062	<0.062	<0.063		<0.062
PCB066	<0.1	<0.1	0.21	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		0.44	<0.1	0.25	0.39	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
PCB070	<0.06	<0.059	<0.06	<0.06	<0.059		<0.059	<0.059	<0.059	<0.059	<0.059		<0.059	<0.06	<0.059	<0.06	<0.06		<0.06	<0.059	<0.059	<0.059	<0.06		<0.059
PCB074	<0.087	<0.086	<0.087	<0.087	<0.086		<0.086	<0.086	<0.086	<0.086	<0.086		<0.086	<0.087	<0.086	0.24	<0.087		<0.087	<0.086	<0.086	<0.086	<0.087		<0.086
PCB077	<0.078	<0.077	<0.078	<0.078	<0.077		<0.076	<0.077	<0.077	<0.077	<0.077		<0.076	<0.078	<0.077	<0.078	<0.078		<0.078	<0.077	<0.077	<0.077	<0.078		<0.077
PCB081	<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12
PCB087	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB099	<0.061	<0.06	<0.061	<0.061	<0.06		<0.06	<0.06	0.23	0.3	0.2		<0.06	0.25	0.25	0.32	0.36		<0.061	<0.06	<0.06	<0.06	<0.061		<0.06
PCB101	0.29	0.32	0.49	0.29	<0.097		0.33	<0.097	0.45	0.55	0.21		0.54	0.49	0.38	0.68	0.54		<0.098	<0.097	<0.097	<0.097	<0.098		0.31
PCB105	<0.055	0.3	0.24	0.2	0.33		0.26	<0.054	0.32	0.47	0.38		<0.054	0.4	0.46	0.47	<0.055		<0.055	<0.054	<0.054	<0.054	<0.055		<0.054
PCB110	<0.046	0.2	0.32	0.22	<0.045		0.26	0.21	0.36	0.43	0.21		0.49	0.38	0.35	0.49	0.45		<0.046	<0.045	<0.046	<0.045	<0.046		<0.046
PCB114	<0.082	<0.082	<0.082	<0.082	<0.081		<0.081	<0.082	<0.082	<0.082	<0.082		<0.081	<0.082	<0.082	<0.082	<0.082		<0.082	<0.081	<0.082	<0.081	<0.082		<0.082
PCB118	<0.084	<0.084	0.29	0.27	<0.083		0.29	0.21	0.29	0.34	<0.084		0.43	0.31	0.34	0.49	0.52		<0.084	<0.083	<0.084	<0.083	<0.084		<0.084
PCB119	<0.094	<0.094	<0.094	<0.094	<0.094		<0.093	<0.094	<0.094	<0.094	<0.094		<0.093	<0.094	<0.094	<0.094	<0.094		<0.094	<0.094	<0.094	<0.094	<0.094		<0.094
PCB123	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
PCB126	<0.08	<0.08	<0.08	<0.08	<0.079		<0.079	<0.08	<0.08	<0.08	<0.08		<0.079	<0.08	<0.08	<0.08	<0.08		<0.08	<0.079	<0.08	<0.079	<0.08		<0.08
PCB128	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		0.2
PCB132/153	1.6	1.8	1.3	1.4	1.5		1.4	1.4	2.3	2.3	1.4		2.5	1.8	2	2	2.3		1.4	1.2	1.5	1.6	1.8		1.3
PCB138/158	0.75	1	0.86	0.71	0.91		0.9	0.77	1.3	1.2	0.67		1.5	1.1	1.1	1.3	1.3		0.72	0.66	0.72	0.81	0.83		0.68

Table 29 (Continued). Bioaccumulation Potential Replicate and Mean Tissue Results for *Nereis virens* Exposed to the Long Beach Federal Approach Channel, LA-2 Reference and Control Sediments.

Analyte	Composite Replicate and Mean Concentrations for *Nereis virens* Tissues																								
	LAREVC-18-ST-1						LAREVC-18-LARE-1						LAREVC-18-LARE-2						CONTROL						T0
	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	
PCB149	0.79	0.81	0.65	0.62	0.75		0.75	0.59	1	0.98	0.52		1.2	0.79	0.87	0.91	1.2		0.54	0.61	0.67	0.84	0.76		0.58
PCB151	<0.067	<0.067	<0.067	<0.067	<0.067		<0.066	<0.067	<0.067	0.26	<0.067		0.28	0.31	<0.067	0.31	<0.067		<0.067	<0.067	<0.067	<0.067	<0.067		0.21
PCB156	<0.058	<0.057	<0.058	<0.058	<0.057		<0.057	<0.057	<0.057	<0.057	<0.057		<0.057	<0.058	<0.057	<0.058	<0.058		<0.058	<0.057	<0.057	<0.057	<0.058		<0.057
PCB157	<0.052	<0.052	<0.052	<0.052	<0.052		<0.051	<0.052	<0.052	<0.052	<0.052		<0.051	<0.052	<0.052	<0.052	<0.052		<0.052	<0.052	<0.052	<0.052	<0.052		<0.052
PCB167	<0.062	<0.061	<0.062	<0.062	<0.061		<0.061	<0.061	<0.061	<0.061	<0.061		<0.061	<0.062	<0.061	<0.062	<0.062		<0.062	<0.061	<0.061	<0.061	<0.062		<0.061
PCB168	<0.049	<0.048	<0.049	<0.049	<0.048		<0.048	<0.048	<0.048	<0.048	<0.048		<0.048	<0.049	<0.048	<0.049	<0.049		<0.049	<0.048	<0.048	<0.048	<0.049		<0.048
PCB169	<0.061	<0.061	<0.061	<0.061	<0.06		<0.06	<0.061	<0.061	<0.061	<0.061		<0.06	<0.061	<0.061	<0.061	<0.061		<0.061	<0.06	<0.061	<0.06	<0.061		<0.061
PCB170	<0.063	<0.063	<0.063	<0.063	<0.063		<0.062	<0.063	<0.063	0.48	<0.063		0.48	0.37	0.37	0.33	0.75		<0.063	<0.063	<0.063	<0.063	<0.063		<0.063
PCB177	<0.087	<0.087	<0.087	<0.087	<0.086		<0.086	<0.087	<0.087	<0.087	<0.087		0.25	<0.087	<0.087	<0.087	<0.087		<0.087	<0.086	<0.087	<0.086	<0.087		0.22
PCB180	0.71	0.77	0.6	0.45	0.47		0.49	0.66	0.92	0.87	0.68		1.1	0.65	0.81	0.88	0.92		<0.042	0.46	0.62	0.94	0.97		0.51
PCB183	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	0.35	0.34	0.2		0.4	0.29	0.27	0.29	0.27		<0.11	0.44	<0.11	0.37	0.35		0.24
PCB187	0.53	0.57	0.37	0.34	0.54		0.46	0.52	0.81	0.75	0.47		0.8	0.53	0.53	0.52	0.73		0.48	0.58	0.53	0.89	0.84		0.44
PCB189	<0.061	<0.061	<0.061	<0.061	<0.06		<0.06	<0.061	<0.061	<0.061	<0.061		<0.06	<0.061	<0.061	<0.061	<0.061		<0.061	<0.06	<0.061	<0.06	<0.061		<0.061
PCB194	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB201	<0.097	<0.096	<0.097	<0.097	<0.096		<0.095	<0.096	<0.096	<0.096	<0.096		<0.095	<0.097	<0.096	<0.097	<0.097		<0.097	<0.096	<0.096	<0.096	<0.097		<0.096
PCB206	<0.19	<0.19	<0.19	<0.19	<0.19		<0.19	<0.19	<0.19	0.39	0.25		0.38	<0.19	<0.19	0.24	<0.19		<0.19	<0.19	<0.19	<0.19	<0.19		0.31
Total PCBs	4.95	6.07	5.93	4.71	4.87	5.31	5.91	4.67	8.65	10.62	5.75	**7.12**	11.99	8.2	7.98	11.09	10.3	9.91	3.14	3.95	4.04	5.45	5.55	4.43	5

Notes:

Values in grey shaded cells represent detected replicate concentrations.

Bolded Values and Blue shaded cells indicate statistically significant differences in mean concentrations between test and LA-5 reference tissues.

Mean values in *italics* could not be statistically evaluated for significance because reference or control were greater than test tissues or one or both sets of tissue replicates are all ND.

J = Estimated value between the method detection limit and reporting limit. A "J" value may also indicate an estimated value due to that value not meeting certain QC objectives.

J+ = A high-biased estimate.

< = Not detected at the method detection limit. ND = not detected.

"U" = not detected at the reporting limit.

Table 30. Bioaccumulation Potential Replicate and Mean Tissue Results for *Nereis virens* Exposed to the Long Beach Federal Approach Channel, LA-2 Reference and Control Sediments.

Analyte	Composite Replicate and Mean Concentrations for *Nereis virens* Tissues																		
	QGVC-18						LA-2 REF						CONTROL						T0
	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	
Percent Lipids	0.69	1.2	1.4	1.0	1.0	1.1	1.1	1.2	1.3	0.98	1.3	1.2	1.3	0.82	0.86	1.5	0.89	1.1	0.94
Metals (mg/kg, wet)																			
Cadmium	<0.0382	0.0382J	0.035J	0.0337J	0.029J	0.034	0.199J	<0.143	<0.143	<0.143	<0.143	0.154	0.0464J	0.0469J	0.0427J	0.0374J	0.0342J	0.041	0.0407J
Copper	2.01	1.83	1.66	1.58	1.46	1.71	7.22*	1.64	2.04	1.42	1.49	1.65	1.8	1.73	1.77	1.77	1.88	1.79	1.34
Lead	0.103J	0.105	0.109	0.104	0.1	0.104	0.642*	0.201J	0.306J	0.22J	0.197J	0.231	0.138	0.221	0.191	0.171	0.165	0.177	0.247
Zinc	36	21.3	23.3	11.7	43.2	27.1	47.8J	30J	17.3J	14J	19.8J	25.8	9.47J	12.7J	22.3J	14.6J	24J	16.6	13.9
OC Pesticides (µg/kg, wet)																			
2,4'-DDD	<0.15	<0.15	<0.15	<0.15	<0.15		<0.15	<0.15	<0.15	<0.15	<0.15		<0.15	<0.15	<0.15	<0.15	<0.15		<0.076
2,4'-DDE	<0.07	<0.07	<0.07	<0.07	<0.07		<0.07	<0.07	<0.07	<0.07	<0.07		<0.07	<0.07	<0.07	<0.07	<0.07		<0.035
2,4'-DDT	<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.062
4,4'-DDD	<0.079	<0.08	<0.079	<0.079	<0.079		<0.08	<0.08	<0.079	<0.079	<0.079		<0.08	<0.079	<0.079	<0.079	<0.08		<0.04
4,4'-DDE	<0.081	<0.081	<0.081	<0.08	<0.081		<0.081	<0.081	<0.08	<0.081	<0.081		<0.081	<0.08	<0.081	<0.08	<0.081		<0.04
4,4'-DDT	<0.1	<0.11	<0.1	<0.1	<0.1		<0.11	<0.11	<0.1	<0.1	<0.1		<0.11	<0.1	<0.1	<0.1	<0.11		<0.052
Total DDT's	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha Chlordane	<0.13	<0.13	<0.13	<0.13	<0.13		<0.13	<0.13	<0.13	<0.13	<0.13		<0.13	<0.13	<0.13	<0.13	<0.13		<0.067
Cis-nonachlor	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.051
Gamma Chlordane	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.053
Heptachlor	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.051
Heptachlor Epox.	<0.088	<0.089	<0.088	<0.088	<0.088		<0.089	<0.089	<0.088	<0.088	<0.088		<0.089	<0.088	<0.088	<0.088	<0.089		<0.044
Methoxychlor	<0.13	<0.13	<0.13	<0.13	<0.13		<0.13	<0.13	<0.13	<0.13	<0.13		<0.13	<0.13	<0.13	<0.13	<0.13		<0.067
Oxychlordane	<0.15	<0.15	<0.15	<0.14	<0.15		<0.15	<0.15	<0.14	<0.15	<0.15		<0.15	<0.14	<0.15	<0.14	<0.15		<0.073
Tech. Chlordane	<5.2	<5.3	<5.2	<5.2	<5.2	ND	<5.3	<5.3	<5.2	<5.2	<5.2	ND	<5.3	<5.2	<5.2	<5.2	<5.3	ND	<5.2
Trans-nonachlor	<0.085	<0.086	<0.085	0.37J	0.31J		<0.086	<0.086	<0.085	<0.085	<0.085		<0.086	<0.085	<0.085	<0.085	<0.086		<0.043
Total Chlordane	ND	ND	ND	0.37	0.31	0.27	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB Congeners (µg/kg, wet)																			
PCB018	<0.071	<0.071	<0.071	<0.07	<0.071		<0.071	<0.071	<0.07	<0.071	<0.071		<0.071	<0.07	<0.071	<0.07	<0.071		<0.071
PCB028	<0.033	<0.034	<0.033	<0.033	<0.033		<0.034	<0.034	<0.033	<0.033	<0.033		<0.034	<0.033	<0.033	<0.033	<0.034		<0.033
PCB037	<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06		<0.06
PCB044	<0.086	<0.087	<0.086	<0.086	<0.086		<0.087	<0.087	<0.086	<0.086	<0.086		<0.087	<0.086	<0.086	<0.086	<0.087		<0.086
PCB049	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB052	<0.062	0.24	<0.062	<0.062	0.2		<0.063	<0.063	<0.062	<0.062	<0.062		<0.063	<0.062	<0.062	<0.062	<0.063		<0.062
PCB066	<0.1	0.28	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
PCB070	<0.059	<0.06	<0.059	<0.059	<0.059		<0.06	<0.06	<0.059	<0.059	<0.059		<0.06	<0.059	<0.059	<0.059	<0.06		<0.059
PCB074	<0.086	<0.087	<0.086	<0.086	<0.086		<0.087	<0.087	<0.086	<0.086	<0.086		<0.087	<0.086	<0.086	<0.086	<0.087		<0.086
PCB077	<0.077	<0.078	<0.077	<0.077	<0.077		<0.078	<0.078	<0.077	<0.077	<0.077		<0.078	<0.077	<0.077	<0.077	<0.078		<0.077
PCB081	<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12		<0.12
PCB087	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB099	<0.06	0.33	0.33	<0.06	0.23		<0.061	<0.061	<0.06	<0.06	<0.06		<0.061	<0.06	<0.06	<0.06	<0.061		<0.06
PCB101	<0.097	0.33	0.32	0.35	0.24		0.26	<0.098	0.28	<0.097	<0.097		<0.098	<0.097	<0.097	<0.097	<0.098		0.31
PCB105	0.3	0.58	0.62	0.37	0.3		0.28	<0.055	0.29	<0.054	0.28		<0.055	<0.054	<0.054	<0.054	<0.055		<0.054
PCB110	<0.046	0.26	0.25	<0.045	<0.046		<0.046	<0.046	<0.045	<0.046	<0.046		<0.046	<0.045	<0.046	<0.045	<0.046		<0.046
PCB114	<0.082	<0.082	<0.082	<0.081	<0.082		<0.082	<0.082	<0.081	<0.082	<0.082		<0.082	<0.081	<0.082	<0.081	<0.082		<0.082
PCB118	<0.084	0.31	<0.084	<0.083	0.24		<0.084	<0.084	0.23	<0.084	<0.084		<0.084	<0.083	<0.084	<0.083	<0.084		<0.084
PCB119	<0.094	<0.094	<0.094	<0.094	<0.094		<0.094	<0.094	<0.094	<0.094	<0.094		<0.094	<0.094	<0.094	<0.094	<0.094		<0.094
PCB123	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
PCB126	<0.08	<0.08	<0.08	<0.079	<0.08		<0.08	<0.08	<0.079	<0.08	<0.08		<0.08	<0.079	<0.08	<0.079	<0.08		<0.08
PCB128	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		0.2
PCB132/153	1.4	2.1	1.9	2	1.6		1.4	1.7	1.4	1.1	1.8		1.4	1.2	1.5	1.6	1.8		1.3
PCB138/158	0.67	1.3	1.2	1	0.82		0.81	0.8	0.78	0.68	0.84		0.72	0.66	0.72	0.81	0.83		0.68

Table 30 (Continued). Bioaccumulation Potential Replicate and Mean Tissue Results for *Nereis virens* Exposed to the Long Beach Federal Approach Channel, LA-2 Reference and Control Sediments.

