that the leaching of tributyltin from boat hulls is also a major source of tributyltin in San Diego Bay. As a consequence of such boat hull leaching, other areas of San Diego Bay not subject to waste discharges from boatyards/shipyards were also found to contain tributyltin concentrations in excess of the State Board's 6 ng/l water quality criteria.

20. Oysters from Humboldt Bay were transplanted to numerous locations throughout San Diego Bay by Regional Board and Department of Fish and Game staff in order to evaluate the biological effects of tributyltin. The oysters were deployed in August, 1987 and collected in December, 1987. The most notable effects are growth reduction and a characteristic shell thickening response known as chambering. Chambering in oysters occurs at tributyltin concentrations as low as 0.15 ug/l and is believed to be a specific biological indicator of elevated concentrations of tributyltin. Because of the enormous amount of biological energy devoted to shell chambering, the edible muscle tissue remains small and the oysters are rendered commercially non-viable. Chambering oysters which are subsequently transplanted to clean waters resume normal growth. The shell thickness index is defined as the ratio of shell length to width and is a measure of the degree of chambering. A low index indicates a high degree of chambering; conversely, a high index indicates a lack of chambering. Upon collection, the oyster shells were measured and the edible tissue extracted and weighed. The results of the study are contained in the Department of Fish and Game's draft report and are summarized below:

Location	Station	Mean Shell Thickness Index	Tissue Weight
Bay Entrance	1-4	4.55-11.84 mm	0.91-7.02 grams
Shelter Island	5-6	4.64 mm	0.37 grams
Commercial Basin	7-9	3.85-6.59 mm	0.25-0.65 grams
Harbor Island South	10	4.04 mm	0.45 grams
Harbor Island West	11-13	3.84-6.50 mm	0.14-0.36 grams
Harbor Island East	16-22	4.31-5.30 mm	0.30-0.68 grams
Navy Channel	14-15	4.79-4.91 mm	0.62-1.30 grams
Glorietta Bay	23-25	3.94-5.28 mm	0.31-1.03 grams
7th Street	26-27	6.60-11.18 mm	0.60-2.0 grams
Sweetwater	28-32	6.71-9.13 mm	1.56-4.79 grams

21. The data cited in Finding 20 shows that the 11.84, 11.18, and 9.13 mm shell thickness indices at Stations 1, 27, and 30 in bay areas less influenced by tributyltin were markedly higher than the 3.85, 5.62, and 6.59 mm shell thickness indices found at Stations 7, 8, and 9 in Commercial Basin. The low shell thickness indices found in the Commercial Basin oysters indicates a high degree of chambering and is a direct result of the elevated tributyltin concentrations found in Commercial Basin. The Commercial Basin oysters also exhibited high mortality and apparently reduced edible tissue weights. Oysters transplanted to other areas of the bay having elevated tributyltin levels in the water column, for example in marinas, exhibited adverse biological effects similar to those observed in Commercial Basin. The Regional Board finds that the waste discharges from Bay City Marine did contribute to the adverse biological effects observed in oysters transplanted to Commercial Basin.

22. Biologists from the Moss Landing Marine Laboratory are currently evaluating the impact of boats on biological communities in San Diego Bay. The preliminary data (contained in the **Preliminary Data Report on Tributyltin and PCBs in San Diego Harbor, March 30, 1988**) reveal general patterns and show that dramatic biological changes have occurred in portions of San Diego Bay where boats are most numerous. In general, areas with high densities of boats such as Commercial Basin, are characterized by the lack of species diversification. Benthic fauna in Commercial Basin is dominated by serpulid tube worms, while other groups of organisms are reduced or absent. Overall, biomass is low and bare substrate is common. While the major emphasis of the study is on the effects of boat densities, with the concomitant leaching of antifouling agents into the bay, the Regional Board believes that the waste discharges containing tributyltin, copper and mercury from Bay City Marine contributed to the adverse biological effects cited in this study.

23. The Bay City Marine waste discharges caused the bay sediment concentrations of mercury and copper in the vicinity of Bay City Marine to exceed the AET sediment concentration criteria cited in Finding 15. The Bay City Marine waste discharges have also contributed to tributyltin concentrations in the water column of Commercial Basin exceeding the State Board's Water Quality Criteria of 6 ng/l. The Bay City Marine waste discharges have also contributed to increased chambering and reduced edible tissue weight in oysters transplanted to Commercial Basin. Furthermore the Bay City Marine waste discharges have contributed to substantial degradation in the biological communities of Commercial Basin. The Bay City Marine waste discharges have impaired the marine habitat and shellfish harvesting beneficial uses of the Commercial Basin portion of San Diego Bay. Based on the foregoing, the Regional Board finds and concludes that the waste discharges from Bay City Marine have caused a condition of pollution as defined in Water Code Section 13050 in the Commercial Basin portion of San Diego Bay. This constitutes a violation of Provision D.1 of Order No. 87-49.

24. Based on the above findings the Regional Board finds that Bay City Marine discharged waste to the Commercial Basin portion of San Diego Bay in violation of requirements set forth in Order No. 87-49.

25. This enforcement action is exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.) in accordance with Section 15321, Chapter 3, Title 14, California Administrative Code.

It Is Hereby Ordered, That in accordance with California Water Code Section 13304, Bay City Marine shall comply with the following directives:

1. Bay City Marine shall forthwith achieve compliance with Prohibition A.2, Discharge Specifications B.1 and B.2, and Provisions D.1 and D.12 of Order No. 87-49

2. Bay City Marine shall submit a detailed technical report for the approval of the Regional Board Executive Officer by September 1, 1988 demonstrating that the best management practices plan currently used at the facility is in full conformance with the requirements set forth in **Title 40, Code of Federal Regulations, Part 125, Subpart K-Criteria and Standards for Best Management Practices Authorized Under Section 304(e) of the Clean Water Act.** The

report shall identify the best management practices plan currently used at the facility and any facets of the best management practices plan currently in use that have proven to be ineffective in preventing the release of pollutants to San Diego Bay. The report shall also identify any changes proposed for the best management practices plan to prevent the discharge of pollutants to San Diego Bay in accordance with the terms and conditions of Order No. 87-49. If changes are proposed to the best management practices plan a filing fee for the modification of Order No. 87-49 to incorporate the changes shall also be submitted with the technical report.

3. Bay City Marine shall submit a report to the Regional Board no later than November 1, 1988 identifying a range of remedial action alternatives to cleanup contaminated bay sediment resulting from the discharge of waste from Bay City Marine. The report shall, at a minimum, contain a detailed analysis of the cost, feasibility, and lateral and vertical extent of contaminated sediment associated with cleanup strategies a), b), and c) described below. In addition to the evaluation of these cleanup strategies Bay City Marine may propose an alternate cleanup strategy by evaluating the criteria described in item d) below. The Regional Board will evaluate the information submitted in the report and select a cleanup level for the contaminated sediment.

a) Removal and/or treatment of the contaminated sediment to attain the following background concentrations of mercury, copper, and tributyltin in the bay sediment described in Finding 10:

Constituent	Dry Weight Concentration
Mercury	0.81 mg/kg
Copper	53 mg/kg
Tributyltin	193 ng/g

b) Removal and/or treatment of the contaminated sediment to attain the following Apparent Effects Threshold (AET) dry weight sediment concentrations for copper and mercury described in Finding 15 and the State Water Resources Control Board's proposed water quality criteria for tributyltin described in Finding 18:

Constituent	Concentration
Mercury	0.49 mg/kg
Copper	170 mg/kg
Tributyltin	6 ng/l

Under this alternative it will be necessary to ascertain the degree of tributyltin migration from the sediments to the water column that will occur and to demonstrate that any tributyltin migration will not cause the 6 ng/l water quality criteria to be exceeded in either the water column or the interstitial water found within the sediment.

c) Removal and/or treatment of contaminated sediment to attain the following Ocean Plan water

quality objectives for copper and mercury described in Finding 6 and the State Water Resources Control Board's proposed water quality criteria for tributyltin described in Finding 18 in the water column and interstitial water:

Constituent	Concentration
Mercury	0.14 µg/l
Copper	5 µg/l
Tributyltin	6 ng/l

Under this alternative it will be necessary to ascertain the degree of copper, mercury, and tributyltin migration from the sediments to the water column that will occur and to demonstrate that any copper, mercury, and tributyltin migration will not cause the above concentrations to be exceeded in either the water column or the interstitial water found within the sediment.

d) Any remedial action alternative proposing the attainment of copper, mercury, and tributyltin concentrations in the sediment, water column and interstitial water that would comply with the following criteria:

1. The proposed copper, mercury, and tributyltin concentrations to be attained in the affected San Diego Bay sediment contamination zone will not alter the quality of San Diego Bay waters to a degree which unreasonably affects the beneficial uses of San Diego Bay.

2. The proposed copper, mercury, and tributyltin concentrations to be attained in the sediment contamination zone will be consistent with the maximum benefit to the people of the state.

3. The proposed copper, mercury, and tributyltin concentrations to be attained in the sediment contamination zone will not result in water quality less than prescribed in the Basin Plan, Ocean Plan or other prescribed policies.

4. Bay City Marine shall no later than May 1, 1989 cleanup the contaminated bay sediment to the level prescribed by the Regional Board under Directive 3 of this order.

5. Bay City Marine shall no later than March 1, 1989 submit a post-cleanup sampling plan to verify the attainment of the prescribed cleanup standards in the area of sediment contamination defined under Directive 3 of this order. Upon the approval of the sampling plan by the Regional Board Executive Officer, Bay City Marine shall collect and analyze the samples prescribed in the sampling plan. The post cleanup sampling results shall be submitted to the Regional Board no later than July 1, 1989.

6. Bay City Marine shall upon implementation of the selected cleanup alternative, submit cleanup progress reports to the Regional Board on a quarterly basis, until in the opinion of the Regional Board Executive Officer, the cleanup of the contaminated sediment has been completed. The reports shall contain information discussing the progress made toward attaining the final selected cleanup criteria for the bay sediment. Specific information to be included in the quarterly progress reports

will be determined by the Regional Board Executive Officer upon the selection of the sediment cleanup standard. The reports shall be submitted in accordance with the following reporting schedule:

Reporting Schedule	Report Due
January, February, March	April 30
April, May, June	July 30
July, August, September	October 30
October, November, December	January 30

7. Bay City Marine shall dispose of all contaminated sediment in accordance with all applicable state and federal regulations.

Provision

1. Bay City Marine is located on lands owned by the San Diego Unified Port District. The Port District is a governmental agency. In addition the current lease for Bay City Marine requires that Bay City Marine comply with any applicable laws of the State of California. Thus under Water Code Section 13304, the Regional Board may name the Port District as a responsible party for the purposes of compliance with this order. The Regional Board will amend this order to include the Port District as a responsible party only if Bay City Marine fails to comply with the terms and conditions of this cleanup and abatement order and the Port District fails to promptly use its governmental powers to achieve compliance with this cleanup and abatement order.

Ordered by Ladin H. Delaney
Ladin H. Delaney
Executive Officer

Dated: June 30, 1988

JBM:DSJ:DTB

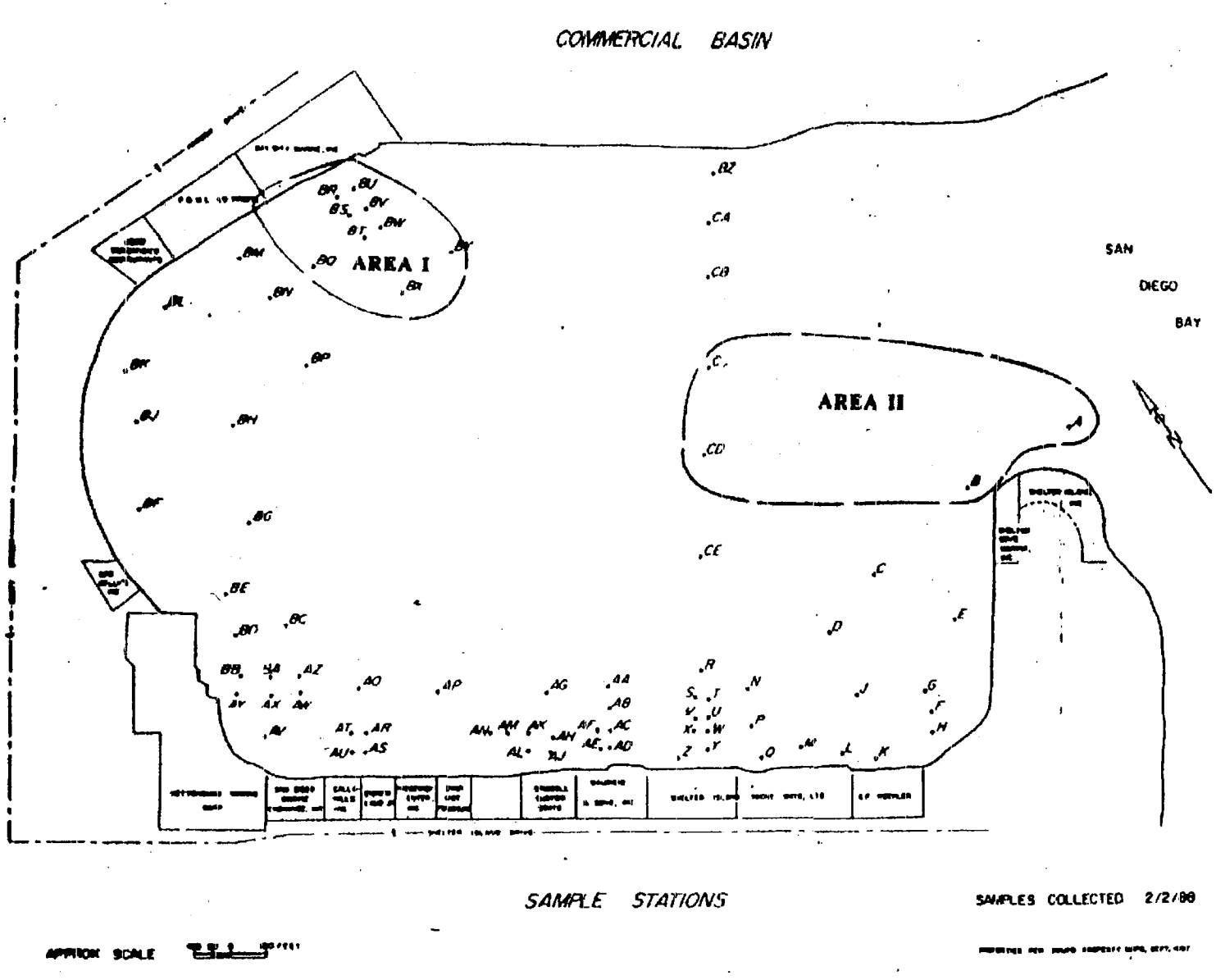


FIGURE 1. Commercial Basin, showing location of stations where sediment samples have been collected. The sediment at stations within Area I has been significantly affected by waste discharges from Bay City Marine, Inc. Stations within Area II are believed to be least influenced by the boatyards of Commercial Basin, and are considered to represent "background conditions".

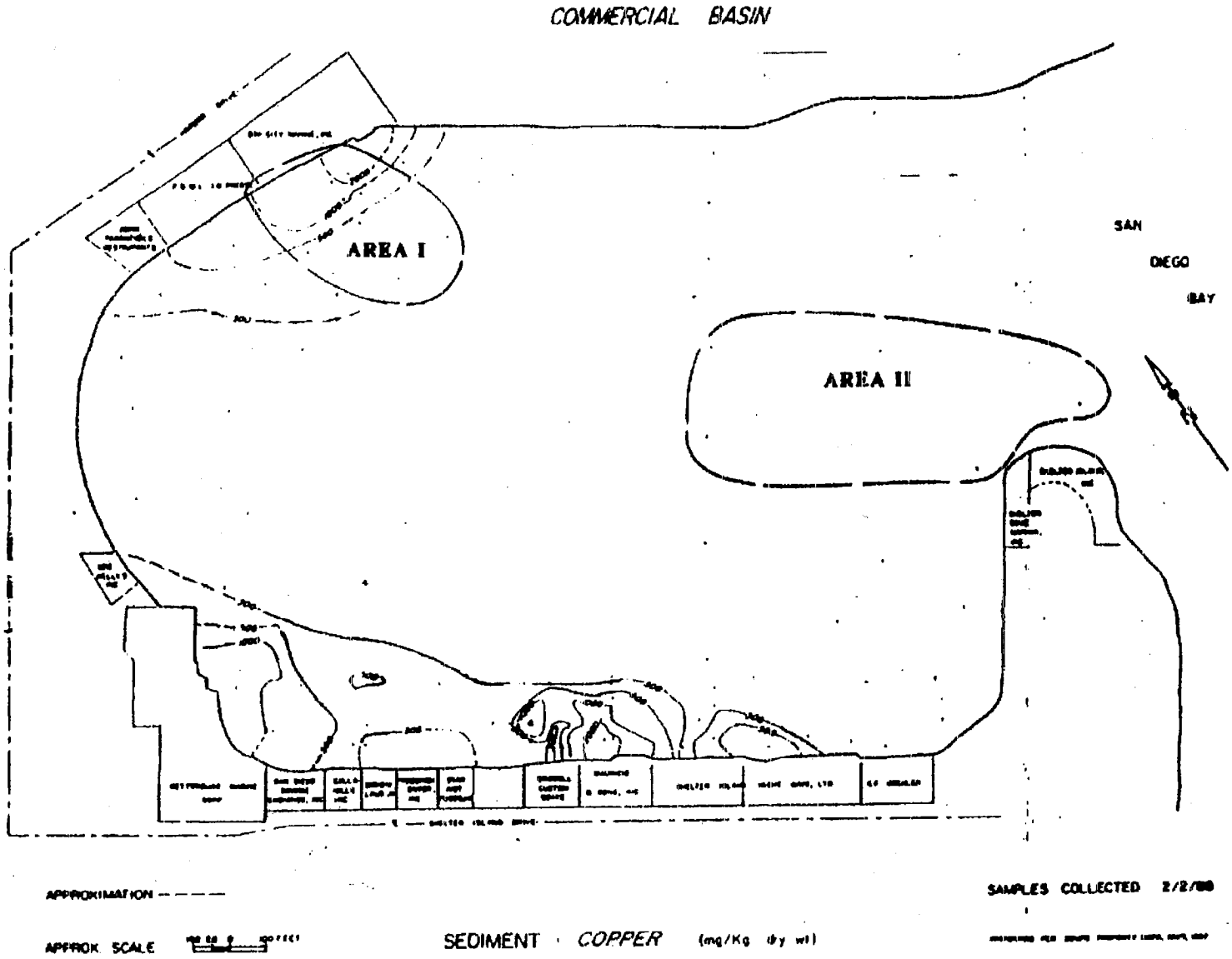


FIGURE 2. Concentration of Copper (mg/Kg) found within surficial sediments of Commercial Basin. The sediment at stations within Area I has been significantly affected by waste discharges from Bay City Marine, Inc. Stations within Area II are believed to be least influenced by the boatyards of Commercial Basin, and are considered to represent "background conditions".

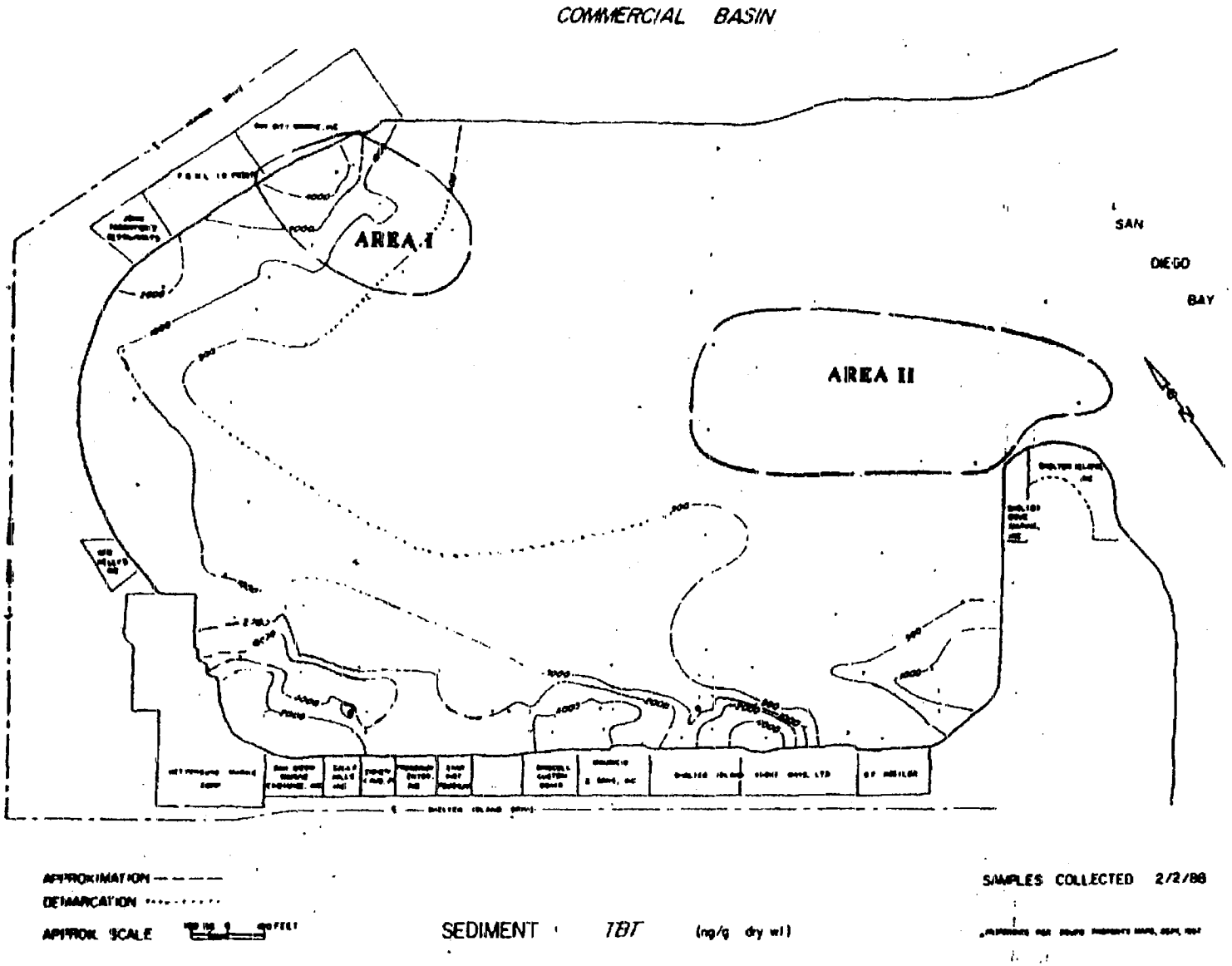


FIGURE 3. Concentration of Tributyltin (ng/g) found within surficial sediments of Commercial Basin. The sediment at stations within Area I has been significantly affected by waste discharges from Bay City Marine, Inc. Stations within Area II are believed to be least influenced by the boatyards of Commercial Basin, and are considered to represent "background conditions".

