

## MEMORANDUM

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**To:** Leonie Mulvihill and Chris Miller, City of Newport Beach  
**Date:** October 13, 2016

**From:** Andrew Martin, Steve Cappellino, and Shelly Anghera, Ph.D., Anchor QEA, LLC  
**Project:** 150243-16.01

**Re:** Current and Relevant Sediment, Water, and Tissue Data to Support the Newport Bay Copper (Cu) TMDLs and Non-TMDL Action Plans for Zinc (Zn), Mercury (Hg), Arsenic (As), and Chromium (Cr)

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The Staff Report for Basin Plan Amendments for Copper Total Maximum Daily Loads (TMDLs) and Non-TMDL Metals Action Plans for Zinc, Mercury, Arsenic, and Chromium in Newport Bay, California (Staff Report; RWQCB Santa Ana 2016) identifies several data sources to support metal listing of water, sediment, and tissue in the Upper and Lower Newport Bay. Most of the data presented were older than 10 years and were collected prior to significant dredging activities that took place in the Upper and Lower Newport Bay.

The State Water Resources Control Board recommends data must be less than 5 years for sediment quality assessments. For dredging evaluations, the U.S. Environmental Protection Agency and Regional Water Quality Control Board (RWQCB) require data to be less than 3 years old for issuance of permits. Only one study (Orange County Coastkeeper and Candelaria 2014) with data less than 5 years old was included in the Staff Report (RWQCB Santa Ana 2016).

There are several relevant and current studies that are representative of current conditions that were not included in Staff Report. Those studies are as follows:

- OC Monitoring Program – Stormwater and Estuary programs from 2006 to present
- Rhine Channel Post-Remediation Study (Anchor QEA 2011)
- Federal Dredging Post-Sediment Condition (Anchor QEA 2013)
- Southern California Bight 2013 Regional Monitoring Program (SCCWRP 2015, 2016)

This memorandum was developed to summarize the best available data that should be used to assess current condition in the Upper and Lower Newport Bay.

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## **ORANGE COUNTY COASTKEEPER AND CANDELARIA**

A description of the Orange County Coastkeeper and Candelaria (2014) study is provided in the Staff Report (RWQCB Santa Ana 2016). Surface sediment and bottom water samples were collected from 15 areas in Newport Bay in October 2012, March 2013, and August 2013.

### **Sediment Results**

A total of 44 samples were collected for sediment in the 15 areas. All sediment samples were analyzed for metals. Copper exceeded the Effects Range Median (ERM) value of 270 parts per million (ppm) in seven samples collected at three sampling areas (Harbor Marina, Lido Village, and Lido Yacht Anchorage). Mercury exceeded the ERM value of 0.7 parts per billion (ppb) in seven samples collected in four sampling areas (Harbor Marina, Lido Village, Lido Yacht Anchorage, and Balboa Island Channel). Zinc exceeded the ERM value of 410 ppm in two samples collected at two sampling areas (Harbor Marina and Lido Village).

Toxicity testing was conducted at all sites where ERM exceedances for metals had been previously measured. During the last sampling event, sediment toxicity was evaluated using the 10-day amphipod (*Eohaustorius estuarius*) survival test at the six sites that had the highest metal concentrations. No toxicity was observed in the six toxicity tests conducted.

### **Water Results**

A total of 30 water samples were collected near the sediment surface in the 15 areas in October 2012 and March 2013 (15 samples for each event). All water samples were analyzed for metals. The copper California Toxics Rule (CTR) value of 3.1 micrograms per liter ( $\mu\text{g/L}$ ) was exceeded in four samples, all of which occurred in the October 2012 event. No copper CTR exceedances occurred in the March 2013 event.

### **Summary of Findings**

A summary of the ERM exceedances is provided in Table 1. Sediment toxicity was conducted at all the stations that had ERM exceedances for the measured metals. No sediment toxicity was observed. Therefore, this study does not support the listing of copper, zinc, and mercury as recommended in the Staff Report. These findings can be used to support the delisting of sediment toxicity in the Lower Newport Bay.

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## **OC MONITORING PROGRAM – STORMWATER AND ESTUARY PROGRAMS FROM 2011 TO PRESENT**

The Orange County Stormwater Program, implemented by the County of Orange, the Orange County Flood Control District, and the cities of Orange County, is a comprehensive approach to satisfying requirements set forth in the National Pollutant Discharge Elimination System permits R8-2009-0030 and R9-2009-2002 that are administered by the Santa Ana RWQCB and San Diego RWQCB, respectively. The program has a variety of components, some of which include inspections and enforcement at commercial and industrial facilities, public education, and water quality monitoring at outfalls within Newport Bay. The program is currently in its fourth permit term.

The Water Quality Monitoring Program element of the Orange County Stormwater Program has several goals to address the following key concerns:

- Is the water safe to drink?
- Is it safe to swim in the waters?
- Is it safe to eat fish and shellfish from the waters?
- Are the aquatic ecosystems health?

These questions are answered through the assessment of environmental data collected as part of the following Water Quality Monitoring Program elements:

- **Long-term mass emissions** monitoring to determine annual contaminant loading in surface runoff
- **Estuary and wetlands** monitoring to assess the impact of municipal separate storm sewer system discharges on aquatic habitat in estuarine or brackish waters
- **Bacteria and pathogens** monitoring to assess impacts of stormwater and non-stormwater runoff on recreational beneficial uses
- **Urban stream bioassessment** monitoring to assess the quality of aquatic habitats
- **Dry weather reconnaissance** monitoring to detect the presence of illicit discharges/illicit connections

This data review focuses on the sediment chemistry and toxicity results generated as part of the estuary and wetlands element of the Water Quality Monitoring Program. The estuary and

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wetlands element includes quarterly dry weather sediment quality monitoring at seven locations within Newport Bay (four locations in Lower Newport Bay and three in Upper Newport Bay). During each quarterly event, sediment samples are collected for analytical chemistry (conventionals, metals, polycyclic aromatic hydrocarbons [PAHs], polychlorinated biphenyls [PCBs], organochlorine pesticides, organophosphate pesticides, and pyrethroids) and sediment toxicity (using a 10-day amphipod [*Eohaustorius estuarius*] survival test). Once per year, an additional sediment toxicity test (using a 48-hour bivalve [*Mytilus galloprovincialis*] sediment-water interface test) and benthic community analyses is conducted.

### **Sediment Quality Results**

Publically available data from the Orange County Public Works website supporting the OC Watersheds monitoring program were reviewed (OC Public Works 2016). Since 2011, the quarterly dry weather sediment quality monitoring program has collected 139 samples in seven locations in Upper and Lower Newport Bay (Figure 1). Copper, arsenic, chromium, and zinc did not exceed respective ERM values in any of these samples (Figure 2). Mercury was the only contaminant measured at concentrations greater than its ERM value (Figure 2), and this occurred at only one station in the Rhine Channel (LNBRIN).

Since 2011, the quarterly dry weather sediment quality monitoring program has conducted 96 sediment toxicity tests. Each station was tested 15 times with the exception of stations LNBRIN (n = 7) and UNBCHB (n = 14). Of those 96 sediment toxicity tests, 18 had a toxic response (i.e., survival less than 80%). Trends in the sediment toxicity results are illustrated in Figure 3 for Upper and Lower Newport Bay. The graphs show typically non-toxic conditions during the last 5 years.

### **Summary of Findings**

A summary of the ERM exceedances is provided in Table 1. ERM exceedances have only occurred within the Rhine Channel since 2011. Sediment toxicity did not co-occur with any metal ERM exceedances except for two events in the Rhine Channel (station LNBRIN). Toxicity has not been observed in the last three sampling events in the Rhine Channel (LNBRIN). This study does not support the sediment listing for copper, zinc, and mercury in the Lower Newport Bay as recommended in the Staff Report. These findings can be used to

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support the delisting of sediment toxicity in the Lower Newport Bay and the Upper Newport Bay as it relates to metals. Compliance with sediment toxicity should not be associated with any metal TMDL. This monitoring program supports the management of Rhine Channel as a separate waterbody, independent of a metals TMDL.

## **RHINE CHANNEL POST-REMEDICATION STUDY**

The Rhine Channel, located in lower Newport Bay, was identified during the 2002 Toxics TMDL as a source of impaired sediments for several metals and organochlorine pesticides. At that time, it was listed as a separate waterbody for regulatory management. In the 2011 TMDL revisions, the Rhine Channel was removed from the list of impaired areas in Newport Bay for OC pesticides based on the assumption that sediment remediation was forthcoming and that all contaminated material would be soon removed.

In late 2011, the City of Newport Beach (City) began dredging within the Rhine Channel to remove impacted sediments. Because of constraints associated with the structural integrity of the bulkheads, and private property access issues, the City was forced to limit dredging to center parts of the channel and was not able to excavate areas within 20 to 50 feet of the bulkhead. The goal for the project was to remove as much of the impacted sediment as possible to take advantage of an available disposal site within the Port of Long Beach (Port). Approximately 80,000 cubic yards (cy) were removed over 3 months and delivered to the Port for sequestration. Figure 4 shows the dredge footprint as a color isopach of sediment removal thicknesses where darker oranges and reds represent the thickest dredge cut and blue shows areas that were not dredged. Post construction monitoring of the surface sediments showed that a clean surface was achieved over all dredged area and it was estimated that approximately 80% of the surface area of the Rhine Channel had been remediated. Areas not dredged along the bulkheads continued to be impacted after dredging was completed. The City and the RWQCB are currently working together to review the significance of the remaining impacted material and determine if additional focused dredging or capping is warranted to comply with the intent of the original TMDL.

During the development of the post-construction sampling plan, the RWQCB insisted that samples be collected in a stratified random fashion to ensure that samples were collected from both dredged and non-dredged areas in an effort to provide representative data for

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existing conditions. Figure 5 shows the locations of the surface sediment samples collected to verify TMDL compliance. The number and location of these stations was not weighted to match the percentage of the area dredged and instead were randomly spread across the site. As expected, the stations that were positioned outside of the dredge footprint continued to show elevated concentrations for multiple constituents. Mercury was elevated post-construction even within the dredge areas due to re-suspension of residuals from un-dredged areas into the deeper channel running down the middle of the Rhine.

### **Sediment Quality Results**

A total of 12 stations were tested for metals, pesticides, and PCBs in the surface and subsurface sediments. Surface samples were compared to the TMDL numeric values to determine compliance and yielded the following results, as presented in Table 2: 8 of the 12 surface samples exceeded the copper ERM, all 12 samples exceeded the mercury ERM, and 3 of the 12 samples exceeded the zinc ERM. No arsenic, cadmium, chromium, or nickel ERM exceedances were observed with any of the samples. No toxicity testing was conducted as part of this investigation.

Further evaluation of the data shows that the samples collected outside of the dredge footprint (stations 12, 13, 14, and 15) represent the highest concentrations measured for most analytes. For example, all three of the zinc ERM exceedances were for stations outside of the dredge area; the three highest copper concentrations observed were for these same three stations; and three of the four highest mercury concentrations were measured outside the dredge area. The results of this data show that the Rhine Channel continues to be one of the primary sources of legacy contaminant sources in Lower Newport Bay, with concentrations many times those observed in other areas. Significant volumes of contaminants were removed under this program, but some remain and will need to be further managed by the City in cooperation with the RWQCB. That effort should continue to occur as a separate effort from the rest of the Bay.