Analyte	Composite Replicate and Mean Concentrations for *Nereis virens* Tissues																		
	QGVC-18						LA-2 REF						CONTROL						T0
	A	B	C	D	E	Mean	A	B	C	D	E	Mean	A	B	C	D	E	Mean	
PCB149	0.56	0.93	0.82	0.85	0.63		0.66	0.7	0.62	0.54	0.66		0.54	0.61	0.67	0.84	0.76		0.58
PCB151	<0.067	<0.067	<0.067	<0.067	<0.067		<0.067	<0.067	<0.067	<0.067	<0.067		<0.067	<0.067	<0.067	<0.067	<0.067		0.21
PCB156	<0.057	<0.058	<0.057	<0.057	<0.057		<0.058	<0.058	<0.057	<0.057	<0.057		<0.058	<0.057	<0.057	<0.057	<0.058		<0.057
PCB157	<0.052	<0.052	<0.052	<0.052	<0.052		<0.052	<0.052	<0.052	<0.052	<0.052		<0.052	<0.052	<0.052	<0.052	<0.052		<0.052
PCB167	<0.061	<0.062	<0.061	<0.061	<0.061		<0.062	<0.062	<0.061	<0.061	<0.061		<0.062	<0.061	<0.061	<0.061	<0.062		<0.061
PCB168	<0.048	<0.049	<0.048	<0.048	<0.048		<0.049	<0.049	<0.048	<0.048	<0.048		<0.049	<0.048	<0.048	<0.048	<0.049		<0.048
PCB169	<0.061	<0.061	<0.061	<0.06	<0.061		<0.061	<0.061	<0.06	<0.061	<0.061		<0.061	<0.06	<0.061	<0.06	<0.061		<0.061
PCB170	0.25	0.39	0.31	0.37	0.33		<0.063	<0.063	<0.063	<0.063	<0.063		<0.063	<0.063	<0.063	<0.063	<0.063		<0.063
PCB177	0.26	0.33	0.26	<0.086	0.2		<0.087	<0.087	<0.086	<0.087	<0.087		<0.087	<0.086	<0.087	<0.086	<0.087		0.22
PCB180	0.53	0.81	0.82	0.81	0.62		0.68	0.65	0.57	0.61	0.67		<0.042	0.46	0.62	0.94	0.97		0.51
PCB183	0.21	0.23	0.23	0.28	0.29		<0.11	0.21	<0.11	<0.11	0.36		<0.11	0.44	<0.11	0.37	0.35		0.24
PCB187	0.45	0.68	0.64	0.69	0.57		0.42	0.63	0.43	0.4	0.7		0.48	0.58	0.53	0.89	0.84		0.44
PCB189	<0.061	<0.061	<0.061	<0.06	<0.061		<0.061	<0.061	<0.06	<0.061	<0.061		<0.061	<0.06	<0.061	<0.06	<0.061		<0.061
PCB194	<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11	<0.11	<0.11	<0.11	<0.11		<0.11
PCB201	<0.096	<0.097	<0.096	<0.096	<0.096		<0.097	<0.097	<0.096	<0.096	<0.096		<0.097	<0.096	<0.096	<0.096	<0.097		<0.096
PCB206	0.28	0.44	0.3	0.33	0.36		<0.19	<0.19	<0.19	<0.19	<0.19		<0.19	<0.19	<0.19	<0.19	<0.19		0.31
Total PCBs	4.91	9.54	8	7.05	6.63	7.23	4.51	4.69	4.6	3.33	5.31	4.49	3.14	3.95	4.04	5.45	5.55	4.43	5

Notes:
*Statistical outlier and removed from statistical analyses.
Values in grey shaded cells represent detected concentrations.
Bolded Values and Blue shaded cells indicate statistically significant differences in mean concentrations between test and LA-5 reference tissues.
Mean values in *italics* could not be statistically evaluated for significance because reference or control were greater than test tissues or one or both sets of tissue replicates are all ND.
J = Estimated value between the method detection limit and reporting limit. A “J” value may also indicate an estimated value due to that value not meeting certain QC objectives.
J+ = A high-biased estimate.
< = Not detected at the method detection limit. ND = not detected.
“U” = not detected at the reporting limit.

Table 31. Statistical Results for the LARE and Long Beach Approach Channel Composite Sample *Macoma nasuta* Tissue Concentrations Compared to Reference and Control Tissue Concentrations.

Analyte	Sample	n	% ND	Mean	Standard Deviation (n-1)	Variation Coefficient	Variance	Lower Bound on Mean (95%)	Upper Bound on Mean (95%)	FDA Action Level
% Lipids	ST-1	5	0	0.468	0.122	0.26	0.0148	--	--	
	LARE-1	5	0	0.502	0.0049	0.0024	0.0024	--	--	
	LARE-2	5	0	0.474	0.062	0.0039	0.0039	--	--	
	QGVC-18	5	0	0.492	0.105	0.213	0.011	--	--	
	LA-2-Ref	5	0	0.454	0.0658	0.145	0.0043	--	--	
	Control	5	0	0.370	0.0387	0.105	0.0015	--	--	
Cadmium (mg/kg)	ST-1	5	60	*0.032*	0.0044	0.137	0.00002	0.0262	0.038	0.3 (Fish)
	LARE-1	5	0	0.038	0.0048	0.128	0.00002	0.0331	0.0423	
	LARE-2	5	20	0.037	0.0093	0.251	0.00009	0.0268	0.0474	
	QGVC-18	5	40	0.033	0.0055	0.165	0.00002	0.0267	0.0395	
	LA-2-Ref	5	20	0.036	0.0062	0.171	0.00004	0.0285	0.0437	
	Control	5	40	0.033	0.0038	0.118	0.00001	0.0275	0.0375	
Copper (mg/kg)	ST-1	5	0	*1.15*	0.308	0.269	0.095	0.851	1.439	
	LARE-1	5	0	*1.68*	0.205	0.122	0.042	1.483	1.873	
	LARE-2	5	0	*1.54*	0.281	0.183	0.0787	1.268	1.804	
	QGVC-18	5	0	*1.39*	0.248	0.179	0.0617	1.151	1.625	
	LA-2-Ref	5	0	1.81	0.771	0.425	0.595	1.081	2.551	
	Control	5	0	1.84	0.553	0.301	0.306	1.31	2.366	
Lead (mg/kg)	ST-1	5	0	0.349	0.164	0.470	0.0268	0.193	0.505	
	LARE-1	5	0	0.619	0.0801	0.129	0.00642	0.542	0.696	
	LARE-2	5	0	0.572	0.116	0.203	0.0135	0.461	0.683	
	QGVC-18	5	0	0.317	0.0531	0.167	0.00282	0.266	0.368	
	LA-2-Ref	5	0	0.142	0.0386	0.272	0.00149	0.106	0.178	
	Control	5	20	0.120	0.0199	0.165	0.00039	0.096	0.144	
Zinc (mg/kg)	ST-1	5	0	*11.8*	2.696	0.229	7.267	9.18	14.32	
	LARE-1	5	0	20.2	9.705	0.481	94.19	10.93	29.43	
	LARE-2	5	0	16.3	3.122	0.192	9.747	13.3	19.26	
	QGVC-18	5	0	15.4	1.308	0.0851	1.712	14.13	16.63	
	LA-2-Ref	5	0	12.5	1.215	0.0974	1.477	11.32	13.64	
	Control	5	0	12.4	2.147	0.174	4.608	10.31	14.41	
Total DDT (µg/kg)	ST-1	5	100	ND	NA	NA	NA	NA	NA	5,000 (Fish DDE &DDT)
	LARE-1	5	100	ND	NA	NA	NA	NA	NA	
	LARE-2	5	100	ND	NA	NA	NA	NA	NA	
	QGVC-18	5	0	19.8	2.867	8.218	0.145	17.03	22.49	
	LA-2-Ref	5	0	6.04	1.296	1.68	0.215	3.759	8.325	
	Control	5	100	ND	NA	NA	NA	NA	NA	

Table 31. Statistical Results for the LARE and Long Beach Approach Channel Composite Sample *Macoma nasuta* Tissue Concentrations Compared to Reference and Control Tissue Concentrations (Continued).

Analyte	Sample	n	% ND	Mean	Standard Deviation (n-1)	Variation Coefficient	Variance	Lower Bound on Mean (95%)	Upper Bound on Mean (95%)	FDA Action Level
Technical Chlordane (µg/kg)	ST-1	5	60	*5.96*	1.005	0.169	1.01	4.605	7.315	300 (Fish)
	LARE-1	5	0	*8.90*	1.801	0.202	3.245	7.18	10.62	
	LARE-2	5	0	*7.38*	1.209	0.164	1.462	6.227	8.533	
	QGVC-18	5	100	ND	NA	NA	NA	NA	NA	
	LA-2-Ref	5	100	ND	NA	NA	NA	NA	NA	
	Control	5	100	ND	NA	NA	NA	NA	NA	
Total Chlordane (µg/kg)	ST-1	5	0	*1.49*	0.567	0.380	0.321	0.95	2.03	300 (Fish)
	LARE-1	5	0	*1.90*	0.216	0.113	0.0466	1.698	2.11	
	LARE-2	5	0	*1.90*	0.333	0.176	0.111	1.579	2.213	
	QGVC-18	5	100	ND	NA	NA	NA	NA	NA	
	LA-2-Ref	5	100	ND	NA	NA	NA	NA	NA	
	Control	5	100	ND	NA	NA	NA	NA	NA	
Lipid Normalized Total Chlordane (µg/kg)	ST-1	5	0	*3.155*	0.616	0.195	0.276	2.567	3.743	300 (Fish)
	LARE-1	5	0	*3.799*	0.35	0.0921	0.156	3.465	4.133	
	LARE-2	5	0	*4.08*	0.973	0.239	0.435	3.152	5.008	
	QGVC-18	5	100	ND	NA	NA	NA	NA	NA	
	LA-2-Ref	5	100	ND	NA	NA	NA	NA	NA	
	Control	5	100	ND	NA	NA	NA	NA	NA	
Total PCB's (µg/kg)	ST-1	5	40	0.337	0.412	1.222	0.17	-0.144	0.818	3,000 (Red Meat)
	LARE-1	5	0	3.54	0.900	0.254	0.809	2.686	4.402	
	LARE-2	5	0	3.28	0.813	0.248	0.662	2.508	4.06	
	QGVC-18	5	0	2.38	0.375	0.158	0.14	2.019	2.733	
	LA-2-Ref	5	20	0.203	0.0939	0.463	0.0088	0.1	0.306	
	Control	5	20	0.193	0.0802	0.416	0.0064	0.105	0.281	

NA = Not Applicable
ND = Not Detected above the MDL.
Mean tissue concentrations shaded in blue are statistically elevated ($p \leq 0.05$) over mean reference and control tissue concentrations.
Mean tissue concentrations shaded in green are statistically elevated ($p \leq 0.05$) over mean reference tissue concentrations only.
Mean values in *italics* could not be statistically evaluated for significance because reference or control were greater than test tissues or one or both sets of tissue replicates are all ND.

Table 32. Statistical Results for the LARE and Long Beach Approach Channel Composite Sample *Nereis virens* Tissue Concentrations Compared to Reference and Control Tissue Concentrations.

Analyte	Sample	n	% ND	Mean	Standard Deviation (n-1)	Variation Coefficient	Variance	Lower Bound on Mean (95%)	Upper Bound on Mean (95%)	FDA Action Level
% Lipids	ST-1	5	0	0.892	0.122	0.137	0.0149	0.776	1.008	
	LARE-1	5	0	1.00	0.122	0.122	0.015	0.883	1.117	
	LARE-2	5	0	1.16	0.315	0.272	0.0993	0.858	1.458	
	QGVC-18	5	0	1.06	0.264	0.25	0.0698	0.806	1.31	
	LA-2-Ref	5	0	1.18	0.137	0.117	0.0189	1.01	1.307	
	Control	5	0	1.07	0.307	0.286	0.0942	0.781	1.367	
Cadmium (mg/kg)	ST-1	5	100	ND	NA	NA	NA	NA	NA	0.3 (Fish)
	LARE-1	5	100	ND	NA	NA	NA	NA	NA	
	LARE-2	5	20	*0.032*	0.0033	0.105	0.00001	0.028	0.036	
	QGVC-18	5	20	*0.034*	0.0032	0.0957	0.00001	0.023	0.038	
	LA-2-Ref	5	80	0.154	0.0224	0.145	0.00050	0.154	0.154	
	Control	5	0	0.042	0.0056	0.134	0.00003	0.036	0.047	
Copper (mg/kg)	ST-1	5	0	*1.50*	0.201	0.134	0.0403	1.31	1.69	
	LARE-1	5	0	*1.30*	0.158	0.122	0.0251	1.15	1.45	
	LARE-2	5	0	1.73	0.119	0.0688	0.0142	1.62	1.85	
	QGVC-18	5	0	1.71	0.216	0.126	0.0466	1.50	1.91	
	LA-2-Ref	4	0	1.65	0.277	0.168	0.0769	1.32	1.97	
	Control	5	0	1.79	0.056	0.0314	0.0032	1.74	1.84	
Lead (mg/kg)	ST-1	5	0	0.237	0.0286	0.121	0.00082	0.209	0.265	
	LARE-1	5	0	0.246	0.0558	0.227	0.00312	0.193	0.299	
	LARE-2	5	0	*0.157*	0.0494	0.315	0.00244	0.110	0.204	
	QGVC-18	5	0	*0.104*	0.0033	0.0314	0.00001	0.101	0.107	
	LA-2-Ref	4	0	0.231	0.051	0.221	0.00260	0.171	0.291	
	Control	5	0	0.177	0.031	0.175	0.00096	0.147	0.207	
Zinc (mg/kg)	ST-1	5	0	25.9	13.36	0.517	178.4	13.1	38.6	
	LARE-1	5	0	26.2	15.03	0.573	225.8	11.9	40.5	
	LARE-2	5	0	23.0	3.838	0.167	14.73	19.4	26.7	
	QGVC-18	5	0	27.1	12.49	0.461	155.9	15.2	39.0	
	LA-2-Ref	5	0	25.8	13.69	0.531	187.3	12.7	38.8	
	Control	5	0	16.6	6.271	0.377	39.32	10.6	22.6	
Total DDT (µg/kg)	ST-1	5	100	ND	NA	NA	NA	NA	NA	5,000 (Fish DDE &DDT)
	LARE-1	5	100	ND	NA	NA	NA	NA	NA	
	LARE-2	5	100	ND	NA	NA	NA	NA	NA	
	QGVC-18	5	100	ND	NA	NA	NA	NA	NA	
	LA-2-Ref	5	100	ND	NA	NA	NA	NA	NA	
	Control	5	100	ND	NA	NA	NA	NA	NA	

Table 32. Statistical Results for the LARE and Long Beach Approach Channel Composite Sample *Nereis virens* Tissue Concentrations Compared to Reference and Control Tissue Concentrations (Continued).

Analyte	Sample	n	% ND	Mean	Standard Deviation (n-1)	Variation Coefficient	Variance	Lower Bound on Mean (95%)	Upper Bound on Mean (95%)	FDA Action Level
Technical Chlordane (µg/kg)	ST-1	5	0	*19.2*	5.12	0.267	26.2	14.32	24.08	300 (Fish)
	LARE-1	5	0	*39.6*	10.1	0.256	103	29.93	49.27	
	LARE-2	5	0	*43.8*	22.6	0.515	510	22.28	65.32	
	QGVC-18	5	100	ND	NA	NA	NA	NA	NA	
	LA-2-Ref	5	100	ND	NA	NA	NA	NA	NA	
	Control	5	100	ND	NA	NA	NA	NA	NA	
Lipid Normalized Technical Chlordane (µg/kg)	ST-1	5	0	*39.6*	8.883	0.224	3.973	31.09	48.05	300 (Fish)
	LARE-1	5	0	*36.6*	8.733	0.239	3.906	28.3	44.94	
	LARE-2	5	0	*21.3*	3.489	0.164	1.56	17.96	24.6	
	QGVC-18	5	100	ND	NA	NA	NA	NA	NA	
	LA-2-Ref	5	100	ND	NA	NA	NA	NA	NA	
	Control	5	100	ND	NA	NA	NA	NA	NA	
Total Chlordane (µg/kg)	ST-1	5	0	*4.09*	0.601	0.147	0.361	3.519	4.383	300 (Fish)
	LARE-1	5	0	*3.83*	0.584	0.153	0.341	3.269	6.353	
	LARE-2	5	0	*5.26*	1.145	0.218	1.31	4.171	0.354	
	QGVC-18		60	*0.226*	0.095	0.420	0.00902	0.098	0.150	
	LA-2-Ref	5	100	ND	NA	NA	NA	NA	NA	
	Control	5	100	ND	NA	NA	NA	NA	NA	
Total PCB's (µg/kg)	ST-1	5	0	5.306	0.641	0.121	0.411	4.70	5.92	3,000 (Red Meat)
	LARE-1	5	0	7.12	2.446	0.344	5.984	4.79	9.45	
	LARE-2	5	0	9.912	1.769	0.178	3.13	8.22	11.6	
	QGVC-18	5	0	7.226	1.711	0.237	2.926	5.60	8.86	
	LA-2-Ref	5	0	4.488	0.719	0.16	0.518	3.80	5.17	
	Control	5	0	4.426	1.042	0.235	1.085	3.43	5.42	

NA = Not Applicable
ND = Not Detected above the MDL.
Mean tissue concentrations shaded in blue are statistically elevated ($p \leq 0.05$) over mean reference and control tissue concentrations.
Mean tissue concentrations shaded in green are statistically elevated ($p \leq 0.05$) over mean reference tissue concentrations only.
Mean values in *italics* could not be statistically evaluated for significance because reference or control were greater than test tissues or one or both sets of tissue replicates are all ND

5.0 DISCUSSION

Subsections that follow describe the physical, chemical, and biological testing results, as summarized in Tables 12 through 32, in terms of sediment screening levels and objectives for beach nourishment and/or ODMDS placement.

5.1 Sediment Observations

Vibracore boring (sediment) logs are included in Appendix G. These logs are discussed separately for the LARE channel areas, the POLB Approach Channel, and the Chaffee Island Nearshore Site.

5.1.1 LARE Sediment Observations

According to the sediment logs and the general descriptions in Tables 12 through 14, the upper sediment from most LARE locations was described as either sandy silt (MH) or silt with sand (MH). This silt layer extended anywhere from one foot below the mudline to the entire core length. Material below the silt layer varied from either fat clay (CH), silty sand (SM) or poorly graded sand with silt (SP-SM). Exceptions to the general description above are as follows:

- Location 03 in the Sand Trap was entirely silty sand (SM).
- Location 26 in the Sand Trap area had a 1.5 ft top layer of fat clay (CH) over silt with sand (MH).
- Location 37 in the Sand Trap was silty sand (SM) with a 1.0 ft layer of poorly graded sand with silt (SP-SM) in between.
- The top 0.5 ft of material at location 18 in the LARE-1 area was silty sand (SM) with alternating layers of sandy silt (MH) and silty sand (SM) below.
- The top two feet in at Location 30 in the LARE-2 area was silty sand (SM) with a 0.7 ft layer of poorly graded sand with silt (SP-SM) below that and sandy fat clay (CH) below that to the bottom of the boring.
- Location 17 had a 0.7 ft top layer of silty sand (SM) over sandy silt (MH) with an interbed of silty sand (SM) between 4.5 ft and 6.7 ft depth.