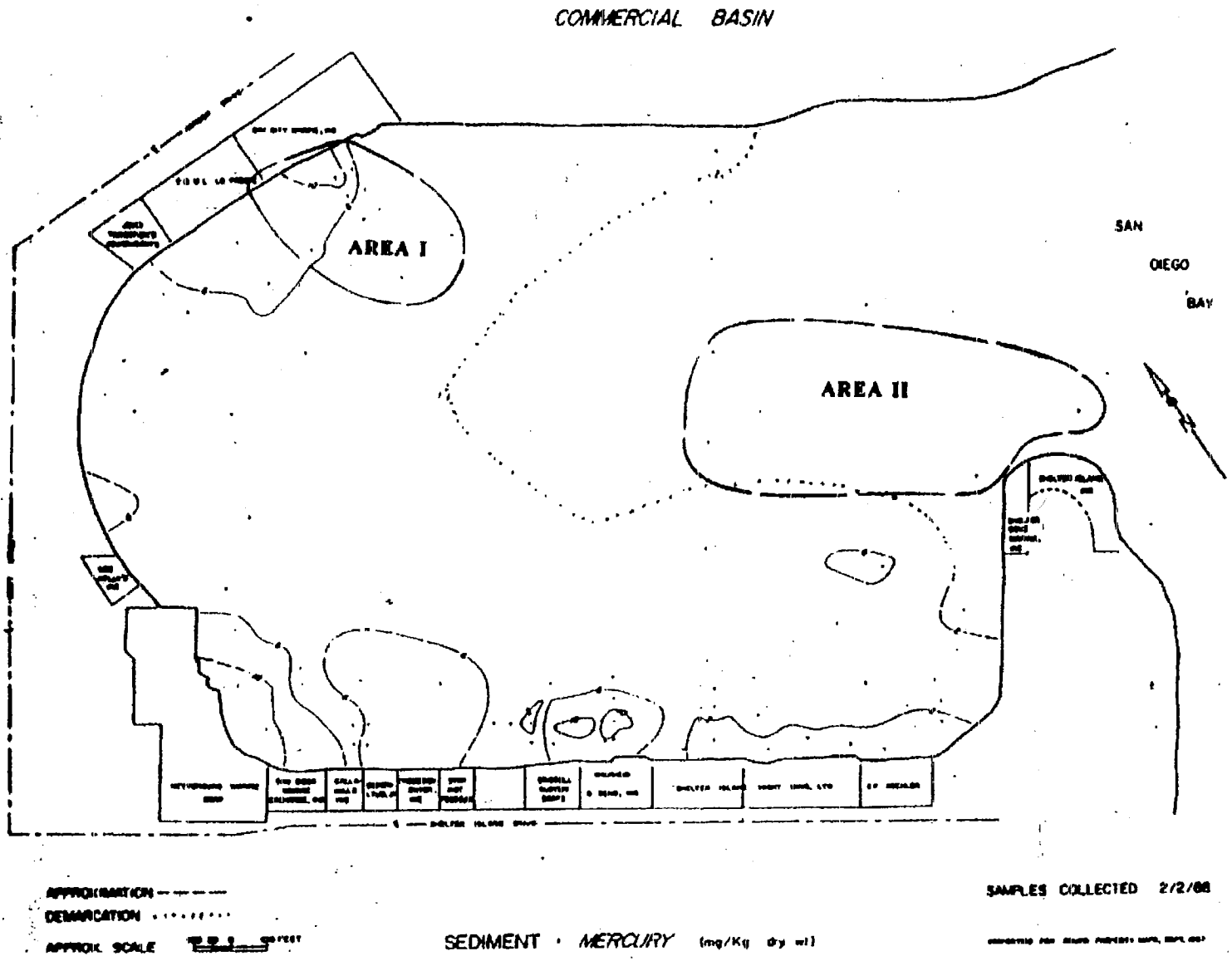


FIGURE 4. Concentration of Mercury (mg/Kg) found within surficial sediments of Commercial Basin. The sediment at stations within Area I has been significantly affected by waste discharges from Bay City Marine, Inc. Stations within Area II are believed to be least influenced by the boatyards of Commercial Basin, and are considered to represent "background conditions".

STATE OF CALIFORNIA PETE WILSON, Governor
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION
9771 Clairemont Mesa Blvd., Ste B
San Diego California 92124-1331
Telephone (619) 265-5114

CERTIFIED MAIL - RETURN RECEIPT REQUESTED
P 788 880 648

December 13, 1991

Mr. Thomas Driscoll
Driscoll Custom Boats
2438 Shelter Island Drive
San Diego, CA 92106

Dear Mr. Driscoll:

ADDENDUM NO. 2 TO CLEANUP AND ABATEMENT ORDER NO. 89-31

Enclosed is a copy of Addendum No. 2 to Cleanup and Abatement Order No. 89-31 which was adopted by the Regional Board on December 9, 1991. Addendum No. 2 to Cleanup and Abatement Order No. 89-31 establishes the cleanup levels for Driscoll Custom Boats.

If you have any questions regarding this matter, please contact Mrs. Kristin K. Schwall of my staff at the above number.

Very Truly Yours,

for

ARTHUR L. COE
Executive Officer

enclosure

cc with enclosure:

Steven P. McDonald
Luce, Forward, Hamilton & Scripps
110 West A Street
San Diego, CA 92101

Mr. Don Nay, Director
San Diego Unified Port District
P.O. Box 488
San Diego, CA 92112

Mr. Jeremy Johnstone
Environmental Engineer
Water Management Division, Compliance Branch (W5-3)
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, California 94105

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

ADDENDUM NO. 2
TO
CLEANUP AND ABATEMENT ORDER NO. 89-31

DRISCOLL CUSTOM BOATS
SAN DIEGO COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board) finds that:

1. On March 3, 1989, the Regional Board Executive Officer issued Cleanup and Abatement Order No. 89-31 for Driscoll Custom Boats. Cleanup and Abatement Order No. 89-31 contains findings alleging that boat repair and maintenance activities at Driscoll Custom Boats have resulted in waste discharges to Commercial Basin in San Diego Bay. These waste discharges are alleged to have created a condition of pollution in violation of discharge prohibitions adopted by the Regional Board pursuant to California Water Code Section 13243.

2. On July 10, 1989, the Regional Board Executive Officer issued Addendum No. 1 to Cleanup and Abatement Order No. 89-31. This addendum revised the compliance dates and directives contained in the cleanup and abatement order.

3. Cleanup and abatement orders were issued to seven boatyards in Commercial Basin in the period from June, 1988 to March, 1989, for the discharge of boatyard waste causing elevated levels of copper, mercury and tributyltin (TBT) in Commercial Basin sediment. The seven boatyards were Bay City Marine, Driscoll Custom Boats, Eichenlaub Marine, Kettenburg Marine, Koehler Kraft, Mauricio and Sons, and Shelter Island Boatyard. Each boatyard was required, by the cleanup and abatement orders, to prepare a remedial action alternatives analysis report (RAAAR) to evaluate a range of sediment cleanup levels and to recommend a cleanup alternative. Final RAAARs were submitted by October, 1990, which presented information on the extent of contaminated sediment in Commercial Basin and possible cleanup levels. The table below indicates when each report was submitted and which consulting firm prepared it.

BOATYARD	CONSULTANT	DATE SUBMITTED
Shelter Island	PTI Environmental Services	6-30-89 & 1-90
Koehler Kraft	Dr. William Bretz, Ph. D.	6-8-90
Bay City Marine	Woodward-Clyde Consultants	10-12-90
Eichenlaub Marine	Woodward-Clyde Consultants	10-12-90
Kettenburg Marine	Woodward-Clyde Consultants	10-12-90
Mauricio & Sons	Woodward-Clyde Consultants	10-12-90
Driscoll Custom	ERC Environmental and Energy Services Company	10-17-90

BACKGROUND SEDIMENT CONCENTRATIONS

4. Copper, mercury, and TBT can be discharged to San Diego Bay by many sources in addition to boatyard sources. Sediment background concentrations can be influenced by the continuous leaching of copper and TBT from the antifouling paint on the hulls of vessels moored in Commercial Basin. Additional copper and TBT can be discharged by underwater hull cleaning activities. Discharges from storm drains can contain high concentrations of many pollutants. Background sediment concentrations should be determined for an area with similar sources absent boatyard sources. These background sediment concentrations are used to evaluate which concentrations of copper, mercury, and TBT are due to the boatyard discharges and which are due to discharges from other sources.

5. The Commercial Basin boatyard cleanup and abatement orders established background levels as 63 mg/kg (dry weight) for copper, 0.81 mg/kg (dry weight) for mercury, and 193 ug/kg (dry weight) for TBT. The Regional Board's background stations, designated as stations A, B, CC, and CD, were located in the center of Commercial Basin and near the entrance in an area believed to be uninfluenced by waste discharges from boatyards.

6. The ERCE (ERC Environmental and Energy Services Company) RAAAR for Driscoll Custom Boats states that Shelter Island Yacht Basin experiences conditions similar to those in Commercial Basin except there are no boatyards in Shelter Island Yacht Basin. ERCE conducted a study to determine the background levels in Shelter Island Yacht Basin. The results of 20 samples in Shelter Island Yacht Basin showed that average background sediment concentrations in Shelter Island Yacht Basin were 96.3 mg/kg (dry weight) for copper, 0.64 mg/kg (dry weight) for mercury, and 52.5 ug/kg (dry weight) for TBT.

7. In June, 1989, the Regional Board conducted a study of the

drainage patterns of Shelter Island Drive to determine the discharge point of any boatyard waste discharged to the street. The Regional Board study concluded that wastes potentially discharged to Shelter Island Drive from Mauricio and Sons, Driscoll Custom Boats, Shelter Island Boatyard, and Koehler Kraft could be discharged to Shelter Island Yacht Basin. Therefore, Shelter Island Yacht Basin may have some influence from the boatyards, but this influence is only in the portion of the basin nearest to Shelter Island Drive. The majority of the basin is not affected by waste discharges from the boatyards.

8. The PTI (PTI Environmental Services) RAAAR for Shelter Island Boatyard stated that the Regional Board's background stations were too near the entrance to the basin and would experience too much dynamic tidal influence. This RAAAR contends that the additional tidal influence near the basin entrance could cause a reduction in the concentrations of contaminants present in the sediments there. The PTI RAAAR proposes that a suitable area for determining background concentrations occurs close to the Shelter Island Boatyard, bounded by the central anchorage area on the north-east and the Shelter Island Boatyard docks on the south-west. The copper in this region was found to be between 100 mg/kg (dry weight) and 360 mg/kg (dry weight) with an average of 254 mg/kg (dry weight) for 12 samples. Mercury and TBT were not evaluated to determine background levels due to the lack of analyses for these constituents.

9. PTI's background copper concentrations described in Finding No. 9 above are all higher than both background levels established by the Regional Board for Commercial Basin (see Finding 6 above) and by ERCE for Shelter Island Yacht Basin (see Finding 7 above). The Regional Board believes that the sediment in the area sampled by PTI may have been influenced by boatyard discharges from Shelter Island Boatyard, Mauricio and Sons, and Driscoll Custom Boats, and thus would not provide a suitable indication of background conditions.

10. The Regional Board concurs with the findings of the ERCE RAAAR that Shelter Island Yacht Basin has conditions which are quite similar to those in Commercial Basin. Both are small enclosed basins adjacent to San Diego Bay. Both basins receive rainfall runoff and miscellaneous flows from storm drains in similar areas of San Diego. Both basins also have large boat harboring facilities and considerable boat traffic. The ERCE study of Shelter Island Yacht Basin has a larger sample base of 20 sample stations, compared to the Regional Board's 4 stations in Commercial Basin and Shelter Island Boatyard's 12 stations in Commercial Basin. Using the information in the ERCE study of Shelter Island

Yacht Basin (see Finding 7 above), the Regional Board concludes that the background sediment concentration for Commercial Basin should be 96.3 mg/kg (dry weight) for copper, 0.64 mg/kg (dry weight) for mercury, and 52.5 ug/kg (dry weight) for TBT.

TRIBUTYLTIN (TBT) STUDY RESULTS

11. The Naval Ocean Systems Center (NOSC) has been conducting a large scale series of studies on tributyltin (TBT) contamination and potential environmental impacts associated with TBT in San Diego Bay.

12. One of the reports discussed in the Woodward-Clyde RAAAR is the NOSC report titled, Ecological Evaluation of Organotin-Contaminated Sediment, July 1985, which evaluates the prospects of ocean disposal for organotin-contaminated sediment. The test sediment sample was collected in Commercial Basin off the Shelter Island Boatyard docks. Particulate-phase tests were conducted with the species Acanthomysis sculpta (mysid), Citharichthys stigmaeus (flatfish), and Acartia tonsa (copepod). Solid-phase tests were conducted with the species Acanthomysis sculpta (mysid), Macoma nasuta (clam), and Neanthes arenaceodentata (polychaete worm). These tests all had high survival rates for Commercial Basin sediment containing 780 ug/kg TBT, 210 mg/kg copper, and 2.7 mg/kg mercury. These tests also showed significant bioaccumulation for TBT and copper but not for mercury. The report stated that the environmental significance of the bioaccumulation estimate is unclear, and therefore, concluded that this Commercial Basin sediment should not have significant impact on the marine environment if discharged into ocean waters.

13. The NOSC report titled, Utility of Mussel Growth in Assessing the Environmental Effects of Tributyltin, April 1990, discusses a series of seven juvenile mussel field transplant experiments conducted in San Diego Bay from 1987 through 1989. One site in Shelter Island Yacht Basin and one site in Commercial Basin were among the locations studied. The results at these two sites showed higher mean seawater TBT concentrations in surface waters than in deeper waters. Mussel bioaccumulation of TBT was also greater and growth rates lower for these sites in surface water when compared to deeper water. The data also indicate a decrease in mean seawater TBT concentrations in Shelter Island Yacht Basin from 530 ng/l in 1987 to 59 ng/l in 1989. Limited data on Commercial Basin appears to indicate the same decreasing trend in mean seawater TBT concentration. The Commercial Basin mean seawater TBT concentration for deeper

water was reported as 32 ng/l for August through October, 1989.

14. The California Department of Food and Agriculture adopted regulations for TBT in January of 1988. The California regulations require 1) the use of TBT paints with release rates of 5 ug/cm^2/day or less, 2) the application of TBT paints by certified commercial applicators and 3) the application of TBT paints only on vessels at least 25 meters (82 feet) in length and on aluminum hulls and vessel parts. Federal legislation and regulations came out in June of 1988, and September of 1988 respectively. Federal regulations limit TBT release rates to 4 ug/cm^2/day and the application of TBT antifouling paints to vessels 25 meters (82 feet) in length or larger.

15. The State Water Resources Control Board (State Board) issued a report titled "Tributyltin, a California Water Quality Assessment," dated December 1988. This report quoted studies which showed the TBT half life to be as short as 4 to 20 days in salt water, and 100-200 days in marine sediment. The report also established a water quality criteria of 6 ng/l in the marine water column.

16. TBT levels in Commercial Basin sediments appear to have decreased markedly from February of 1988 when the Regional Board sampled the sediment until the time the boatyards sampled the sediment in early 1989 through early 1990, as shown in the following table.

BOATYARD	REGIONAL BOARD SAMPLE TBT RESULTS (ug/kg)	DATES	BOATYARD SAMPLE TBT RESULTS (ug/kg)	DATES
Shelter Island	273 - 6,187	2-2-88	3.1-7.4	2-89,4-89
Koehler Kraft	70 - 1,752	2-2-88	38-434	2-90
Bay City Marine	375 - 6,029	2-2-88	0.9-22	2-89,4-89
Eichenlaub Marine	827 - 12,910	2-2-88	0.9-1.5	2-89,4-89
Kettenburg Marine	1,102 - 7,177	2-2-88	1.0-11	2-89,4-89
Mauricio & Sons	958 - 9,607	2-2-88	0.7-19	2-89,4-89
Driscoll Custom	907 - 9,871	2-2-88	4.6-590	10-89,11-89

17. Regional Board staff believes that this apparent reduction in TBT concentrations in the sediment is due to the following factors:

    a. The application of TBT antifouling paints on boats under 25 meters (82 feet) is now prohibited. A large proportion of the boats found in Commercial Basin are under 25 meters (82 feet) and are prohibited from using TBT antifouling paints. These small boats should not

be releasing TBT into the water through leaching, underwater hull cleaning, or other maintenance activities on these boats. Therefore, a large source of TBT has been eliminated from Commercial Basin.

b. TBT undergoes rapid natural degradation in the environment. Depending on environmental conditions, tributyltin is eventually degraded into dibutyltin, monobutyltin, and ultimately to elemental tin. The half life of TBT has been shown to be as short as 4 to 20 days in salt water, and 100-200 days in marine sediment. Tributyltin is one to two orders of magnitude more toxic than dibutyltin, which is more toxic than monobutyltin. With the prohibition of the use of TBT antifouling paints on small boats, it is believed that natural degradation will reduce TBT levels to acceptable levels in a relatively short period of time.

c. NOSC data indicate that a decrease has occurred in mean seawater TBT concentrations in Shelter Island Yacht Basin from 530 ng/l in 1987 to 59 ng/l in 1989. Limited data on Commercial Basin appears to indicate the same decreasing trend in mean seawater TBT concentration.

18. The Regional Board believes that the TBT contamination in the Commercial Basin sediments has been greatly reduced due to natural degradation processes and the elimination of the use of TBT in paint for small boats such as the size found in Commercial Basin. The water column TBT concentration in Commercial Basin is expected to be below the level which would adversely affect the beneficial uses. The Regional Board believes that it is not necessary to establish a cleanup level for TBT in Commercial Basin.

COPPER AND MERCURY STUDY RESULTS

19. The Woodward-Clyde RAAAR contained a sediment biological effects study prepared by Kinnetic Laboratories, Inc. One sediment station at each client boatyard (Bay City Marine, Kettenburg Marine, Eichenlaub Marine, and Mauricio and Sons Marine) and one reference station in the center of the basin were used in this study. Benthic infaunal counts, an amphipod sediment toxicity test, and a bivalve larvae sediment elutriate test were performed for each station. The amphipod 10-day survival and reburial test used the species Grandidierella japonica following the test procedures described in Swartz et al. (1985). The 48-hour bivalve larvae survival and shell abnormality test used a

1:4 sediment to water elutriate mixture as described in ASTM Test Method E-724-80. The sediment biological effects study prepared for the Woodward-Clyde RAAAR concluded that there were no significant adverse biological effects associated with sediment containing 530 mg/kg (dry weight) of copper and 4.8 mg/kg (dry weight) of mercury.

20. PTI's RAAAR for Shelter Island Boatyard also performed a sediment biological effects study. PTI's RAAAR used eleven sample stations. A benthic infaunal count, and an amphipod sediment toxicity test were performed for each station. The 10-day survival, avoidance, and reburial test used the species Rhepoxynius abronius following the test procedures described in Swartz et al. (1985) as amended by Chapman and Becker (1986). Only two stations, far removed from the greatest boatyard activities, exhibited any chronic effects in the amphipod tests. Two additional stations exhibited depressed infaunal diversity and numbers near the boatyard activities. The copper and mercury concentrations of the four stations which showed adverse test results are lower than the concentrations at one station which showed no adverse results. It appears that the adverse test results were not caused by copper and mercury concentrations, but resulted from high sand content, low organic content, or other pollutants. PTI's RAAAR reported that high amphipod survival and no depression in infaunal assemblage were found in the sediment from the area adjacent to Shelter Island Boatyard with the sediment metal concentrations of 275 mg/kg (dry weight) for copper, 4.2 mg/kg (dry weight) for mercury, and 23 ug/kg (dry weight) for TBT.