### **Summary of Findings**

A summary of the ERM exceedances is provided in Table 1. This monitoring program supports the management of Rhine Channel as a separate waterbody, independent of a metals TMDL.

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## **FEDERAL DREDGING POST SEDIMENT CONDITION**

Beginning in May 2012 and continuing into January 2013, the City, the County of Orange, and the U.S. Army Corps of Engineers dredged a large area within Lower Newport Bay to take advantage of a disposal area at the Port and a source of funds from all three entities. The project included two phases that targeted the removal of approximately 1.3 million cy of sediment; 1 million was determined suitable for ocean disposal and the remaining 300,000 was suitable only for confined disposal. The unsuitable material was delivered to the Port and placed into the Middle Harbor fill site with the material from the Rhine Channel (removed just prior to the federal dredging project). Figure 6 shows the areas within Lower Newport Bay that were dredged under this program.

Following the nearly year-long dredging effort, the City was asked to conduct a post-construction sediment collection program to document existing conditions of the sediment surface for the purpose of updating the RWQCB's TMDL database for Newport Bay. It was assumed at that time that the new sediment data would replace the previous values observed for the various dredge units used in conjunction with toxicity tests to determine sediment suitability. Eleven stations were selected for testing as shown in Figure 6.

### **Sediment Quality Results**

Metals were detected in all samples as shown in Table 3. At one station, mercury measured 1 milligram per kilogram (mg/kg), slightly above the ERM value of 0.71 mg/kg. All other metal values were less than ERM values. Copper and zinc values were considered estimates for all stations because the percent recovery values for the associated matrix spike/matrix spike duplicate were less than the project control limits, indicating a potentially low bias. Estimated values were considerably less than the respective ERM values.

The post-construction sampling also included toxicity testing using the sediment-water interface test with bivalves (*Mytilus galloprovincialis*). All 11 stations were tested in four batches, each with a laboratory control. Mean percent normal alive embryos in the controls ranged from 79.3 to 94.1%, meeting the criterion of 70% normal alive. Results for test sediments were control-normalized (divided by control survival). Mean percent normal

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alive embryos ranged from 81.2 to 113% in test sediments. Test sediment values were statistically compared to their respective controls, and no significant differences were found.

### **Summary of Findings**

These data show that large portions of Lower Newport Bay were dredged during 2012 and 2013 for navigation and contaminant removal and the results were successful. More than 300,000 cy of contaminated sediment were removed, and the post-construction testing verified that the final surface concentrations were not only below the ERM but also exhibited no toxicity to a species very sensitive to metals (especially copper). A summary of the ERM exceedances is provided in Table 3. The one ERM exceedance that was detected, mercury, was only 0.3 ppb above the ERM and was almost an order of magnitude lower than the concentrations observed in the Rhine Channel. This study does not support the sediment listing for copper, zinc, and mercury in the Lower Newport Bay as recommended in the Staff Report. These findings can be used to support the delisting of sediment toxicity in the Lower Newport Bay and the Upper Newport Bay as it relates to metals. Compliance with sediment toxicity should not be associated with any metal TMDL. This monitoring program supports the management of Rhine Channel as a separate waterbody, independent of a metals TMDL.

### **BIGHT '13 SEDIMENT QUALITY OBJECTIVE ASSESSMENT (SCCWRP 2015)**

The Southern California Bight (SCB) is the approximate 400 miles of coastline from Point Conception in Santa Barbara County to Cabo Colnett in Ensenada, Mexico. The Southern California Coastal Water Research Project (SCCWRP) coordinates multiple agencies and organizations to conduct an extensive monitoring program within the SCB every 5 years. The most recent monitoring program occurred in 2013 (i.e., Bight '13). The Bight program began in 1994, and data gathered during monitoring events has allowed for long-term tracking of benthic communities, fisheries, water quality, sediment chemistry and toxicity, and the general health of the SCB over time.

The Bight '13 program consisted of several key study elements, including the following:

- Nutrients
  - Contaminant Impact Assessment (CIA; i.e., Coastal Ecology)
  - Shoreline Microbiology
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- Marine Protected Areas
- Trash and Debris

The CIA was designed to understand the existing condition of the benthic environment and biological resources in the SCB. This goal was achieved by developing a robust sampling program to determine the extent, magnitude, and trends of direct effects from sediment contaminants, and indirect risks of sediment contaminants to seabirds. For the purposes of this review, only sampling approach and results from the CIA were reviewed, as this element of the Bight '13 program is the most relevant to the Newport Bay TMDL.

In the Bight '13 program, nearly 400 sites throughout the SCB were sampled to accomplish the goal and objectives of the CIA. Specifically, in Newport Bay, nine sites were sampled: four in Lower Newport Bay and five in Upper Newport Bay. It should be noted that none of the Bight '13 stations were located in Rhine Channel. At each location, the top 5 centimeters of sediment were collected with a Van Veen grab sampler. Samples were submitted for sediment chemistry (conventionals, metals, PAHs, organochlorine pesticides, PCBs, and polybrominated dipheynyl ethers), benthic community analysis, and sediment toxicity (using a 10-day amphipod [*Eohaustorius estuarius*] survival test and a 48-hour bivalve [*Mytilus galloprovincialis*] sediment-water interface test). In addition, trawls were conducted to determine fish and macroinfauna community structure and assess gross fish pathology.

### **Sediment Quality Results**

Nine samples were collected as part of the Bight '13 monitoring program within Newport Bay (SCCWRP 2016). None of the metals of concern (copper, arsenic, chromium, mercury, or zinc) exceeded ERM values from any of these stations. The toxicity line of evidence was categorized as moderate at two stations in Upper Newport Bay and as high at one station in Upper Newport Bay. All other Newport Bay stations were determined to be non-toxic. In 2014, SCCWRP resampled the station categorized as having high toxicity in 2013 in order to conduct a toxicity investigation evaluation. The follow-up testing showed no occurrence of toxicity.

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## Summary of Findings

Metals were not present in sediments at concentrations greater than the ERM as summarized in Table 1. The observed moderate toxicity in two out of nine samples was not paired with ERM exceedances of any metal; therefore, there is no direct linkage between metals in sediment to benthic impairments, nor dissolved copper (fluxed from sediment) in overlying water to aquatic organisms. This study does not support the sediment listing for copper, zinc, and mercury in the Lower Newport Bay as recommended in the Staff Report. These findings can be used to support the delisting of sediment toxicity in the Lower Newport Bay and the Upper Newport Bay as it relates to metals. Compliance with sediment toxicity should not be associated with any metal TMDL. This monitoring program supports the management of Rhine Channel as a separate waterbody, independent of a metals TMDL.

## FISH TISSUE DATA ON CEDEN

CEDEN is a central location to find and share information from various monitoring programs and includes water quality, aquatic habitat, and wildlife health data. CEDEN aggregates this data and makes it accessible to environmental managers and the public. Tissue data from Newport Bay collected after 2006 are available on CEDEN (<http://www.ceden.org/>) and were collected as part of the Newport Bay Watershed Bio Trend Monitoring Program from 2007 through 2010, Surface Water Ambient Monitoring Program in 2009, and the State's Mussel Watch Program in 2010. These data may not be reflective of current conditions, but they are the most recent data available and can be used to demonstrate the range of metals that may be considered background conditions for Newport Bay and the Orange County coastal region.

## Tissue Summary

Tables 4, 5, and 6 provide a summary of three monitoring programs. Figure 7 shows the concentration of mercury in fish outside of the harbor to fish inside Newport Bay. Figure 8 shows concentrations of arsenic and cadmium in fish outside of the harbor to fish inside Newport Beach.

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## Summary of Findings

Fish tissue from fish caught inside Newport Bay are similar to or less than fish tissue of fish caught just outside of the bay and along the Southern California coast. Therefore, fish caught in Newport Bay do not appear to be exposed to any additional metals that may be associated with Newport Harbor. The CEDEN database also includes mussel data; a more thorough data review should be included in any future tissue assessments for Newport Harbor.

## REFERENCES

- Anchor QEA, 2011. *Final Dredging and Disposal Operations Report Rhine Channel Contaminated Sediment Cleanup*. Prepared for the Santa Ana Regional Water Quality Control Board. December 2011.
- Anchor QEA, 2013. *Water Quality and Sediment Monitoring Report Lower Newport Bay Federal Dredging*. Prepared for the Santa Ana Regional Water Quality Control Board. July 2013.
- OC Public Works, 2016. Water Quality Monitoring. Cited: January 2011 to October 2016. Available from: <http://ocwatersheds.com/rainrecords/waterqualitydata>.
- Orange County Coastkeeper and L.M. Candelaria, 2014. *Metals Sediment Study in Lower Newport Bay (Post-dredging). Final Report*. Report for Santa Ana Regional Water Board. March 2014.
- RWQCB (Regional Water Quality Control Board) Santa Ana, 2016. *Staff Report – Basin Plan Amendments for Copper TMDLs and Non-TMDL Metals Action Plans for Zinc, Mercury, Arsenic and Chromium in Newport Bay, California*. August 30, 2016.
- SCCWRP (Southern California Coastal Water Research Project), 2015. Southern California Bight 2013 Regional Monitoring Program: Volume I Sediment Toxicity. December 2015.
- SCCWRP, 2016. Southern California Bight 2013 Regional Monitoring Program: Volume IV Sediment Chemistry. April 2016.
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**Table 1**  
**Summary of Sediment Quality Results for Evaluations Less than 5 Years Old in Upper and Lower Newport Bay**

Study	Sediment Samples	ERM Exceedances for Copper	ERM Exceedances for Mercury	ERM Exceedances for Zinc	ERM Exceedances for Arsenic	ERM Exceedances for Chromium	Toxicity Tests	Toxic Samples
Orange County Coastkeeper and Candelaria (2014)	44	7	7	2	0	0	6 <sup>1</sup>	0 <sup>1</sup>
Bight '13	9	0	0	0	0	0	91 + 1 <sup>1,3</sup> 9 <sup>2</sup>	4 <sup>1,4</sup> 0 <sup>2</sup>
Federal Dredging Post Sediment Condition (Anchor QEA 2013)	11	0	1	0	0	0	11 <sup>1</sup> 11 <sup>2</sup>	0 <sup>1</sup> 0 <sup>2</sup>
OC Monitoring (2011 to 2016) 139 sediment samples, 96 toxicity samples	139	0	7 (all in Rhine Channel)	0	0	0	96 <sup>1</sup> 19 <sup>2</sup>	18 <sup>1,4</sup> 0 <sup>2</sup>
Rhine Channel Post Remediation Study (Anchor QEA 2011)	12	8	12	3	0	0	--	--
Summary for Lower and Upper Newport Bay	215	15	27	5	0	0	122 <sup>1</sup> 39 <sup>2</sup>	22 <sup>1,4</sup> 0 <sup>2</sup>
Summary for Lower and Upper Newport Bay without Rhine Channel	196	7	8	2	0	0	120 <sup>1</sup> 32 <sup>2</sup>	20 <sup>1,4</sup> 0 <sup>2</sup>

Notes:

1 = 10-day amphipod acute test

2 = 48-hour sediment/water interface *Mytilus* development test

3 = Station B13-8274 was toxic in the 2013 assessment and retested in 2014 for potential toxicity investigation evaluation testing. Survivorship was normal in the 2014 reassessment.