Some core locations had large amounts of vegetative debris as well as occasional trash, and had a distinct odor of decomposing plant material. The vegetative debris was quite extensive in the Sand Trap area. At one location (02) the vibracore was unable to penetrate through this material and no sediment sample could be obtained. At the direction of USACE-Los Angeles District, supplemental cores were added to the Sand Trap with the purpose delineating the extent of the vegetative mat. As shown on Figure 12, most of the debris was hung up on the west and south side walls of this channel area. Plant debris in the LARE-1 and LARE-2 areas were less extensive.

5.1.2 POLB Approach Channel Sediment Observations

The sediment logs and Table 15 descriptions for the POLB Approach Channel describe the sediments from two of four POLB Approach Channel locations sampled as being mostly silty sand (SM). Locations 03 and 04 were described as mostly sandy silt (ML). Other than a few seashells, there was no odor, trash or other debris noted for the Approach Channel cores.

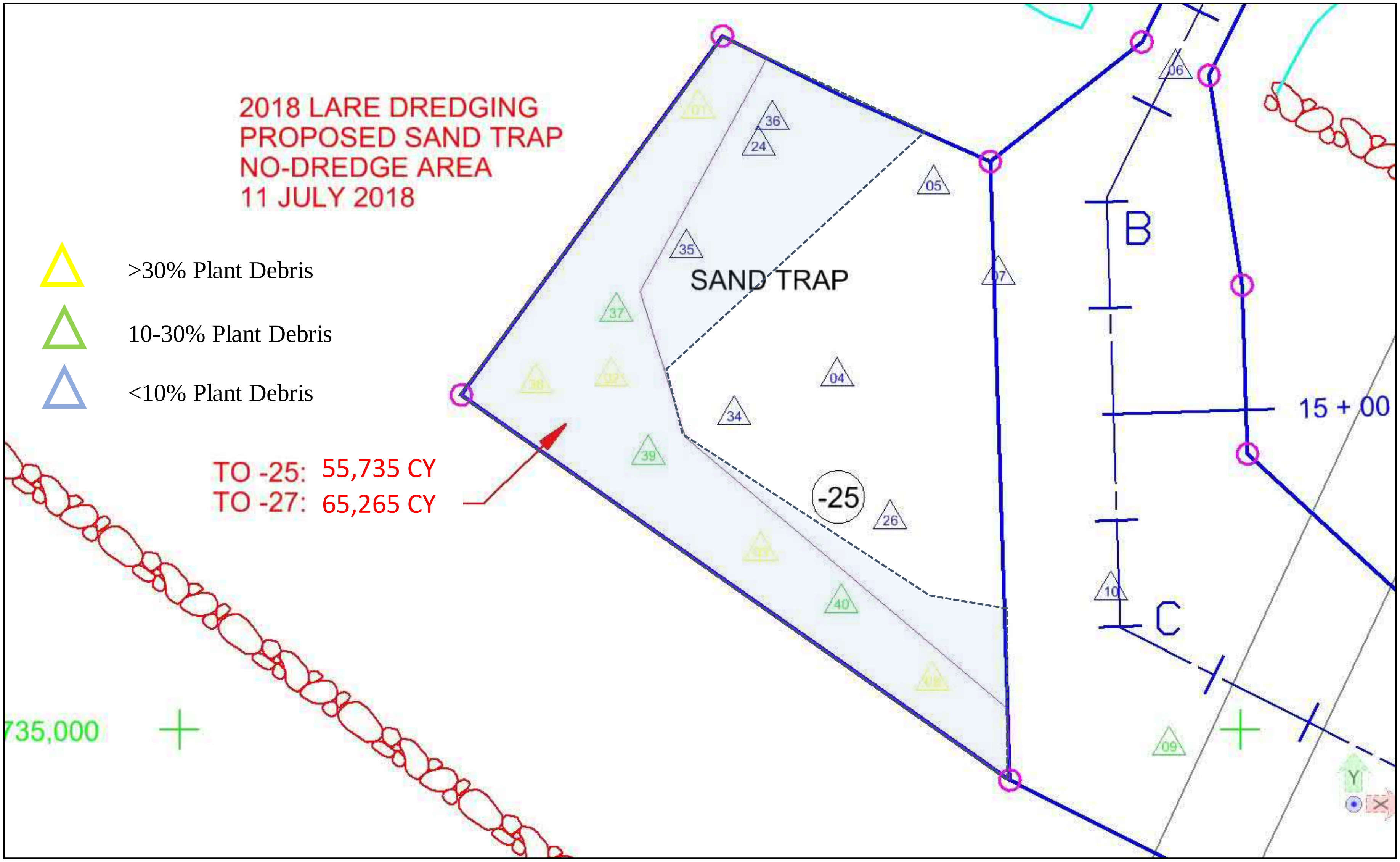


Figure 12. Extent of Vegetative Debris in LARE Sand Trap Channel Area.

88

5.1.3 Chaffee Island Nearshore Site Sediment Observations

The sediment logs and Table 16 sediment descriptions for the Chaffee Island Nearshore Site indicate the surface sediments from the site were a mixture of sandy silt (ML) and silty sand (SM), which make them comparable to the LARE and POLB Approach Channel sediments.

5.2 Sediment Grain Size

The LARE and POLB Approach Channel grain size results are discussed separately below in terms of sand content as well as their physical compatibility to the Chaffee Island Nearshore Site.

5.2.1 LARE Grain Size

Tables 12 through 14 data show that grain size characteristics of the LARE sediments varied among core locations but not necessarily among dredge areas. The weighted average composite grain size gradation was calculated for all three dredge areas using the individual core data. The weighted average sand content, defined as the quantity of sediment that did not pass through the #200 sieve, was 40% for ST-1, 38% for LARE-1, and 33% for LARE-2. In comparison, the average sand content for the Chaffee Island Nearshore Site was 50%.

5.2.2 POLB Approach Channel Grain Size

Grain size analyses confirmed observation that the sediments form the POLB Approach Channel had a large proportion of sand (Table 15). The weighted average composite sand content for the dredge area as a whole was 55% compared to an average of 50% in the Chaffee Island Nearshore Site (Table 16).

5.2.3 Chaffee Island Nearshore Area Physical Compatibility Analysis

Results of the physical compatibility analysis between the LARE and POLB Approach Channel sediments are provided in Appendix K as a separate report prepared by the Los Angeles District USACE. Compatibility analyses were based on USACE LAD guidelines that specify that individual sediment samples collected from each dredge unit and/or the composite gradation curve for the overall dredge footprint areas can be no more than 10% above the finest limit gradation curve of the beach fill or placement area. The finest limit curve is one of the three curves representing the overall composite grain size gradation of the weighted average calculated profile or “beach compatibility envelope” of the placement area(s). The compatibility envelope is based on the weighted average of the finest, coarsest and average grain sizes from the individual beach profile samples. The “finest limit” gradation is based on the percent passing through U.S. Sieve size no. 200 (0.08 mm). The guidelines also specify that the dredged sediment can be greater than the “coarsest limit” placement profile sample grain size composite curve, as long as aesthetic quality of the dredged sediment in this coarser size range is acceptable.

The maximum allowable percentage of fines for Chaffey site was calculated to be approximately 75%. This was derived from adding 10% to 65%, which was the finest sample (No. 200 sieve test

result) amongst the eleven grab samples collected from this site. The finest sample result was 65% for grab sample location CINS-18-1, which was collected in about 19 feet of water.
The following physical compatibility observations were made for each dredge unit:

- Eleven of thirteen individual vibracores (LAREVC-18-01, 03, 04, 05, 08, 26, 34, 35, 37, 39 and 40) collected from ST-1 fit within the grain size compatibility envelope for Chaffey Island. Cores LAREVC-18-36 and -24 did not fit the envelope based on a weighted average grain size analysis of each of these two individual vibracores. The composite weighted average overall fines content for all 13 core samples is approximately 59%. This means that approximately 59% of the sediment is finer than the No. 200 sieve (or is silty to clayey) and 41% is composed of sandy sediment with a greater size than this sieve. Thus, the composite grain size curve for all thirteen vibratory core samples collected from ST-1 does fit within the overall grain size compatibility envelopes for Chaffey Island.
- Eight cores (LAREVC-18-09, 10, 13, 15, 16, 17, 18 and 20) out of fourteen individual cores collected from LARE-1 fit within the grain size compatibility envelope for Chaffey Island. Cores LAREVC-18-06, 07, 11, 12, 14 and 19 did not fit the envelope based on a weighted average grain size analysis of each individual vibracore. The composite weighted average overall fines content for all fourteen core samples was approximately 62%. Thus, the composite grain size curve for all fourteen vibratory core samples collected from LARE-1 does fit within the overall grain size compatibility envelopes for Chaffey Island.
- Seven cores (LAREVC-18-22 and 28 to 33) out of eleven individual cores collected from LARE-2 fit within the grain size compatibility envelope for Chaffey Island. Cores LAREVC-18-21, 23, 25 and 27 did not fit the envelope based on a weighted average grain size analysis of each individual vibracore. The composite weighted average overall fines content for all eleven core samples was approximately 67%. Thus, the composite grain size curve for all eleven vibratory core samples collected from LARE-2 does fit within the overall grain size compatibility envelope for Chaffey Island.
- All four of the individual cores collected from the POLB Approach Channel (QGVC-01 to 04) fit within the grain size compatibility envelope for Chaffey Island. The composite weighted average overall fines content for all four core samples was approximately 55%. Thus, the composite grain size curve for all four vibratory core samples collected from the POLB Approach Channel does fit within the overall grain size compatibility envelope for Chaffey Island.

5.3 Bulk Sediment Chemistry

Chemical results for the LARE sediment composites samples (Table 17) and the LARE individual core analyses (Table 18) are discussed below and separately from the POLB Approach Channel composite sample results (Table 19).

5.3.1 LARE Sediment Chemistry

Compared to NOAA effects based screening levels (Long et. al., 1995 and Long and Morgan, 1991) and LA-2 reference data, contaminant concentrations were elevated for some inorganic contaminants in the LARE composite samples. Cadmium, copper, lead, and nickel exceeded corresponding ERL values in all three composite samples, and zinc exceeded the corresponding ERM value in all three composite samples. There were no inorganic ERL exceedances in the LA-

2 reference sample. Results were similar on an individual core basis except zinc exceeded the corresponding ERM value at one location in LARE-2 (LAREVC-18-33). Zinc values were between corresponding ERL and ERM in samples from all other locations.

Some organic contaminants were elevated in the LARE samples above LA-2 reference values or they exceeded NOAA effects based screening levels. The following discusses each elevated organic contaminant or class of contaminant separately:

- Dibutyltin was not detected in the LA-2 reference sample but was detected in the ST-1 composite sample and nine of the eleven individual core samples.
- There are no ERL or ERM values for oil and grease and total recoverable petroleum hydrocarbon (TRPH) but concentrations for oil and grease ranged from 1,100 mg/kg to 1,600 mg/kg compared to 19 mg/kg for the LA-2 reference sample, and TRPH concentrations ranged from 550 mg/kg to 810 mg/kg and were not detected in the LA-2 reference sample. Oil and Grease in the individual core samples from LARE-1 and LARE-2 ranged from 650 mg/kg to 1,900 mg/kg, and TRPH in the individual core samples ranged from 360 mg/kg to 1,200 mg/kg.
- Total DDT and 4,4'-DDE were elevated above ERL values in all three composite samples but not ERM values. The same holds true for all individual core samples tested. Total DDT and 4,4'-DDE also exceed ERL values in the LA-2 reference sample but at concentrations about three times less than the LARE composite samples.
- ERLs and ERMs for chlordane were not identified in Long at.al. (1995) but are identified in and earlier paper by Long and Morgan (1991). Total chlordane concentrations (as the sum of alpha- and gamma-chlordane, cis- and trans-nonachlor and oxychlordane) in the LARE samples were well above the ERM value. Technical chlordane, which is a complex mixture of over 120 structurally related compounds and is not included in total chlordane, was three to six times higher than total chlordane. Chlordane compounds were not detected in the LA-2 reference sample.
- Total PCB congener concentrations were elevated above the ERL value but below the ERM value in all three composite samples, and PCB congeners were not present in the LA-2 reference sediments. There were 13 individual core locations in the LARE-1 and LARE-2 composite areas analyzed for PCB congeners. All total PCB concentrations for these locations were between the ERL and ERM values. The highest concentrations observed (94.9 and 142 µg/kg) were for two locations just outside the 2013 "No Dredge" area in LARE-1 (LAREVC-18-19 and LAREVC-18-15, respectively). Concentrations within the 2013 LARE-1 "No Dredge" area ranged from 58.8 to 83.7 µg/kg. For the LARE-2 composite area, the total PCB concentration (36.2 µg/kg) for the single location outside the 2013 "No Dredge" area (LAREVC-18-28) was about half that of the concentrations of the five locations within the 2013 "No Dredge" area (61.2 to 78.6 µg/kg).
- No individual PAH compounds exceeded an ERL value in the composite samples. However, total low molecular weight PAHs in the ST-1 and LARE-1 composite samples exceeded the corresponding ERL value. There were no PAH ERL exceedances in the the individual locations from the LARE-1 composite area. Acenaphthene and phenanthrene concentrations exceeded ERL values in one individual core location from the LARE-2 composite area (LAREVC-18-29). In addition, total low molecular weight PAHs exceeded the corresponding ERL value in two out of six LARE-2 locations and total high molecular weight PAHs exceeded the corresponding ERL value in three out of the six LARE-2

locations. There were no PAH ERM exceedances. PAH compounds were not detected in the LA-2 reference sample above the reporting limit.

- A couple phthalate esters were also elevated in the LARE composite samples. There are no ERL or ERM values available for phthalate esters. There are however marine sediment effects based screening values for bis-(2-ethylhexyl) phthalate consisting of TELs and PELs (see Section 3.2.7). Bis-(2-ethylhexyl) phthalate concentrations were well above the PEL in all three LARE composite samples, indicating that adverse effects are probable. Bis(2-ethylhexyl) phthalate was well below the TEL in the LA-2 reference sample. Concentrations of benzyl butyl phthalate in the LARE composite samples were also elevated by a magnitude above the LA-2 reference concentration. Individual core phthalate esters varied among locations but generally indicated the same pattern.
- The semi-volatile compounds 3 and 4 methylphenol (m-, p- cresol) were detected as a combined concentration in all three LARE composite samples as well as all individual core samples. Concentrations were one to two magnitudes higher than the MDL, and cresol was not detected in the LA-2 reference sample. Cresols are used as a preservative and in the production of other synthetic compounds. No marine toxicity sediment screening values could be found for cresols.
- Bisphenol A (BPA), a plasticizer, was found at concentrations two magnitudes higher than the MDL in all three LARE composite samples and one to two magnitudes higher than the MDL in the individual core samples. It was not detected in the LA-2 reference sample. No marine toxicity sediment screening values could be found for BPA.
- The pyrethroid pesticides cis- and trans- permithrin, bifenthrin, cyfluthrin, cypermethrin, deltamethrin/tralomethrin and Esfenvalerate:Fenvalerate were detected in the LARE composite samples generally above reporting limits and they were not detected in the LA-2 reference sample above MDLs. Somewhat less concentrations were detected in the individual core analyses. No readily available marine toxicity sediment screening values could be found for pyrethroids.

Arsenic and benzo (a) pyrene concentrations in the three LARE composite samples were elevated above human health screening values (RSLs and CHHSLs). Arsenic was elevated over both the RSL and CHSSL values for both residential and industrial settings and benzo (a) pyrene was elevated above the CHSSL value for residential settings. Benzo (a) pyrene concentrations were also elevated above the CHSSL industrial value at two locations within the LARE-2 composite area. Elevated arsenic concentrations occur commonly in Southern California dredge sediments and soils, and the concentrations of arsenic in the LARE samples were less than the background concentration (3.5 mg/kg) of soils throughout California (Bradford et al., 1996). Human health complications from arsenic is not expected. Benzo (a) pyrene concentrations were slightly elevated above residential settings. Residential values are based on a 24-hour per day exposure, which would not occur on recreational beaches. Therefore, there could be human health implications if the LARE sediments are reused for beach nourishment are not expected.

As a general overall indicator of potential amphipod toxicity, mean ERM quotients were calculated for all LARE samples. These ranged from 0.18 to 0.19 in the composite samples and 0.12 to 0.19 in the individual core samples. A mean quotient less than 0.1 is indicative of a low probability (<12%) of a highly toxic response to marine amphipods (Long and MacDonald, 1998). With a mean ERM quotient of 0.19, there is less than a 30% chance of a highly toxic response.

Similar levels of sediment concentrations have been previously found in the LARE sediments (see Section 2.2).

5.3.2 POLB Approach Channel Sediment Chemistry

Overall analyte concentrations in the POLB Approach Channel area composite sample, as summarized in Table 18, were below detection limits or low compared to NOAA effects based screening values and LA-2 reference concentrations. The only constituents detected above NOAA ERL values were total DDT and 4,4'-DDE, which were also elevated above ERL values in the LA-2 reference sample but at concentrations about a third less. There were no sample values that exceeded a NOAA ERM value. Low levels of metals and some PAH compounds were the only other constituents reported above a laboratory reporting limit. Phthalate compounds were also detected in both the composite sample and LA-2 reference sample but at levels below the RL or method blank detections negated the results. Based on the chemistry results, no adverse ecological effects are predicted from the dredge material. This is further supported by the fact mean ERM quotient was only 0.06. As stated previously, with an ERMq of 0.1, there is less than a 12% probability of a toxic response.

Except for arsenic, all detected concentrations in the POLB Approach Channel composite sample were well below RSLs and CHHSLs for residential soils developed for human protection.

5.4 Toxicity Testing Results for Ocean Placement

Benthic and water column bioassays and bioaccumulation exposures were used to assess toxicity and bioaccumulation potential for the LARE and POLB Approach Channel composite areas. Results of the Tier III assays are discussed separately in the following subsections.

Summaries of test conditions and test acceptability criteria can be found in Appendix P of the bioassay laboratory report (Appendix J). Aliquots of composite sediment samples were centrifuged at 2,500 g for 15 minutes and the resulting supernatant pore waters were carefully collected and analyzed for routine water quality characteristics, which are provided in Table 22. Initial porewater measurements indicated that high total ammonia could have been a confounding factor for the Tier III analyses.