21. The Woodward-Clyde RAAAR addressed bioaccumulation in one water column bivalve, four species of benthic invertebrates, two species of water column fish, and three species of bottom dwelling fish. Specimens were collected at each client boatyard (Bay City Marine, Kettenburg Marine, Eichenlaub Marine, and Mauricio and Sons Marine) and one reference station in the center of the basin. Tissues were then analyzed for copper and mercury. Bioaccumulation of copper was found to be significant only in the bubble snail, but an adverse effect level for tissue burden was not defined. An action level for copper has not been developed by the U.S. Food and Drug Administration (FDA), but the FDA action level for mercury in oysters of 1.0 mg/kg was not exceeded in any of the organisms sampled in Commercial Basin. The major food items of brown pelicans, topsmelt and anchovies, had no detectable levels of mercury in their tissue and appear to pose little if any risk of bioaccumulation of mercury to these birds. The study concluded that there is little if any risk of copper and mercury bioaccumulation from the Commercial Basin sediments.

22. The ERCE RAAAR for Driscoll Custom Boats analyzed State of California Mussel Watch data from Commercial Basin and Shelter Island Yacht Basin collected from 1977 through 1988. Mussel watch data was then compared to sediment contaminant concentrations. Sediment in Commercial Basin near the mussel watch stations averaged 947 mg/kg copper and 6.75 mg/kg mercury. Sediment in Shelter Island Yacht Basin averaged 96.3 mg/kg copper and 0.64 mg/kg mercury. The report concluded that mussels exposed in Commercial Basin and in Shelter Island Yacht Basin contained similar tissue concentrations of metals despite the much higher sediment metals concentrations in Commercial Basin.

WATER QUALITY STANDARDS

23. Several of the RAAARs examined the sediment concentrations which would not cause the following concentrations to be exceeded in the water column; 3 ug/l for copper, 0.04 ug/l for mercury, and 6 ng/l for TBT. At the time of these reports there were no applicable numerical water quality standards for enclosed bays such as San Diego Bay. Therefore, these water quality standards were taken from the "Water Pollution Control Plan, Ocean Waters of California, 1988" and from the report titled, "Tributyltin a California Water Quality Assessment," December 1988.

24. The State Board adopted the "1991, California Enclosed Bays and Estuaries Plan, Water Quality Control Plan for Enclosed Bays and Estuaries of California" (Enclosed Bays and Estuaries Plan) on April 11, 1991. This Enclosed Bays and Estuaries Plan contains numerical water quality standards which are applicable to San Diego Bay; a 1-hour average of 2.9 ug/l for copper, a 1-hour average of 2.1 ug/l for mercury, a 30-day average of 25 ng/l for mercury, and a 30-day average of 5 ng/l for TBT.

25. The Woodward-Clyde RAAAR, Driscoll Custom Boats RAAAR, and the Shelter Island RAAAR attempted to define a relationship between sediment concentrations and interstitial water concentrations. The results of these analyses are summarized in the table below. Woodward-Clyde and Driscoll Custom Boats developed vastly different numbers for the copper relationship. Woodward-Clyde developed the only mercury relationship, because all of the interstitial water samples for Driscoll Custom Boats were below the detection limit for mercury. The Shelter Island Boatyard RAAAR reported that, due to the uncertainties and number of variables, a relationship between sediment concentration and interstitial water concentration could not accurately be

developed for metals such as copper and mercury. The variables and factors involved in the metal sorption process in sediments are quite complex, and are not entirely understood at this time. The Regional Board believes that an accurate relationship was not developed between sediment concentration and interstitial water concentration for copper or mercury.

	Woodward-Clyde		Driscoll Boats		Shelter Island	
	Sediment mg/kg	Water ug/l	Sediment mg/kg	Water ug/l	Sediment mg/kg	Water ug/l
Copper	378	3	.849	3	none	3
Mercury	3.5	0.04	none	0.04	none	0.04
TBT	none	0.006	0.01	0.006	0.01-0.0229	0.006

APPARENT EFFECTS THRESHOLD (AET)

26. In September of 1988, a report titled "Sediment Quality Values Refinement: Volume I; 1988 Update and Evaluation of Puget Sound AET" was published for the Puget Sound Estuary Program, U.S. Environmental Protection Agency. The report was prepared by PTI Environmental Services with funding from the National Estuary Program, U.S. Environmental Protection Agency. The 1988 AET sediment concentrations in dry weight for copper and mercury are listed below. An AET for TBT was not developed in this report.

Chemical	Amphipod AET Values	Oyster AET Values	Benthic AET Values
Copper	1,300 mg/kg	390 mg/kg	530 mg/kg
Mercury	2.1 mg/kg	0.59 mg/kg	2.1 mg/kg

27. California AETs have now been developed for the State Board and published in a report titled "Evaluation of the AET Approach for Assessing Contamination in Marine Sediments in California, November 1989." These numbers were derived on an experimental basis and have not been adopted by the State Board. Three data sets were used to develop three sets of AET values for 1) "All of California," 2) "Southern California," and 3) "Northern California." Reliability was used in the report to measure the suitability of the AET values with respect to correctly predicting biologically impacted and non-impacted stations. Reliability for the "All of California" AET was relatively high for the amphipod and bivalve AET, but only moderate for the benthic AET. Reliability for the "Southern California" Benthic AET was relatively low, and reliability for "Southern California"

amphipod values could not be determined because all values are preliminary. The "All of California" and the "Southern California" AET sediment concentrations in dry weight for copper and mercury, based on dry weight normalization, are listed below.

SOUTHERN CALIFORNIA

Chemical	Amphipod AET Values	Bivalve* AET Values	Benthic AET Values
Copper	>690 mg/kg	---	310 mg/kg
Mercury	---	---	---

ALL OF CALIFORNIA

Chemical	Amphipod AET Values	Bivalve* AET Values	Benthic AET Values
Copper	>690 mg/kg	66 mg/kg	310 mg/kg
Mercury	1.2 mg/kg	0.51 mg/kg	0.51 mg/kg

* Bivalve AET could be calculated only from data collected in Northern California.

"---" indicates AET data could not be calculated with available data.

DETERMINATION OF CLEANUP LEVELS

28. The Regional Board, in determining the appropriate level of cleanup in this matter, is guided by the State Water Resources Control Board's Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California." This policy provides that existing water quality be maintained when it is reasonable to do so. This policy further provides that any change in water quality 1)be consistent with maximum public benefit, 2)will not unreasonably affect beneficial uses, and 3)will not result in water quality less than that prescribed in the policies. The Regional Board has determined that discharges of copper, mercury, and TBT from the seven Commercial Basin Boatyards have resulted in a change in water quality in the affected portion of San Diego Bay; the change in water quality threatens to adversely affect the marine habitat beneficial use of San Diego Bay.

29. The ERCE RAAAR provided cost estimates for the removal of contaminated sediment to meet original Regional Board background levels (63 mg/kg copper), AET levels (390 mg/kg copper), and the cleanup levels (530 mg/kg copper and 4.8 mg/kg mercury) as shown in the table below. A range of costs were presented varying from the most economical option

of ocean disposal of sediment through the most expensive option of landfill disposal of the sediment. The construction disposal option involves using the sediment removed from Commercial Basin for construction fill. The costs for background include only areas within the Driscoll lease hold. These cost estimates assume the use of a clam dredge. The cleanup level cost includes estimates of overdredging required to meet these levels. The background and AET costs do not include overdredging estimates.

COST ESTIMATES (DOLLARS)

Disposal Options	Background (63 mg/kg Cu) 3,529 YDS^3	AET (390 mg/kg Cu) 1,865 YDS^3	CLEANUP (530 mg/kg Cu 4.8 mg/kg Hg) 3,510 YDS^3
OCEAN DISPOSAL NO TREATMENT	272,701	283,563	295,963
LANDFILL CLASS I	not estimated	2,238,029	3,918,013
LANDFILL CLASS III	939,764	778,698	1,210,710
CONSTRUCTION W/ TREATMENT	856,077	528,543	738,625

30. The Regional Board, based on the available information, is directing the seven boatyards in Commercial Basin to reduce the sediment copper and mercury concentrations in the affected portion of the San Diego Bay to a sediment copper concentration less than 530 mg/kg (dry weight) and to sediment mercury concentration less than 4.8 mg/kg (dry weight) as recommended by the sediment toxicity and infaunal studies performed for the Woodward-Clyde RAAAR. This cleanup level represents less than 100 percent removal of the affected sediment. The Regional Board has determined that this cleanup level is reasonable, consistent with the maximum public benefit, and should not unreasonably affect beneficial uses. It was not possible to fully determine if these cleanup levels will result in water quality less than that prescribed in the Enclosed Bays and Estuaries Plan. However, these cleanup levels were chosen using biological effects data. The Regional Board believes that the beneficial uses will be protected by these cleanup levels. Post-cleanup sampling is designed to confirm that the beneficial uses will be protected.

31. The Regional Board is also guided by the Environmental Protection Agency's antidegradation policy contained in 40 CFR 131.12. The federal antidegradation policy requires that changes in water quality be consistent with the following three part test:

    a. Existing instream water uses and level of water quality necessary to protect the existing uses shall be maintained and protected.

    b. Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, the quality shall be maintained and protected unless the State finds ... that allowing the lower water quality is necessary to accommodate important economic or social development....

    c. Where high quality waters constitute an outstanding National resource ... that water quality shall be maintained and protected."

    The Regional Board has determined that 1) the cleanup levels established in this order will protect and maintain existing instream water uses, 2) the water quality will not exceed levels necessary to support propagation of fish, shellfish, and wildlife, and recreation in and on the water, and 3) the water quality in the affected area will be improved upon implementation of these cleanup levels.

32. This enforcement action is exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.) in accordance with Section 15321, Chapter 3, Title 14, California Code of Regulations.

IT IS HEREBY ORDERED that, pursuant to California Water Code Section 13304, Cleanup and Abatement Order No. 89-31 is amended to include the following directives:

1. Driscoll Custom Boats shall reduce the sediment copper and mercury concentrations in Commercial Basin attributable to waste discharges from Driscoll Custom Boats to a sediment copper concentration less than 530 mg/kg (dry weight) and to a sediment mercury concentration less than 4.8 mg/kg (dry weight) by April 30, 1993.

2. Driscoll Custom Boats shall achieve compliance with Directive No. 1 of this Order in accordance with the following time schedule:

	REQUIREMENT	COMPLETION DATE
a.	Submit a plan for cleanup of contaminated sediment to the indicated level. The cleanup plan shall include a description of all dredging and other cleanup or remediation activities to be conducted, a map depicting the area to be dredged and the project depth, the permits and other governmental approvals needed, and a time schedule for completion of each task. The plan shall be subject to the approval of the Regional Board Executive Officer.	March 1, 1992
b.	Submit a plan for testing to the Environmental Protection Agency (EPA) and the Army Corps of Engineers (COE) for their review and concurrence to determine the suitability of the contaminated sediment for untreated ocean disposal or a suitable construction site. A copy of this plan shall also be submitted to the Regional Board.	May 1, 1992
c.	Upon approval of the plan described in Directive 2.b above, the Plan shall be implemented and a report of the results shall be submitted to EPA, COE, and the Regional Board. An application for the permit to ocean dispose without treatment or to dispose at a suitable construction site, and other information reasonably necessary for processing and approval of the disposal permits, shall accompany the report to EPA, COE, and the Regional Board.	October 1, 1992
d.	Submit a post-cleanup sampling plan to verify the attainment of the prescribed cleanup standards in the area of sediment contamination defined in the remedial action alternatives analyses report submitted for this facility.	November 15, 1992

	REQUIREMENT	COMPLETION DATE
e.	Upon the approval of the cleanup plan by the Regional Board Executive Officer, complete the cleanup or remediation of the contaminated bay sediment to the level prescribed in Directive No. 1 of this Order.	April 30, 1993
f.	Upon the approval of the post-cleanup sampling plan by the Regional Board Executive Officer, implement the plan and submit the sampling results.	June 30, 1993

3. Driscoll Custom Boats shall, upon adoption of this addendum, submit progress reports to the Regional Board on a quarterly basis until, in the opinion of the Regional Board Executive Officer, the cleanup of the contaminated sediment has been completed. The reports shall contain information discussing the progress made toward attaining the final selected cleanup criteria for the bay sediment. The reports shall be submitted in accordance with the following reporting schedule:

REPORTING SCHEDULE	REPORT DUE
January 1 through March 31	April 30
April 1 through June 30	July 31
July 1 through September 30	October 31
October 1 through December 31	January 31

4. In addition to the cleanup alternative described in Directives 1 and 2, Driscoll Custom Boats may submit by December 1, 1992, information supporting alternative cleanup levels and/or additional cost data for consideration by the Regional Board. Upon request of a public hearing on this information by December 1, 1992, a hearing shall be scheduled by the Regional Board Executive Officer for the first regular Board meeting in 1993. This information shall specify the alternative cleanup levels, and shall include a description of the remediation activities to be conducted and a time schedule for completion of each task. If information from sites which are not in Commercial Basin is

used in determining these alternate cleanup levels, site-specific data must also be included to establish the relevancy of data from another site. Any alternative cleanup levels must also comply, to the satisfaction of the Regional Board, with the following criteria:

a. The proposed copper and mercury concentrations to be attained in the contaminated sediment in San Diego Bay will not alter the water quality of San Diego Bay to a degree which unreasonably affects the beneficial uses of San Diego Bay.

b. The proposed copper and mercury concentrations to be attained in the contaminated sediment in San Diego Bay will comply with State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California" and the U.S. Environmental Protection Agency's Antidegradation Policy contained in 40 CFR 131.12.

c. The proposed copper and mercury concentrations to be attained in the contaminated sediment in San Diego Bay will comply with State Water Resources Control Board's "Water Quality Control Policy for the Enclosed Bays and Estuaries of California, May 1974," and the "1991, California Enclosed Bays and Estuaries Plan, Water Quality Control Plan for Enclosed Bays and Estuaries of California."

PROVISION

1. Driscoll Custom Boats shall submit, to the Regional Board, on or before each compliance date contained in this Addendum, a Report of Compliance or Noncompliance with the specified task.

NOTIFICATION

1. Pursuant to Section 13304 of the Water Code, Driscoll Custom Boats is hereby notified that the Regional Board is entitled to, and will, seek reimbursement for all reasonable costs actually incurred by the Regional Board to investigate unauthorized discharges of waste and to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action, required by Cleanup and Abatement Order No.

89-31 and Addenda thereto. Reimbursable costs are costs incurred by the Regional Board following December 9, 1991. Upon receipt of a billing statement for such costs Driscoll Custom Boats shall reimburse the Regional Board.

I, Arthur L. Coe, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Addendum adopted by the California Regional Water Quality Control Board, San Diego Region, on December 9, 1991.

ARTHUR L. COE
Executive Officer

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

ADDENDUM NO. 6 TO
CLEANUP AND ABATEMENT ORDER NO. 88-78

KETTENBURG MARINE CORPORATION
AND
WHITTAKER CORPORATION

SAN DIEGO COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board) finds that:

1. On June 30, 1988, the Regional Board Executive Officer issued Cleanup and Abatement Order No. 88-78, Kettenburg Marine Corporation, San Diego County. Cleanup and Abatement Order (CAO) No. 88-78 was issued to Kettenburg Marine Corporation for elevated concentrations of copper, mercury, and tributyltin in sediments in San Diego Bay adjacent to the Kettenburg Marine Corporation boatyard at 2810 Carleton Street, San Diego, resulting from waste discharges to San Diego Bay from the Kettenburg Marine Corporation boatyard. CAO No. 88-78 has been amended by five subsequent addenda.

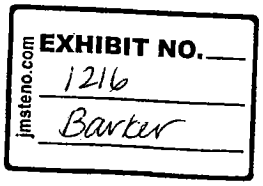
2. Before Kettenburg Marine Corporation operated the boatyard at 2810 Carleton Street, Whittaker Corporation operated the Kettenburg Marine boatyard at the same site.

3. A 1974 Regional Board staff report indicated that surface and core sediment samples taken from San Diego Bay adjacent to the Kettenburg Marine west marine railway and yard drain on April 3, 1974 contained elevated concentrations of heavy metals, including copper and mercury.

4. Discharges to San Diego Bay from the Kettenburg Marine boatyard were observed by Regional Board staff during the time when the boatyard was operated by Whittaker Corporation.

5. On November 4, 1974, this Regional Board adopted Order No. 74-74 (NPDES No. CA0107654), Waste Discharge Requirements for Kettenburg Marine. On September 24, 1979, this Regional Board adopted Order No. 79-56 (NPDES No. CA0107654), which reissued waste discharge requirements for Kettenburg Marine.

6. By letter dated January 9, 1985, Whittaker Corporation notified Regional Board staff that Kettenburg Marine Division of Whittaker Corporation had been sold to Kettenburg Marine Corporation. On August 22, 1985, this Regional Board adopted Order No. 85-



02 (NPDES No. CA0107654), Waste Discharge Requirements for Kettenburg Marine Corporation, San Diego County, which reissued the waste discharge requirements for the boatyard at 2810 Carleton Street and reflected the change in ownership to Kettenburg Marine Corporation.

7. Based on the previous findings, it is reasonable to conclude that Whittaker Corporation caused or allowed the discharge to San Diego Bay of materials containing copper and mercury and that the discharge of such materials contributed to the elevated concentrations of copper and mercury in San Diego Bay sediments adjacent to the site at 2810 Carleton Street.

8. This enforcement action is exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.) in accordance with Section 15321, Chapter 3, Title 14, California Code of Regulations.

IT IS HEREBY ORDERED that, pursuant to California Water Code Section 13304, Cleanup and Abatement Order No. 88-78 is amended as follows:

Whittaker Corporation is added as a responsible party to Cleanup and Abatement Order No. 88-78, as amended. The directives of Cleanup and Abatement Order No. 88-78, as amended, shall hereafter be construed to refer to both Kettenburg Marine Corporation and Whittaker Corporation, unless otherwise stated. The title headings of Cleanup and Abatement Order No. 88-78 and addenda thereto are amended to read "Kettenburg Marine Corporation and Whittaker Corporation, San Diego County."

I, Arthur L. Coe, Executive Officer of the San Diego Regional Water Quality Control Board, do hereby certify the foregoing is a full, true , and correct copy of an addendum adopted by the California Regional Water Quality Control Board, San Diego Region, on November 10, 1994.

Arthur L. Coe
Executive Officer

State of California
Regional Water Quality Control Board
San Diego Region

Executive Officer Summary Report
May 12, 1994

ITEM: 7

SUBJECT: SHIPYARD AND BOATYARD SEDIMENT MONITORING PROGRAMS: DISCUSSION OF REQUESTS FOR MODIFICATION OR DELETION

DISCUSSION: Shipyard and boatyard sediment monitoring programs were adopted by the Board in October 1989. The monitoring programs were subsequently revised by technical change orders issued by the Executive Officer. June - November 1992 was the first semiannual period in which monitoring required by the programs was conducted. Reports for monitoring conducted in that period were due in December 1992. Staff has received several requests from boatyard operators for modification or deletion of the monitoring programs. This agenda item is intended to provide boatyard and shipyard operators and other interested parties with an opportunity to make their concerns, recommendations and requests about the sediment monitoring programs known to the Board and to enable the Board to provide direction to staff about possible changes to the sediment monitoring programs.

ISSUE: Should changes be made to the monitoring programs issued to shipyards and boatyards?

RECOMMENDATION: A recommendation may be made at the Board meeting.

NOTE: ATTACHMENTS WERE PRESENTED @ BD MTG

KETTENBURG
03-0107

State of California
Regional Water Quality Control Board
San Diego Region

Executive Officer Summary Report
May 12, 1994

ITEM: 7

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ISSUE: Should changes be made to the monitoring programs issued to shipyards and boatyards?

RECOMMENDATION: A recommendation may be made at the Board meeting.

NOTE ATTACHMENTS WERE PRESENTED @ BD MTG

OCEANSIDE MARINE
File 03-0111.02

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

CLEANUP AND ABATEMENT ORDER NO. 89-32

KOEHLER KRAFT COMPANY
SAN DIEGO COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board) finds that:

1. Koehler Kraft Company, a California corporation, owns and operates a boat repair facility named Koehler Kraft Company. The facility is located on the shoreline of the Commercial Basin portion of San Diego Bay at 2302 Shelter Island Drive on land owned by the San Diego Unified Port District. Boat work performed at Koehler Kraft Company includes vessel repairs and modifications, vessel cleaning, sanding and painting, and vessel washing to remove loose paint and fouling organisms.