4 = Toxic response does not co-occur with ERM exceedance in metals, except for two instances in the Rhine Channel where Hg exceeds the ERM.

-- = not evaluated

**Table 2**  
**Results of Physical and Chemical Analyses of Surface Sediment Grab Samples**

Location Name	TMDL Numeric Targets	ERL	ERM	RC-02	RC-04	RC-06	RC-08	RC-10	RC-11	RC-12	RC-13	RC-14	RC-15	RC-16	RC-17
Sample ID				RC-02-SG	RC-04-SG	RC-06-SG	RC-08-SG	RC-10-SG	RC-11-SG	RC-12-SG	RC-13-SG	RC-14-SG	RC-15-SG	RC-16-SG	RC-17-SG
Sample Date				12/11/2012	12/11/2012	12/11/2012	12/11/2012	12/11/2012	12/11/2012	12/12/2012	12/12/2012	12/12/2012	12/12/2012	12/12/2012	12/12/2012
Depth				0 - 2 cm	0 - 2 cm	0 - 2 cm	0 - 2 cm	0 - 2 cm	0 - 2 cm	0 - 2 cm	0 - 2 cm	0 - 2 cm	0 - 2 cm	0 - 2 cm	0 - 2 cm
<b>Conventional Parameters (percent)</b>															
Total organic carbon	--	--	--	1.6	2	1.6	1	0.92	1.2	2.3	2.4	2	2.4	1.6	1.4
Total solids	--	--	--	37	30.6	35.4	47.2	51	40.5	29.1	25.8	29.4	27.3	34.7	37.6
<b>Grain Size (percent)</b>															
Gravel (>2 mm)	--	--	--	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Sand (2.00 mm - 1.00 mm)	--	--	--	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Sand, Coarse	--	--	--	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Sand, Medium	--	--	--	0 U	0 U	0 U	0 U	0.33	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Sand, Fine	--	--	--	0 U	0.7	0 U	0 U	10.6	0 U	0.05	0 U	0.42	0.88	0 U	0 U
Sand, Very Fine	--	--	--	2.64	7.36	1.54	0.3	8.96	0.81	4.55	2.49	5.41	2.8	1.11	0.42
Silt	--	--	--	59.3	53.44	53.31	58.05	51.39	58.73	52.18	54.65	50.17	55.5	57.81	57.44
Fines (silt + clay)	--	--	--	97.36	91.94	98.46	99.7	80.11	99.19	95.41	97.51	94.17	96.32	98.89	99.58
Clay, <5 micron	--	--	--	38.06	38.5	45.15	41.65	28.72	40.46	43.22	42.85	44	40.82	41.08	42.14
<b>Metals (mg/kg)</b>															
Arsenic	--	8.2	70	8.36	11.5	8.93	7.27	6.54	6.89	16.5	19.1	15.9	14.4	10.9	8.22
Cadmium	--	1.2	9.6	0.496	0.541	0.617	0.388	0.403	0.314	0.912	0.877	0.833	0.841	0.778	0.736
Chromium	52	81	370	16.7	33	17.4	14.3	15.7	18.7	35.3	41.6	35.8	42.2	29.8	28.3
Copper	18.7	34	270	400	428	399	220	166	178	673	862	605	624	318	249
Lead	30.2	46.7	218	80.4 J	84.5 J	71.3 J	44.2 J	34.8 J	28.5 J	118	127	96.4	101	63.1	41.3
Mercury	0.13	0.15	0.71	5.2	3.9	2.8	2.3	1.6	1.1	5.6	6.3	4.9	4.3	3	1.3
Nickel	--	20.9	51.6	7.82	17.3	8.63	8.5	7.82	10.9	20.1	23.2	20.6	23.1	19.6	16.5
Selenium	--	--	--	0.0987 U	0.119 U	0.321	0.0774 U	0.0716 U	0.0902 U	1.26	0.991	0.933	1.64	0.604	0.844
Zinc	124	150	410	257 J	285 J	280 J	165 J	160 J	155 J	430	486	370	425	283	280

Notes:

USEPA Stage 2A data validation was completed by Anchor QEA.  
 Results are reported in dry weight basis.  
 Totals are calculated as the sum of all detected results (U=0). If all results are not detected, the highest detection limit value is reported as the sum.  
 Total chlordane is the sum of alpha-chlordane and gamma-chlordane only.  
 Total DDx is the sum of 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, 2,4'-DDD, 2,4'-DDE, and 2,4'-DDT if measured.  
 Total PCB congeners is the total of all PCB congeners listed in this table.

Detected concentration is greater than TMDL numeric targets  
 Detected concentration is greater than ERL screening level  
 Detected concentration is greater than ERM screening level

**Bold** = detected result  
 -- = not reported or not applicable  
 cm = centimeters  
 ERL = effects range low  
 ERM = effects range median  
 J = estimated value  
 mg/kg = milligrams per kilogram  
 mm = millimeter  
 U = compound analyzed but not detected at greater than the detection limit  
 TMDL = total maximum daily load  
 All non-detect results are reported at the method detection limit.

**Table 3**  
**Results of the Chemical Analyses of Surface Sediment Grab Samples for the Federal Channel Post-Dredge Condition**

	Sediment Quality Guideline (ERM)	Phase I Station IDs								Phase II Station IDs		
		LW	LE	Y1	Y2	NC	WL	BR	CG	BE	LS	Y3
<b>Conventional Parameters (percent)</b>												
Total organic carbon	--	<b>1.8</b>	<b>1.7</b>	<b>1.4</b>	<b>1.4</b>	<b>1.7</b>	<b>1.7</b>	<b>1.3</b>	<b>0.74</b>	<b>1.7</b>	<b>1.8</b>	<b>1.9</b>
Total solids	--	<b>40.6</b>	<b>41.9</b>	<b>46.9</b>	<b>45.7</b>	<b>42.5</b>	<b>41.2</b>	<b>54.1</b>	<b>69.2</b>	<b>42.5</b>	<b>39.4</b>	<b>39.6</b>
<b>Grain Size (percent)</b>												
Gravel (>2 mm)	--	--	--	--	--	--	--	--	--	--	0 U	0 U
Sand (2.00 - 1.00 mm)	--	--	--	--	--	--	--	--	<b>1.42</b>	--	0 U	0 U
Sand, Coarse	--	--	--	--	--	--	--	--	<b>8.02</b>	--	0 U	0 U
Sand, Medium	--	--	<b>0.12</b>	--	--	<b>0.06</b>	--	<b>1.76</b>	<b>22.81</b>	--	0 U	0 U
Sand, Fine	--	<b>0.05</b>	<b>6.31</b>	<b>1.06</b>	<b>0.56</b>	<b>3.78</b>	--	<b>7.8</b>	<b>29.01</b>	<b>1.24</b>	0 U	0 U
Sand, Very Fine	--	<b>3.74</b>	<b>6.11</b>	<b>9.13</b>	<b>4.61</b>	<b>5.4</b>	<b>0.27</b>	<b>11.99</b>	<b>11.31</b>	<b>2.7</b>	0 U	0 U
Silt	--	<b>66.2</b>	<b>60.05</b>	<b>63.37</b>	<b>64.32</b>	<b>62.29</b>	<b>66.83</b>	<b>56.96</b>	<b>19.41</b>	<b>62.02</b>	0 U	<b>47.33</b>
Clay, <5 micron	--	<b>30.01</b>	<b>27.41</b>	<b>26.45</b>	<b>30.51</b>	<b>28.47</b>	<b>32.9</b>	<b>21.48</b>	<b>8.01</b>	<b>34.04</b>	<b>100</b>	<b>100</b>
Fines (silt + clay)	--	<b>96.21</b>	<b>87.46</b>	<b>89.82</b>	<b>94.83</b>	<b>90.76</b>	<b>99.73</b>	<b>78.45</b>	<b>27.42</b>	<b>96.06</b>	<b>100</b>	<b>52.67</b>
<b>Metals (mg/kg)</b>												
Arsenic	70	<b>8.06</b>	<b>8.07</b>	<b>7.45</b>	<b>6.78</b>	<b>7.23</b>	<b>8.14</b>	<b>4.08</b>	<b>3.34</b>	<b>7.97</b>	<b>7.51</b>	<b>7.99</b>
Cadmium	9.6	<b>1.15</b>	<b>1.35</b>	<b>1.38</b>	<b>1.58</b>	<b>1.45</b>	<b>1.44</b>	<b>1.02</b>	<b>0.51</b>	<b>1.2</b>	<b>1.21</b>	<b>1.44</b>
Chromium	370	<b>37.2</b>	<b>46.8</b>	<b>25.2</b>	<b>36.3</b>	<b>37.5</b>	<b>42.1</b>	<b>23.7</b>	<b>11.7</b>	<b>41.9</b>	<b>35.3</b>	<b>30.3</b>
Copper	270	<b>93.6 J</b>	<b>95 J</b>	<b>76.3 J</b>	<b>72.1 J</b>	<b>93.9 J</b>	<b>103 J</b>	<b>56 J</b>	<b>39.6 J</b>	<b>135 J</b>	<b>91.4</b>	<b>74.8</b>
Lead	218	<b>31.2</b>	<b>31.9</b>	<b>23.4</b>	<b>24.8</b>	<b>31.1</b>	<b>32.3</b>	<b>17.8</b>	<b>8.97</b>	<b>46.6</b>	<b>31.5</b>	<b>24.5</b>
Mercury	0.71	<b>0.15</b>	<b>0.15</b>	<b>0.11</b>	<b>0.096</b>	<b>0.13</b>	<b>0.22</b>	<b>0.1</b>	<b>0.12</b>	<b>1</b>	<b>0.282</b>	<b>0.117</b>
Nickel	51.6	<b>25.2</b>	<b>26.8</b>	<b>18.9</b>	<b>27.8</b>	<b>23.7</b>	<b>26.3</b>	<b>15.7</b>	<b>7.77</b>	<b>25.5</b>	<b>21.6</b>	<b>20.9</b>
Selenium	4	<b>0.75 J</b>	<b>0.665 J</b>	<b>0.262 J</b>	<b>0.722 J</b>	<b>0.664 J</b>	<b>0.692 J</b>	<b>0.36 J</b>	<b>0.188 J</b>	<b>0.648 J</b>	<b>0.612</b>	<b>0.433</b>
Tin	48	<b>3.19</b>	<b>3.34</b>	<b>1.95</b>	<b>3.16</b>	<b>2.96</b>	<b>3.02</b>	<b>1.91</b>	<b>1.1</b>	<b>3.51</b>	<b>2.04</b>	<b>2.09</b>
Zinc	410	<b>215 J</b>	<b>217 J</b>	<b>175 J</b>	<b>172 J</b>	<b>209 J</b>	<b>229 J</b>	<b>155 J</b>	<b>78.5 J</b>	<b>206 J</b>	<b>194</b>	<b>182</b>

## Notes:

Results are reported in dry weight basis

Totals are calculated as the sum of all detected results (U=0). If all results are not detected, the highest method detection limit value is reported as the sum.