5.4.1 Solid Phase Amphipod (Ampelisca abdita) and Polychaete Worm (Neanthes arenaceodentata) Test Results

Ammonia concentrations in all three LARE composite samples, but not the POLB Approach Channel sample nor the LA-2 reference sample, were elevated above the ITM maximum concentration of 30 mg/L for tests involving *Ampelisca abdita* (Table 22). Accordingly, prior to solid phase testing, the sediments were purged of ammonia by daily replacement of the overlying water with fresh 28ppt seawater, coupled with aeration, until the porewater total ammonia levels were below 15 mg/L, after which the tests were initiated. Ammonia porewater concentrations at test initiation and test termination are provided in Table 33 for both species used.

Table 33. Total Ammonia Porewater Concentrations at Test Initiation and Test Termination for the SP Bioassays.

Sample ID	Total Ammonia (mg/L N) *Ampelisca abdita* Test		Total Ammonia (mg/L N) *Neanthes arenaceodentata* Test	
	Test Initiation	Test Termination	Test Initiation	Test Termination
Lab Control	2.54	<1.00	2.78	<1.00
LA-2 REF	6.20	3.82	7.21	3.11
LAREVC-18-ST-1	13.2	1.48	17.2	5.49
LAREVC-18-LARE-1	4.71	<1.00	25.7	14.1
LAREVC-18-LARE-2	8.54	4.33	6.71	<1.00
QGVC-18	NM	8.46	7.87	NM

NM = Not measured due to insufficient sample volume.

Mean survival of *Ampelisca abdita* after the 10-day exposures to the control sediment was acceptable at 97% (Table 20). Mean *Ampelisca* survival in the LA-2 reference sample (92%) was significantly reduced ($p<0.05$) from the lab control. Mean *Ampelisca* survival in the LARE composite samples ranged from 95% to 99% and was 100% in the POLB Approach Channel composite sample after 10 days of exposures. Since the results and were not reduced from the mean LA-2 reference survival nor were they statistically reduced from the lab control, the LARE and POLB Approach Channel sediments are not considered to be toxic to *Ampelisca*.

Mean survival in the control sediment for the 10-day *Neanthes arenaceodentata* test was acceptable at 100% (Table 21). Mean *Neanthes* survival in the LARE composite samples, the POLB Approach Channel composite sample and the LA-2 reference sample after 10 days of exposure were all 100%, indicating no toxicity to *Neanthes*.

5.4.2 SPP (Suspended Particulate Phase) Water Column Bioassays

Total ammonia was measured in the 100% SPP extracts formed from the LARE composite samples prior to SPP test initiations. These results are provided in Table 34 and show that total ammonia was elevated in the LARE composite samples but relatively low in the POLB Approach Channel composite sample.

Table 34. Total Ammonia Concentrations in the SPP Extracts Prior to Initiation of the SPP Tests.

Sample ID	Total Ammonia (mg/L N)
LAREVC-18-ST-1	62.0
LAREVC-18-LARE-1	66.2
LAREVC-18-LARE-2	25.1
QGVC-18	3.55

48-Hour Mussel Larvae Survival and Normal Embryonic Development Test

Mean survival of *Mytilus galloprovincialis* (mussel) embryos was 100% in all laboratory control exposures, indicating an acceptable survival response to the test organisms (Table 23). Mean survival in the site water control sample was 89.7%. There was also 100% survival in the 1% and 10% dilutions for the ST-1 and LARE-1 composite samples and 100% survival in the 1%, 10% and 25% dilutions for the LARE-2 composite sample. The 50% dilution and the undiluted replicates in all three LARE composite samples caused 100% mortality along with the 25% dilutions for the ST-1 and LARE-1 composite samples. The resulting embryo LC_{50} values were 17.5% elutriate for ST-1 and LARE-1 composite samples and 37.5% elutriate for the LARE-2 composite sample. Mean *Mytilus* survival in the POLB Approach Channel composite sample was 100% for all dilutions including among the undiluted replicates. Qualitatively, the LC_{50} concentrations correlate well with the total ammonia concentrations in the elutriates at test initiation.

Mean normally developed mussel embryos ranged from 95.6% to 99.2% in the laboratory control samples and 80.3% in the site water control (Table 23). Since total mortality of embryos is the same as no normally developed embryos, the mean normally developed embryo results are the same for the 1%, 10% and 25% dilutions as they were for survival results. The resulting chronic EC_{50} values were 17.3% for the ST-1 and LARE-1 composite samples and 37.5% for the LAR-2 composite sample. The EC_{50} for the POLB Approach Channel composite sample was greater than 100% elutriate concentration as mean normally developed embryos in the 100% elutriate extract was 98%.

96-Hour Mysid Survival Test

Mean survival of *Americamysis bahia* exposed for 96 hours to the undiluted SPP extracts formed from the LARE composite samples was zero percent in the ST-1 and LARE-1 composite samples, 100% for the LARE-2 composite sample, and 98% in the POLB Approach Channel composite sample compared to mean control survivals of 98% to 100% (Table 21). Mean survival in the 50% dilutions for the ST-1 composite sample was statistically reduced from mean survival in the lab control ($p<0.05$) at 88%. Resulting LC_{50} values were 62.3% elutriate for ST-1 and 68.3% elutriate for LARE-1 composite samples. Resulting LC_{50} values were greater than 100% elutriate for the LARE-2 and POLB Approach Channel composite samples, indicating no toxicity after 96 hours of exposure to these samples.

96-Hour Juvenile Fish Survival Test

Mean survival of *Menidia beryllina* exposed for 96 hours to the undiluted SPP extracts formed from the LARE composite samples was zero percent in the ST-1 and LARE-1 composite samples, 12% for the LARE-2 composite sample, and 96% in the POLB Approach Channel composite sample compared to mean control survivals of 92% to 96% (Table 25). The 12% mean survival for the LARE-2 composite sample was statistically reduced from the laboratory control ($p<0.05$). Mean survival in the 50% dilutions for the ST-1 composite sample was also statistically reduced from mean survival in the lab control at 44%. Resulting LC_{50} values were 47.4% elutriate for ST-1 composite sample, 65% elutriate for LARE-1 composite sample, and 77.4% for the LARE-2 composite sample. The resulting LC_{50} value was greater than 100% elutriate for the POLB Approach Channel composite sample, indicating no toxicity after 96 hours of exposure to these samples.

Ammonia Effects

As eluded to earlier, ammonia was probably a confounding factor in the reduced survival and normal development for the SPP tests. Except for QGVC-18, the undiluted SPP elutriates had total ammonia concentrations (Table 34) above the no observable effects concentration (NOEC) toxic threshold for bivalve larvae of 4.0 µg/L for total ammonia (Tang et al, 1997) in all three samples. The LARE-1 elutriate exhibited the greatest reduced survival and normal development. This sample had the highest initial total ammonia concentration of 66.2 mg/L. At a temperature of 15.3ºC and a pH of 7.87 at test initiation, the unionized ammonia concentration for the LARE-1 100% elutriate extract was 1.37 mg unionized NH_3/L. The USEPA national 1-hour average saltwater criteria for unionized ammonia is 0.233 mg unionized NH_3/L (USEPA, 1989).

Mixing Model Calculations

As described above, the lowest median effects concentration was an EC_{50} of 17.3% elutriate for the 48-hour mussel embryo development tests for both the ST-1 and LARE-1 composite sample. This value was used in the ADAMS initial mixing model (STFATE) described in the ITM for calculation of the Limiting Permissible Concentration (LPC) for placement at LA-2 using a 5,000 cy dump barge filled to 80% capacity. Model inputs include gran size distribution. Weighted average grain size results for LARE-1 were used for this purpose. Although an assumed clay percentage of 16% was used based on previous 2013 data and several individual 2018 samples. Details of these calculations are provided in Table 35 and a full output of the model is provided in Appendix N.

The model predicted that the liquid and suspended particulate matter at the edge of the LA-2 placement area during initial mixing would not exceed the toxicity standard (1% of the EC_{50} concentration). The model also predicted that the concentration of liquid and suspended particulate matter within the placement area four hours after dumping would not exceed that toxicity standard. Therefore, the LPC for placement of the LARE sediments at LA-2 ODMDS would not be exceeded despite the observed toxicity.

Table 35. Initial Mixing Calculations for Placement of LARE Sediments at LA-2 ODMDS.

Model		ADDAMS STFATE Module Vs. 5.01
Placement Site		LA-2
Sample		Composite ST-1 and LARE-1
Simulation		Descent, Collapse and Diffusion
Inputs	Type of Analysis	Section 103 Regulatory Analysis for Ocean Sites
	Grid	25 x 25
	Placement Area Size (ft) (USACE/USEAPA, 2004)	6,000 x 6,000 grid with 2,000 x 2,000 placement area
	Placement Site Depth (ft) (USACE/USEAPA, 2004)	Variable from 360 to 1,050 feet
	Dump Location	Center of Placement Site
	Roughness	0.005
	Water Density (g/cc)	1.0254 surface, 1.0398 @ 9,000 ft.
	Vessel Type	Spilt Hull Barge
	Vessel Volume (cy)	5,000
	Material Volume (cy)	4,000
	Vessel Length (ft)	230
	Vessel Width (ft)	60
	Vessel Draft Full (ft)	20
	Vessel Draft Empty (ft)	10
	Vessel velocity (fps)	3
	Time to Empty Vessel (s)	20
	Gravel Fraction (weighted average)	0.0
	Sand Fraction (average of weighted averages)	0.38
	Silt Fraction (weighted average)	0.46
	Clay Fraction (weighted average)	0.16
	Current Velocity (fps) (USACE/USEAPA, 2004)	Single depth averaged velocity of 0.5 in X direction and 0.5 in Z direction.
	Coefficients	Default
	Transport diffusion Output (ft)	3 depths (0, 500, 1000)
	LC_{50} of Sample (%)	17.3
	Simulation Duration (s)	14,400
	Long Term Time Step (s)	900
Output	Max Dilution Required to Meet Toxicity Criteria (%)	0.173
	Max Conc. of Sand 4 hrs. After Dump (%)	0.0
	Max Conc. of Silt 4 hrs. After Dump (%)	2.55
	Max. Conc. of Clay 4 hrs. After Dump (%)	0.888
	Max. Conc. of liquid Matter 4 hrs. After Dump (%)	0.0
	Max Conc. of Sand Outside Site Within 4 hrs. After Dump (%)	0.0
	Max Conc. of Silt Outside Site Within 4 hrs. After Dump (%)	1.95
	Max. Conc. of Clay Outside Within 4 hrs. After Dump (%)	1.02
	Max. Conc. of liquid at Edge Within 4 hrs. After Dump (%)	0.0
	LPC Exceeded?	No

5.5 Bioaccumulation Testing for Ocean Placement

Bioaccumulation potential testing is discussed in terms of meeting the LPC for ocean placement. Each chemical evaluated is discussed separately.

5.5.1 Bioaccumulation Survival

Though the main purpose of the bioaccumulation tests is to determine whether contaminants of concern will bioaccumulate up to marine invertebrates from sediment, survival of the clams and worms during the exposure period was also measured. After 28-day bioaccumulation exposures, mean survival for *Macoma* ranged from 95% to 99% and mean survival for *Nereis* ranged from 95% to 100% (Table 26) compared to 99% and 100% in the control exposures, respectively. Therefore, the 28-day survival data for the clams and worms further supports the results of the toxicity tests described above that indicate that the test sediments are not toxic to benthic organisms.

5.5.2 Assessment of Bioaccumulation Potential

Tissues of the clams and worms resulting from the bioaccumulation exposures were analyzed for contaminants of concern. Based on sediment chemistry data and consultation with the USEPA Region IX, tissues derived from the bioaccumulation exposures were analyzed for cadmium, copper, lead, zinc, DDT compounds, chlordane compounds, and PCB congeners.

As indicated in the OTM, the statistical comparison of tissue residues in the treatments to the reference tissue residues provides a starting point to the tiered evaluation. Because variability between replicates in the reference tissues is typically low, a statistical significance may be observed without biological relevance. In this case, other points of comparison and interpretation are used, including an evaluation of the magnitude of difference, a comparison of observed tissue residues with critical body residue levels. These points of evaluation will be discussed in the following sections.

The null hypothesis tested was that residue concetrations in the the test tissues were not statistically different than residue concentrations in the reference tissues. Statistical conclusions for *Macoma* are provided in Table 31 and statistical conclusions for *Nereis* are provided in Table 32. Mean concentrations in blue shaded cells indicate statistically significant differences with mean reference tissue concentrations.

Statistical hypothesis testing was not or could not be conducted for all analytes in all samples for the following reasons:

- Cadmium was not statistically evaluated in the ST-1 *Macoma* tissues because cadmium in the reference and control tissues had higher mean concentriatons.
- Copper was not statistically evaluated for any of the *Macoma* test tissues because the copper in the reference and control tissues had higher mean concentriatons.
- Chordane compounds were not statistically evaluated for any of the *Macoma* test tissues because these anlytes were not detected in any of the control and refrence replicate tissue samples.

- DDT compounds were not dected in any of the ST-1, LARE-1 and LARE-2 *Macoma* tissues.
- Cadmium was not statistically evaluated in the LARE-2 and POLB Approach Channel (QGVC-18) *Nereis* tissues because cadmium in the reference and control tissues had higher mean concentriatons.
- Copper was not statistically evaluated in the ST-1 and LARE-1 *Nereis* tissues because copper in the reference and control tissues had higher mean concentriatons.
- Lead was not statistically evaluated in the LARE-2 and QGVC-18 *Nereis* tissues because lead in the reference and control tissues had higher mean concentriatons.
- DDT compounds were not detected in any *Nereis* test, reference, and control tissue replicates.
- Chlordane compounds were not statistically evaluated for any of the *Nereis* test tissues because these anlytes were not detected in any of the control and refrence replicate tissue samples.

Since mean cadmium and copper concentrations in both *Macoma* and *Nereis* test tissues were not statistically elevated over mean reference concentrations for any of the composite samples being evaluated, bioaccumulation of cadmium and copper is not predicted and therefore ecological and human health effects associated with cadmium and copper uptake from these sediments are not predicted to be observed at the LA-2 ODMDS. Therefore, only the statistically significant bioaccumulation of lead, zinc, chlordanes, DDTs and PCBs will be discussed further.

Macoma tissue results for total chlordane and *Nereis* tissue results for technical chlordane were lipid normalized since a positive relationship was found beween lipid and PCB concentrations (Figures 13 and 14).

For mean tissue concentrations that were detected in the test tissues and were determined to be statistically higher than mean reference concentrations, the upper 95% confidence limits (95% UCL) as well as the means were compared to FDA action levels and the lowest relevant ecological effects data among invertebrates unless, in the case of DDT, there are no relevant ecological effects data for marine invertebrates. As previously mentioned, ecological effects data used were Toxicity Reference Values (TRVs) in USACE's online Environmental Residue Effects Database (ERED)(https://ered.el.erdc.dren.mil/). Preference was given to use of LOEC endpoints. TRVs chosen were only for measurable biological effects such as mortality, reproduction and growth. As directed by the USEPA, selection and use of TRVs for certain organic compounds followed TRV selection and use guidelines developed by the San Francisco Estuary Institute (SFEI) for San Francisco Bay (Lin and Davis, 2018). The San Francisco guidelines include the use of uncertainty factors (UFs) applied to TRVs that don't have a chronic LOEC endpoint.

5.5.3 Uptake of Lead

Mean concentrations of lead in the LARE-1, LARE-2 and QCVC-18 *Macoma* tissue samples after 28 days of exposures were statistically higher than mean concentrations of lead in the *Macoma* tissues from the 28 days of control and reference exposures (Table 31). Lead was not statistically elevated in the *Macoma* ST-1 test tissues compared to the *Macoma* reference tissues, and lead was not statistically elevated in any of the *Nereis* test tissues compared to the *Nereis* reference tissues.

The distribution of lead uptake among *Macoma* test, control, and reference tissues are shown on Figure 15.

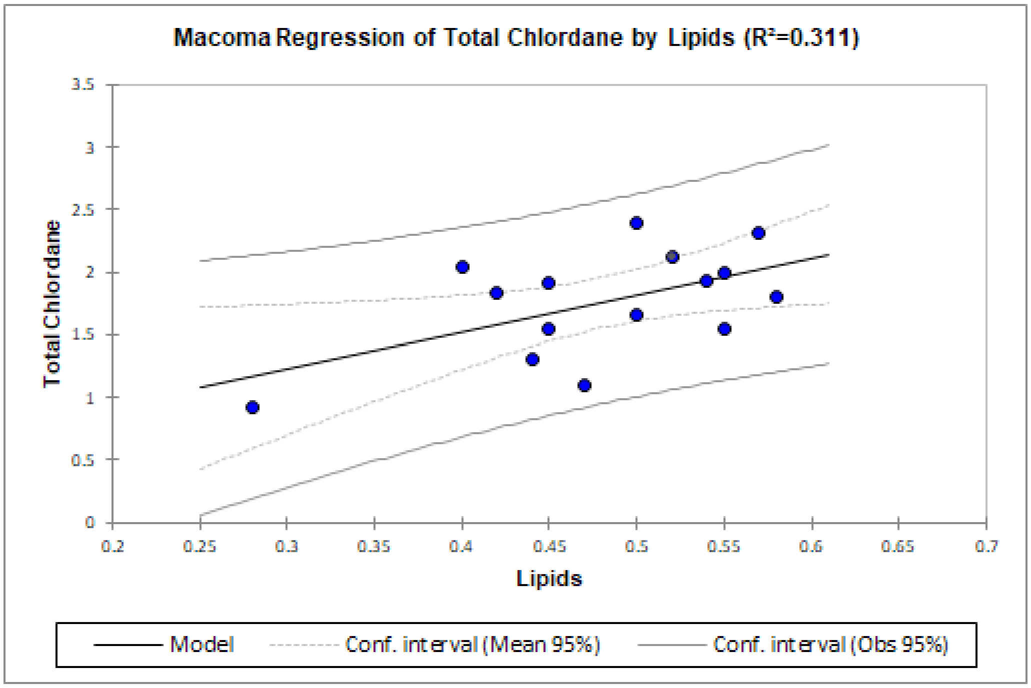


Figure 13. Relationship Between Total Chlordane and Lipid Concentrations in Nereis Tissues.