2 Koehler Kraft Company is alleged to have, in violation of discharge prohibitions adopted by the Regional Board pursuant to Section 13243 of the California Water Code, discharged waste, or caused or permitted waste to be deposited where it was discharged, into waters of the State and created a condition of pollution.

3. The **Comprehensive Water Quality Control Plan, San Diego Basin (9)** (Basin Plan), adopted by the Regional Board on March 17, 1975, contains the following prohibitions applicable to waters subject to tidal actions, including the waters of San Diego Bay:

   a) "Discharge of industrial wastewaters exclusive of cooling water, clear brine or other waters which are essentially chemically unchanged, into waters subject to tidal action is prohibited."

   b) "The dumping or deposition of chemical wastes, chemical agents or explosives into waters subject to tidal action is prohibited."

4. The Basin Plan establishes the following beneficial uses for waters of San Diego Bay including Commercial Basin:

   Industrial Service Supply
   Navigation
   Water Contact Recreation
   Ocean Commercial and Sport Fishing

hydrologic continuity to waters of the open ocean; however, the bay waters are subject to less dilution than ocean waters. Thus the water quality standard to protect the beneficial uses of San Diego Bay waters should be at least as stringent as the standards in the Ocean Plan which provide for the protection of open ocean waters. Accordingly the Regional Board finds that, in the absence of numerical water quality standards specifically applicable to San Diego Bay, the numerical water quality standards contained in the Ocean Plan should be used to protect the beneficial uses of San Diego Bay.

8. By letter dated May 20, 1988 the Regional Board Executive Officer requested Koehler Kraft Company to submit a complete NPDES permit application to the Regional Board by November 15, 1988. The Koehler Kraft Company did not respond to this letter.

9. On February 2 and August 26, 1988, Regional Board staff conducted inspections of Koehler Kraft Company. Regional Board staff noted that the facility yard consisted of earthen fill material and concrete pads. One yard drain was noted that received runoff from storm events as well as miscellaneous water flows from the work area. During the inspections Regional Board staff collected samples from the yard drain sump; the sample results are summarized below:

Sample Date	Sample Type	Copper Concentration	Mercury Concentration
February 2, 1988	Sediment	4,850 mg/kg	0.30 mg/kg
February 2, 1988	Paint Chip	1,505 mg/kg	0.61 mg/kg
August 26, 1988	Sediment	2,500 mg/kg	0.46 mg/kg

The above data shows that elevated concentrations of copper and mercury were found in the yard drain sediment. The data provides evidence that waste containing copper and mercury was discharged into San Diego Bay directly by miscellaneous water flows entering the yard drain from the work area or indirectly by storm runoff contacting waste deposits in the facility work area. The high copper concentrations in the yard drain noted above result in the sediment material being classified as a hazardous waste.

10. On February 2, 1988 Regional Board staff and California Department of Fish and Game staff collected sediment samples from the Commercial Basin portion of San Diego Bay at the station locations shown in Figure 1. Five of the sediment samples collected on February 2, 1988 were from a portion of Commercial Basin directly

Department of Fish and Game staff collected 3 sediment samples for tributyltin analysis from the Shelter Island Yacht Basin portion of San Diego Bay on May 10, 1988. Shelter Island Yacht Basin receives no boatyard discharges but has extensive marina facilities. The tributyltin concentration in these sediment samples ranged from 93 to 319 ng/g, with a mean concentration of 174 ng/g. Since there are no direct discharges of waste from boatyard facilities into Shelter Island Yacht Basin, the Regional Board believes that the existing concentrations of tributyltin in Shelter Island Yacht Basin sediments results from the leaching of tributyltin from antifouling marine paints on vessel hulls. The 174 ng/g tributyltin concentration found in Shelter Island Yacht Basin is close to the 193 ng/g concentration cited in Finding 11 as representing "background conditions" in Commercial Basin. For this reason the Regional Board believes that the 193 ng/g tributyltin concentration found at the "background" stations of Commercial Basin incorporates the contribution of tributyltin which can be expected from the leaching from vessel hulls alone.

14. Several conclusions can be drawn from the data which has been obtained in Commercial Basin. The bay sediment data discussed in Findings 10 and 11 shows that concentrations of copper, mercury, and tributyltin at Stations F, G, H and J are elevated with respect to the background concentrations. The paint composition data cited in Finding 12 shows that copper and tributyltin are used in marine anti-fouling paints. (Mercury is also present in marine antifouling paints in use prior to 1970.) The sample results of waste collected from the Koehler Kraft Company surface yard drain cited in Finding 9 shows that copper and mercury were present in elevated concentrations. Discharges of miscellaneous water flows from the work area through the exposed yard drains into San Diego Bay cited in Finding 9 contained elevated concentrations of copper and mercury. Based on the foregoing the Regional Board finds and concludes that the elevated concentrations of copper, mercury, and tributyltin in the bay sediment at Stations F, G, H and J resulted from discharges of paint chips and other waste from Koehler Kraft Company into San Diego Bay. These waste discharges constitute a violation of the Basin Plan prohibitions cited in Finding 3. These waste discharges also show that Koehler Kraft Company is discharging pollutants into San Diego Bay, a navigable water of the United States. Accordingly Koehler Kraft Company must file an NPDES permit application containing the items described in the Regional Board's letter dated May 20, 1988.

15. In September, 1986 a report titled **Development of Sediment**

tolerant to heavy metal contamination than the organisms found in Puget Sound. The Regional Board finds and concludes that, in this instance, the Puget Sound AET values represent the best information available on the sediment pollutant concentrations for copper and mercury which could adversely affect the beneficial uses of San Diego Bay.

17. As previously stated in Finding 12, tributyltin is a biocide used in antifouling vessel paints. The antifouling paint prevents the fouling of the vessel hull by releasing tributyltin into the surrounding water. Depending on environmental conditions, tributyltin is eventually degraded into dibutyltin, monobutyltin, and ultimately to elemental tin. Tributyltin is one to two orders of magnitude more toxic than dibutyltin, which is more toxic than monobutyltin. Tributyltin is lipophilic, rapidly adsorbs to marine sediments, and can penetrate biological membranes. Sensitivity to tributyltin varies among aquatic species. Gastropods and bivalves are the most susceptible organisms affected at tributyltin water concentrations as low as 0.02 to 0.14 µg/l, followed by crustaceans at 0.09 to 0.14 µg/l, algae at 0.1 to 0.35 µg/l, and fishes at concentrations of 0.2 µg/l or greater. Sublethal effects on marine biota caused by tributyltin include reproductive abnormalities, growth retardation, anatomical abnormalities, bioaccumalation, and behavior changes.

18. Tributyltin has been investigated by the State Water Resources Control Board's Priority Chemicals Program. By memorandum dated December 30, 1987 State Board staff presented a summary of the findings and recommendations contained in the forthcoming report **Tributyltin in California Waters.** In this report State Board staff recommended a water quality criteria of 6 ng/l for tributyltin in seawater to protect aquatic life. State Board staff also recommended that this criteria serve as the basis for adoption of water quality objectives in the California Ocean Plan and basin plans. In the absence of a standard for tributyltin in San Diego Bay, the State Board's recommended criteria of 6 ng/l will be applied for purposes of establishing sediment cleanup levels. Water quality objectives for tributyltin in marine sediments have not been established.

19. Regional Board and Department of Fish and Game staff conducted a sampling survey of tributyltin water column concentrations throughout San Diego Bay on August 19, 1987. The tributyltin water column sample results are contained in the Department of Fish and Game's draft report, **Preliminary Data Report on Tributyltin and PCBs in San Diego Harbor, March 30, 1988**

concentrations as low as 0.15 ug/l and is believed to be a specific biological indicator of elevated concentrations of tributyltin. Because of the enormous amount of biological energy devoted to shell chambering, the edible muscle tissue remains small and the oysters are rendered commercially non-viable. Chambering oysters which are subsequently transplanted to clean waters resume normal growth. The shell thickness index is defined as the ratio of shell length to width and is a measure of the degree of chambering. A low index indicates a high degree of chambering; conversely, a high index indicates a lack of chambering. Upon collection, the oyster shells were measured and the edible tissue extracted and weighed. The results of the study are contained in the Department of Fish and Game's draft report and are summarized below:

Location	Station	Mean Shell Thickness Index	Tissue Weight
Bay Entrance	1-4	4.55-11.84 mm	0.91-7.02 grams
Shelter Island	5-6	4.64 mm	0.37 grams
Commercial Basin	7-9	3.85-6.59 mm	0.25-0.65 grams
Harbor Island South	10	4.04 mm	0.45 grams
Harbor Island West	11-13	3.84-6.50 mm	0.14-0.36 grams
Harbor Island East	16-22	4.31-5.30 mm	0.30-0.68 grams
Navy Channel	14-15	4.79-4.91 mm	0.62-1.30 grams
Glorietta Bay	23-25	3.94-5.28 mm	0.31-1.03 grams
7th Street	26-27	6.60-11.18mm	0.80-2.0 grams
Sweetwater	28-32	6.71-9.13 mm	1.56-4.79 grams

21. The data cited in Finding 20 shows that the 11.84, 11.18, and 9.13 mm shell thickness indices at Stations 1, 27, and 30 in bay areas less influenced by tributyltin were markedly higher than the 3.85, 5.62, and 6.59 mm shell thickness indices found at Stations 7, 8, and 9 in Commercial Basin. The low shell thickness indices found in the Commercial Basin oysters indicates a high degree of chambering and is a direct result of the elevated tributyltin concentrations found in Commercial Basin. The Commercial Basin oysters also exhibited high mortality and apparently reduced edible tissue weights. Oysters transplanted to other areas of the bay having elevated tributyltin levels in the water column, for example in marinas, exhibited adverse biological effects similar to those observed in Commercial Basin. The Regional Board believes that the waste discharges from Koehler Kraft Company did contribute to the adverse biological effects observed in oysters transplanted to Commercial Basin. However the extent to which the

Cleanup and Abatement
Order No. 89-32
Koehler Kraft Company

It Is Hereby Ordered, That in accordance with California Water Code Section 13304, Koehler Kraft Company shall comply with the following directives:

1. Koehler Kraft Company shall forthwith terminate all waste discharges to San Diego Bay.

2. Koehler Kraft Company shall, no later than April 10, 1989, submit an NPDES permit application containing the items listed in the Regional Board's May 20, 1988 letter to Koehler Kraft Company.

3. Koehler Kraft Company shall submit a report to the Regional Board no later than June 30, 1989 (May 3, 1989 if Koehler Kraft Company elects to follow the time schedule described in directive 4(b) below) identifying a range of remedial action alternatives to cleanup contaminated bay sediment resulting from the discharge of waste from Koehler Kraft Company. The report shall, at a minimum, contain a detailed analysis of the cost, feasibility, and lateral and vertical extent of contaminated sediment associated with cleanup strategies a), b), and c) described below. In addition to the evaluation of these cleanup strategies Koehler Kraft Company may propose an alternate cleanup strategy by evaluating the criteria described in item d) below. The Regional Board will evaluate the information submitted in the report and select a cleanup level for the contaminated sediment.

   a) Removal and/or treatment of the contaminated sediment to attain the following background concentrations of mercury, copper, and tributyltin in the bay sediment described in Finding 11:

Constituent	Dry Weight Concentration
Mercury	0.81 mg/kg
Copper	63 mg/kg
Tributyltin	193 ng/g

   b) Removal and/or treatment of the contaminated sediment to attain the following Apparent Effects Threshold (AET) dry weight sediment concentrations for copper and mercury described in Finding 15 and the State Water Resources Control Board's proposed water quality criteria for tributyltin described in Finding 18:

Constituent	Concentration
Mercury	0.49 mg/kg

3 The proposed copper, mercury, and tributyltin concentrations to be attained in the sediment contamination zone will not result in water quality less than prescribed in the Basin Plan, Ocean Plan or other prescribed policies.

4. The remedial action alternative analysis report described in Directive No. 3 shall be prepared and submitted in accordance with the following alternative time schedule and criteria:

(a) Koehler Kraft Company may participate in the cleanup project being undertaken by Mauricio and Sons Inc., Bay City Marine, and Kettenburg Marine in accordance with the following time schedule:

(1) Koehler Kraft Company shall complete collection of the Phase 1 samples described in **Commercial Basin Boatyards Sediment Sampling Plan, San Diego California, Woodward Clyde Consultants** by March 17, 1989. All Phase 1 samples shall be taken to a depth of 6 inches.

(2) Koehler Kraft Company shall submit a report by March 24, 1989, which describes the results of sampling performed in accordance with Directive 4(a)(1) of this Order. The report shall include a discussion of the procedures which will be used to collect and analyze samples for Phase 2. The report shall also include a discussion of the locations proposed for the collection of samples and the constituents for which the samples will be analyzed.

(3) Upon approval of the Phase 2 sampling plan by the Regional Board Executive Officer, Koehler Kraft Company shall complete collection of samples as described in Directive No. 4(a)(2) of this Order no later than May 1, 1989.

(4) Koehler Kraft Company shall submit a report by June 15, 1989, which describes the results of sampling performed in accordance with Directive No. 4 (a)(3) of this Order.

(b) Koehler Kraft Company may as an alternative to Directive 4(a) of this Order comply with the following time schedule for submission of sample data:

(1) Koehler Kraft Company shall submit a sampling plan by March 24, 1989, to determine the vertical and horizontal extent of the bay sediment contamination resulting from the discharge of waste by Koehler Kraft Company.

Provisions

1. Koehler Kraft Company is located on lands owned by the San Diego Unified Port District. The Port District is a governmental agency. In addition the current lease for Koehler Kraft Company requires that the Koehler Kraft Company comply with any applicable laws of the State of California. Thus under Water Code Section 13304, the Regional Board may name the Port District as a responsible party for the purposes of compliance with this order. The Regional Board will amend this order to include the Port District as a responsible party only if Koehler Kraft Company fails to comply with the terms and conditions of this cleanup and abatement order.

2. Koehler Kraft Company shall provide Regional Board staff with a schedule of sampling activities as it becomes available to enable the Regional Board to witness sampling activities and obtain split samples. Each sample result submitted to the Regional Board shall, as a minimum, contain the following information:

   a) The date, location, and time of sampling;
   b) Sample sediment depth;
   c) The individual(s) who performed each sampling or measurement;
   d) The date(s) analyses were performed;
   e) The laboratory and the name of each individual who performed each analyses;
   f) The analytical techniques or methods used including preservation techniques
   g) The number of samples composited to represent the concentration at each point; and
   h) The results of such analyses. Sediment sample results shall be reported in terms of dry weight.

3. Koehler Kraft Company shall submit copies of all field notes and sample logs prepared during the collection of samples.

4. Sample results shall be submitted both in tabular form and plotted on a map of the sampling area with lines of equal concentration included.

5. Collection, transport and analysis of sediment samples (excluding

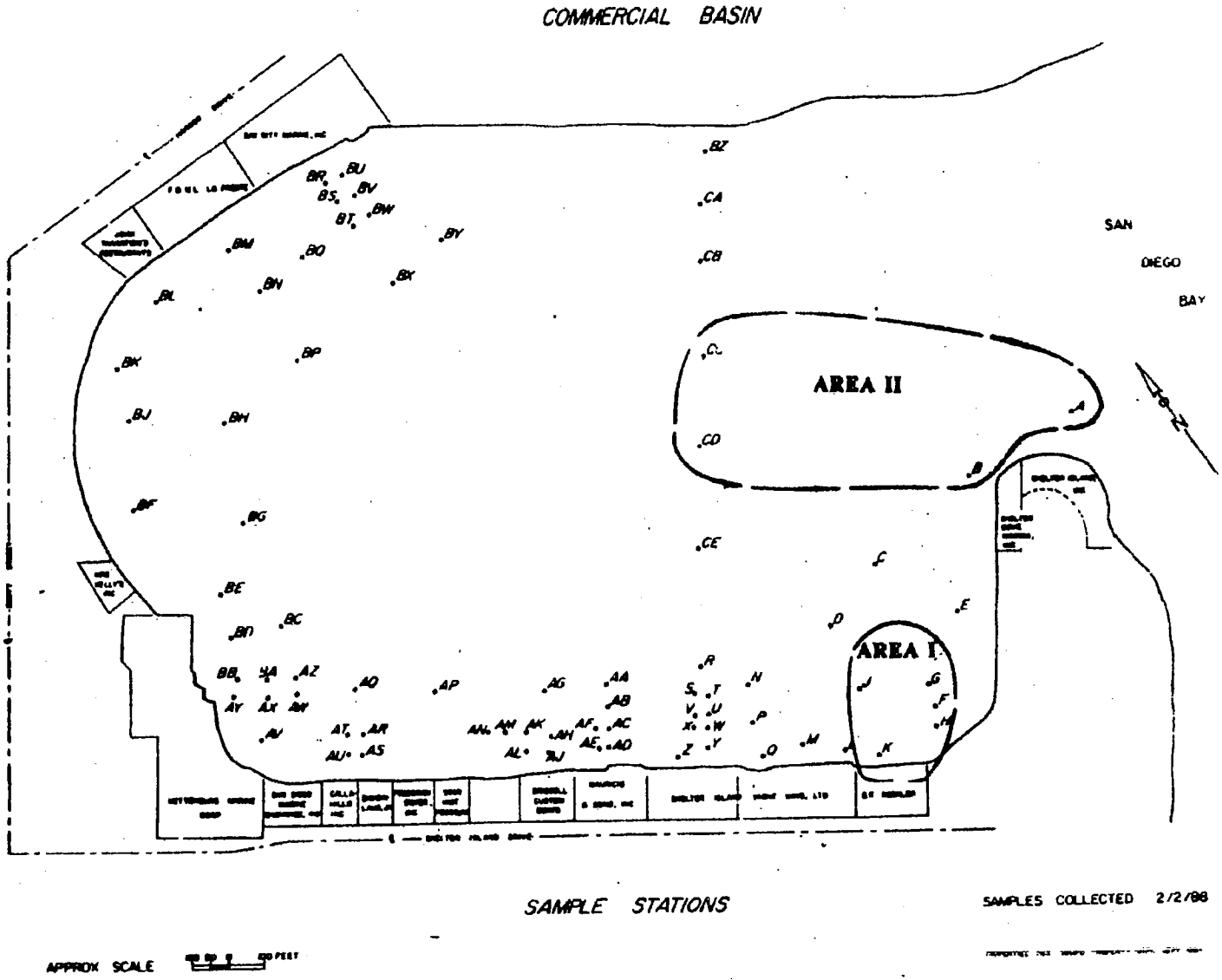

FIGURE 1. Commercial Basin, showing location of stations where sediment samples have been collected. The sediment at stations within Area I has been affected by waste discharges from Koehler Kraft Company. Stations within Area II are believed to be least influenced by the boatyards of Commercial Basin, and are considered to represent "background conditions."

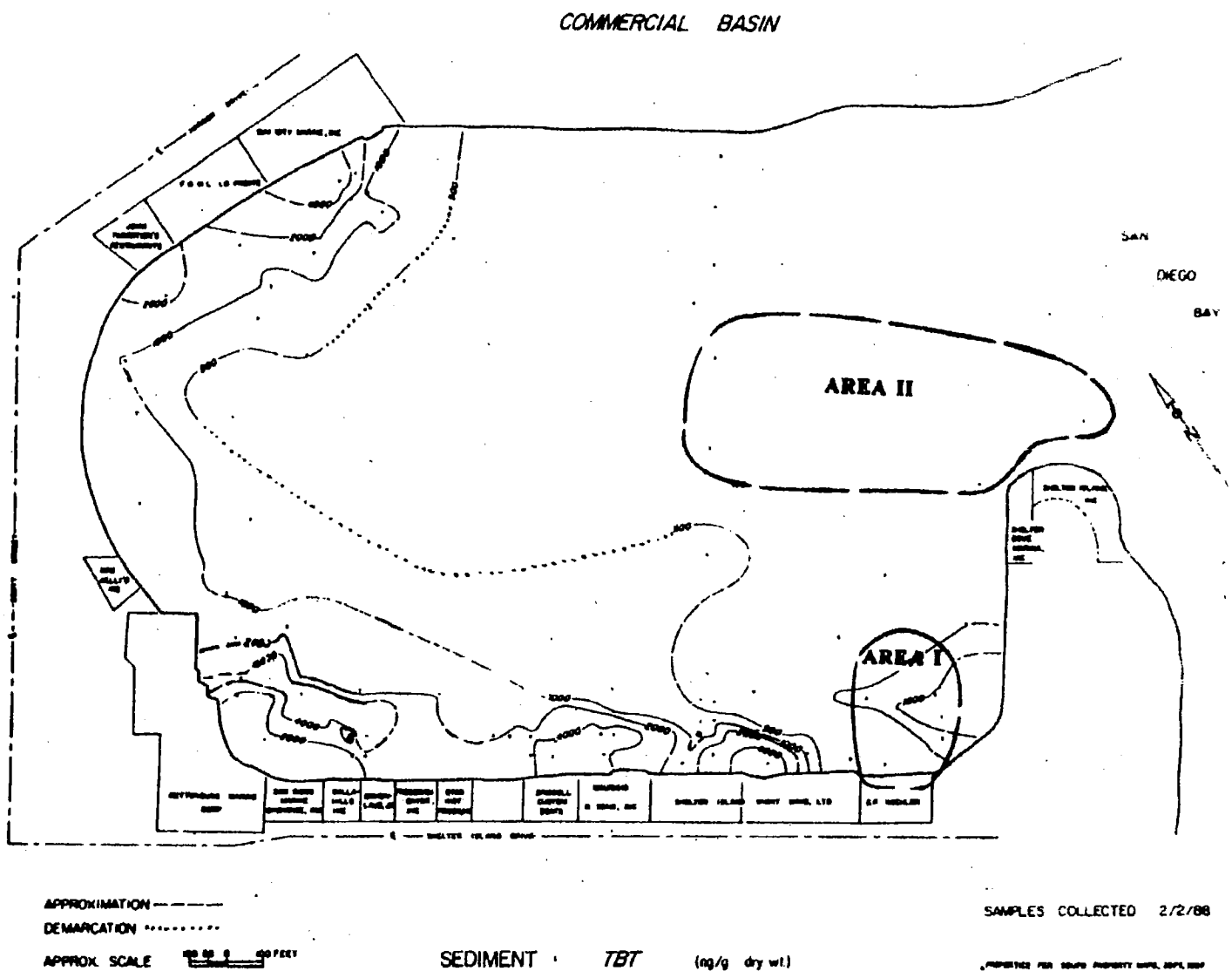

FIGURE 3. Concentration of Tributyltin (ng/g) found within surficial sediments of Commercial Basin. The sediment at stations within Area I has been affected by waste discharges from Koehler Kraft Company. Stations within Area II are believed to be least influenced by the boatyards of Commercial Basin, and are considered to represent "background conditions."