Total PAH is the sum of the 25 PAH compounds analyzed for this sampling event.

Total PCB Congeners is the sum of all reported PCB congeners.

Total Chlordane includes alpha-chlordane (cis-chlordane), beta-chlordane (trans-chlordane), cis-nonachlor, trans-nonachlor, and oxychlordane.

Total DDX is the sum of 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, 2,4'-DDD, 2,4'-DDE, and 2,4'-DDT.

 Detected concentration is greater than Work Plan Sediment Guidelines

 Non-detected concentration is above one or more identified screening levels
**Bold** = Detected result

J = Estimated value

U = Compound analyzed but not detected above detection limit. Undetected results are reported at the method detection limit.

-- No criteria exists

ERM = effects range median

mg/kg = milligrams per kilogram

mm = millimeter

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

**Table 4**  
**Mercury Concentrations in Fish Sourced from Along the Orange County Coast (SWAMP 2009)**  
**Relative to Screening Levels Used in the Staff Report. All fish**

<b>Composite Station Code</b>	<b>Composite Common Name</b>	<b>Tissue Prep</b>	<b>Tissue Name</b>	<b>Analyte</b>	<b>Unit</b>	<b>Result</b>
80113SASB	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.257
80113SASB	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.25
80114ORCO	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.247
80111CCSA	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.229
80114ORCO	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.226
80114ORCO	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.217
80113SASB	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.207
80114ORCO	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.207
80111CCSA	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.205
80114ORCO	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.185
80111CCSA	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.145
80113SASB	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.131
80114ORCO	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.127
80114ORCO	Barred Sand Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.126
80113SASB	Barred Surfperch	Skin off	Fillet	Mercury, Total	µg/g ww	0.123
80113SASB	Barred Surfperch	Skin off	Fillet	Mercury, Total	µg/g ww	0.08
80113SASB	Barred Surfperch	Skin off	Fillet	Mercury, Total	µg/g ww	0.077
80113SASB	Barred Surfperch	Skin off	Fillet	Mercury, Total	µg/g ww	0.074
80113SASB	Barred Surfperch	Skin off	Fillet	Mercury, Total	µg/g ww	0.062
80113SASB	Barred Surfperch	Skin off	Fillet	Mercury, Total	µg/g ww	0.06
80113SASB	Barred Surfperch	Skin off	Fillet	Mercury, Total	µg/g ww	0.058
80113SASB	Barred Surfperch	Skin off	Fillet	Mercury, Total	µg/g ww	0.051
80113SASB	Barred Surfperch	Skin off	Fillet	Mercury, Total	µg/g ww	0.05
80111CCSA	Brown Smooth-hound Shark	Skin off	Fillet	Mercury, Total	µg/g ww	1.45
80111CCSA	Brown Smooth-hound Shark	Skin off	Fillet	Mercury, Total	µg/g ww	1.45
80113SASB	Brown Smooth-hound Shark	Skin off	Fillet	Mercury, Total	µg/g ww	0.715
80113SASB	Chub Mackerel	Skin off	Fillet	Mercury, Total	µg/g ww	0.052
80111CCSA	Chub Mackerel	Skin off	Fillet	Mercury, Total	µg/g ww	0.047
80111CCSA	Chub Mackerel	Skin off	Fillet	Mercury, Total	µg/g ww	0.047
80113SASB	Chub Mackerel	Skin off	Fillet	Mercury, Total	µg/g ww	0.042
80111CCSA	Chub Mackerel	Skin off	Fillet	Mercury, Total	µg/g ww	0.041
80111CCSA	Chub Mackerel	Skin off	Fillet	Mercury, Total	µg/g ww	0.041

Composite Station Code	Composite Common Name	Tissue Prep	Tissue Name	Analyte	Unit	Result
80111CCSA	Chub Mackerel	Skin off	Fillet	Mercury, Total	µg/g ww	0.038
80111CCSA	Chub Mackerel	Skin off	Fillet	Mercury, Total	µg/g ww	0.038
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.345
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.243
80113SASB	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.218
80113SASB	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.201
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.199
80113SASB	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.192
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.186
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.185
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.174
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.157
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.156
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.156
80113SASB	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.155
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.143
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.139
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.137
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.133
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.126
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.126
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.118
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.113
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.113
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.111
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.109
80113SASB	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.107
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.106
80113SASB	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.105
80113SASB	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.103
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.102
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.102
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.086
80114ORCO	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.079
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.077

Composite Station Code	Composite Common Name	Tissue Prep	Tissue Name	Analyte	Unit	Result
80111CCSA	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.076
80113SASB	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.063
80113SASB	Kelp Bass	Skin off	Fillet	Mercury, Total	µg/g ww	0.038
80113SASB	Spotfin Croaker	Skin off	Fillet	Mercury, Total	µg/g ww	0.046
80111CCSA	White Croaker	Skin off	Fillet	Mercury, Total	µg/g ww	0.199
80111CCSA	White Croaker	Skin off	Fillet	Mercury, Total	µg/g ww	0.196
80111CCSA	White Croaker	Skin off	Fillet	Mercury, Total	µg/g ww	0.152
80114ORCO	White Croaker	Skin off	Fillet	Mercury, Total	µg/g ww	0.131

Notes:

µg/g = microgram per gram wet weight

**Table 5**  
**Arsenic and Cadmium Concentrations from Mussels Collected in the Ocean in the Vicinity of Newport Bay (California State Mussel Watch Program 2010)**

Analyte	Station	Result	Unit
As	NBWJ/Newport Beach-West Jetty	1.733	µg/g wet weight
As	ABWJ/Anaheim Bay-West Jetty	1.603	µg/g wet weight
As	SDHI/San Diego-Harbor Island	0.962	µg/g wet weight
As	DNPT/Dana Point	2.145	µg/g wet weight
As	CCSB/Crystal Cove State Beach	1.904	µg/g wet weight
Cd	SDHI/San Diego-Harbor Island	0.303	µg/g wet weight
Cd	ABWJ/Anaheim Bay-West Jetty	0.178	µg/g wet weight
Cd	CCSB/Crystal Cove State Beach	0.275	µg/g wet weight
Cd	DNPT/Dana Point	0.368	µg/g wet weight
Cd	NBWJ/Newport Beach-West Jetty	0.407	µg/g wet weight

Notes:

µg/g = microgram per gram

As = arsenic

Cd = cadmium

**Table 6**  
**Metals Concentrations in Fish Collected as Part of the Newport Bay Watershed Bio Trend Monitoring Program from 2007 through 2010 and Downloaded from CEDEN**

Station	Sampling Date	Common Name	Tissue Prep	Tissue Type	Analyte	Unit	Result	Qual	MDL
801SARPOL	7/10/2008	California Halibut	Skin on	Not recorded	Arsenic	µg/g ww	0.55	=	0.02
801SARJAM	6/20/2007	California Halibut	Skin on	Not recorded	Arsenic	µg/g ww	0.32	=	0.02
801SARJAM	8/12/2008	California Killifish	Skin on	Not recorded	Arsenic	µg/g ww	0.48	=	0.02
801SARPOL	6/19/2007	Shiner Surfperch	Skin on	Not recorded	Arsenic	µg/g ww	0.96	=	0.02
801SARPOL	6/19/2007	Spotted Sand Bass	Skin off	Not recorded	Arsenic	µg/g ww	0.58	=	0.02
801SARPOL	7/10/2008	Spotted Sand Bass	Skin off	Not recorded	Arsenic	µg/g ww	0.29	=	0.02
801SARJAM	5/25/2010	Top Smelt	Skin off	Not recorded	Arsenic	µg/g ww	0.41	=	0.02
801SARJAM	8/12/2008	Top Smelt	Skin on	Not recorded	Arsenic	µg/g ww	0.59	=	0.02
801SARPOL	7/10/2008	California Halibut	Skin on	Not recorded	Cadmium	µg/g ww		ND	0.002
801SARJAM	8/12/2008	California Killifish	Skin on	Not recorded	Cadmium	µg/g ww		ND	0.002
801SARPOL	6/19/2007	Shiner Surfperch	Skin on	Not recorded	Cadmium	µg/g ww	0.027	=	0.002
801SARPOL	6/19/2007	Spotted Sand Bass	Skin off	Not recorded	Cadmium	µg/g ww	0.005	=	0.002
801SARPOL	7/10/2008	Spotted Sand Bass	Skin off	Not recorded	Cadmium	µg/g ww		ND	0.002
801SARJAM	8/12/2008	Top Smelt	Skin on	Not recorded	Cadmium	µg/g ww	0.013	=	0.002
801SARJAM	5/25/2010	Top Smelt	Skin off	Not recorded	Cadmium	µg/g ww	0.007	=	0.002
801SARJAM	6/20/2007	California Halibut	Skin on	Not recorded	Chromium	µg/g ww	0.46	=	0.15
801SARPOL	6/19/2007	Shiner Surfperch	Skin on	Not recorded	Chromium	µg/g ww	0.75	=	0.15
801SARPOL	6/19/2007	Spotted Sand Bass	Skin off	Not recorded	Chromium	µg/g ww	0.7	=	0.15
801SARJAM	8/12/2008	Top Smelt	Skin on	Not recorded	Chromium	µg/g ww	0.55	=	0.15
80112NWPT	6/16/2009	Black Perch	Skin off	Fillet	Mercury	µg/g ww	0.047	=	0.012
80112NWPT	6/17/2009	Black Perch	Skin off	Fillet	Mercury	µg/g ww	0.041	=	0.012
80112NWPT	6/16/2009	Shiner Surfperch	Skin off	Fillet	Mercury	µg/g ww	0.051	=	0.012