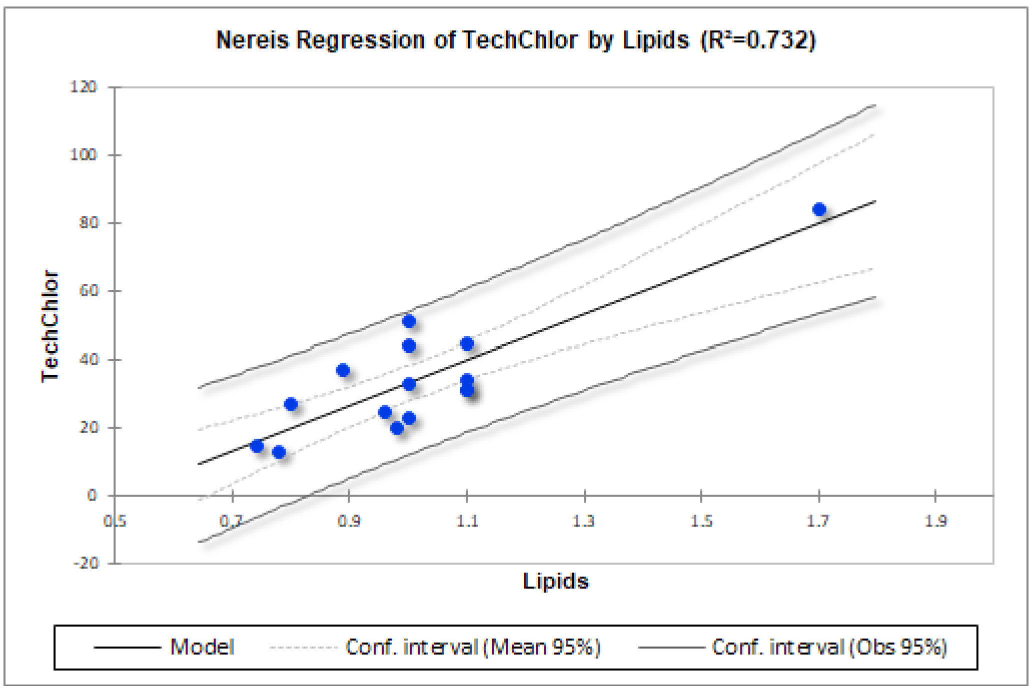


Figure 14. Relationship Between Technical Chlordane and Lipid Concentrations in *Nereis* Tissues.

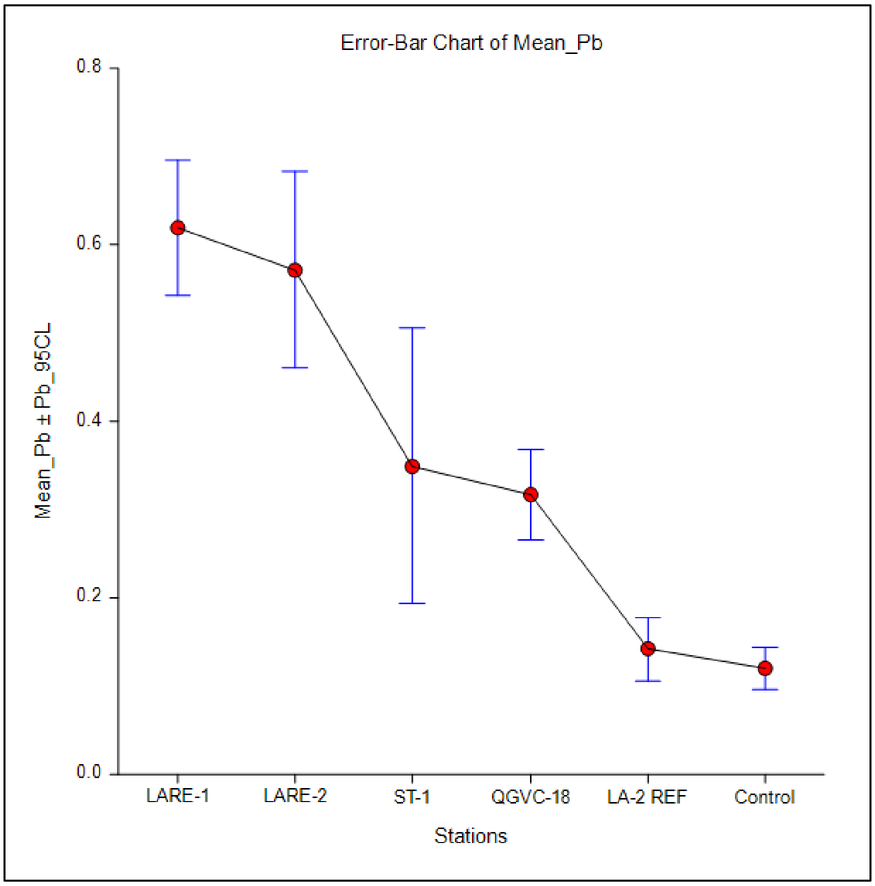


Figure 15. Distribution of *Macoma Nasuta* Lead Uptake.

Statistically significant mean uptakes of lead in the LARE-1, LARE-2 and QGVC-18 *Macoma* test tissues (0.619, 0.572 and 0.317mg/kg, respectively) were about two to five times higher than the mean uptakes in both the reference *Macoma* tissues (0.142 mg/kg) and control *Macoma* tissues (0.12 mg/kg). Mean uptakes of lead in the *Macoma* test tissues were also about three to seven times higher than the concentration of lead in the composite baseline (T0) tissue sample (0.091mg/kg). The mean uptake of lead in the *Nereis* test tissues (0.104 to 0.246 mg/kg) was less than or not statistically elevated above the mean uptake in the control tissues (0.177 mg/kg) and reference tissues (0.231 mg/kg) and was similar or less than the concentration in the composite base line tissue sample (0.247 mg/kg).

There is no FDA Action Level for lead and there are no known fish advisories based on lead. Therefore, mean and upper 95% confidence limit (95% UCL) lead tissue burdens are only discussed in terms of ecological effects based on TRVs. The lowest, most relevant lead value in the ERED for a marine invertebrate was a survival and development LOEC of 31.4 mg/kg for the Purple Sea Urchin *Paracentrotus lividus*, which is a couple magnitudes higher than the LARE federal channels and QCVC-18 95% UCL *Macoma* tissue concentrations. There was also a survival NOEC of 0.58 mg/kg for the Purple Sea Urchin that was similar to or slightly lower than the LARE federal channels and QCVC-18 mean *Macoma* tissue concentrations. Since there is little evidence showing that lead biomagnifies (Suedel et al., 1994), it seems unlikely that lead bioaccumulation from the LARE federal channels and the Port of Long Beach Approach Channel sediments will have any ecological impacts. Therefore, the statistically significant bioaccumulation of lead observed with the *Macoma* assays is considered minor and ecological effects associated with lead uptake from these sediments are not predicted to be observed at LA-2 ODMDS.

5.5.4 Uptake of Zinc

Mean concentrations of zinc in the LARE-1, LARE-2 and QCVC-18 *Macoma* tissue samples after 28 days of exposures were statistically higher than mean concentrations of zinc in the *Macoma* tissues from the 28 days of control and reference exposures (Table 31). Zinc was not statistically elevated in the *Macoma* ST-1 test tissues compared to the *Macoma* reference tissues, and zinc was not statistically elevated in any of the *Nereis* test tissues compared to the *Nereis* reference tissues. The distribution of zinc uptake among *Macoma* test, control, and reference tissues is shown on Figure 16.

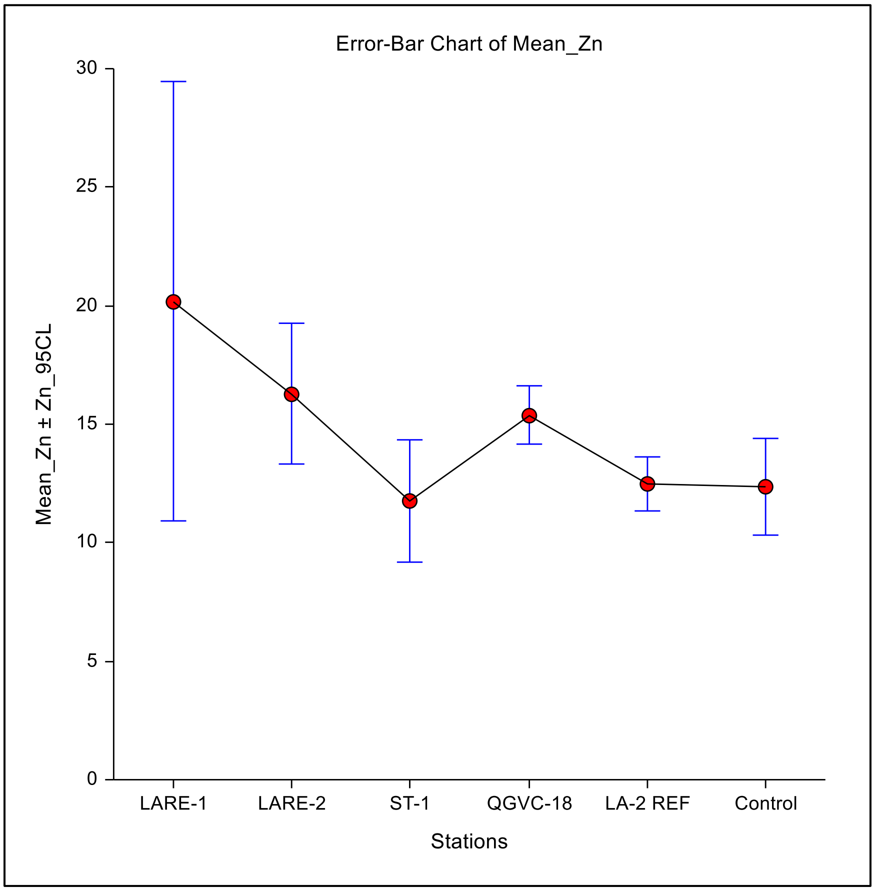


Figure 16. Distribution of *Macoma Nasuta* Zinc Uptake.

Statistically significant mean uptakes of zinc in the LARE-1, LARE-2 and QGVC-18 *Macoma* test tissues (20.2, 16.3 and 15.4 mg/kg, respectively) were about 1.2 to 1.6 times higher than the mean uptakes in both the reference *Macoma* tissues (12.5 mg/kg) and control *Macoma* tissues (12.4 mg/kg). Note that the concentration of zinc in the composite T0 tissue sample (14.3 mg/kg) was slightly higher than the mean concentrations in the reference and control tissues. Thus zinc concentrations in the *Macoma* test tissues are biased high and can be considered conservative. The mean uptake of zinc in the *Nereis* test tissues (23.0 to 27.1 mg/kg) were not statistically elevated above the mean uptake in the control tissues (16.6 mg/kg) and reference tissues (25.8 mg/kg) and were only slightly higher than the concentration in the composite T0 tissue sample (13.9 mg/kg).

There is no FDA Action Level for zinc and there are no known fish advisories based on zinc. Therefore, zinc tissue burdens are only discussed in terms of ecological effects based on TRVs. There are several low and relevant zinc TRVs in the ERED for marine invertebrates. These TRVs, which were similar to or slightly higher than mean and 95% UCL concentrations in the LARE-1, LARE-2 and QGVC-18 *Macoma* test tissues, are summarized in Table 36.

Table 36. Lowest Relevant TRVs for Zinc in the ERED Database.

Species	Classification	TRV (mg/kg)	Toxicity End Point	Exposure Route	Effect
Allorchestes	Amphipod	28	LOEC	Water	Growth and
Mytilus edulis	Mollusk	25	LOEC	Water	Growth
Mytilus edulis	Mollusk	26	LOEC	Water	Mortality
Paracentrotus lividus	Echinoderm	40.6	LOEC	Water	Development
Australonereis ehlersi	Polychaete	20	NOEC	Combined	Mortality

Since there is little evidence showing that zinc biomagnifies (Suedel et al., 1994) plus the lowest, relevant TRV in Table 37 (polychaete) is equal to the lowest mean *Macoma* tissue concentration (LARE-1) and there was no polychaete toxicity, it seems unlikely that zinc bioaccumulation from the LARE federal channels and the POLB Approach Channel sediments will have any ecological impacts. Therefore, the statistically significant bioaccumulation of zinc observed with the *Macoma* assays is considered minor and ecological effects associated with zinc uptake from these sediments are not predicted to be observed at the LA-2 ODMDS.

5.5.5 Uptake of Total DDT

DDT compounds were not detected in any of the tissues analyzed except for *Macoma* tissues associated with the POLB Approach Channel composite sample and the LA-2 reference sample. The statistically significant ($p \leq 0.05$) mean concentration of total DDT in the QCVC-18 tissue samples for *Macoma* (Table 31) was 19.5 µg/kg compared to 6.04 µg/kg in the LA-2 reference tissue samples (roughly three times higher). The distribution of total DDT uptake for *Macoma* among all test, control, and reference tissues is shown on Figure 17.

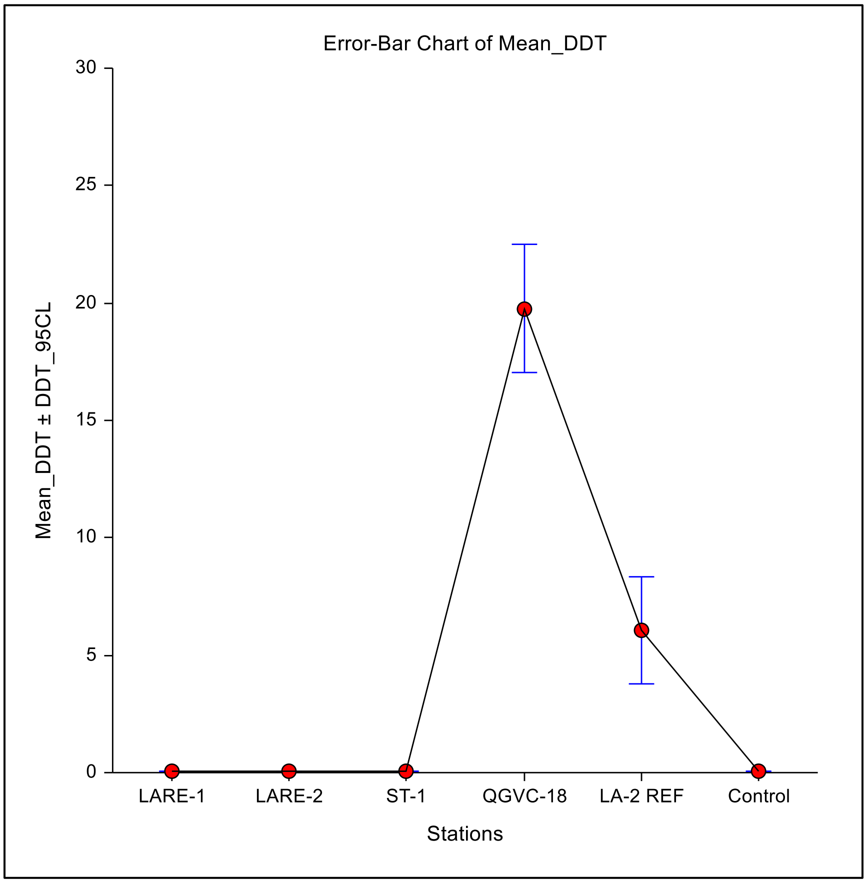


Figure 17. Distribution of *Macoma Nasuta* Total DDT Uptake.

Bioaccumulation protocols assume tissue concentrations are in at least 80% of steady-state with surrounding sediments when comparing tissue values to Action Levels and effects data. According to the ITM, at least 80% of steady-state is not usually reached for DDT compounds after 28 days of exposures. According to USACE guidance (Kennedy et. al., 2010), about 58% of total DDT, 60% of 2,4'-DDE, and about 50% of 4,4'-DDE reaches steady-state in *Macoma* after 28 days of exposure. Therefore, the measured tissue DDT values from the 28-day exposures to *Macoma* were multiplied by correction factors of 1.7 for total DDT and 2,4'-DDE, and 2.0 for 4,4'-DDE. Mean and 95% UCL steady-state adjusted clam tissue DDT concentrations are provided in Table 37.

The mean and 95% UCL steady-state adjusted *Macoma* tissue concentrations were further evaluated against the FDA Action Level for DDE and DDT and to relevant TRVs in the ERED. The steady-state adjusted mean and 95% UCL total DDT concentrations for the QGVC-18 *Macoma* tissues show that they are magnitudes lower than the FDA Action level of 5,000 µg/kg. Most of the ERED data are associated with organisms belonging to freshwater food webs. TRVs for total DDT cited in the SFEI San Francisco Bay bioaccumulation guidance document (Lin and Davis, 2018) were used as the most relevant TRVs. These TRVs are summarized in Table 38.

Table 37. Mean and 95% UCL Steady-State Adjusted *Macoma Nasuta* Tissue Concentrations for DDTs.

Analyte	Steady-State Correction Value (Kennedy et. al., 2010)	Steady-State Corrected Mean Values (µg/kg)		Steady-State Corrected 95% UCL Values (µg/kg)		FDA Action Level (µg/kg)
		QGVC-18	LA-2 Ref	QGVC-18	LA-2 Ref	
2,4'-DDE	1.7	2.6	0.68	3.01	0.976	5,000
4,4'-DDE	2.0	39.6	12.1	45	16.6	5,000
Total DDT	1.7	34	10	38.2	14.1	5,000

Table 38. Relevant TRVs from the ERED from Lin and Davis (2018).