QUALITY ASSURANCE LABORATORY
CHAIN OF CUSTODY

COMPANY: Regional Board

PROJECT NAME/NUMBER:

Q.A. LOG NUMBER: 1993-89 TO 2002-89

SAMPLE ID	DATE OF SAMPLE	SAMPLE LOCATION	CONT TYPE	SAMPLE TYPE	ANALYSIS REQUIRED	COMMENTS
LOM889-111 -MK58	2-12;14-89		glass	sediment	Cu; Hg; TBT	
-MK52	"		"	"		
-MK39	"		"	"		
-KK13	"		"	"		
-MK59	"		"	"		
-MK4	"		"	"		
-MK3	"		"	"		
-MK31	"		"	"		
-KK3	"		"	"		
-MK66	"		"	"		

TRANSPORT CONDITION:

CORRECT CONTAINER TYPE: YES_____ NO_____

SEND RESULTS TO ATTN: Lance McMahan

PHONE #: 265-5114

MAIL: _____

_____

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Lance McMahan	3/1/89 12:10p	J. LMG
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY

CUT 008181

STATE OF CALIFORNIA
GEORGE DEUKMEJIAN, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

9771 Clairemont Mesa Blvd., Suite B
San Diego, California 92124-1331
Telephone: (619) 265-5114

July 5, 1988

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Don Nay, Director
San Diego Unified Port District
P.O. Box 488
San Diego, California 92112

Dear Mr. Nay:

Enclosed is a copy of Cleanup and Abatement Order No. 88-86. This Cleanup and Abatement Order was issued on June 30, 1988 to Mauricio and Sons, Inc. under the authority of California Water Code Section 13304 for discharging waste in violation of Order No. 85-03, NPDES No. CA0107719, *Waste Discharge Requirements for Mauricio and Sons, Inc., San Diego County.*

As you know, Mauricio and Sons, Inc. is located on lands owned by the San Diego Unified Port District. Therefore, as stated in Provision 1 of Cleanup and Abatement Order No. 88-86, the Regional Board may name the Port District as a responsible party for the purposes of compliance with this order. Provision 1 states that the Regional Board will amend Order No. 88-86 to include the Port District as a responsible party only if Mauricio and Sons, Inc. fails to comply with the terms and conditions of this cleanup and abatement order and the Port District fails to promptly use its governmental powers to achieve compliance with this cleanup and abatement order.

You are hereby notified that you have the right to a public hearing before the Regional Board concerning Cleanup and Abatement Order No. 88-86 on August 29, 1988. If you desire to have a public hearing at the Regional Board's August 29 meeting, you must notify this office of your request for the public hearing in writing by July 29, 1988. If no written request for a public hearing is received by July 29, a public hearing will not be scheduled. The August 29 Regional Board meeting will begin at 9:00 a.m. in Room B109 of the State Office Building, 1350 Front Street, San Diego.

If you have any questions concerning this matter please call Mr. James Munch at the above number.

Very truly yours,

LADIN H. DELANEY
Executive Officer

JBM:bdk

cc: Mr. Jeremy Johnstone, Environmental Engineer
Environmental Protection Agency
215 Fremont Street
San Francisco, California 94105

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.

Put your address in the "RETURN TO" space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following servi... ...ailable. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. 2. ☐ Restricted Delivery.

3. Article Addressed to:

Mr. Don Nay, Director
San Diego Unified Port District
P.O. Box 488
San Diego, CA 92113

4. Article Number
P 468 501 870

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature – Addressee
X

6. Signature – Agent
X

7. Date of Delivery
JUL 12 ...

8. Addressee's Address *(ONLY if requested and fee paid)*

PS Form 3811, Feb. 1986 DOMESTIC RETURN RECEIPT

Cleanup & Abatement Order No. 88-86 Mau...

Mr. Don Nay
P.O. Box 488
San Diego, CA 2113

7-5-88

T.15

Abatement Order No. 88-86 Mauricio & Sons.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

CLEANUP AND ABATEMENT ORDER NO. 88-86

MAURICIO AND SONS INC.
SAN DIEGO COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board) finds that:

1. On October 22, 1979 this Regional Board adopted Order No. 79-66, NPDES NO. CA0107719, **Waste Discharge Requirements for Mauricio and Sons Inc.**. Order No. 79-66 established waste discharge requirements prohibiting the discharge of various boat repair wastes to San Diego Bay. The facility is located on the shoreline of the Commercial Basin portion of San Diego Bay at 2420 Shelter Island Drive on land owned by the San Diego Unified Port District in the City of San Diego. On April 22, 1985, this Regional Board adopted Order No. 85-03, NPDES No. CA0107719, **Waste Discharge Requirements for Mauricio and Sons Inc., San Diego County**. Order No. 85-03 renewed the waste discharge requirements contained in Order No. 79-66 and established additional waste discharge requirements prohibiting the discharge of various boat repair wastes to San Diego Bay.

2. By letter dated February 4, 1988, Mr. Anthony Mauricio, Jr., President, Mauricio and Sons Inc. reported that the company's facility at 2420 Shelter Island Drive had been sold to Nielson and Beaumont Marine, Inc.. The letter stated that Mauricio and Sons Inc. would be responsible for any NPDES permit violations up to February 5, 1988 and that Nielson and Beaumont Marine would be responsible from that day forward. The NPDES permit violations discussed in this order occurred prior to February 5, 1988. Accordingly the Regional Board has named Mauricio and Sons Inc. as the party responsible for compliance with the directives of this order.

3. NPDES permits in the San Diego Region currently require shipyard and boatyard operators to follow best management practices plans to prevent the discharge of substances such as refuse, rubbish, spent abrasives, paint, paint chips, and marine fouling organisms cleaned from vessel hulls. Mauricio and Sons, Inc. was required to submit a best management practices plan as part of the report of waste discharge for Order No. 85-03. The best management practices plan identified various measures that Mauricio and Sons, Inc. would undertake to prevent the discharge of pollutants to San Diego Bay. The best management practices plan was accepted by the Regional Board and incorporated into Finding 6 of Order No. 85-03.

4. Order No. 85-03 contains the following applicable terms and conditions:

   a) Prohibition A.2: "The deposition or discharge of refuse, rubbish, materials of petroleum origin, spent abrasives (including old primer and antifouling paint), paint, paint chips, or marine fouling organisms into San Diego Bay or at any place where they would be eventually transported to San Diego Bay is prohibited."

b) Discharge Specification B.2: "Effluent discharged to San Diego Bay must be essentially free of....:

b) "Settleable material or substances that form sediments which degrade benthic communities or other aquatic life."

c) "Substances toxic to marine life due to increases in concentrations in marine waters or sediments."

c) Discharge Specification B.3: "The discharger shall comply with the Water Pollution Control Plan described in Finding No. 6."

d) Provision D.1: "Neither the treatment nor the discharge of pollutants shall create a pollution, contamination, or nuisance as defined by Section 13050 of the California Water Code."

e) Provision D.11: "The discharger shall, at all times, properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the discharger to achieve compliance with the conditions of this Order. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Order."

5. The **Water Quality Control Policy for the Enclosed Bays and Estuaries of California, 1974** (hereinafter referred to as the Bays and Estuaries Policy) adopted by the State Water Resources Control Board on May 16, 1974, contains water quality standards applicable to waste discharges to enclosed bays and estuaries such as San Diego Bay. The Bays and Estuaries Policy does not contain numerical water quality objectives for waste discharges to bays and estuaries. The Bays and Estuaries Policy requires that discharges of municipal wastewater and industrial process wastewaters to enclosed bays and estuaries be phased out at the earliest practicable date. On June 16, 1988 the State Board found in Order No. 88-4 that miscellaneous water flows from boatyards containing pollutants such as dry paints and sandblasting abrasives did not qualify as a industrial process wastewater under the Bays and Estuaries policy. Thus the Regional Board is not prohibited from granting waste discharge requirements for discharges such as those described in Order No. 88-4.

6. On November 17, 1983 the State Water Resources Control Board adopted the **Water Quality Control Plan, Ocean Waters of California, 1983** (hereinafter Ocean Plan). The Ocean Plan contains the following applicable water quality objectives for copper and mercury:

Constituent	6-Month Median	Daily Maximum	Instantaneous Maximum
Copper	5 µg/l	20 µg/l	50 µg/l
Mercury	0.14 µg/l	0.56 µg/l	1.4 µg/l

7. In the findings and directives of this cleanup and abatement order, effluent limitations and water quality objectives contained in the Ocean Plan are used as a baseline to determine the potential effects of waste discharges from Mauricio and Sons, Inc. on the water quality and beneficial uses of San Diego Bay as well as appropriate cleanup levels. The Ocean Plan is applicable to point source discharges of waste to ocean waters; however the Ocean Plan is not applicable to waste discharges to enclosed bays such as San Diego Bay. The beneficial uses of San Diego Bay are identical to those of the ocean. San Diego Bay waters are in hydrologic continuity to waters of the open ocean; however, the bay waters are subject to less dilution than ocean waters. Thus the water quality standard to protect the beneficial uses of San Diego Bay waters should be at least as stringent as the standards in the Ocean Plan which provide for the protection of open ocean waters. Accordingly the Regional Board finds that, in the absence of numerical water quality standards specifically applicable to San Diego Bay, the numerical water quality standards contained in the Ocean Plan should be used to protect the beneficial uses of San Diego Bay

8. The **Comprehensive Water Quality Control Plan, San Diego Basin (9)** (Basin Plan) adopted by the Regional Board on March 17, 1975, established the following beneficial uses for the waters of San Diego Bay:

Industrial Service Supply
Navigation
Water Contact Recreation
Ocean Commercial and Sport Fishing
Saline Water Habitat
Preservation of Rare and Endangered Species
Marine Habitat
Fish Migration
Shellfish Harvesting

9. On February 2, 1988 Regional Board staff and California Department of Fish and Game staff collected sediment samples from the Commercial Basin portion of San Diego Bay at the station locations shown in Figure 1. Eight of the sediment samples collected on February 2, 1988 were from a portion of Commercial Basin directly fronting Mauricio and Sons, Inc. at Stations AA, AB, AC, AD, AE, and AF. The sample results are summarized below:

Constituent	Range of Dry Weight Concentration		Number of Samples
Copper	276-3120	mg/kg	8
Tributyltin	958-9607	ng/g	8
Mercury	3.61-12.22	mg/kg	8

As shown in Figures 2, 3, and 4 concentrations of copper, tributyltin, and mercury decrease markedly with distance from the Mauricio and Sons, Inc. facility.

10. Sediment samples were also collected at Stations A, B, CC, and CD on February 2, 1988. Because of their locations these four stations are expected to be least influenced by Commercial Basin boatyard activities (See Area II in Figures 1 through 4). These stations had markedly lower concentrations of copper, tributyltin, and mercury than the stations fronting the Mauricio and Sons, Inc.. The sample results for these stations are summarized below:

Constituent	Range of Dry Weight Concentration		Number Of Samples	Mean Dry Weight Concentration	
Copper	49-77	mg/kg	4	63	mg/kg
Tributyltin	83-240	ng/g	4	193	ng/g
Mercury	0.53-1.26	mg/kg	4	0.81	mg/kg

For purposes of evaluating the environmental effects of boatyard activities in Commercial Basin, the Regional Board believes it is reasonable to use the sediment quality at Stations A, B, CC, and CD to represent "background conditions".

11. Cuprous oxide, other copper compounds and tributyltin are antifouling agents commonly used in vessel paints to inhibit the growth of marine organisms on hull bottoms. Mercury and mercuric salts were extensively used in antifouling marine paints as an antifouling agent prior to 1970. In 1970 the use of mercury and mercuric salts in antifouling marine paints was discontinued.

12. The background concentration of tributyltin in the sediments and water column of San Diego Bay can also be influenced by the continuous leaching of tributyltin from the hulls of vessels moored in the bay in addition to waste discharges from boatyards/shipyards. In order to estimate the tributyltin contribution from moored vessels, Regional Board and the Department of Fish and Game staff collected 3 sediment samples for tributyltin analysis from the Shelter Island Yacht Basin portion of San Diego Bay on May 10, 1988. Shelter Island Yacht Basin receives no boatyard discharges but has extensive marina facilities. The tributyltin concentration in these sediment samples ranged from 138 to 231 ng/g, with a mean concentration of 195 ng/g. Since there are no direct discharges of waste from boatyard facilities into Shelter Island Yacht Basin, the Regional Board believes that the existing concentrations of tributyltin in Shelter Island Yacht Basin sediments results from the leaching of tributyltin from antifouling marine paints on vessel hulls. The 195 ng/g tributyltin concentration found in Shelter Island Yacht Basin is essentially equal to the 193 ng/g concentration cited in Finding 10 as representing "background conditions" in Commercial Basin. For this reason the Regional Board believes that the 193 ng/g tributyltin concentration found at the "background" stations of Commercial Basin incorporates the contribution of tributyltin which can be expected from the leaching from vessel hulls alone.

13. Mauricio and Sons Inc. has a sedimentation sump just adjacent to the tideline and beneath the marine railway which receives runoff from storm events as well as miscellaneous water flows

from the work area. The purpose of this sump is to remove, by gravity settling, particulate matter such as paint chips from the miscellaneous work area water flows. Overflow water from the sump is discharged to San Diego Bay. The sump is periodically inundated by bay water during periods of unusual high tides. In order to obtain a chemical analysis of paint chips that may have been discharged from this sump, Regional Board staff collected a sample of the waste deposit in the sump on February 2, 1988. The sample results are as follows:

Constituent	Dry Weight Concentration
Copper	17,300 mg/kg
Mercury	5.16 mg/kg

14. Paint chips were extracted from additional sediment samples collected March 8, 1988 at twenty stations in Commercial Basin by Regional Board and Department of Fish and Game staff. The paint chips were quantified and analyzed for heavy metals and tributyltin and the sediment samples were analyzed for tributyltin. The paint chips were not analyzed for mercury due to insufficient sample size. Results of the paint chip and sediment analysis for Stations AB, AD, AE, and AF in dry weight are as follows:

Station	Paint Chips[1]	Copper Paint Chip	Tributyltin Paint Chip	Tributyltin Sediment
AB	0.05 grams	62,000 mg/kg	-	1,821 ng/g
AD	0.34 grams	27,000 mg/kg	-	2,549 ng/g
AE	1.17 grams	2,100 mg/kg	2,125.827 mg/kg	3,695 ng/g
AF	1.72 grams	180,000 mg/kg	-	10,420 ng/g

1 Paint chip quantity extracted from approximately 3,500 grams (dry weight) of sediment.

A linear regression analysis of the sample results from the 20 stations done by the Department of Fish and Game shows that there is a statistically significant correlation between the concentration of paint chips and the tributyltin concentration in the sediment. The concentration of tributyltin in sediment increases as the concentration of paint chips in sediment increases.

15. Several conclusions can be drawn from the data which has been obtained in Commercial Basin. The bay sediment data discussed in Findings 9 and 10 shows that concentrations of copper, mercury, and tributyltin at Stations AA, AB, AC, AD, AE, and AF are very elevated with respect to the background concentrations. Furthermore, the bay sediment data collected by Regional Board staff on February 2, 1988 shows that sediment concentrations of copper, mercury, and tributyltin in the bay sediment decrease markedly with distance from the Mauricio and Sons, Inc. facility. The paint composition data cited in Finding 11 shows that copper and tributyltin are used in marine antifouling paints. (Mercury is also present in marine antifouling paints in use prior to 1970.) The sample results of waste collected from the Mauricio and Sons, Inc. sump cited in Finding 13 shows that copper and mercury were present in elevated concentrations. Analysis of paint chips segregated from the bay sediment at Stations AB, AD, AE, and AF showed high concentrations of copper and tributyltin. Based on the foregoing the Regional

Board finds and concludes that the elevated concentrations of copper, mercury, and tributyltin in the bay sediment at Stations AA, AB, AC, AD, AE, and AF resulted from discharges of paint chips and other waste from Mauricio and Sons, Inc. into San Diego Bay. These waste discharges constitute a violation of Prohibition A.2, Discharge Specifications B.2 and B.3 and Provisions D.1 and D.11 of Order No. 85-03.

16. In September, 1986 a report titled **Development of Sediment Quality Values for Puget Sound** was published as a joint effort of the Puget Sound Estuary Program and the Puget Sound Dredged Disposal Analysis. The work was performed by Tetra Tech, Inc. with funding and support from the U. S. Environmental Protection Agency, the U. S. Army Corps of Engineers and the State of Washington Departments of Ecology and Natural Resources. The report evaluates options for sediment management and identifies numerical values for concentrations of chemicals in sediments that appear to be associated with adverse biological effects in Puget Sound. One methodology discussed in the report for determining limiting sediment concentrations is the Apparent Effects Threshold (AET) approach. The determination of AET sediment values for various chemicals was based on oyster bioassays, amphipod bioassays and abundance of benthic infauna. The AET sediment concentration for a given chemical is defined as the sediment concentration of a chemical, above which, statistically significant biological effects (eg., mortality in amphipod bioassays, depressions in the abundance of benthic infauna) could always be expected to occur. The lower limit AET sediment concentrations in dry weight for copper and mercury concentrations (AET values for tributyltin have not been developed) in sediment are listed below:

Chemical	Amphipod AET Value	Oyster AET Value	Benthic AET Value
Copper	310.0 mg/kg	290.0 mg/kg	170.0 mg/kg
Mercury	1.7 mg/kg	0.49 mg/kg	0.52 mg/kg

The discharges of waste from Mauricio and Sons, Inc. cited in previous findings have caused bay sediment concentrations of mercury and copper in the vicinity of Mauricio and Sons, Inc. to exceed the AET sediment concentration criteria cited above.

17. Currently there are no sediment quality values specifically established for San Diego Bay. Although there are limitations that are inherent in transferring AET sediment quality standards from one water body to another, the Puget Sound AET values still provide useful guidance in predicting the environmental consequences of the sediment quality in Commercial Basin. There are several similarities in the environmental conditions which are present in Puget Sound and San Diego Bay. The potential sources of both copper and mercury contaminants are believed to be similar in Puget Sound and San Diego Bay. Both water bodies have extensive areas of boat and ship repair facilities. Although the natural biota may be somewhat different between the two areas, it is unlikely that San Diego Bay organisms would be significantly more tolerant to heavy metal contamination than the organisms found in Puget Sound. The Regional Board finds and concludes that, in this instance, the Puget Sound AET values represent the best information available on the sediment pollutant concentrations for copper and mercury which could adversely affect the beneficial uses of San Diego Bay.

18. As previously stated in Finding 11, tributyltin is a biocide used in antifouling vessel paints. The

antifouling paint prevents the fouling of the vessel hull by releasing tributyltin into the surrounding water. Depending on environmental conditions, tributyltin is eventually degraded into dibutyltin, monobutyltin , and ultimately to elemental tin. Tributyltin is one to two orders of magnitude more toxic than dibutyltin, which is more toxic than monobutyltin. Tributyltin is lipophilic, rapidly adsorbs to marine sediments, and can penetrate biological membranes. Sensitivity to tributyltin varies among aquatic species. Gastropods and bivalves are the most susceptible organisms affected at tributyltin water concentrations as low as 0.02 to 0.14 µg/l, followed by crustaceans at 0.09 to 0.14 µg/l, algae at 0.1 to 0.35 µg/l, and fishes at concentrations of 0.2 µg/l or greater. Sublethal effects on marine biota caused by tributyltin include reproductive abnormalities, growth retardation, anatomical abnormalities, bioaccumulation, and behavior changes.