Station	Sampling Date	Common Name	Tissue Prep	Tissue Type	Analyte	Unit	Result	Qual	MDL
80112NWPT	6/16/2009	Shiner Surfperch	Skin off	Fillet	Mercury	µg/g ww	0.041	=	0.012
80112NWPT	7/25/2009	Spotted Sand Bass	Skin off	Fillet	Mercury	µg/g ww	0.245	=	0.012
80112NWPT	7/25/2009	Spotted Sand Bass	Skin off	Fillet	Mercury	µg/g ww	0.207	=	0.012
80112NWPT	7/25/2009	Spotted Sand Bass	Skin off	Fillet	Mercury	µg/g ww	0.202	=	0.012
80112NWPT	7/25/2009	Spotted Sand Bass	Skin off	Fillet	Mercury	µg/g ww	0.195	=	0.012
80112NWPT	6/16/2009	Spotted Sand Bass	Skin off	Fillet	Mercury	µg/g ww	0.167	=	0.012
80112NWPT	7/25/2009	Spotted Sand Bass	Skin off	Fillet	Mercury	µg/g ww	0.16	=	0.012
80112NWPT	7/25/2009	Spotted Sand Bass	Skin off	Fillet	Mercury	µg/g ww	0.122	=	0.012
80112NWPT	7/25/2009	Spotted Sand Bass	Skin off	Fillet	Mercury	µg/g ww	0.12	=	0.012
80112NWPT	7/25/2009	Spotted Sand Bass	Skin off	Fillet	Mercury	µg/g ww	0.09	=	0.012
80112NWPT	7/25/2009	Spotted Sand Bass	Skin off	Fillet	Mercury	µg/g ww	0.085	=	0.012
80112NWPT	10/21/2009	White Croaker	Skin off	Fillet	Mercury	µg/g ww	0.232	=	0.012
80112NWPT	10/21/2009	White Croaker	Skin off	Fillet	Mercury	µg/g ww	0.227	=	0.012
80112NWPT	10/21/2009	White Croaker	Skin off	Fillet	Mercury	µg/g ww	0.221	=	0.012
801SARPOL	7/10/2008	California Halibut	Skin on	Not recorded	Zinc	µg/g ww	369	=	0.8
801SARJAM	6/20/2007	California Halibut	Skin on	Not recorded	Zinc	µg/g ww	13.3	=	0.8
801SARJAM	8/12/2008	California Killifish	Skin on	Not recorded	Zinc	µg/g ww	24.8	=	0.8
801SARPOL	6/19/2007	Shiner Surfperch	Skin on	Not recorded	Zinc	µg/g ww	21	=	0.8
801SARPOL	6/19/2007	Spotted Sand Bass	Skin off	Not recorded	Zinc	µg/g ww	8.05	=	0.8
801SARPOL	7/10/2008	Spotted Sand Bass	Skin off	Not recorded	Zinc	µg/g ww	6.32	=	0.8
801SARJAM	8/12/2008	Top Smelt	Skin on	Not recorded	Zinc	µg/g ww	33.7	=	0.8
801SARJAM	5/25/2010	Top Smelt	Skin off	Not recorded	Zinc	µg/g ww	31	=	0.8

Notes:

µg/g = microgram per gram wet weight

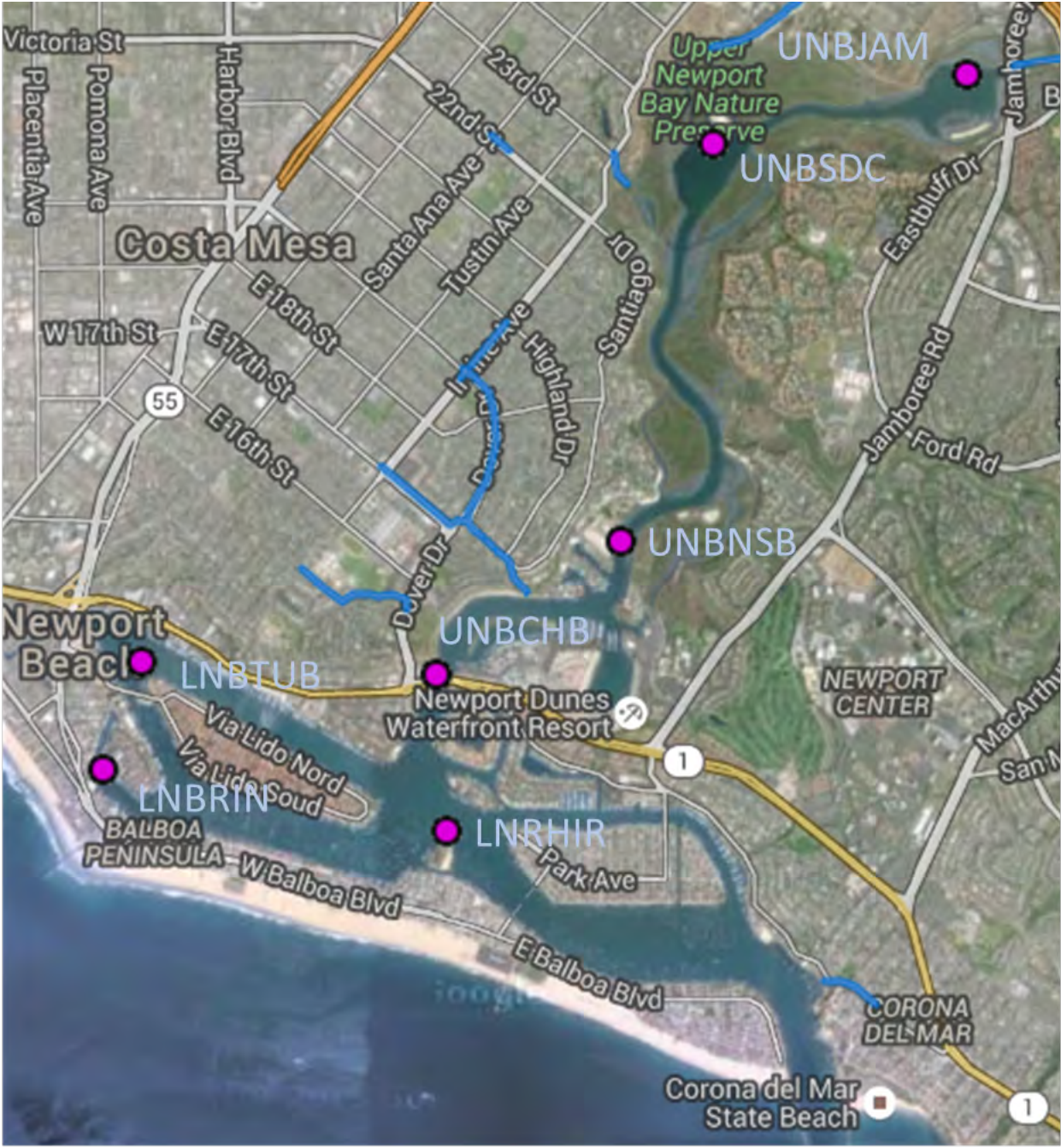
MDL = method detection limit

ND = non detect

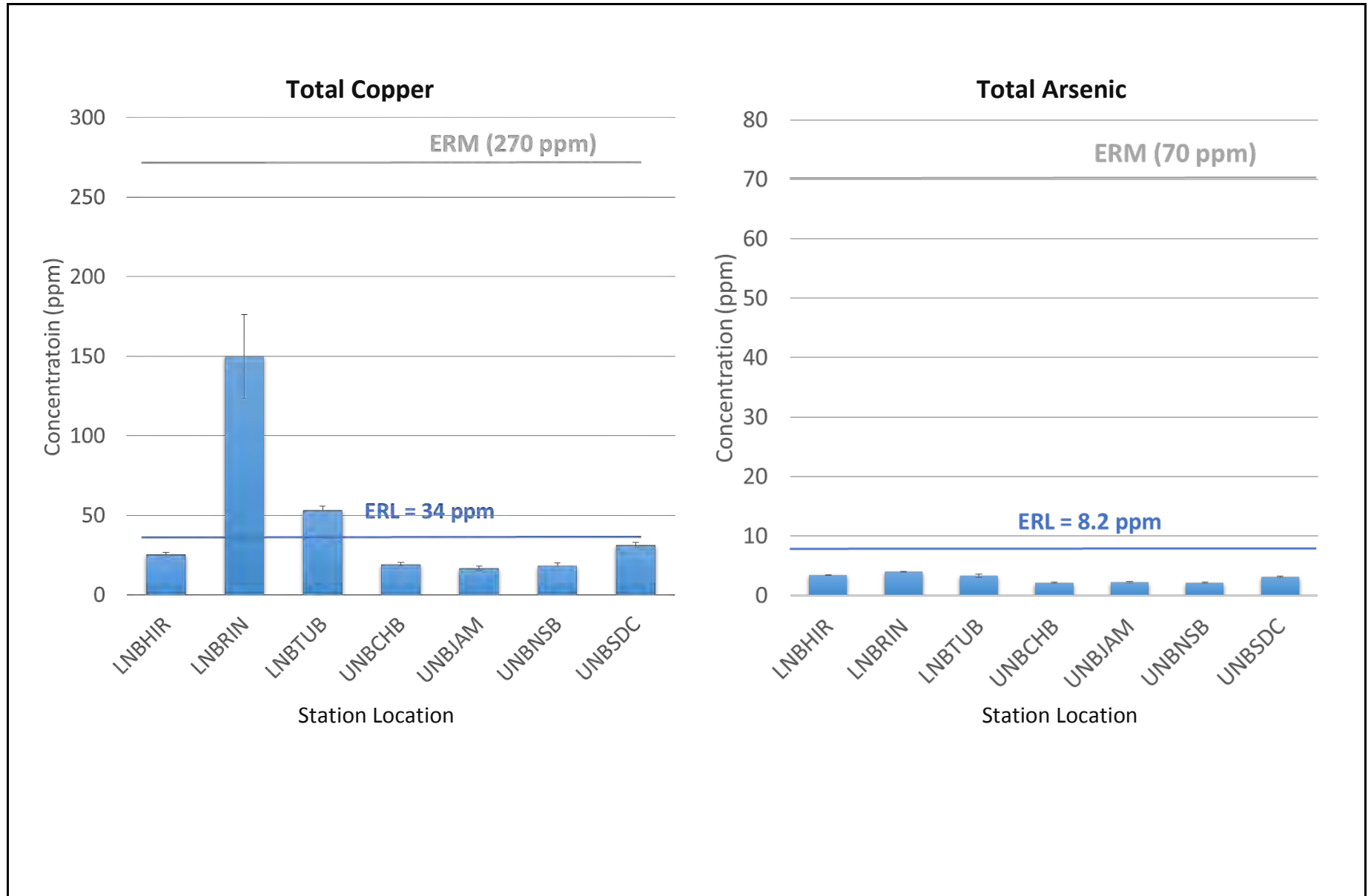
# FIGURES

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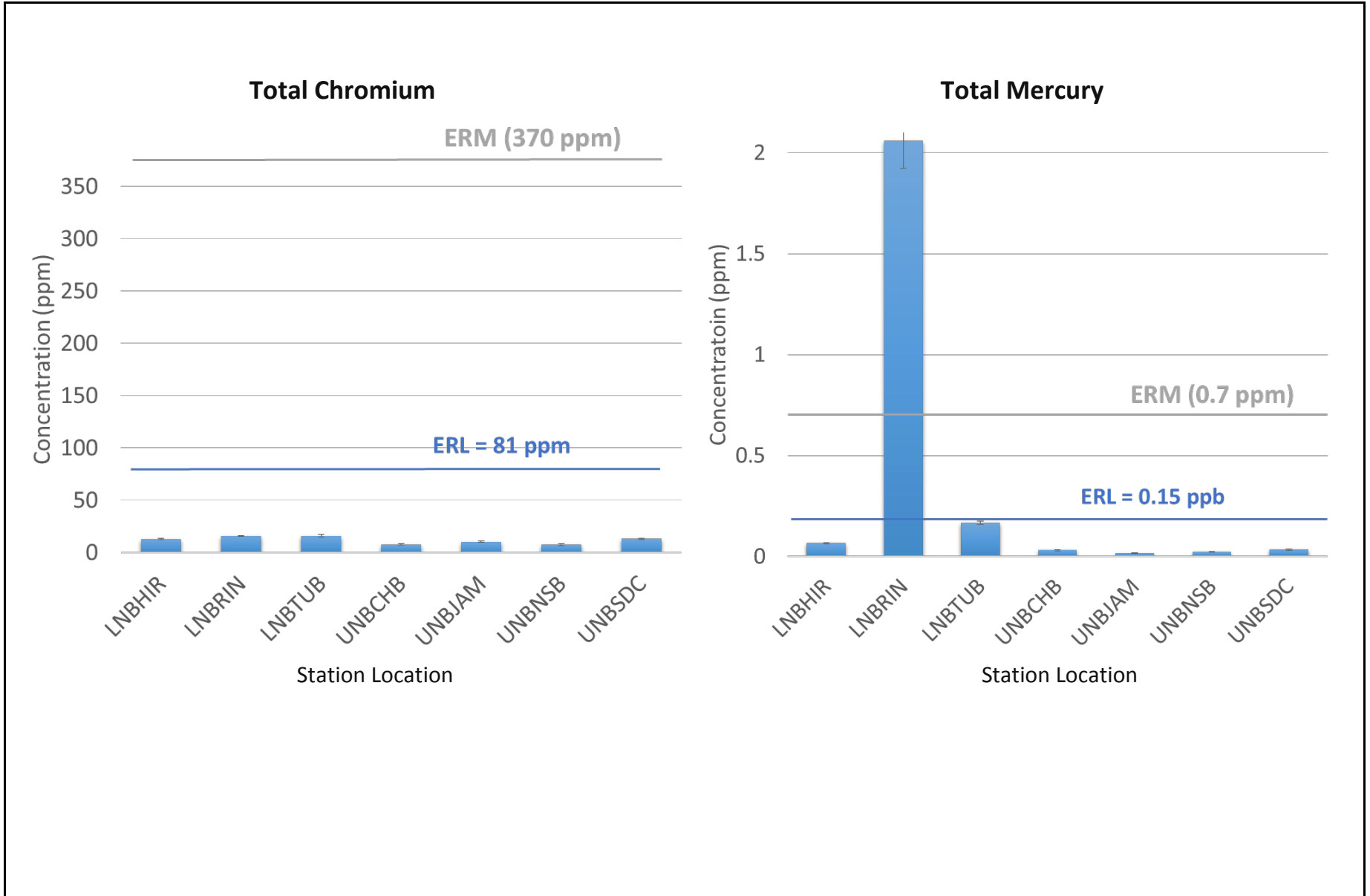
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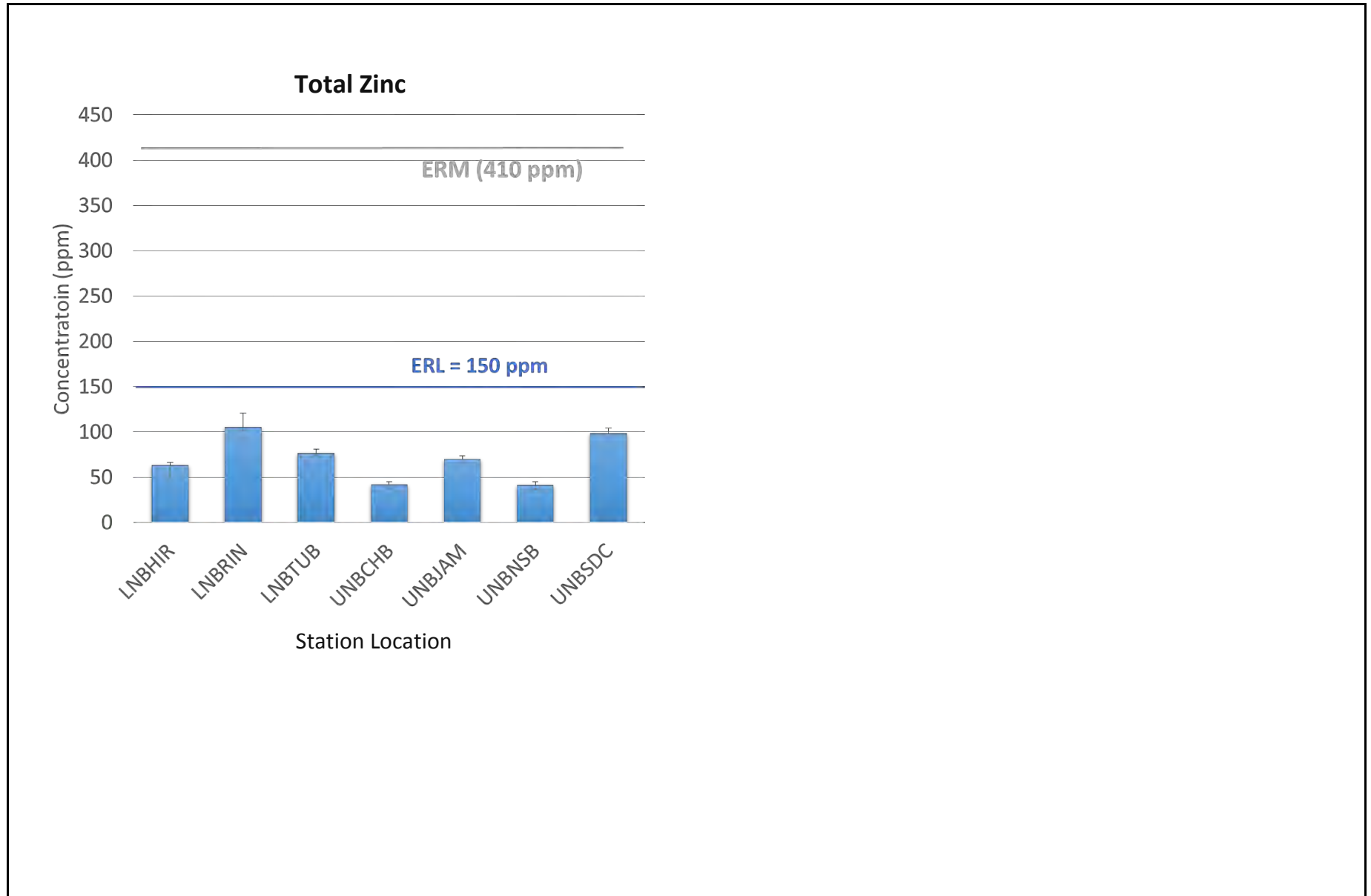
**Figure 1**  
Vicinity Map and Station Locations for OC Monitoring Program  
Newport Bay Copper TMDLs and Non-TMDL Action Plans  
City of Newport Beach

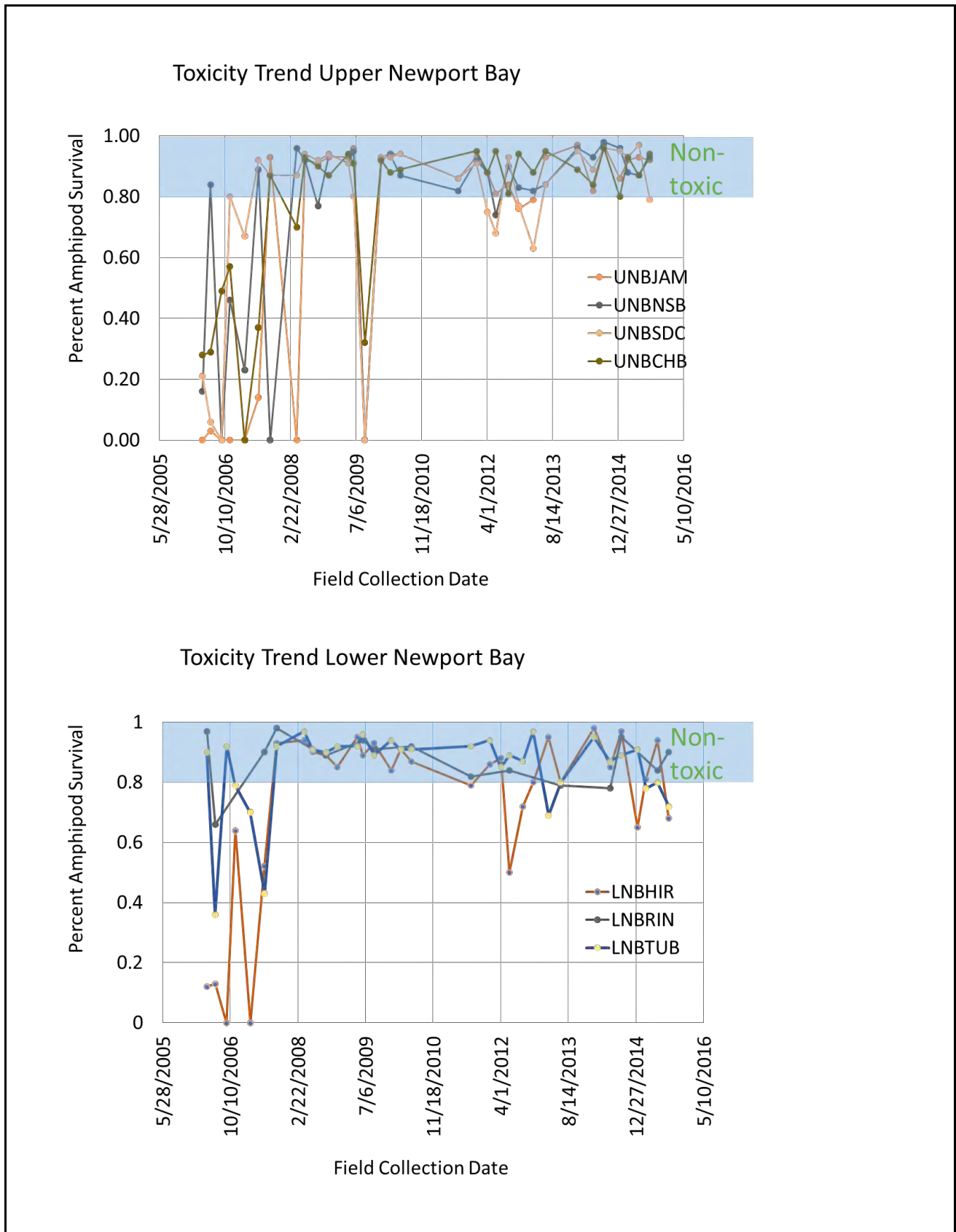


**Figure 2**  
Summary of Metals Concentrations in Newport Bay Sediment Relative to ERM Values  
Newport Bay Copper TMDLs and Non-TMDL Action Plans  
City of Newport Beach