Analyte	Species	ERED Effects Concentration (µg/kg)	Effect Class	Toxicity Measure	Exposure Route	Uncertainty Factor Used	UF Adjusted TRV
Total DDT	*Leptocheirus plumulosus* (Amphipod)	2,690	Mortality	LC_{50}	Sediment	20	134
Total DDT	*Neanthes arenaceodentata*	69,480	Growth	Not Known	Water	10	6,948

According to San Francisco Bay guidance, the lowest relevant, adjusted TRV for total DDT was a 134 µg/kg based on a survival LC_{50}. This value is 3.5 times higher than the steady-state adjusted 95% UCL concentration for the QGVC-18 *Macoma* tissues and 3.9 times higher than the steady-state adjusted mean concentration.

The trophic transfer and biomagnification of DDT and its derivatives in aquatic food chains have been well documented. AMEC Foster Wheeler (2016) conducted a comprehensive aquatic food web study in San Diego Bay. They generally found an increase in total DDT with increasing trophic levels. Mean concentrations in foraging fish (11.3 µg/kg) and predatory fish (12.3 µg/kg) were generally twice as high as mean concentrations among benthic invertebrate classes (6.0 to 7.1 (µg/kg). Other studies summarized in a paper by Suedel et al. (1994), though, indicates that trophic transfer of DDD and DDE does not occur sufficiently to result in marine food-chain biomagnification. Regardless, all pertinent DDT residue effects data are many times higher than the steady-state adjusted mean and 95% UCL tissue concentrations and biomagnification factors would need to be quite high for predators eating invertebrates to obtain tissue burdens that would be high enough to for concentrations to reach levels in fish that would exceed screening levels for the protection of humans (OHHEA Advisory Tissue Levels of no more than three servings per week at concentrations of 390 to 520 µg/kg wet weight). Therefore, ecological and human effects associated with DDT analog uptake from QGVC-18 sediments are not predicted to be observed at the LA-2 ODMDS.

5.5.6 Uptake of Total Chlordane and Technical Chlordane

Total chlordane, as the sum of chlordane-alpha, chlordane-gamma, cis-nonachlor, oxychlordane, trans-nonachlor, was not detected in any of the control and LA-2 reference tissues. Despite no statistical testing, it is evident that there was some uptake of chlordane compounds during the 28-day exposure period to the ST-1, LARE-1 and LARE-2 composite sediments (Tables 31 and 32). Chlordane compounds were only detected at low concentrations (between the MDL and RL in two out of the five tissue replicates) in the QGVC-18 *Nereis* tissues. The method detection limit assumed for total chlordane is the highest detection limit among the individual chlordane constituents, which is 0.067 µg/kg for chlordane-alpha. Mean concentrations of total chlordane (1.49 to 1.9 µg/kg) in the *Macoma* test tissues were about 22 to 28 times higher than the method detection limit. Excluding the QGVC-18 test tissues, mean concentrations of total chlordane (3.83 to 5.26 µg/kg) in the *Nereis* test tissues were about 57 to 79 times higher than the method detection limit. The distributions of total chlordane uptake among all test, control, and reference tissues are shown on Figure 18 for *Macoma* and Figure 19 for *Nereis*.

As was seen with total chlordane, there was uptake of technical chlordane in the *Macoma* and *Nereis* tissues after exposures to the ST-1, LARE-1 and LARE-2 sediments (Tables 31 and 32). There was no uptake of technical chlordane in either species after exposures to the QGVC-18 sediments (Table 31). Like total chlordane, statistical analyses were not conducted on technical chlordane since it was not detected in the control and reference tissues. The method detection limit for technical chlordane is 5.3 µg/kg. Mean concentrations of technical chlordane in the *Macoma* test tissues (6.0 to 8.9 µg/kg) were about 1.1 to 1.7 times higher than the method detection limit. Mean concentrations of technical chlordane (19 to 44 µg/kg) in the *Nereis* test tissues were about 3.5 to 8.5 times higher than the method detection limit. The distribution of technical chlordane uptake among all test, control, and reference tissues is shown on Figure 20 for *Macoma* and Figure 21 for *Nereis*.

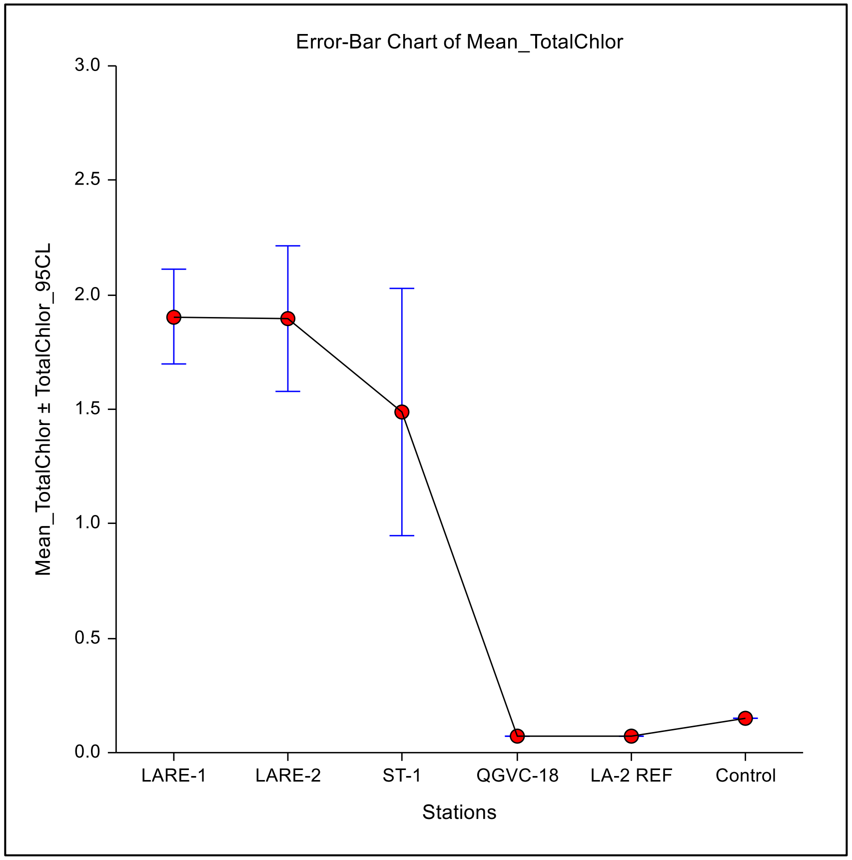


Figure 18. Distribution of *Macoma Nasuta* Total Chlordane Uptake.

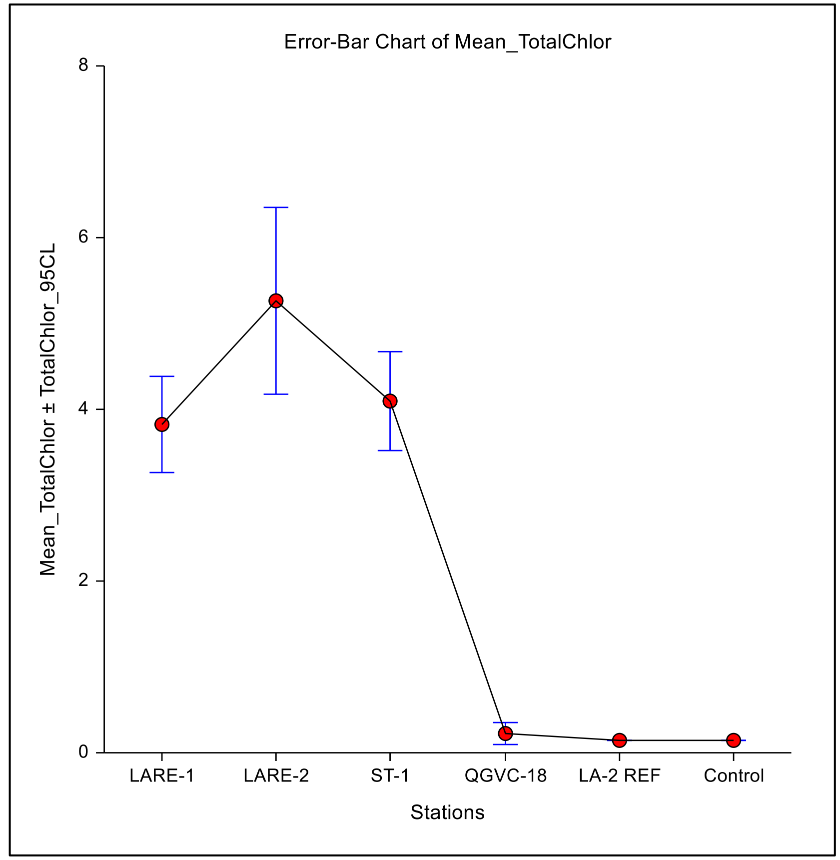


Figure 19. Distribution of *Nereis virens* Total Chlordane Uptake.

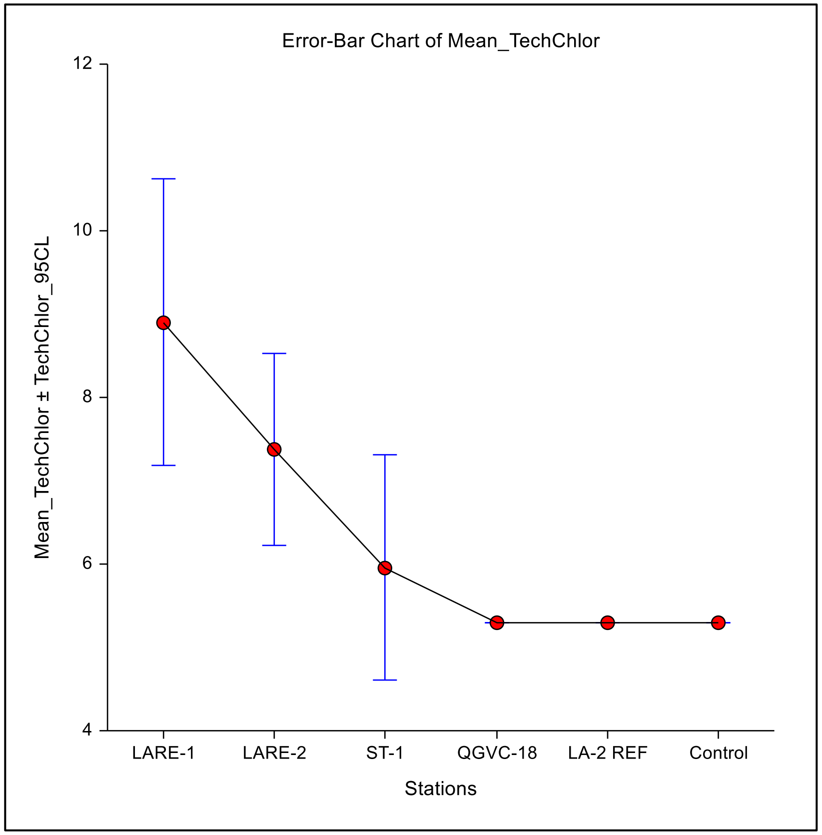


Figure 20. Distribution of *Macoma Nasuta* Technical Chlordane Uptake.

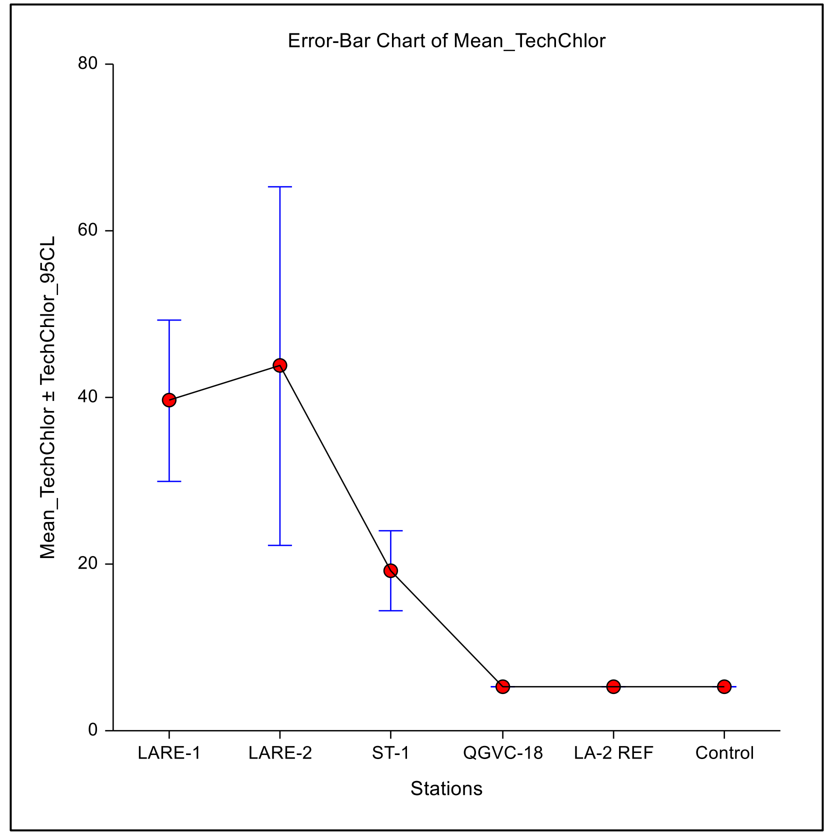


Figure 21. Distribution of *Nereis virens* Technical Chlordane Uptake.

Like DDT, chlordane does not reach 80% steady-state after 28 days. The log K_{ow} for chlordane is 6.0. Therefore, percent of steady-state of chlordane according to Figure 6-1 of the ITM is 50%. As such, a multiplication factor of two was applied to mean and 95% UCL total and technical chlordane values for the discussion that follows. Mean and 95% UCL steady-state adjusted total and technical chlordane concentrations for the ST-1, LARE-1 and LARE-2 tissues are provided in Table 39 for *Macoma* and Table 40 for *Nereis*.

Table 39. Mean and 95% UCL Steady-State Adjusted *Macoma Nasuta* Tissue Concentrations for Total Chlordane and Technical Chlordane.

Dredge Unit	Steady-State Correction Value	Steady-State Corrected Mean Values (µg/kg)			Steady-State Corrected 95% UCL Values (µg/kg)			FDA Action Level (µg/kg)
		Total Chlordane	LipidN Total Chlordane	Technical Chlordane	Total Chlordane	LipidN Total Chlordane	Technical Chlordane	
ST-1	2	2.98	6.30	11.9	4.06	7.48	14.6	300
LARE-1	2	3.8	7.58	17.8	4.22	8.26	21.2	
LARE-2	2	3.8	6.56	14.8	4.42	10.02	17.1	

Table 40. Mean and 95% UCL Steady-State Adjusted *Nereis Virens* Tissue Concentrations for Total Chlordane and Technical Chlordane.

Dredge Unit	Steady-State Correction Value	Steady-State Corrected Mean Values (µg/kg)			Steady-State Corrected 95% UCL Values (µg/kg)			FDA Action Level (µg/kg)
		Total Chlordane	Technical Chlordane	LipidN Technical Chlordane	Total Chlordane	Technical Chlordane	LipidN Technical Chlordane	
ST-1	2	8.18	38.4	42.6	9.33	48.2	49.2	300
LARE-1	2	7.65	79.2	79.1	8.77	98.5	96.1	
LARE-2	2	10.5	87.6	73.2	12.7	131	89.9	
QCVC-18	2	0.452	ND	ND	0.708	ND	ND	

ND = Not Detected

The steady-state adjusted and lipid normalized 95% UCL total chlordane concentrations for *Macoma* and the steady-state adjusted 95% UCL total chlordane concentrations for *Nereis* tissues are statistically less than the FDA Action level of 300 µg/kg (by 28 times or greater). The steady-state adjusted 95% UCL technical chlordane concentrations for *Macoma* and the steady-state and lipid normalized 95% UCL technical chlordane concentrations for *Nereis* are three times or greater less than the FDA Action Level. Therefore, the LARE tissue chlordane concentrations are statistically less than FDA Action Levels and there is minimal threat to humans for the consumption of shell fish with accumulated chlordane from the LARE sediments.

All TRVs for chlordane in the ERED are associated with technical chlordane. The lowest marine invertebrate effects value for technical chlordane in the ERED is an impaired growth NOED value of 22 µg/kg for an Eastern Oyster (*Crassostrea virginica*). However, exposure is through injection which makes it less relevant. The next highest and more relevant TRV for marine organisms in the database is an acute LC_{50} value of 1,700 µg/kg for the penaeid shrimp *Farfantepanaeus duorarum*. Per San Francisco Bay guidance (Lin and Davis, 2018), a UF of 20 was applied to the ERED TRV bring the adjusted TRV to 85 µg/kg. Mean and 95% UCL LARE and ST-1 tissue concentrations are higher than the very conservative NOEC. The 95% UCL lipid normalize and steady-state adjusted *Nereis* concentrations for the LARE exposures also slightly exceeded the adjusted TRV. However, the adjusted means fall below the adjusted TRVs. Based on the ERED queries and San Francisco Bay guidance, ecological effects associated with chlordane uptake from test sediments are not predicted to be observed at LA-2 ODMDS.

5.5.7 Uptake of PCBs

The distribution of total PCB uptake among test, control and reference tissues is shown on Figure 22 for *Macoma*. There was statistically significant ($p \leq 0.05$) mean uptake of total PCBs in M*acoma* exposed to the LARE-1, LARE-2 and QGVC-18 composite samples compared to the average uptake of total PCBs in the tissues of *Macoma* exposed to both the LA-2 reference and control sediments (Table 31). Average uptake of total PCBs in *Macoma* exposed to these sediments was 3.54, 3.28, and 2.38 µg/kg, respectively, compared to 0.203 and 0.193 µg/kg for *Macoma* exposed to the LA-2 reference and control sediments, respectively. As such, the mean concentrations of total PCBs in the LARE-1, LARE-2 and QGVC-18 composite sample *Macoma* tissues were about a magnitude higher than the mean reference and control concentrations. The mean uptake from the ST-1 composite sample was not statistically different from mean uptakes in the reference and control sediments.