19. Tributyltin has been investigated by the State Water Resources Control Board's Priority Chemicals Program. By memorandum dated December 30, 1987 State Board staff presented a summary of the findings and recommendations contained in the forthcoming report **Tributyltin in California Waters.** In this report State Board staff recommended a water quality criteria of 6 ng/l for tributyltin in seawater to protect aquatic life. State Board staff also recommended that this criteria serve as the basis for adoption of water quality objectives in the California Ocean Plan and basin plans. In the absence of a standard for tributyltin in San Diego Bay, the State Board's recommended criteria of 6 ng/l will be applied for purposes of establishing sediment cleanup levels. Water quality objectives for tributyltin in marine sediments have not been established.

20. Regional Board and Department of Fish and Game staff conducted a sampling survey of tributyltin water column concentrations throughout San Diego Bay on August 19, 1987. The tributyltin water column sample results are contained in the Department of Fish and Game's draft report, **Preliminary Data Report on Tributyltin and PCBs in San Diego Harbor, March 30, 1988** and are summarized below:

Location	Station	Range of Tributyltin Concentrations	Number of Samples	Mean Tributyltin Concentrations
Bay Entrance	1-4	<7-36 ng/l	4	22 ng/l
Shelter Is Yacht Bn	5-6	210 ng/l	1	210 ng/l
Commercial Basin	7-9	75-420 ng/l	3	262 ng/l
Harbor Island South	10	24 ng/l	1	24 ng/l
Harbor Island West	11-13	160 ng/l	1	160 ng/l
Harbor Island East	16-22	10-28 ng/l	2	19 ng/l
Navy Channel	14-15	34-56 ng/l	2	45 ng/l
Glorietta Bay	23-25	98 ng/l	1	98 ng/l
7th Street	26-27	<7 ng/l	1	<7 ng/l
Sweetwater	28-32	18-21 ng/l	2	20 ng/l

As shown in the table above the mean tributyltin concentrations in bay waters ranged from a low of <7 ng/l at the 7th Street station to a high of 262 ng/l in Commercial Basin. The mean concentration of tributyltin in Commercial Basin, based on the August 19 sample data, exceeded

the mean tributyltin concentrations in all other areas of San Diego Bay. The mean tributyltin concentration of 262 ng/l in Commercial Basin is in excess of concentrations known to cause adverse effects on marine biota and is over 43 times greater than the State Board's Water Quality Criteria of 6 ng/l. As discussed in Findings 9 and 10, the discharge of paint chips significantly contributed to the elevated concentrations of tributyltin in the sediment fronting Mauricio and Sons, Inc.. These sediment concentrations in turn contributed to the elevated tributyltin concentrations found in the water column of Commercial Basin. The Regional Board recognizes that the leaching of tributyltin from boat hulls is also a major source of tributyltin in San Diego Bay. As a consequence of such boat hull leaching, other areas of San Diego Bay not subject to waste discharges from boatyards/shipyards were also found to contain tributyltin concentrations in excess of the State Board's 6 ng/l water quality criteria.

21. Oysters from Humboldt Bay were transplanted to numerous locations throughout San Diego Bay by Regional Board and Department of Fish and Game staff in order to evaluate the biological effects of tributyltin. The oysters were deployed in August, 1987 and collected in December, 1987. The most notable effects are growth reduction and a characteristic shell thickening response known as chambering. Chambering in oysters occurs at tributyltin concentrations as low as 0.15 ug/l and is believed to be a specific biological indicator of elevated concentrations of tributyltin. Because of the enormous amount of biological energy devoted to shell chambering, the edible muscle tissue remains small and the oysters are rendered commercially non-viable. Chambering oysters which are subsequently transplanted to clean waters resume normal growth. The shell thickness index is defined as the ratio of shell length to width and is a measure of the degree of chambering. A low index indicates a high degree of chambering; conversely, a high index indicates a lack of chambering. Upon collection, the oyster shells were measured and the edible tissue extracted and weighed. The results of the study are contained in the Department of Fish and Game's draft report and are summarized below:

Location	Station	Mean Shell Thickness Index		Tissue Weight	
Bay Entrance	1-4	4.55-11.84	mm	0.91-7.02	grams
Shelter Island	5-6	4.64	mm	0.37	grams
Commercial Basin	7-9	3.85-6.59	mm	0.25-0.65	grams
Harbor Island South	10	4.04	mm	0.45	grams
Harbor Island West	11-13	3.84-6.50	mm	0.14-0.36	grams
Harbor Island East	16-22	4.31-5.30	mm	0.30-0.68	grams
Navy Channel	14-15	4.79-4.91	mm	0.62-1.30	grams
Glorietta Bay	23-25	3.94-5.28	mm	0.31-1.03	grams
7th Street	26-27	6.60-11.18	mm	0.80-2.0	grams
Sweetwater	28-32	6.71-9.13	mm	1.56-4.79	grams

22. The data cited in Finding 21 shows that the 11.84, 11.18, and 9.13 mm shell thickness indices at Stations 1, 27, and 30 in bay areas less influenced by tributyltin were markedly higher than the 3.85, 5.62, and 6.59 mm shell thickness indices found at Stations 7, 8, and 9 in Commercial Basin. The low shell thickness indices found in the Commercial Basin oysters indicates a high degree of chambering and is a direct result of the elevated tributyltin concentrations found in Commercial Basin. The Commercial Basin oysters also exhibited high

mortality and apparently reduced edible tissue weights. Oysters transplanted to other areas of the bay having elevated tributyltin levels in the water column, for example in marinas, exhibited adverse biological effects similar to those observed in Commercial Basin. The Regional Board believes that the waste discharges from Mauricio and Sons, Inc. did contribute to the adverse biological effects observed in oysters transplanted to Commercial Basin. However the extent to which the adverse biological effects were caused by the waste discharges, as opposed to the leaching of tributyltin from boat hulls, is not known.

23. Biologists from the Moss Landing Marine Laboratory are currently evaluating the impact of boats on biological communities in San Diego Bay. The preliminary data (contained in the **Preliminary Data Report on Tributyltin and PCBs in San Diego Harbor, March 30, 1988**) reveal general patterns and show that dramatic biological changes have occurred in portions of San Diego Bay where boats are most numerous. In general, areas with high densities of boats such as Commercial Basin, are characterized by the lack of species diversification. Benthic fauna in Commercial Basin is dominated by serpulid tube worms, while other groups of organisms are reduced or absent. Overall, biomass is low and bare substrate is common. While the major emphasis of the study is on the effects of boat densities, with the concomitant leaching of antifouling agents into the bay, the Regional Board believes that the waste discharges containing tributyltin, copper and mercury from Mauricio and Sons, Inc. contributed to the adverse biological effects cited in this study.

24. The Mauricio and Sons, Inc. waste discharges caused the bay sediment concentrations of mercury and copper in the vicinity of Mauricio and Sons, Inc. to exceed the AET sediment concentration criteria cited in Finding 16. The Mauricio and Sons, Inc. waste discharges have also contributed to tributyltin concentrations in the water column of Commercial Basin exceeding the State Board's Water Quality Criteria of 6 ng/l. The Mauricio and Sons, Inc. waste discharges have also contributed to increased chambering and reduced edible tissue weight in oysters transplanted to Commercial Basin. Furthermore the Mauricio and Sons, Inc. waste discharges have contributed to substantial degradation in the biological communities of Commercial Basin. The Mauricio and Sons, Inc. waste discharges have impaired the marine habitat and shellfish harvesting beneficial uses of the Commercial Basin portion of San Diego Bay. Based on the foregoing, the Regional Board finds and concludes that the waste discharges from Mauricio and Sons, Inc. have caused a condition of pollution as defined in Water Code Section 13050 in the Commercial Basin portion of San Diego Bay. This constitutes a violation of Provision D.1 of Order No. 85-03.

25. Based on the above findings the Regional Board finds that Mauricio and Sons, Inc. discharged waste to the Commercial Basin portion of San Diego Bay in violation of requirements set forth in Order No. 85-03.

26. This enforcement action is exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.) in accordance with Section 15321, Chapter 3, Title 14, California Administrative Code.

It Is Hereby Ordered, That in accordance with California Water Code Section 13304, Mauricio and Sons, Inc. shall comply with the following directives:

1. Mauricio and Sons, Inc. shall submit a report to the Regional Board no later than November 1, 1988 identifying a range of remedial action alternatives to cleanup contaminated bay sediment resulting from the discharge of waste Mauricio and Sons, Inc.. The report shall, at a minimum, contain a detailed analysis of the cost, feasibility, and lateral and vertical extent of contaminated sediment associated with cleanup strategies a), b), and c) described below. In addition to the evaluation of these cleanup strategies Mauricio and Sons, Inc. may propose an alternate cleanup strategy by evaluating the criteria described in item d) below. The Regional Board will evaluate the information submitted in the report and select a cleanup level for the contaminated sediment.

   a) Removal and/or treatment of the contaminated sediment to attain the following background concentrations of mercury, copper, and tributyltin in the bay sediment described in Finding 10:

Constituent	Dry Weight Concentration
Mercury	0.81 mg/kg
Copper	63 mg/kg
Tributyltin	193 ng/g

   b) Removal and/or treatment of the contaminated sediment to attain the following Apparent Effects Threshold (AET) dry weight sediment concentrations for copper and mercury described in Finding 16 and the State Water Resources Control Board's proposed water quality criteria for tributyltin described in Finding 19:

Constituent	Concentration
Mercury	0.49 mg/kg
Copper	170 mg/kg
Tributyltin	6 ng/l

   Under this alternative it will be necessary to ascertain the degree of tributyltin migration from the sediments to the water column that will occur and to demonstrate that any tributyltin migration will not cause the 6 ng/l water quality criteria to be exceeded in either the water column or the interstitial water found within the sediment.

   c) Removal and/or treatment of contaminated sediment to attain the following Ocean Plan water quality objectives for copper and mercury described in Finding 6 and the State Water Resources Control Board's proposed water quality criteria for tributyltin described in Finding 19 in the water column and interstitial water:

Constituent	Concentration	
Mercury	0.14	µg/l
Copper	5	µg/l
Tributyltin	6	ng/l

Under this alternative it will be necessary to ascertain the degree of copper, mercury, and tributyltin migration from the sediments to the water column that will occur and to demonstrate that any copper, mercury, and tributyltin migration will not cause the above concentrations to be exceeded in either the water column or the interstitial water found within the sediment.

d) Any remedial action alternative proposing the attainment of copper, mercury, and tributyltin concentrations in the sediment, water column and interstitial water that would comply with the following criteria:

1. The proposed copper, mercury, and tributyltin concentrations to be attained in the affected San Diego Bay sediment contamination zone will not alter the quality of San Diego Bay waters to a degree which unreasonably affects the beneficial uses of San Diego Bay.

2. The proposed copper, mercury, and tributyltin concentrations to be attained in the sediment contamination zone will be consistent with the maximum benefit to the people of the state.

3. The proposed copper, mercury, and tributyltin concentrations to be attained in the sediment contamination zone will not result in water quality less than prescribed in the Basin Plan, Ocean Plan or other prescribed policies.

2. Mauricio and Sons, Inc. shall no later than May 1, 1989 cleanup the contaminated bay sediment to the level prescribed by the Regional Board under Directive 1 of this order.

3. Mauricio and Sons, Inc. shall no later than March 1, 1989 submit a post-cleanup sampling plan to verify the attainment of the prescribed cleanup standards in the area of sediment contamination defined under Directive 1 of this order. Upon the approval of the sampling plan by the Regional Board Executive Officer, Mauricio and Sons, Inc. shall collect and analyze the samples prescribed in the sampling plan. The post cleanup sampling results shall be submitted to the Regional Board no later than July 1, 1989.

4. Mauricio and Sons, Inc. shall upon implementation of the selected cleanup alternative, submit cleanup progress reports to the Regional Board on a quarterly basis, until in the opinion of the Regional Board Executive Officer, the cleanup of the contaminated sediment has been completed. The reports shall contain information discussing the progress made toward attaining the final selected cleanup criteria for the bay sediment. Specific information to be included in the quarterly progress reports will be determined by the Regional Board Executive Officer upon the selection of the sediment cleanup standard. The reports shall be submitted in accordance with the following reporting schedule:

Reporting Schedule	Report Due
January, February, March	April 30
April, May, June	July 30
July, August, September	October 30
October, November, December	January 30

5. Mauricio and Sons, Inc. shall dispose of all contaminated sediment in accordance with all applicable state and federal regulations.

Provision

1. Mauricio and Sons, Inc. is located on lands owned by the San Diego Unified Port District. The Port District is a governmental agency. In addition the current lease for Mauricio and Sons, Inc. requires that the Mauricio and Sons, Inc. comply with any applicable laws of the State of California. Thus under Water Code Section 13304, the Regional Board may name the Port District as a responsible party for the purposes of compliance with this order. The Regional Board will amend this order to include the Port District as a responsible party only if Mauricio and Sons, Inc. fails to comply with the terms and conditions of this cleanup and abatement order and the Port District fails to promptly use its governmental powers to achieve compliance with this cleanup and abatement order.

Ordered by Ladin H. Delaney

Ladin H. Delaney
Executive Officer

Dated: July 5, 1988

JBM:DSJ:DTB

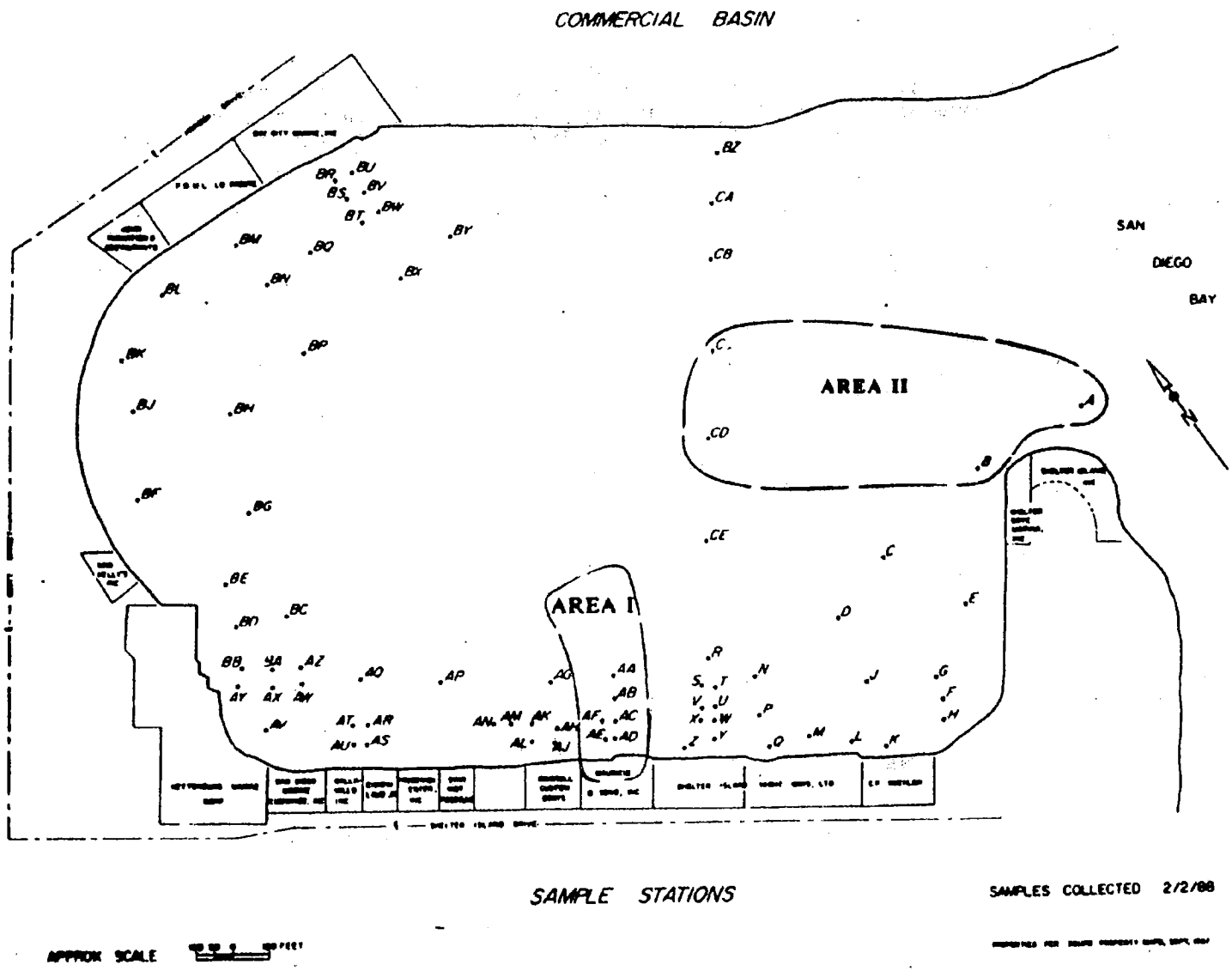

FIGURE 1. Commercial Basin, showing location of stations where sediment samples have been collected. The sediment at stations within Area I has been significantly affected by waste discharges from Mauricio and Sons, Inc. Stations within Area II are believed to be least influenced by the boatyards of Commercial Basin, and are considered to represent "background conditions".

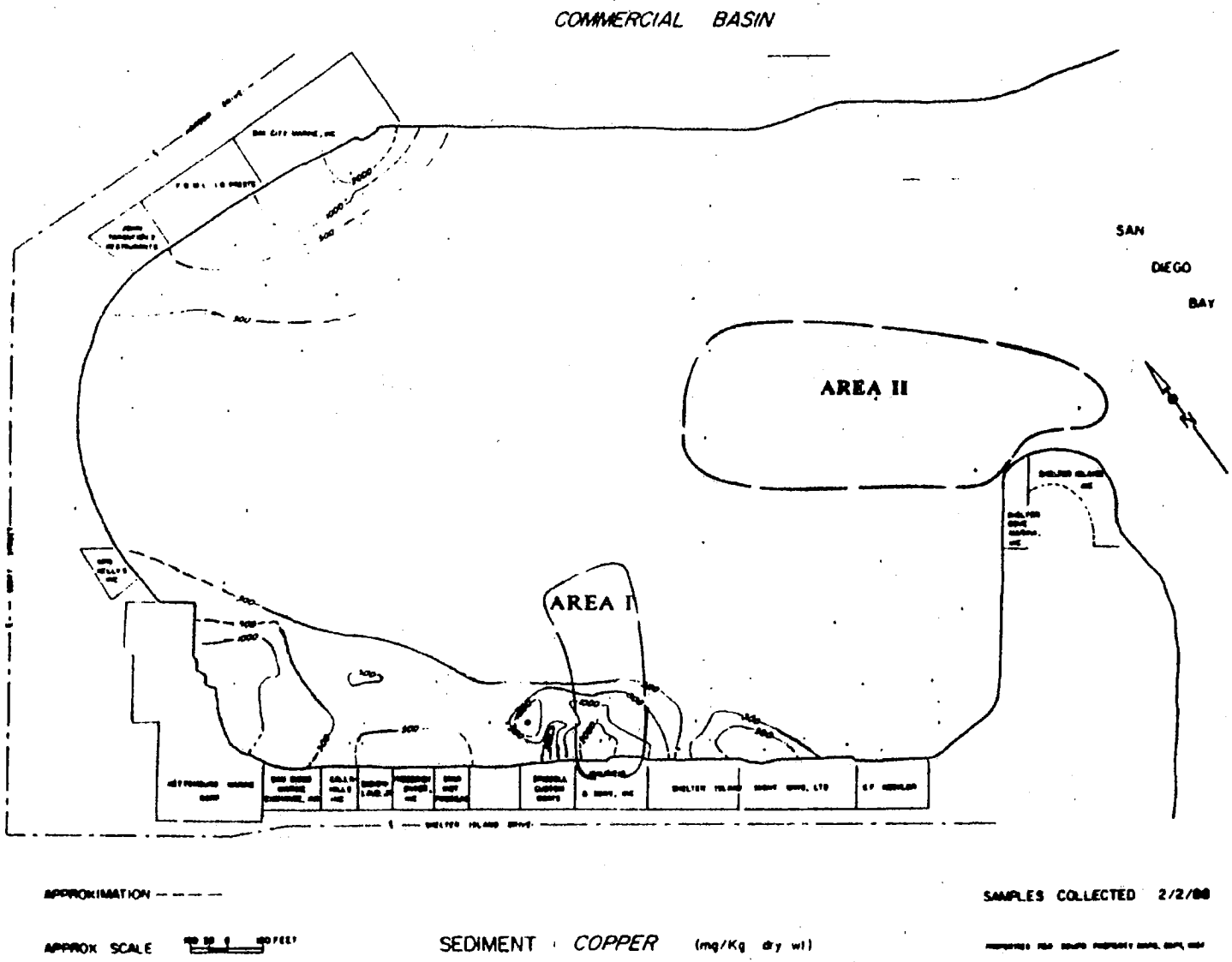

FIGURE 2. Concentration of Copper (mg/Kg) found within surficial sediments of Commercial Basin. The sediment at stations within Area I has been significantly affected by waste discharges from Mauricio and Sons, Inc. Stations within Area II are believed to be least influenced by the boatyards of Commercial Basin, and are considered to represent "background conditions".