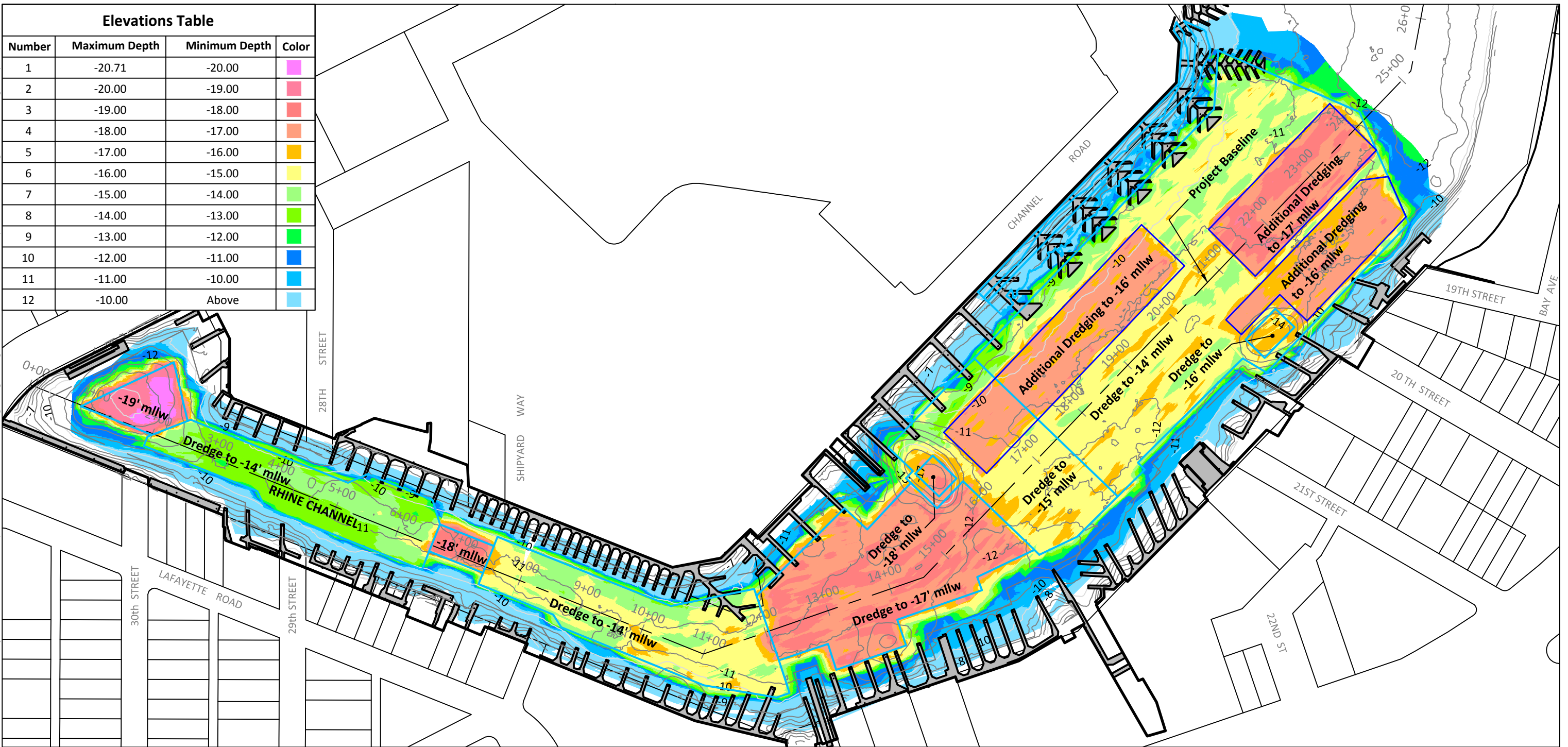
**Figure 2**  
Summary of Metals Concentrations in Newport Bay Sediment Relative to ERM Values  
Newport Bay Copper TMDLs and Non-TMDL Action Plans  
City of Newport Beach




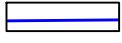
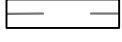



L:\AutoCAD Project Files\090243-01 Newport CAD\Rhine Channel\Dredge Progress Figures\090243-01-RP-086 Composite Elev Banding 11-1-2011.dwg Composite 11-1-11  
 Nov 15, 2013 9:00am mpratschner


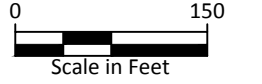
Elevations Table			
Number	Maximum Depth	Minimum Depth	Color
1	-20.71	-20.00	Pink
2	-20.00	-19.00	Light Pink
3	-19.00	-18.00	Red
4	-18.00	-17.00	Orange
5	-17.00	-16.00	Yellow
6	-16.00	-15.00	Light Green
7	-15.00	-14.00	Green
8	-14.00	-13.00	Light Blue
9	-13.00	-12.00	Blue
10	-12.00	-11.00	Dark Blue
11	-11.00	-10.00	Light Blue
12	-10.00	Above	White



**SOURCE:** Drawing prepared from City of Newport Beach and ESRI basemaps, and all Dutra surveys performed as of November 1, 2011.  
**HORIZONTAL DATUM:** California State Plane, Zone 6, NAD83, feet.  
**VERTICAL DATUM:** Mean Lower Low Water (MLLW).  
**NOTES:** Contours shown are from pre-dredge bathymetric survey conducted by Gahagan & Bryant Associates, Inc., on July 1, 2011.

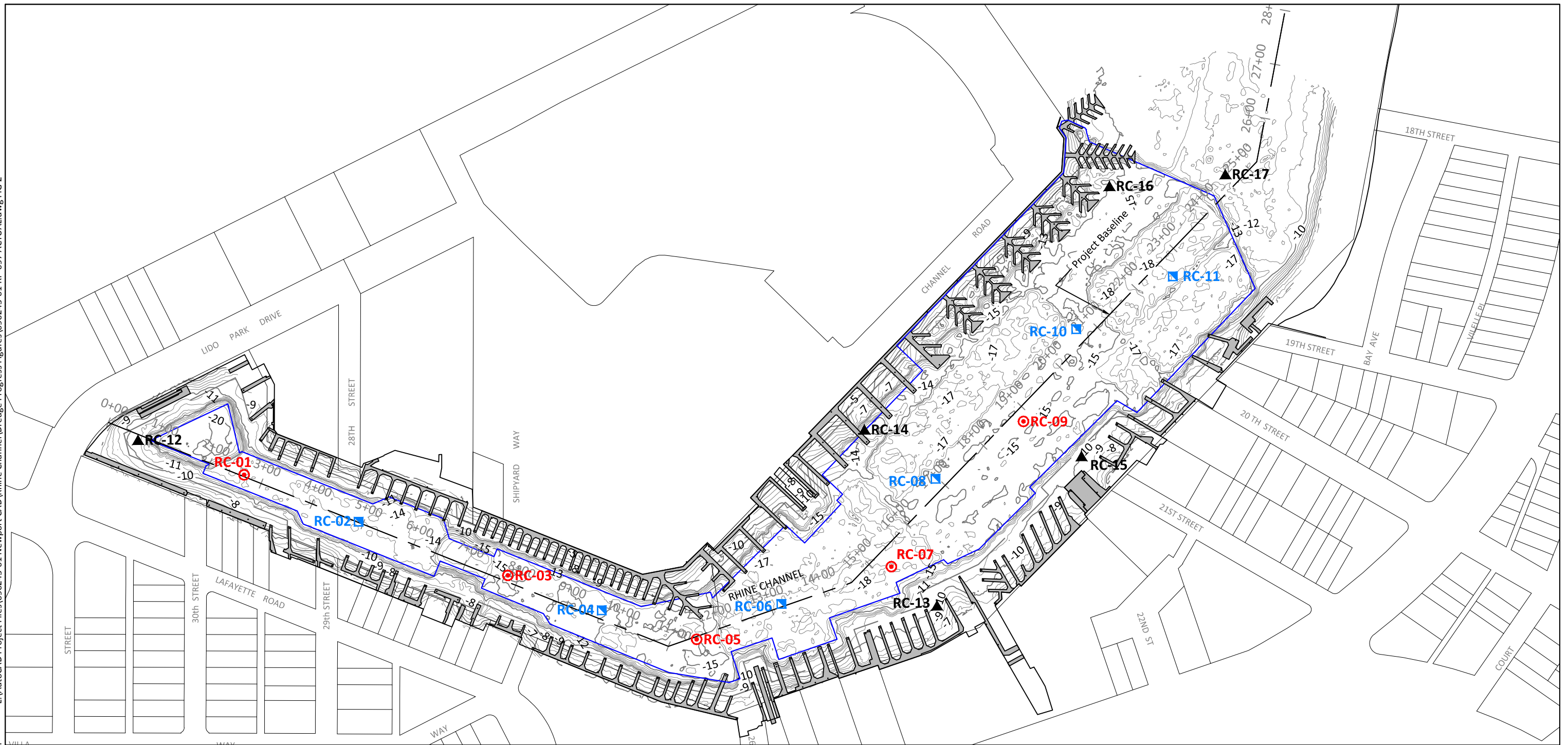
**LEGEND:**  
 Dredge Footprint  
 Additional Dredging  
 Limits of Work (Top of Slope)

 Existing Docks



**Figure 4**  
 Dredge Depths and Final Elevations within Rhine Channel  
 Newport Bay Copper TMDL and Non-TMDL Action Plans  
 City of Newport Beach



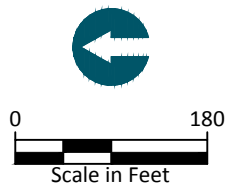
**SOURCE:** Drawing prepared from City of Newport Beach and ESRI basemaps, and all Dutra Surveys performed as of November 1, 2011.  
**HORIZONTAL DATUM:** California State Plane, Zone 6, NAD83, feet.  
**VERTICAL DATUM:** Mean Lower Low Water (MLLW).

**NOTES:**  
 Contours shown are from post-dredge bathymetric survey conducted by Gahagan & Bryant Associates, Inc., on November 2, 2011.

**LEGEND:**

- RC-# Actual Sampling Locations for Sediment Coring
- ▲ RC-# Actual Sampling Locations for Surface Sediment
- RC-# Actual Sampling Locations for Sediment Coring and Surface Sediment

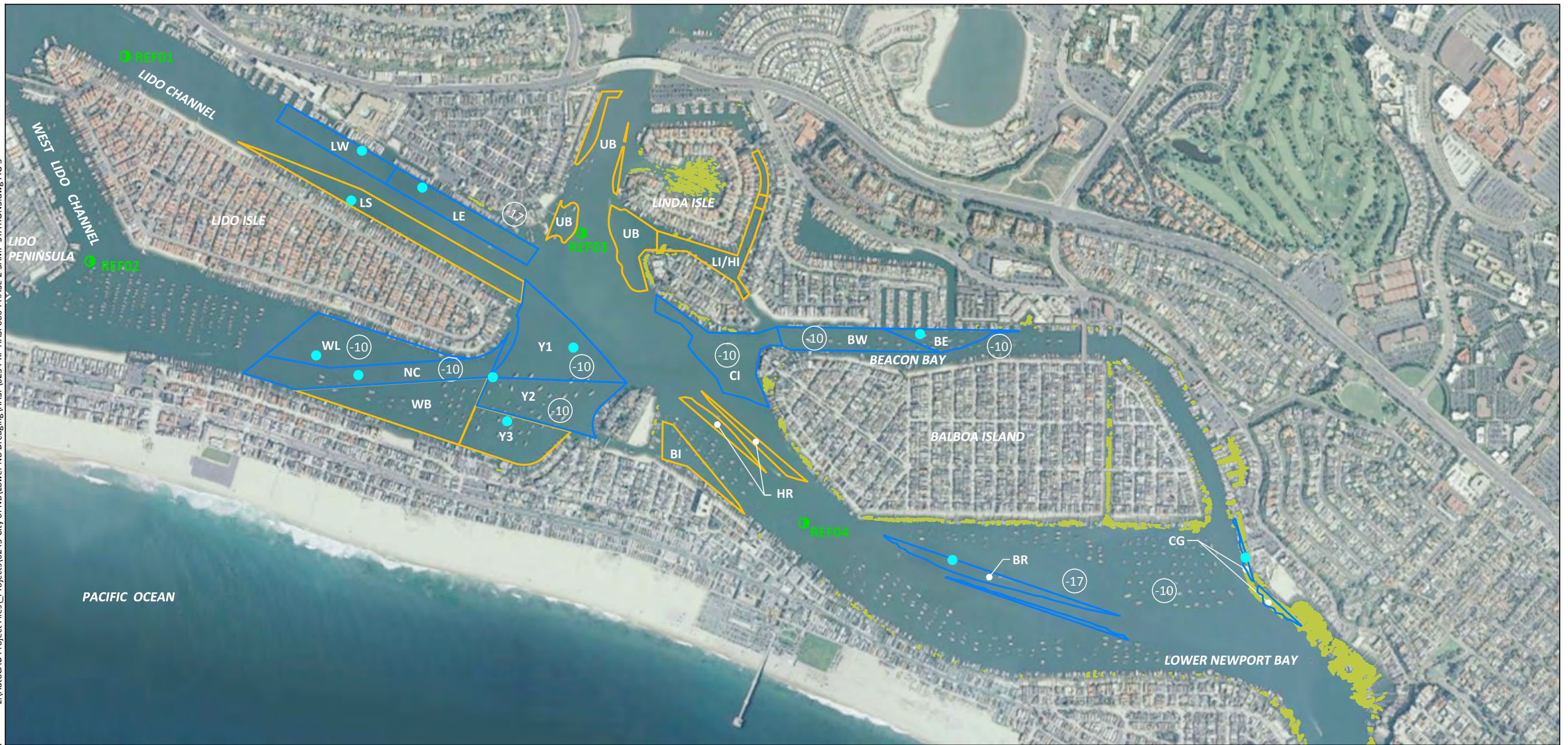
- 10 Post-Dredge Bathymetry
- Dredge Boundary