The distribution of total PCB uptake among test, control and reference *Nereis* tissues is shown on Figure 23. There was statistically significant ($p \leq 0.05$) mean uptake of total PCBs in *Nereis* exposed to the ST-1, LARE-1, LARE-2 and QGVC-18 composite samples compared to the average uptake of total PCBs in the tissues of *Nereis* exposed to the LA-2 reference and control sediments (Table 32). Average uptake of total PCBs in *Nereis* exposed to these sediments was 5.30, 7.12, 9.91 and 7.23 µg/kg, respectively, compared to 4.49 and 4.43 µg/kg for *Nereis* exposed to the LA-2 reference and control sediments, respectively. As such, the mean concentrations of total PCBs in the composite sample *Nereis* tissues were about a 1.2 to 2.2 times higher than the mean reference and control concentrations. Furthermore, total PCBs in the baseline (TO) worm tissue composite sample was 5.0 µg/kg, thus PCB concentrations in the test tissues are biased high and can be considered conservative. Since only one time zero tissue sample was analyzed, composite, reference and control tissue concentrations were not time zero corrected.

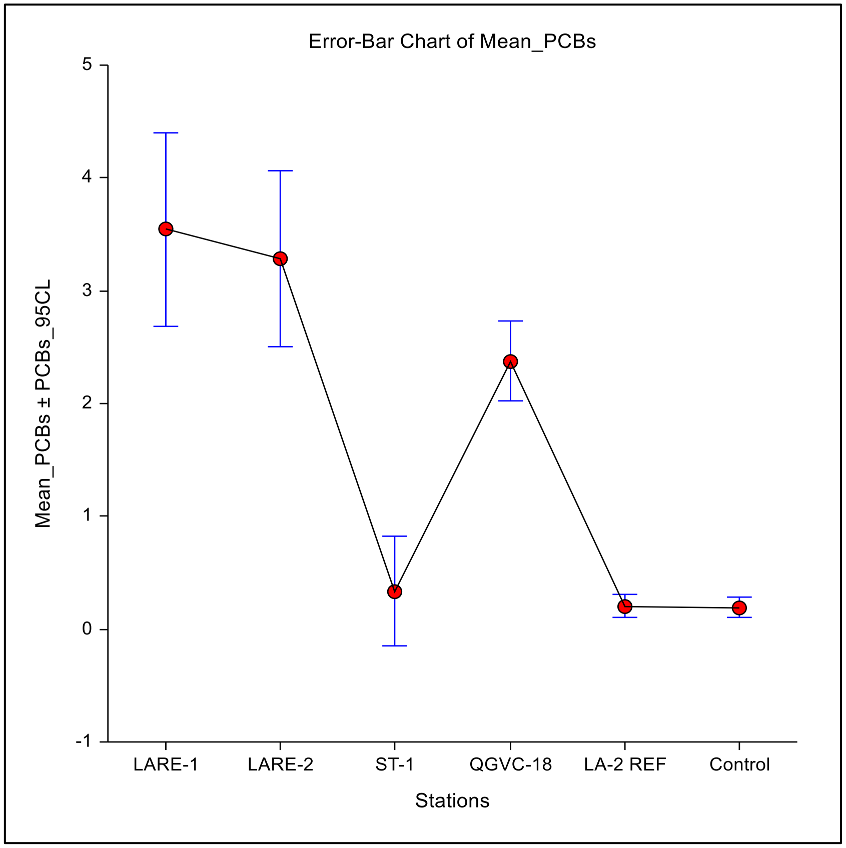


Figure 22. Distribution of *Macoma Nasuta* TPCB Uptake.

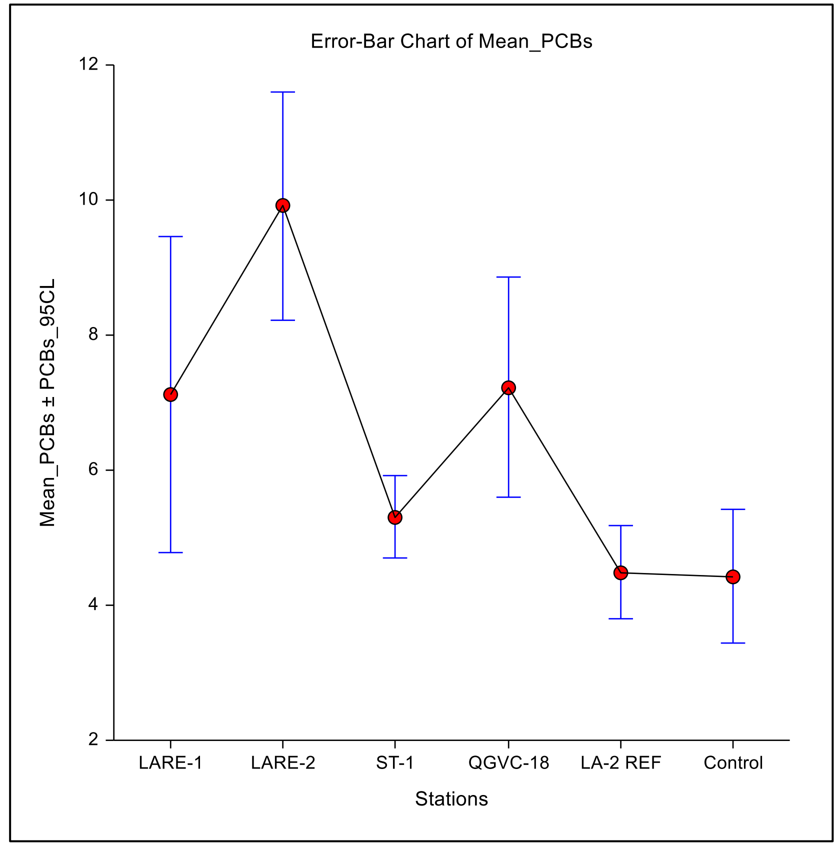


Figure 23. Distribution of *Nereis virens* TPCB Uptake.

The mean and 95% UCL total PCB concentrations were further evaluated against the FDA Action Level and to relevant TRVs for total PCBs in the ERED. The mean and 95% UCL total PCBs were not steady-state adjusted since all PCB congeners reach at least 80% steady-state after 28 days of exposure (Kennedy et. al., 2010). The 95% UCL tissue concentrations were magnitudes less than the FDA Action Level (2,000 µg/kg). The ERED queries were limited to LOEC endpoints with measurable biological effects to marine invertebrates. Although there are numerous endpoints in the ERED that are relevant to invertebrates, one value, recommended by USEPA for other Southern California dredge projects, was selected as being most relevant. Specifically, USEPA identified a LOEC of 146 µg/kg (Total PCBs), associated with growth impairment of the sea star *Asterias rubens*, as the most appropriate TRV from the ERED. San Francisco Bay guidance (Lin and Davis, 2018) also identified a study conducted on *Asterias rubens* to come up with the lowest, most relevent TRV. However, this study was based on a growth impairment LOEC of 1,620 µg/kg total PCBs. Since a full dose-response curve was not development in coming up with this LOEC, an uncertainty factor of 10 was applied lowering the TRV to 162 µg/kg. The mean and 95% UCL total PCB concentrations for all four composite samples and both species were compared to the selected TRVs and were found to be statistically lower and more than 10-fold lower than these values. Therefore, ecological effects associated with PCB uptake from the test sediments are not predicted to be observed at LA-2 ODMDS.

5.5.8 Bioaccumulation Potential Conclusions

Based on the data presented, the dredged material meets the LPC for bioaccumulation and complies with the benthic criteria of paragraph 227.13(c)(3) in Title 40, Code of Federal Regulations, Parts 220-228 (40 CFR 220-228)(USACE and USEPA, 1991, Appendix A). As a result, no further information is necessary to determine compliance with bioaccumulation regulations.

5.6 Conclusions and Recommendations

Sediment along the South and West Sides of the LARE Sand Trap contained mostly vegetative debris. As such, sediments from the area identified on Figure 12 and Figure 24 (55,700 cy) will be left in place.

As agreed upon with USEPA and because of an elevated total PCB concentration, sediment from core location LAREVC-18-15 was not included in the composite sample for Tier III testing. Currently, there is approximately1,600 cy of sediments in the vicinity of this core location that will be left in places, as identified on Figure 24, since an alternative site to place the material has not been identified.

The Chaffey Island Nearshore Site was the preferred site for dredge material placement because it was thought to offer the maximum beneficial use of dredged material for the surrounding community. The weighted average grain size composite curves for sediments within all three LARE and the one POLB Approach Channel dredge units fit within the overall grain size envelope for the Chaffey Island nearshore placement site. However, 12 individual LARE locations (two from ST-1, six from LARE-1, and four from LARE-2) did not fit well within the Chaffee Island compatibility envelope and are therefore not physically compatible with Chaffey Island placement site based on individual core by core analysis. Based on the physical compatibility analysis alone, all physically suitable sediments from the Long Beach Approach Channel are suitable for placement at the Chafee Island nearshore placement site. However, recent negotiations between the Los Angeles District USACE and USEPA took place on March 12, 2019 that resulted in an agreement to either not place any of the LARE sediments at the Chaffee Island nearshore site since the weighted average fines content in each LARE dredge unit was too high to provide meaningful nourishment of the adjacent beach or show through sediment transport modeling that receiver beaches would be adequately nourished. Initial sediment transport modeling efforts were undertaken by Los Angeles District Corps of Engineers Coastal Engineering Section that showed approximate areas that sediment might travel to once placed at the Chaffee Island nearshore site. Additional complex modeling was planned that could show more accurate distributions of the sediment transported. Results from the additional modeling would not change the fact that more than 50% of the sediment to be placed at this site was fine grained and even though transported, it would still be distributed at much above fine grained size limits typically considered acceptable for beneficial use. Based on these concerns, Los Angeles District USACE made the decision to forego the additional modeling and remove Chaffee Island nearshore from further consideration as a placement site for the LARE and POLB Approach Channel sediments.

The LARE and POLB Approach Channel sediments showed moderate chemical contamination. Chemical data for several constituents that were above NOAA effects levels and human health objectives. In terms of ecological effects, cadmium, copper, lead, nickel, zinc, Chlordane, 4,4' DDE, total DDTs, total low molecular weight PAHs, PCBs, and perhaps pyrethroid pesticides were the major contaminants of concern in in the LARE composite and individual core samples. Total DDT and 4,4' DDE were the only contaminants of concern in the POLB Approach Channel composite sample.

Despite the observed sediment concentrations, none of the sediments from any of the composite areas were toxic to *Ampelisca* and *Neanthes*. Although, water column toxicity was evident for bivalve larvae, mysids and fish exposed to the LARE composite samples but not to the QGVC-18 composite sample. The highest toxicity observed was with the bivalve larvae tests with EC_{50} concentrations ranging from 17.3% to 37.5% elutriate. However, initial mixing calculations indicate that the sediments would not exceed the LPC for dumping through the water column. Test water ammonia concentrations are suspected to be at least partially responsible for the observed water column toxicity.

Due to the lack of benthic toxicity, the fact that the water column LPC after initial dilution was not exceeded, and the fact that critical body residues compared to FDA action levels, TRVs, and fish advisory levels indicate that all contaminant concentrations in tissues of organisms exposed to LARE and POLB Approach Channel sediments were below corresponding published levels, it is recommended that all sediments from LARE and the Port of Long Beach Approach Channel be environmentally suitable for placement at the LA-2 ODMDS.

Based on the data gathered, Figure 24 and Table 41 identifies recommended suitability of each dredge unit for both placement options and the volumes recommended for each placement option. It is also recommended to place all 39,000 cy of sediments to be dredged from the Port of Long Beach Approach Channel, which includes overdepth, at the Chaffee Island Nearshore Site.

The USEPA concurred with the recommendation that all sediment not to be left in place (currently about 225,000 cy from LARE) will be placed at the LA-2 ODMDS. It is anticipated that the amount of sediment to be actually dredged and placed at LA-2 will increase due to infill of sediment since the last condition survey. This revised amount of sediment placement due to infill is estimated to be between 250,000 and 300,000 cy from the entire LARE footprint, which again does not include sediment in the vicinity of core location LAREVC-18-15 and the leafy debris in ST-1. In addition, the approximately 39,000 cy of sediment from the Long Beach Approach Channel could increase to approximately 50,000 cubic yards due to infill since the last condition survey.

Table 41. Dredge Material Placement Suitability for the LARE and POLB Approach Channel Sediments.

Dredge Units	Suitable for Placement At		Current Volumes[4] (cy) Recommended to be placed at		Volumes (cy) of Material to be Left in Place
	Chaffee Island	LA-2 ODMDS	Chaffee Island[6]	LA-2 ODMDS	
ST-1	Yes/No[1,5]	Yes	0	19,900	55,700
LARE-1	Yes/No[2,5]	Yes	0	131,100	1,600
LARE-2	Yes/No[3,5]	Yes	0	73,700	0
QGVC-18	Yes	Yes	0	39,000	0
		Total Volume:	0	263,700[7]	31,500

[1]Sediments within the overall ST-1 dredge unit not previously excluded were physically compatible for placement at the Chaffee Island Nearshore Site. However, two individual locations (LAREVC-18-24 and 36) were not..
[2]Sediments within the overall LARE-1 dredge unit were physically compatible for placement at the Chaffee Island Nearshore Site, However, six individual locations (LAREVC-18-06, 07, 11, 12, 14 and 19) were not.
[3]Sediments within the overall LARE-2 dredge unit were physically compatible for placement at the Chaffee Island Nearshore Site. However, four individual locations (LAREVC-18-21, 23, 25 and 27) were not.
[4]Volumes include overdepth volumes and are calculated from May 2018 LADUSACE bathymetry condition survey.
[5] Recent negotiations with USEPA on March 12, 2019 reveal that none of the sediment from ST-1 can be placed at Chaffee Island
[6]Based on initial transport modeling results and the overall high percentage of fines among all channel areas, Los Angeles District USACE will not pursue the placement of any dredged material at the Chaffee Island Nearshore Site.
[7]The Current volumes based on May 2018 bathymetry is predicted to increase to between 250,000 and 300,000 cy for LARE and 50,000 cy for the POLB Approach Channel from future infill.

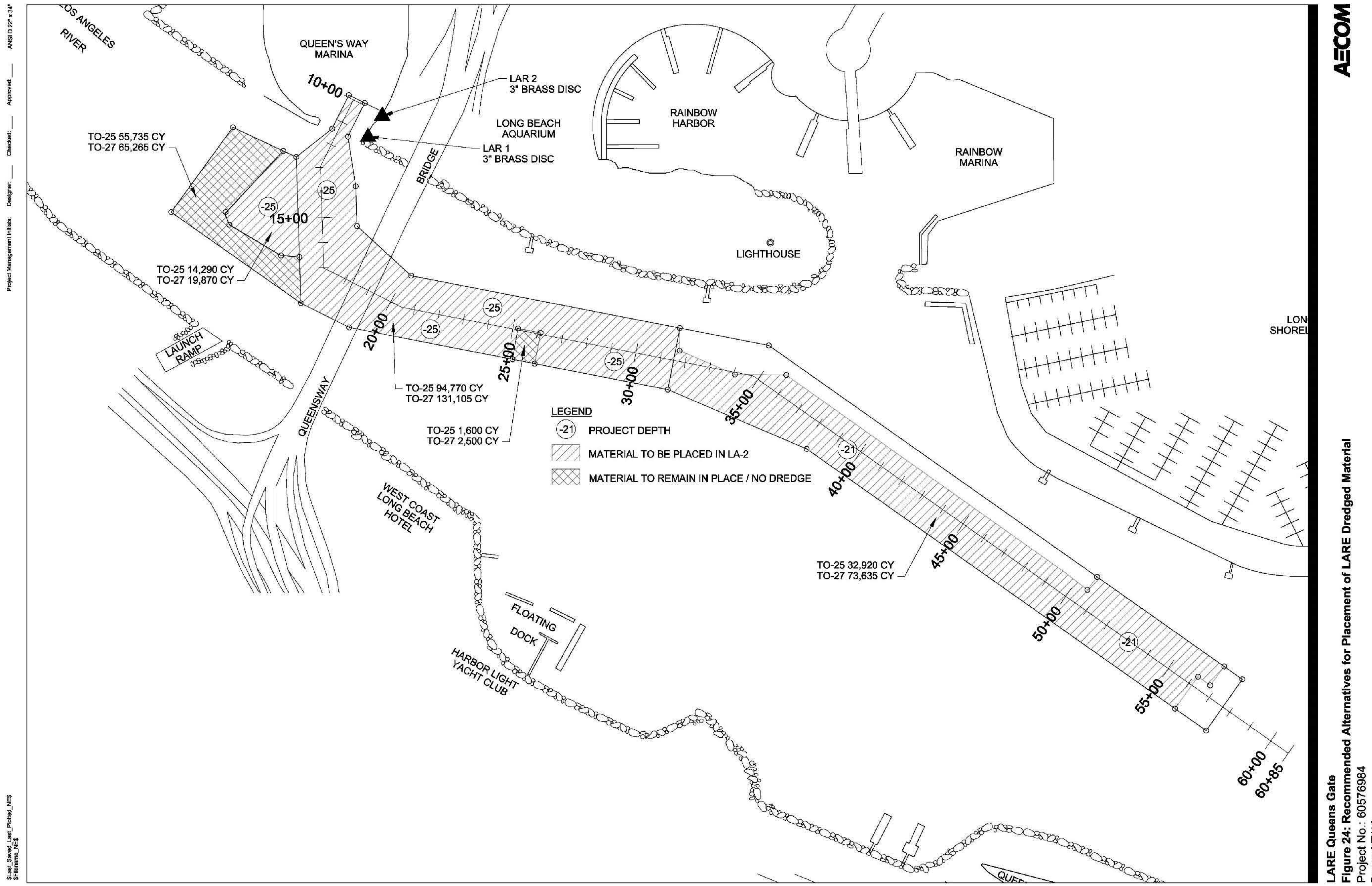


Figure 24. Recommended Placement of LARE Dredged Material.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

Formal QA/QC procedures were followed for this project. The objectives of the QA/QC Program were to fully document the field and laboratory data collected, to maintain data integrity from the time of field collection through storage and archiving, and to produce the highest quality data possible. Quality assurance involved all of the planned and systematic actions necessary to provide confidence that work performed by the project team conformed to contract requirements, laboratory methodologies, state and federal regulation requirements, and corporate Standard Operating Procedures (SOPs). The program is designed to allow the data to be assessed by the following parameters: Precision, Accuracy, Comparability, Representativeness, and Completeness. These parameters are controlled by adhering to documented methods and procedures (SOPs), and by the analysis of quality control (QC) samples on a routine basis.