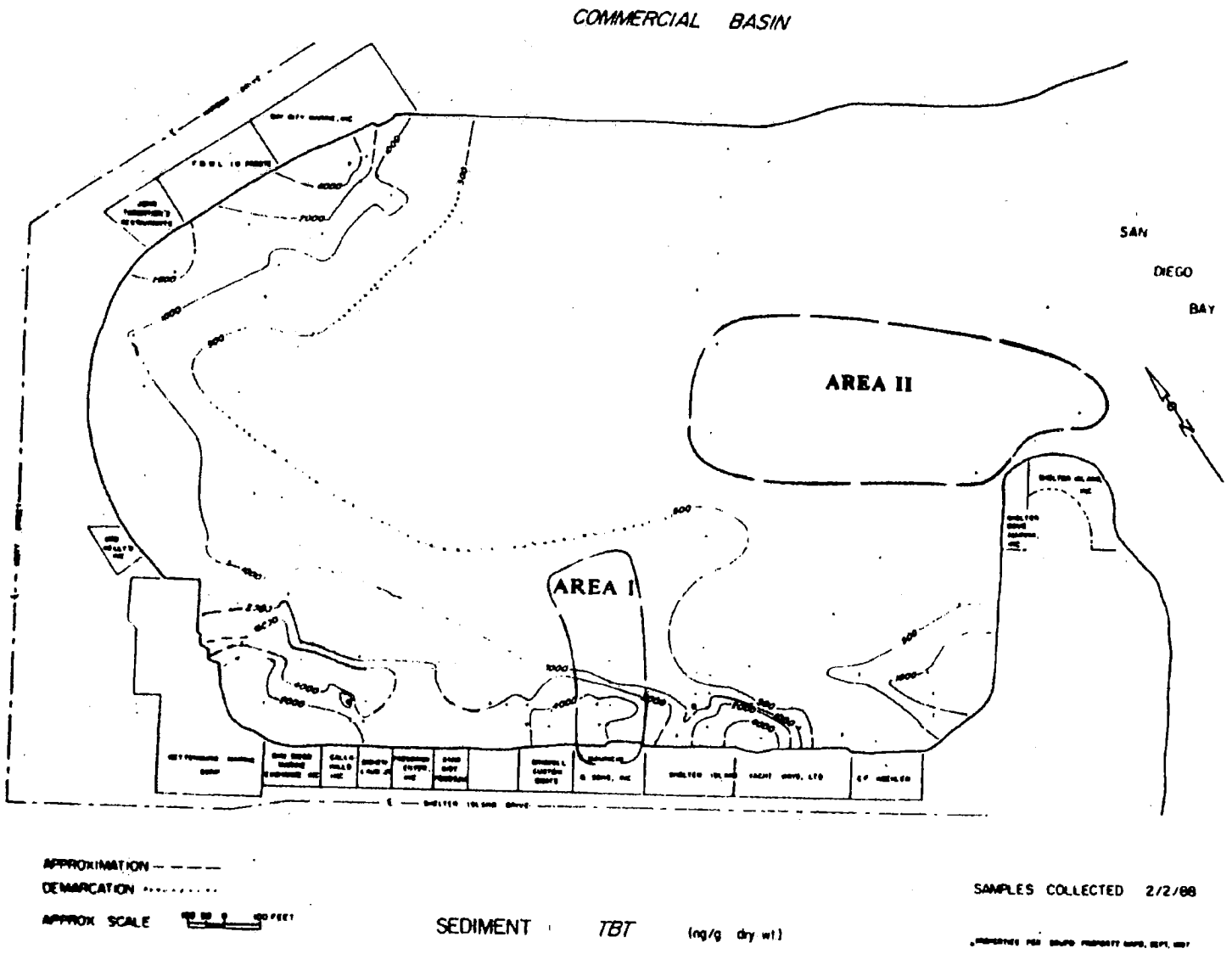

FIGURE 3. Concentration of Tributyltin (ng/g) found within surficial sediments of Commercial Basin. The sediment at stations within Area I has been significantly affected by waste discharges from Mauricio and Sons, Inc. Stations within Area II are believed to be least influenced by the boatyards of Commercial Basin, and are considered to represent "background conditions".

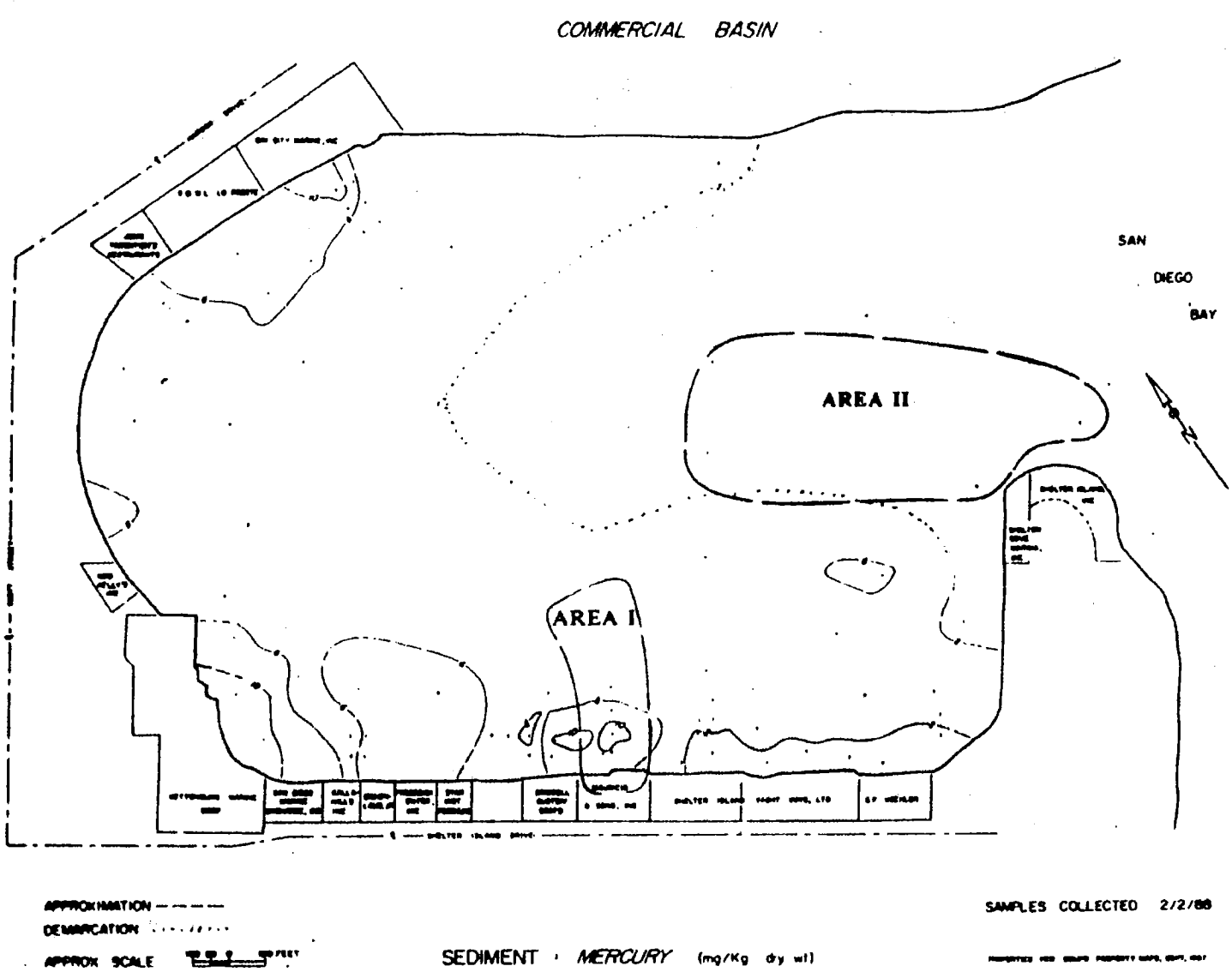

FIGURE 4. Concentration of Mercury (mg/Kg) found within surficial sediments of Commercial Basin. The sediment at stations within Area I has been significantly affected by waste discharges from Mauricio and Sons, Inc. Stations within Area II are believed to be least influenced by the boatyards of Commercial Basin, and are considered to represent "background conditions".

CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION
6154 Mission Gorge Road
Mail: Suite 205/Enter: Suite 1061
San Diego, California 92120-1939
Telephone (619) 265-5114

GEORGE DEUKMEJIAN Governor

December 12, 1985 CERTIFIED - RETURN RECEIPT REQUESTED

Mr. Glenn M. Howell
Vice President
Paco Terminals, Inc.
P. O. Box 2026
National City, California 92050

Dear Mr. Howell:

CLEANUP AND ABATEMENT ORDER NO. 85-91

Enclosed is a copy of Cleanup and Abatement Order No. 85-91. Prior to initiation of Paco Terminals, Inc. operation in 1979 Regional Board staff and Department of Fish and Game staff performed sampling at various designated stations in the portion of San Diego Bay adjacent to Paco Terminals, Inc. This sampling has continued on a regular basis to the present. Samples taken included both bay sediment and mussel tissue, which is an excellent proven bioaccumulative indicator of toxic pollutant concentrations. Results of the aforementioned sampling have shown a considerable increase in copper concentrations adjacent to Paco Terminals, Inc. in both San Diego Bay sediment and mussel tissue.

The increase of copper concentration in San Diego Bay sediments adjacent to Paco Terminals, Inc. are a direct result of copper ore discharges from the unloading, storing and shiploading operations of Paco Terminals, Inc. The Department of Fish and Game has determined, in a memorandum to me dated December 31, 1984, that, "In effect, the Paco situation represents a marine toxic waste site which if left in place will negatively influence the normally occurring, natural living resources of that area for an indefinite time period." The discharge of copper ore to San Diego Bay also represents a violation of the terms and conditions of Order No. 84-50, (NPDES No. CA0107930) and accordingly I am issuing Cleanup and Abatement Order No. 85-91 under authority of California Water Code Section 13304. Section 13304 provides:

(a) Any person who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirement or other order or prohibition issued by a regional board or the state board, or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance, shall upon order of the regional board clean up such waste or abate the effects thereof or, in the case of threatened pollution

or nuisance, take other necessary remedial action. Upon failure of any person to comply with such cleanup or abatement order, the Attorney General, at the Request of the board, shall petition the superior court for that county for the issuance of an injunction requiring such person to comply therewith. In any such suit, the court shall have jurisdiction to grant a prohibitory or mandatory injunction, either preliminary or permanent, as the facts may warrant.

(b) The Regional Board may expend available moneys to perform any cleanup, abatement, or remedial work required under the circumstances set forth in subdivision (a) which in its judgment is required by the magnitude of endeavor or urgency of prompt action needed to prevent substantial pollution, nuisance, or injury to any waters of the state. Such action may be taken in default of, or in addition to, remedial work by the waste discharger or other persons, and regardless of whether injunctive relief is being sought. The regional board may perform the work itself, or by or in cooperation with any other governmental agency, and may use rented tools or equipment, either with operators furnished or unoperated. Notwithstanding any other provisions of law, the regional board may enter into oral contracts for such work, and the contracts, whether written or oral, may include provisions for equipment rental and in addition the furnishing of labor and materials necessary to accomplish the work. Such contracts shall be exempt from approval by the Department of General Services pursuant to the provisions of Section 14780 of the Government Code.

(c) If such waste is cleaned up, the effects thereof abated, or, in the case of threatened pollution or nuisance, other necessary remedial action is taken by any governmental agency, the person or persons who discharged the waste, discharges the waste, or threatened to cause or permit the discharge of the waste within the meaning of subdivision (a), shall be liable to that governmental agency to the extent of the reasonable costs actually incurred in cleaning up such waste, abating the effects thereof, or taking other remedial action. The amount of such costs shall be recoverable in a civil action by, and paid to, such governmental agency and the state board to the extent of the latter's contribution to the cleanup costs from the State Water Pollution Cleanup and Abatement Account or other available funds.

(d) If, despite reasonable effort by the regional board to identify the person responsible for the discharge of waste or the condition of pollution or nuisance, such person is not identified at the time cleanup, abatement or remedial work must be performed, the Regional Board shall not be required to issue an order under this section.

(e) "Threaten," for purposes of this section, means a condition creating a substantial probability of harm, when the probability and potential extent of harm make it reasonably necessary to take immediate action to prevent, reduce, or mitigate damages to persons, property, or natural resources.

(f) This section does not impose any new liability for acts occurring before January 1, 1981, if the acts were not in violation of existing laws or regulations at the time they occurred.

(Amended by Stats. 1971, Ch. 1288, Stats, 1980, Ch. 808.)

(Note the authority of regional boards in subsection (b) to expend available moneys to perform cleanup work when a cleanup order has been issued under subsection (a), and prompt action is needed to prevent substantial pollution or nuisance. Full authority to take all necessary action can be delegated to the Executive Officer (Section 13223). "Available moneys" ordinarily refers to moneys in the State Water Pollution and Abatement account (Section 13441). Funds made available from an outside source, such as the Federal Government, could also constitute "available moneys." Note that authority to expend moneys for cleanup requires an exercise of judgment be in writing. A letter to the state board should request needed funds and give the reasons in the context of the statute, such as the existence of an "urgency of prompt action is needed to prevent substantial pollution." A previous phone call could ascertain whether necessary funds are available.)

You should be aware that the status of Paco Terminals, Inc. and Cleanup and Abatement Order No. 85-91 will be discussed by the Regional Board at their upcoming December 16, 1985 meeting. The meeting will begin at 9:30 a.m. in Room B109 of the State Building, 1350 Front Street, San Diego. You or your representative(s) may wish to attend this meeting.

I strongly urge a prompt and complete response to each directive of Cleanup and Abatement Order No. 85-91. Both my staff and I will be happy to work with you toward achieving compliance with the Cleanup and Abatement Order. If you have any questions or would like to set up a meeting to discuss this matter further, please contact Mr. Jim Munch at (619) 265-5114.

Very truly yours,

Ladin H. Delaney

LADIN H. DELANEY
Executive Officer

JM:rs

Enclosures

cc: Mr. Tomas Firle
Environmental Coordinator
Port of San Diego
P. O. Box 488
San Diego, California 92112

Mr. George Devendorf
National City Fire Department
333 East 16th Street
National City, California 92050

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

CLEANUP AND ABATEMENT ORDER NO. 85-91

PACO TERMINALS, INC.
NATIONAL CITY
SAN DIEGO COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board), finds that:

1. On November 26, 1979 the Regional Board adopted Order No. 79-72, National Pollutant Discharge Elimination System (NPDES) Permit No. CA0107930, *Waste Discharge Requirements for Paco Terminals, Inc.* Order No. 79-72 regulated a potential intermittent discharge of copper ore from Paco Terminals, Inc., a copper ore transfer facility, located adjacent to San Diego Bay. Order No. 79-72 contained an expiration date of November 26, 1984. On November 26, 1984 the Regional Board adopted Order No. 84-50, NPDES No. CA0107930, *Waste Discharge Requirements for Paco Terminals, Inc. San Diego County.* Order No. 84-50 renewed the requirements of Order No. 79-72 and added additional discharge prohibitions to eliminate potential intermittent discharges of copper ore to San Diego Bay from Paco Terminals, Inc.

2. Paco Terminals, Inc. ships an annual minimum of 137,750 tons of copper concentrate, a rendered form of cupric ferrous sulfide ore (chalcopyrite) through the San Diego Unified Port District's 24th Street Marine Terminal on San Diego Bay. The copper ore is shipped to the marine terminal via railroad gondola cars. Front-end loaders then stockpile the copper ore on asphalt pads adjacent to the loading pier for storage. Upon arrival of a transport ship the copper ore is moved to a container crane by the front-end loaders. The container crane then loads, using a clamshell bucket, the copper ore onto ships for export to other destinations.

3. Due to the potential discharge of copper ore to San Diego Bay by both storm runoff from the marine terminal area coming in contact with the copper ore and windborne transport of the copper ore, Paco Terminals, Inc. was required by the Regional Board to develop a Water Pollution Control Plan (Best Management Practices) to prevent the copper ore from being discharged to San Diego Bay under Provision B.2 of Order No. 79-72.

   By letter dated November 26, 1979 Paco Terminals, Inc. submitted the following Water Pollution Control Plan, which was subsequently approved by Regional Board staff.

   a. Onsite storm drain inlets would be covered with a water filtration material to prevent any discharge of copper ore through the storm drains to San Diego Bay due to storm runoff.

b. Copper ore stockpiles would be covered with a nylon reinforced polyethylene material to prevent the discharge or spillage of copper ore to San Diego Bay through wind action or storm water runoff.

c. During ship loading operations water trucks would be used to prevent the discharge or spillage of copper ore to San Diego Bay through wind action. In addition, net and nylon reinforced polyethylene tarps would be used to prevent the discharge or spillage of copper ore to San Diego Bay.

d. After ship loading operations, street sweepers would be used to remove any residual copper ore from the pavement area.

4. On July 31, 1984 Paco Terminals, Inc. submitted their application for renewal of Order No. 79-72 and amended their November 26, 1979 Best Management Practices Plan. The amended Best Management Practices Plan was approved by the Regional Board and included as Finding No. 7 to Order No. 84-50:

"a. The storage pad at Berth Four, 24th Street Terminal is constructed in such a manner that the pad slopes landward in a line approximately 150 feet from the pierface. Concentrates, once removed from the railcars will be stored in stockpiles behind the slopeline which will be clearly identified. This will eliminate the possibility of any run off of concentrates over the pierface into the bay. By placing the concentrates a greater distance from the bay, the possibility of concentrate being blown into the bay will be further reduced. (See Attachment A of this Order)

b. By storing the concentrate as described in paragraph a, all run off water from the stockpiled concentrates will flow landward and will be contained in the storage pad area. Storm drains on the pad will be sealed and closed with the exception of a twelve inch riser pipe, the open end of which will be covered with polyester filtration cloth. This type of drainage system will allow water to flow into the storm drain only after it has reached sufficient depth to allow settling of the concentrates. The filtration cloth will further reduce the possibility of discharge of contaminants.

c. Concentrates will only be placed on the shipside of the slopeline during actual loading operation as the concentrates are being placed onboard ship. It is expected that there will be a maximum of five working days per month during which the concentrates would be placed on the shipside of the slopeline. At all other times the concentrates will be stored on the landside of the slopeline.

d. At no time will concentrates be stored or placed within 20 feet of the pierface. This 20 foot safety zone will ensure that concentrates are kept back from the pierface to eliminate the possibility of spillage into the bay as concentrates are being handled on the dock. This safety zone will be clearly identified. (See Temporary Storage Boundary - Exhibit "A" attached hereto)

e. Concentrates, once unloaded and stockpiled at the facility, will be completely covered with nylon reinforced polyethylene tarps which will be held in place by rubber ties. Tarps will be positioned and secured to prevent any blowing of the stockpiled concentrates. The tarps will remain over the concentrates at all times and will only be removed immediately before vessel loading.

f. Once tarps are removed from the concentrates in preparation for loading, and at all times during the loading operation, Paco Industries, Inc. will maintain on hand a manned 3,000 gallon water truck. This truck is capable of spraying a 40 foot wide path of water and will constantly patrol the entire dock area, spraying water as frequently as necessary to wet down the concentrates, thereby preventing it from being blown by the wind. Spraying of water on the shipside of the slopeline will be in the minimum amounts necessary to prevent blowing of concentrates. In no event will amounts of water be added to concentrates in this area which will permit run off into the bay.

g. During loading operations, concentrates will be released from the clam bucket in to the ship's hold in such a manner that concentrates will not be spilled into the water.

h. At the completion of loading concentrates on board ship, any concentrate residue remaining on the dock will be immediately cleaned up with front end loaders and by hand with shovels and brooms. There will be a new emphasis on manual labor (shovels and brooms) in cleanup operations since this is the most thorough cleanup method. In no event will water be used to clean concentrate residue from the storage pad on the ship side of the slopeline. Any remaining concentrates will be stockpiled landside of the slopeline and placed under tarps as described above."

5. Order No. 79-72 contains the following applicable receiving water limitations and provisions:

a) Receiving Water Limitation A

"This discharge shall not cause a violation of any applicable water quality standard for receiving waters adopted by the Regional Board or the State Water Resources Control Act and regulations adopted thereunder. If more stringent applicable water quality standards are promulgated or approved pursuant to Section 303 of the Federal Water Pollution Control Act, or amendments thereto, the Regional Board will revise and modify this Order in accordance with such more stringent standards."

The water quality standards referenced above are contained in the Regional Board's *Comprehensive Water Quality Control Plan Report 1978 Amendments, San Diego Basin (9)* (Basin Plan). One pertinent water quality objective contained in the Basin Plan states:

"All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal or aquatic life..."

b) Provision B.1

"Neither the treatment nor the discharge of pollutants shall create a pollution, contamination, or nuisance as defined in the California Water Code."

c) Provision B.2

"Paco Terminals, Inc. shall develop and implement a Water Pollution Control Plan, acceptable to the Executive Officer of this Regional Board, detailing means of controlling the discharge of pollutants from the copper ore stockpiling and loading operation at the 24th Street Marine Terminal. In developing the plan, the discharger should consider methods of segregating the stockpiled copper to prevent contact with storm runoff discharged to San Diego Bay. Upon approval by the Executive Officer and the Regional Administrator, the Water Pollution Control Plan developed by the discharger shall become a condition of this permit."