**Figure 5**  
 Post-Dredge Bathymetric Data and Actual Sampling Locations  
 Newport Bay Copper TMDLs and Non-TMDL Action Plans  
 City of Newport Beach

L:\AutoCAD Project Files\Projects\0243-City of NB\Lower NB Dredging\HASP\0234-RP HASP006-PHASE-2-SAMP-STATIONS.dwg FIG 3

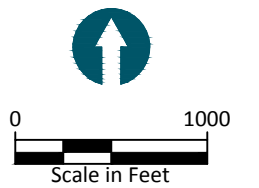
Jul 19, 2013 11:52am mpratschner



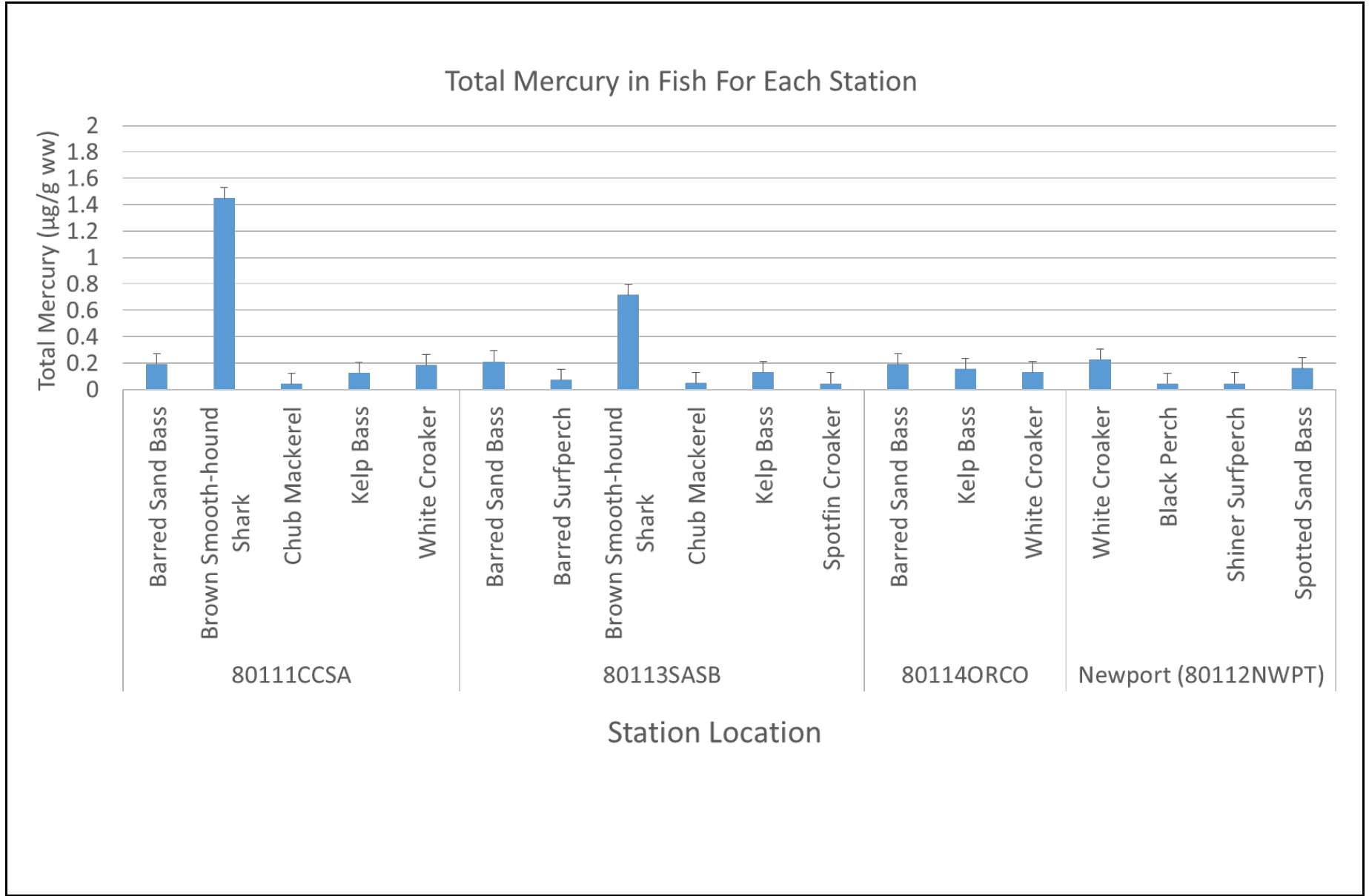
**SOURCE:** Drawing prepared from Bing maps. Dredge units from U.S. Army Corps of Engineers.  
**HORIZONTAL DATUM:** California State Plane, Zone 6, NAD83.  
**VERTICAL DATUM:** Mean Lower Low Water (MLLW).

**LEGEND:**

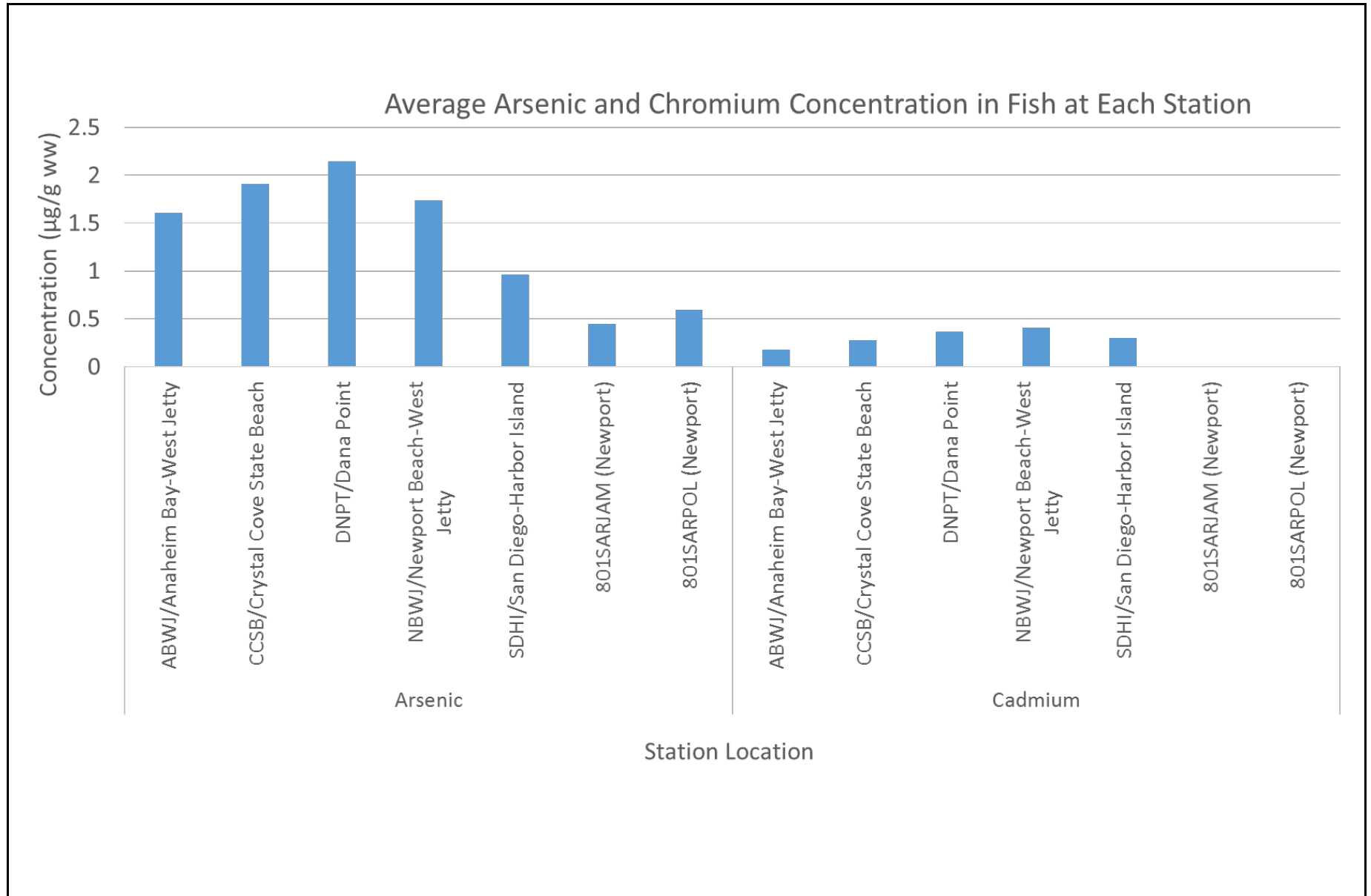
- Phase I Dredge Unit
- Phase II Dredge Unit
- 10 Dredge Depth
- REF# Reference Site
- Sampling Locations



**Figure 6**  
 Post-Dredge Sediment Sampling Locations  
 Newport Bay Copper TMDLs and Non-TMDL Action Plans  
 City of Newport Beach



**Figure 7**  
 Total Mercury in Fish for Each Station  
 Newport Bay Copper TMDLs and Non-TMDL Action Plans  
 City of Newport Beach



**Figure 8**  
 Average Arsenic and Chromium Concentration in Fish at Each Station  
 Newport Bay Copper TMDLs and Non-TMDL Action Plans  
 City of Newport Beach