6.1 Field Sampling Quality Management

Field QC procedures were followed and included adherence to SOPs, field documentation, formal sample documentation and tracking, use of certified clean laboratory containers, protocol cleaning, and sample preservation. There were no field QC issues to report.

6.2 Chemical Analysis Quality Management

Analytical chemistry QC is formalized by EPA and State Certification agencies, and involves internal quality control checks for precision and accuracy. Any issues associated with the analytical laboratory quality control checks are summarized in Appendix M.

QA/QC findings presented are based on the validation of the data according to the quality assurance objectives detailed in the project SAP (AECOM and Kinnetic Laboratories, 2018) and in Appendix M and using guidance from EPA National Functional Guidelines for inorganic and organic data review (USEPA, 2017a and 2017b).

As the first step in the validation process, chemical analyses were checked to see if they were completed within EPA recommended holding times and the results were carefully reviewed to check that the laboratories met project reporting limits. All analyses were completed within EPA a specified holding times. Elevated quantification limits were realized for numerous sediment and tissue analyses. Despite method recommended cleanup procedures using silica gel and Alumina packed columns, in numerous cases the extracts were dark or did not clean up well. As a result, dilutions were necessary to counteract the interferences, resulting in the elevated reporting limits and method detection limits.

QA/QC records (2,500 total) for the sediment, water and tissue analyses included method blanks, laboratory duplicates, laboratory control samples and their duplicates (LCS/LCSDs), matrix spikes and matrix spike duplicates (MS/MSDs), post digestion spikes (PDS) and surrogates. Total numbers of QC records by type are summarized in Table 42. A total of 169 sediment sample results and 58 tissue results were qualified as a result of the QC review, resulting in 3.4% of the total sample results. Those qualifiers are summarized in Table 43 with 140 qualifications due to matrix spike excursions, 14 due to method blank detections, and 15 due to poor precision with laboratory duplicates. The reasons behind these qualifications are explained in Appendix M. Despite the QC issues, overall evaluation of the analytical QA/QC data indicates that the chemical data are for the most part within established performance criteria and can be used for characterization of sediments in the LARE and POLB Approach Channel project areas.

Table 42. Counts of QC records per Chemical Category

Analyte Group	BLK	Lab DUP	LCS / LCSD	MS / MSD	PDS	SURR	Total
Sediment							
Conventionals							
Percent Solids	3	5					**8**
Ammonia	2	1	4	4			**11**
Total Organic Carbon	2	1	4	4			**11**
Total Volatile Solids	3	4	0	0			**7**
O&G	3	1	6	4			**14**
TRPH	3	1	6	4			**14**
Total Metals	20	10	20	40	19		**109**
PAH's, Phthalates & Phenols	96	48	34	68		120	**366**
Chlorinated Pesticides	58	29	44	86		76	**293**
PCB Congeners	120	40	60	90		44	**354**
Butyltins	12	4	6	8		20	**50**
Pyrethroids	26	13	52	52		19	**162**
Sediment Totals	**348**	**157**	**236**	**360**	**19**	**279**	**1399**
Water							
Conventionals							
Total Suspended Solids	2	5	4				**11**
Total and Dissolved Metals	39	1	74	40			**154**
Water Totals	**41**	**6**	**78**	**40**			**165**
Tissue							
Conventionals							
% Lipids	4	4					**8**
Total Metals	16		16	32	16		**80**
Chlorinated Pesticides	60		36	72		208	**376**
PCB Congeners	160		60	120		132	**472**
Tissue Totals	**240**	**4**	**112**	**224**	**16**	**340**	**936**

Notes:
"BLK" = Method Blank
"DUP" = Duplicate
"LCS" = Laboratory Control Sample
"MS" = Matrix Spike
"PDS" = Post-Digestion Spike
"SURR" = Surrogate

Table 43. Final QC Qualification Applied to Sample Results.

Analyte	# Samples Qualified	Final Qualifier	BLK	DUP	LCS	MS	PDS	SURR
Metals – Sediment								
Silver	1	U	U					
OC Pesticides – Sediment								
4,4'-DDT	16	UJ				UJ		
Aldrin	15	UJ-				UJ-		
Beta-BHC	1	UJ				UJ		
Dieldrin	15	UJ				UJ		
Endosulfan Sulfate	16	UJ				UJ		
Endosulfan I	15	UJ				UJ		
Endrin Ketone	15	UJ				UJ		
Heptachlor	15	UJ-				UJ-		
Methoxychlor	1	UJ				UJ		
Toxaphene	1	UJ				UJ		
Trans-nonachlor	15	J		J				
Pyrethroid Pesticides – Sediment								
Bifenthrin	15	J-				J-		
Permethrin (cis/trans)	15	J-				J-		
Phthalates – Sediment								
Di-n-Butyl Phthalate	13	U	U					
Metals – Tissues								
Zinc	20	J				J		
OC Pesticides – Tissues								
4,4'-DDT	19	UJ				UJ		
Methoxychlor	19	UJ				UJ		
Total number of affected samples	227							
Percentage of all samples	3.4%							

Notes:
"BLK" = Method Blank
"DUP" = Duplicate
"LCS" = Laboratory Control Sample
"MS" = Matrix Spike
"PDS" = Post-Digestion Spike
"SURR" = Surrogate

6.3 Biological Testing

Quality assurance procedures employed for this project for the bioassay tests were consistent with the procedures detailed in the ITM and OTM. Sediments used for biological testing were stored at ≤4° C and were used within the eight week holding time period.

Summary bioassay and bioaccumulation testing and quality assurance information is provided in the bioassay reports (Appendix J). This report includes documentation of: 1) test animal collection, shipping and holding/acclimation, 2) water quality parameters monitored during the tests, and 3) the positive (reference toxicant) controls. Negative control performance is also included in the bioassay report.

Data quality objectives and the associated quality control measures for aquatic toxicity testing are stipulated in the specified bioassay protocols. Measures included test temperatures and acceptable limits of variation, minimum acceptable dissolved oxygen levels with aeration procedures used, and acceptable pH range. These parameters were measured at test initiation and daily thereafter. Salinity ranges are specified for marine tests and the samples were adjusted accordingly. Salinity was measured daily for the bioassays. Measurements of porewater ammonia and sulfides were conducted upon receipt and prior to SP test initiation and at test completion. Overlying water ammonia measurements were made at SP test initiation and termination. Ammonia measurements for the SPP tests were conducted at test initiation and termination. Ammonia measurements for the bioaccumulation exposures were made at test initiation and weekly thereafter. Laboratory instruments were calibrated daily. All water quality parameters measured at the beginning and during biological testing were within appropriate limits.

Protocols also provide guidance on test organisms procurement, care and acclimation. Pacific EcoRisk maintains laboratory logbooks documenting these factors. Organism assignment to test tanks and test tank positioning in the laboratory are randomized.

Two other important bioassay QA measures are the inclusion of a negative experimental control, where organisms are simultaneously exposed to laboratory test conditions in the absence of a toxicant stress, and the inclusion of reference toxicant bioassays, in which the organisms are exposed to standard toxicants. Reference toxicant bioassays using potassium chloride (KCL) were run concurrently with and under the same conditions as the bioassays of the test material. Control charts are maintained in the laboratory for each species/toxicant combination. A minimum of five bioassays is required for a valid control chart, and upper and lower limits are developed which are two standard deviations on either side of the mean. Precision is quantified in the control charts by calculation of the coefficient of variation (CV). The application of a maximum acceptable value for the CV or the minimum significant difference (MSD) increases data reliability, and many newer protocols specify such maximum acceptable values. With the exception of the *Neanthes* reference toxicant test, bioassays met both negative and positive control test acceptability criteria (TAC) for this project. The reference toxicant LC_{50} for the *Neanthes* reference toxicant test was slightly greater than the "typical response" range upper threshold, suggesting that the test organisms used in these tests were slightly less sensitive than is typical. The LC_{50}s for the remaining tests were consistent with the "typical response" range established by the reference toxicant test database for each species.

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2020 DRAFT ENVIRONMENTAL ASSESSMENT LOS ANGELES RIVER ESTUARY AND PORT OF LONG BEACH ENTRANCE CHANNEL MAINTENANCE DREDGING

Appendix C

Air Quality Analysis Calculations

Maintenance Dredging

Emission Source Data for Maintenance Dredging

Construction Activity/Equipment Type	Power Rating	Load Factor	# Active	Hourly Hp-Hrs	Fuel Use GPH	Hrs per Day (1)	Total Work Days (2)	DailyTotal Hp-Hrs (1)
Clamshell dredge	N/A	N/A	N/A	N/A	N/A	22	180	N/A
Tug boat-clamshell dredge	800	0.20	1	160	8.0	22	180	176
Hopper Dredge-propulsion	1,140		2	2,280	NA	24	180	TBD
Hopper Dredge-generator	805	0.70	2	1,127	NA	15	180	16,905

Hopper propulsion load factor = 50% for loaded transit, 10% for empty transit, 10% for dredging

Tug boat propulsion factor 0.20 for idling; 0.50 for towing; and 0.4 for dredge barge movement (fuel use for 0.5 is 20 GPH, for 0.4 is 16 GPH)

Emission Factors for Construction Equipment

Equipment Type	ROG	CO	NOx	SOx	PM10
Clamshell dredge (lb/hr)	1.1	0.3	1.1	1.0	0.7
Tugboat (lbs/1,000 Gal)	18.2	57.0	419.0	75.0	9.0
Hooper Dredge (lb/hp-hr)	0.0001	0.0055	0.0130	0.0081	0.0007

Daily Emissions from Construction Activities Clamshell Dredge

	Pounds per day				
Construction Activity/Equipment Type	**ROG**	**CO**	**NOx**	**SOx**	**PM10**
Clamshell dredge	23.8	6.6	24.0	20.9	15.2
Tug boat-clamshell dredge					
Idling	1.5	4.6	33.5	6.0	0.7
Towing sediment barge	1.5	4.6	33.5	6.0	0.7
Shifting dredge barge	0.3	0.9	6.7	1.2	0.1
Crew boat (3)	0.9	0.4	0.8	0.1	0.1
Worker Vehicles (3)	0.1	1.2	0.9	0.1	0.1
Peak Daily Emissions	**28.0**	**18.2**	**99.4**	**34.3**	**16.9**
SCAQMD Daily Significance Thresholds	**75**	**550**	**100**	**150**	**150**

Daily Emissions from Construction Activities Hopper Dredge

	Pounds per day				
Construction Activity/Equipment Type	**ROG**	**CO**	**NOx**	**SOx**	**PM10**
Hopper dredge-dredging	2.0	111.8	264.2	164.4	14.2
Hopper dredge-transit loaded	0.2	9.4	22.2	13.8	1.2
Hopper dredge-transit unloaded	0.0	1.8	4.1	2.6	0.2
Crew boat (3)	0.4	0.3	0.8	0.1	0.1
Worker Vehicles (3)	0.2	2.1	1.0	0.1	0.2
Peak Daily Emissions	**2.8**	**125.3**	**292.4**	**181.1**	**15.9**
SCAQMD Daily Significance Thresholds	**75**	**550**	**100**	**150**	**150**

(1) Assumes 2-hour down time per day for shift change, maintenance, fueling. Three shifts per day.
(2) Assumes average duration of three weeks for hydraulic and clamshell and 60 days for hopper.
(3) See Appendix C for source date, emissions factors, and emissions calculations.

Assume dredge volume of 150,000 cubic yards, maximum expected based on funding limitations
Emissions factors for Maintenance Dredging for tugboat and bulldozer taken from the Port of Los Angeles Channel Deepening Project Final Supplemental Environmental Impact Statement/Environmental Impact Report, September 2000.
Emissions factors for Maintenance Dredging for the Clamshell Dredge provided by Justice and Associates for a Manson clamshell dredge.
Emission factors for hopper dredge taken from AP-42 for diesel engines.
Hopper dredge specifications based on Corps dredge Yaquina

Capacity: 1,000 cubic yards
2 x 1,140 hp main engines
2 x 805 hp generators
2 x 565 hp pumps (generator load factor = 565/805 = 70%)
Loaded speed 10 knots
Unloaded speed 10.5 knots
Distance to disposal site 7 nm
Transit time loaded = 45 minutes (18 minutes in south Coast air basin, 27 minutes outside)
Transit time unloaded = 40 minutes (17 minutes in south coast air basain, 23 minutes outside soputh coast air basin)
Dredge cycle = 3 hours

	5 dredge cycles per day
	Assume 15 hours dredging, 4 hours transit loaded, 3.5 hours transit unloaded, 0.75 maneuvering loaded, 0.75 hours maneuvering unloaded per day
	5,000 cubic yards per day, 40-day project duration to dredge 150,000 cubic yards
Clamshell tug operations	Distance to disposal site 7 nm
	Transit outside 3 nm is outside SCAQMD and is not included in calculations
	Tug operations: 22 hours per day total, 4 trips per day to disposal site
	1 hour moving barge
	4 hour towing barge inside south coast air basin (approximately 1 hour per trip)
	7 hour towing barge outside south coast air basin (not included), includes 30 minutes at disposal site and 70 minutes transit)
	10 hour idling
	Tug speed towing loaded barge 6 knots
	Tug speed towing unloaded barge 8 knots
	4 disposal events per day

Total Project Construction Emissions

	Tons				
	ROG	**CO**	**NOx**	**SOx**	**PM10**
Project Emissions					
Clamshell Dredge	2.5	1.6	8.9	3.1	1.5
Hopper Dredge	0.3	11.3	26.3	16.3	1.4
de minimis Thresholds	**10**	**100**	**10**	**100**	**70**

GHG Emissions

Maintenance Dredging

Emission Source Data for Maintenance Dredging

Construction Activity/Equipment Type	Power Rating	Load Factor	# Active	Hourly Hp-Hrs	Fuel Use GPH	Hrs per Day	Total Work Days(3)	DailyTotal Hp-Hrs (1)
Clamshell dredge	1,890	1.0	1	1,890	N/A	22	180	41,580
Tug boat-clamshell dredge	800	0.20	1	160	8.0	22	180	176
Crew Boat	50	NA	1	NA	NA	4	180	NA
Tug boat-hydraulic dredge	1,600	NA	1	NA	NA	2	180	NA
Worker vehicles	NA	NA	18	NA	NA	2	180	NA
Hopper Dredge	2,000					22	180	22,000

Emission Factors for Construction Equipment

	Grams per HP-HR
Equipment Type	**CO2**
Clamshell dredge	568
Tugboat	509
Crew Boat	75
Tug boat-hydraulic dredge	93.9
Worker vehicles	1.1
Hopper Dredge	183

Estimated Emissions from Construction Equipment

	CO2	
Equipment Type	**lbs/day**	**tons total**
Clamshell dredge	27.6	2.5
Tugboat	24.7	2.2
Crew Boat	0.7	0.1
Tug boat-hydraulic dredge	0.4	0.0
Worker vehicles	0.1	0.0
Hopper Dredge	8.9	0.8
Total		
Clamshell dredge	53.0	4.8
Hopper Dredge	9.6	0.9
Total Equivalent CO2		
Clamshell dredge	53.4	4.8
Hopper Dredge	9.7	0.9

CO2 Equivalent = CO2*1.008

Pollutant	Averaging Time	National Standard	California Standard
Carbon Monoxide (CO)	8 hours	9 ppm	9 ppm
	1 hour	35 ppm	20 ppm
Lead (Pb)	Rolling 3 month	0.15 $\mu g/m^3$	$1.2x10^{-5} \mu g/m^3$
Nitrogen Dioxide (NO_2)	1 hour	100 ppb	180 ppb
	1 year	53 ppb	30 ppb
Ozone (O_3)	8 hours	0.07 ppm	0.07 ppm
Particulate matter (PM)	1 year	12 ug/m3	12 ug/m3
	24 hours	150 ug/m3	50 ug/m3
Sulfur Dioxide ($S0_2$)	1 hour	75 ppb	25 ppb
	3 hours	0.5 ppb	-

Appendix D

Cultural Resources MFR

CESPL-PD-RQ January 2020

MEMORANDUM FOR RECORD

SUBJECT: Environmental Assessment for the Los Angeles River Estuary and Port of Long Beach Entrance Channel Maintenance Dredging Project, Los Angeles County, California—No Potential to Cause Effects.

1. This memorandum for record (MFR) documents for the files the reasons why the proposed project does not have the potential to cause effects in accordance with Section 106 of the National Historic Preservation Act. This MFR addresses the issue as indicated in 36 CFR 800.3(a)(1). No cultural resources listed on, or eligible for, the National Register of Historic Places (NRHP) are present.

2. The proposed modifications include:

a. Dredging approximately 331,000 cubic yards of sediment while maintaining authorized channel dimensions in the federal channel within the Los Angeles River Estuary.

b. Dredging approximately 37,000 cubic yards of sediment while maintaining authorized channel dimensions in the federal channel within the Port of Long Beach Entrance Channel.

c. Disposal of sediments from the federal channels in the LA-2 Ocean Dredged Material Disposal Site.

3. In the unlikely event that cultural resources are uncovered during construction, work in that immediate area would be required to stop until the procedures outlined in 36 CFR 800.13 are complied with.

Appendix E

Comment Letters and Responses (Final EA only)