6. Order No. 85-40 contains the following applicable prohibitions, receiving water limitations and provisions:

a) Prohibition A.2

"The deposition of discharge of copper concentrate ore into San Diego Bay or at any place where it would be eventually transported to San Diego Bay is prohibited."

Note: California Water Code Section 13050 defines contamination, pollution and nuisance as follows:

i) "Contamination" means an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" shall include any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected.

ii) "Pollution" means an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects (1) such waters for beneficial uses, or (2) facilities which serve such beneficial uses. "Pollution" may include "contamination".

iii) "Nuisance" means anything which: (1) is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, and (2) affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal, and (3) occurs during or as a result of the treatment or disposal of wastes.

b) Discharge Specification B.2(c)

"Effluent discharged to San Diego Bay must be essentially free of...substances toxic to marine life due to increases in concentrations in marine waters or sediments."

c) Discharge Specification B.3

"The discharger shall comply with the Water Pollution Control Plan described in Finding No. 7. Any proposed amendment to the Water Pollution Control Plan must be approved in writing by the Executive Officer."

d) Receiving Water Limitations C.1(d)

"Water shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses."

e) Receiving Water Limitation
C.5(a) "Toxicity"

"All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life."

f) Receiving Water Limitation
C.6 "Toxic Materials Limitations

"The discharge shall not cause the following toxic material limitations to be exceeded in the receiving waters upon the completion of initial dilution except that limitations indicated for radioactivity shall apply directly to the undiluted waste effluent."

Constituent	Unit	6-Month[1] Median	Daily[2] Maximum	Instantaneous[3] Maximum
Copper	µg/l	5	20	50

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1 The six-month median concentration limit shall apply as a moving median of daily values for any 180-day period in which daily values represent flow-weighted average concentrations within a 24-hour period. For intermittent discharges, the daily values shall be considered to equal zero for days on which no discharge occurred.

2 The daily maximum limitation shall apply to the results of a single composite sample collected over a period of 24 hours.

3 The instantaneous maximum concentration limit shall apply to grab sample determinations.

(g) Provision D.1

"Neither the treatment nor the discharge of pollutants shall create a pollution, contamination, or nuisance as defined by Section 13050 of the California Water Code."*

(h) Provision D.6

"This discharge shall not cause a violation of any applicable water quality standard for receiving waters adopted by the Regional Board or the State Water Resources Control Board as required by the Clean Water Act and regulations adopted thereunder. If more stringent applicable water quality standards are promulgated or approved pursuant to Section 303 of the Clean Water Act or Amendments thereto, the Regional Board will revise and modify this Order in accordance with the more stringent standards."

The water quality standards referenced above are contained in the Regional Board's *Comprehensive Water Quality Control Plan Report, San Diego Basin (9)* (Basin Plan) and amendments. One pertinent water quality objective contained in the Basin Plan states:

> "All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal or aquatic life..."

7. The Water Quality Control Plan for Ocean Waters of California - 1983 (Ocean Plan) was adopted by the State Board on November 17, 1983. The 1983 Ocean Plan established beneficial uses of the ocean waters of the state, water quality objectives, general requirements for management of waste discharges to the ocean, quality requirements for waste discharges, and discharge prohibitions.

8. In a legal opinion issued on January 18, 1984 by the Office of the Chief Counsel for the State Water Resources Control Board, it was determined that the California Ocean Plan water quality standards can be applied to discharges in the absence of standards in the Bays and Estuaries policy. Such authority can be taken from the Porter-Cologne Act, Water Code Section 13000 et seq. which requires Regional Boards, in the adoption of waste discharge requirements, to implement relevant basin plans and to take into consideration the beneficial uses to be protected, the water quality objectives reasonably required for that purpose, and the provisions of Water Code Section 13241.

9. The beneficial uses of San Diego Bay are:

---

*Note: The definition of pollution, contamination and nuisance is stated in Finding No. 5 and California Water Code Section 13050.

(a) Industrial service supply
(b) Navigation
(c) Water contact recreation
(d) Noncontact water recreation
(e) Ocean commercial and sport fishing
(f) Saline water habitat
(g) Preservation of rare and endangered species
(h) Marine habitat
(i) Fish migration
(j) Shellfish harvesting

10. On October 28, 1968 the State Water Resources Control Board adopted Resolution No. 68-16, *Statement of Policy with Respect to Maintaining High Quality Waters in California* (hereinafter referred to as the Nondegradation Policy). Under the terms and conditions of the Nondegradation Policy, the existing (pre-discharge) water quality of the San Diego Bay must be maintained unless it is demonstrated that a decrease in water quality (1) will be consistent with maximum benefit to the people of the State, (2) will not unreasonably affect beneficial uses, and (3) will not result in water quality less than prescribed in the Basin Plan or other adopted policies.

11. Monitoring performed by Regional Board staff from 1979 to 1984 at locations adjacent to Paco Terminals Inc. has detected increasing levels of copper concentrations in the bay sediments. Results of samples collected in April, 1979, prior to initiation of Paco Terminals Inc. operations, indicate an average copper concentration adjacent to Paco Terminals Inc. of 110 milligrams per kilogram (mg/kg). The average copper concentration in samples collected by Regional Board staff in June 1983 and June 1984 at the locations previously sampled in 1979 were 5551 mg/kg and 13,717 mg/kg respectively.

12. Additional documentation of elevated copper concentrations in San Diego Bay waters and sediments has been obtained from the California State Mussel Watch Program. Department of Fish and Game staff collected mussel tissue samples suspended in the San Diego Bay water column in December, 1982, January, 1984 and January 1985. The mussel tissue sample results indicate an average copper concentration of 49.2 mg/kg in December 1982, 78.7 mg/kg in January 1984 and 88.1 mg/kg in January 1985. All mussel tissue sampling data collected during 1982 through 1984 exceeded the 90 percent Elevated Toxic Pollutant Levels (ETPL) for mussel tissue copper concentrations established by the State Mussel Watch Program. The ETPL has been developed to identify locations where levels of toxic substances are significantly higher than the levels measured statewide. The 90 percent EPTL is that concentration of a toxic substance that equals or exceeds 90 percent of all measurements of the toxic substance in the same type of sample throughout the state.

13. The copper concentrations found in the mussel tissue are not a direct measurement of copper concentrations in San Diego Bay waters, however the mussel tissue copper concentrations are an excellent indicator of the relative presence of copper at one sampling station versus another sampling station. The high concentrations of copper found within the mussel tissue indicates that a significant amount of copper is migrating from the copper ore-contaminated sediments into the water column.

14. The test mussels used in the State Mussel Watch Program were suspended in the upper water column approximately 25 feet above the contaminated Bay sediment and would accurately reflect the copper concentrations in the water column at that depth. However, the copper concentration in the water column would likely increase as distance from the contaminated Bay sediment decreases. Thus it is likely that the Bay water closest to the sediment and the interstitual water found within the sediments can be expected to have higher concentrations of copper, as compared to the copper concentrations at the 10 foot depth contour assimilated by the test mussels. The copper concentration within the sediments can be expected to have detrimental effects on a wide range of benthic biota, particularly invertebrates, depressing the viability and productivity of the benthos in the Bay sediments adjacent to Paco Terminals Inc.

15. By memorandum dated December 31, 1984 to Mr. Ladin H. Delaney, Regional Board Executive Officer, Mr. John L. Baxter, Regional Manager, Department of Fish and Game made the following observation based on Department of Fish and Game staff review of samples collected by Regional Board and Department of Fish and Game staff:

> "...in the Paco situation, the large volume of copper ore which has been introduced to marine sediments in solid form have contaminated the benthos directly and, by leaching into the surrounding waters, have contaminated the water column at significant concentrations."

The memorandum also stated that:

> "In effect, the Paco situation represents a marine toxic waste site which if left in place will negatively influence the normally occurring, natural living resources of that area for an indefinite time period."

16. By letter dated July 16, 1985 Regional Board staff requested Paco Terminals, Inc. to submit a report which addressed (1) the areal extent of contamination, (2) actions taken for cleanup and (3) a schedule for cleanup. On August 30, 1985 Paco Terminals, Inc. submitted a report, *An Evaluation of Copper in the Marine Environment in the Vicinity of Paco Terminals, Inc., San Diego Bay, California*", prepared by Westec Services, Inc. in response to the Regional Board July 16, 1985 letter. Included in the report were the analysis of samples collected on August 16, 1985 by Westec Services, Inc. of San Diego Bay sediment in the Paco Terminals, Inc. area. The report stated the following:

> "Analysis of grab samples revealed that concentrations of total copper (2300 to 28,600 ppm) at stations (9, 15, 16, 22, 23) along the pier face and near the storm drain (9300 ppm) were higher than elsewhere in the study area. This is consistent with data collected by the RWQCB and Paco's NPDES monitoring studies."

17. The general extent of copper contamination of San Diego Bay sediment caused by Paco Terminals, Inc. based on locations and results of sediment grab samples collected by Regional Board staff and Westec Services, Inc. discussed earlier, includes but is not necessarily limited to:

(a) From the seaward pierface of Paco Terminals, Inc., which includes the shiploading operations, extending westerly in a rectangular manner to approximately 250 feet from the pierface and a width of 1000 feet along the seaward pierface.

(b) The area extending northerly to approximately 250 feet from the storm drain outfall located at the north pierface of the 24th Street Marine Terminal.

More definite studies to delineate the precise area of San Diego Bay sediment contamination by Paco Terminals, Inc. will be performed under the directives of this Order.

18. On October 1, 1985 Regional Board staff conducted an on-site compliance inspection. During the inspection Regional Board staff noted the following conditions which were not in accord with Paco Terminals, Inc. Best Management Practices Program described in Finding No. 4:

(a) A thin layer of copper ore residue covered the entire site up to the seaward pierface;

(b) The majority of the storm drains were uncovered and contained copper ore.

Both Items a and b above are direct violations of Prohibition A.2 and Discharge Specifications B.3 of Order No. 84-50 as stated in Finding No. 6 of this Order.

19. For reasons stated previously, the increasing copper concentration in the portion of San Diego Bay adjacent to Paco Terminals, Inc. is a direct result of discharge or spillage of copper ore from Paco Terminals, Inc. operations. The Regional Board sediment sampling program and the State Mussel Watch Program have clearly documented extremely high, and constantly increasing concentrations of copper in both the sediments and water column of San Diego Bay adjacent to Paco Terminals, Inc. The Regional Board believes the increased copper concentrations caused by discharge or spillage of copper ore from Paco Terminals, Inc. since initiation of operations, is a direct result of one or both of the following:

(a) Inadequate implementation of the previously mentioned Best Management Practices Plan, submitted by Paco Terminals, Inc. as described in Findings No. 3 and 4.

(b) Some inherent weakness in the Water Pollution Control Plan itself which led to the discharge or spillage of copper ore in San Diego Bay.

Accordingly Paco Terminals, Inc. has violated Provision B.2 of Order No. 79-72 stated in Finding No. 5 and Discharge Specification B.3 of Order No. 84-50 stated in Finding No. 6. Based on the October 1, 1985 Regional Board staff inspection of Paco Terminals, Inc. described in Finding No. 18 Paco Terminals, Inc. is threatening to continue to cause violations of Discharge Specification B.3 of Order No. 84-50.

20. Paco Terminals, Inc. has caused a threatened violation of Discharge Specification B.2(c) of Order No. 84-50 stated in Finding No. 6 of this Order. The marked increase in copper concentrations in San Diego Bay sediments caused by the discharge or spillage of copper ore into San Diego Bay has been previously documented in this Order. The migration of copper from the contaminated sediments into the water column threatens to cause an adverse or degraded condition in marine biota detrimental to the marine habitat beneficial use of San Diego Bay.

21. Paco Terminals, Inc. has caused a threatened violation of Receiving Water Limitation A or Order No. 79-72 stated in Finding No. 5, Receiving Water Limitation C.5(a) of Order No. 84-50 stated in Finding No. 6 and Provision D.6 of Order No. 84-50 stated in Finding No. 6. As stated in the previous findings of this Order both the Regional Board and the Department of Fish and Game have found that the copper ore discharged to San Diego by Paco Terminals, Inc. is present in San Diego Bay sediments in concentrations that could be toxic to the marine life of San Diego Bay.

22. Paco Terminals, Inc. has caused a threatened violation of Provision B.1 of Order No. 79-72 as stated in Finding 5 and Provision D.1 of Order No. 84-50 as stated in Finding No. 6. Paco Terminals, Inc. has discharged copper ore to San Diego Bay in concentrations that have created a condition of pollution in San Diego Bay waters as defined in California Water Code Section 13050 and Finding No. 5 of this Order. This finding is based on the following conclusions:

(a) The migration of copper from the contaminated sediment to the water column is threatening to cause the copper receiving water limitation of 5 µg/l described in Receiving Water Limitation C.6 of Order No. 84-50 and stated in Finding No. 6 of this Order to be exceeded in San Diego Bay waters.

(b) The water quality objective for copper described in Receiving Water Limitation C.6 of Order No. 84-50 provides for the reasonable protection of the beneficial uses of San Diego Bay waters stated in Finding No. 6 of this Order. Thus in causing the copper concentration of San Diego Bay waters to exceed 5 µg/l Paco Terminals, Inc. has created a condition of pollution in San Diego Bay which threatens to impair the marine habitat beneficial use of San Diego Bay.

23. Paco Terminals, Inc. in causing the discharge or spillage of copper ore into San Diego Bay has violated Prohibition A.2 of Order No. 84-50 as stated in Finding No. 6 of this Order.

24. Paco Terminals, Inc. has caused a threatened violation of Receiving Water Limitation C.6 of Order No. 84-50 as stated in Finding No. 6 of this Order. As previously stated the copper concentrations at the Regional Board sediment sampling stations currently average 13,717 mg/kg. The migration of this copper into the water column has caused elevated copper concentrations of up to 88.1 mg/kg in mussel tissue sampled under the State Mussel Watch Program. Thus leaching of the copper from the affected sediment could cause the 5 µg/l standard for copper to be exceeded in San Diego Bay waters.

25. This enforcement action is exempt from the provision of the California Environmental Quality Act (Public Resources Code, Section 21000 et. seq.) in accordance with Section 15321, Chapter 3, Title 14, California Administrative Code.

IT IS HEREBY ORDERED, That pursuant to Section 13304 of the California Water Code:

1. Paco Terminals, Inc. shall submit a report to this office no later than March 1, 1986 identifying a range of remedial action alternatives to cleanup present, and prevent future, contamination of San Diego Bay resulting from the discharge of copper ore from Paco Terminals, Inc. 24th Street Marine Terminal operations. The report shall examine and determine the (1) cost, (2) efficiency, (3) feasibility, and (4) lateral and vertical extent of copper contaminated sediment associated with each of the following cleanup strategies:

   (a) Removal and/or treatment of the copper contaminated sediment to attain copper concentrations in the affected San diego Bay sediment contamination zone essentially equivalent to copper concentrations occurring in the sediment contamination zone prior to initiation of operations at Paco Terminals, Inc. in 1979. As documented in Regional Board staff's July 20, 1985 letter to Paco Terminals, Inc. Regional Board staff sampling found copper levels in San Diego Bay sediments adjacent to Paco Terminals, Inc. in April 1979 to average 110 mg/kg. Any other data obtained by Paco Terminals, Inc. pertaining to copper concentration levels in adjacent San Diego Bay sediments prior to initiation of operations by Paco Terminals, Inc. will also be considered if, in the judgement of Regional Board staff, sufficient documentation is provided.

   (b) Removal and/or treatment of copper contaminated sediment to attain the following copper concentrations in San Diego Bay waters to protect the San Diego Bay beneficial uses noted in Finding No. 9.

Constituent	Unit	6-Month[1] Median	Daily[2] Maximum	Instantaneous[3] Maximum
Copper	µg/l	5	20	50

---

1 The six-month median concentration limit shall apply as a moving median of daily values for any 180-day period in which daily values represent flow-weighted average concentrations within a 24-hour period. For intermittent discharges, the daily values shall be considered to equal zero for days on which no discharge occurred.

2 The daily maximum limitation shall apply to the results of a single composite sample collected over a period of 24 hours.

3 The instantaneous maximum concentration limit shall apply to grab sample determinations.

Under this cleanup alternative it will be necessary to ascertain the degree of copper migration from the sediments to the water column that will occur and to demonstrate that the copper migration will not cause the copper limitations be exceeded in either the water column or the interstitual water found within the sediment.

(c) A remedial action alternative proposing the attainment of copper concentrations in the affected San Diego Bay sediment contamination zone which concedes contaminated San Diego Bay waters to a degraded status. Under this alternative Paco Terminals, Inc. may propose a level of contaminated sediment cleanup less stringent than that required under cleanup alternatives (a) or (b) listed above.

Under this alternative it will be necessary to ascertain the degree of copper migration from the sediments to the water column that will occur, and, subsequently to determine the effects that the "mobilized" copper will have upon the marine life of San Diego Bay. It will also be necessary to establish, to the satisfaction of the Regional Board, that the proposed copper concentrations would comply with the following criteria in accordance with the State "Non-Degradation Policy":

1. The proposed copper concentrations to be attained in the affected San Diego Bay sediment contamination zone would not alter the equality of San Diego Bay waters to a degree which unreasonably affects the San Diego beneficial uses listed in Finding No. 9.

2. The proposed copper concentrations to be attained in the affected San Diego Bay sediment copper contamination zone will be consistent with the maximum benefit to the people of the state.

3. The proposed copper concentrations to be attained in the San Diego Bay sediment copper contamination zone will not result in water quality less than prescribed in the Basin Plan, Ocean Plan, or other adopted policies.

2. The cleanup alternatives required under Directive 1 of this Order will be evaluated in detail by Regional Board staff. This evaluation will include technical considerations, estimated costs and anticipated water quality effects associated with each alternative. Based on this evaluation a specific cleanup alternative will be selected by Regional Board staff for implementation. Upon notification by the Executive Officer, Paco Terminals, Inc. shall implement the cleanup alternative selected by Regional Board staff.

3. In the interim period until final cleanup is selected, implemented and completed, Paco Terminals, Inc. shall maintain full compliance with the Best Management Practices as described in the terms and conditions of Order No. 84-50.

4. Paco Terminals, Inc. shall dispose of all copper contaminated water and sediment in accordance with all applicable state and federal regulations.

5. Paco Terminals, Inc. shall, upon implementation of the selected cleanup alternative, submit monthly progress reports discussing the cleanup progress status and the progress made toward attaining the final selected cleanup criteria. Specific information to be included in the monthly progress report will be determined by Regional Board staff upon selection of final cleanup alternatives.

I Ladin H. Delaney, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of a Cleanup and Abatement Order issued on December 12, 1985.

Ladin H. Delaney

LADIN H. DELANEY
Executive Officer

December 12, 1985

JM:rs

UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF CALIFORNIA

PACO TERMINALS, INC., Plaintiff, vs. AMAX COPPER, INC., ET AL., Defendants.	No. 88-1897 G(M)

DEPOSITION OF GLENN M. HOWELL

May 31 and June 1, 1990
San Diego, California

VOLUME III
Pages 339 - 593

Celeste Gammon, CSR No. 2984

REPORTED BY:

HARRELL W. BRUNSON, COURT REPORTERS
SUITE 600
SCRIPPS BUILDING
525 "C" STREET
SAN DIEGO CALIFORNIA 92101
233-7483

you dated July 16, 1985. This letter was signed by Mr. Arthur Coe on behalf of Ladin Delaney. Would you take a moment to review this exhibit, please.

A. Anything in specific or do you want me to read all 24 pages?

Q. Do you recall having received this letter?

A. I recall seeing the document, yes.

Q. Do you recall that this letter directed you to undertake certain actions to investigate copper concentrate -- releases of copper concentration into San Diego Bay?

A. Yes.

(Defendants' Exhibit 22 marked.)

BY MR. LYTZ:

Q. Mr. Howell, I'm handing to you a copy of Defendants' Exhibit 22. Defendants' Exhibit 22 appears to be a Cleanup and Abatement Order No. 85-91 issued to PACO Terminals under a letter dated December 12th, 1985. Would you take a moment to review this document.

A. Again, any particular section or just in general?

Q. Just generally.

Have you had an opportunity to review the document?

A. Yes, generally.

Q. Do you recall having received this document?

A. Yes.

Q. Did you review this document when you received it?

A. Yes.

(Defendants' Exhibit 23 marked.)

BY MR. LYTZ:

Q. Mr. Howell, I'm handing to you Defendants' Exhibit 23, which appears to be a letter dated September 3rd, 1985 addressed to Mr. Craig D. Anderson at the Air Pollution Control District and signed by you. Would you review the document.

Is the signature on Page 2 of this letter your signature, Mr. Howell?

A. Yes.

Q. Do you recall having sent this letter to Mr. Anderson on or about September 3rd, 1985?

A. Yes.

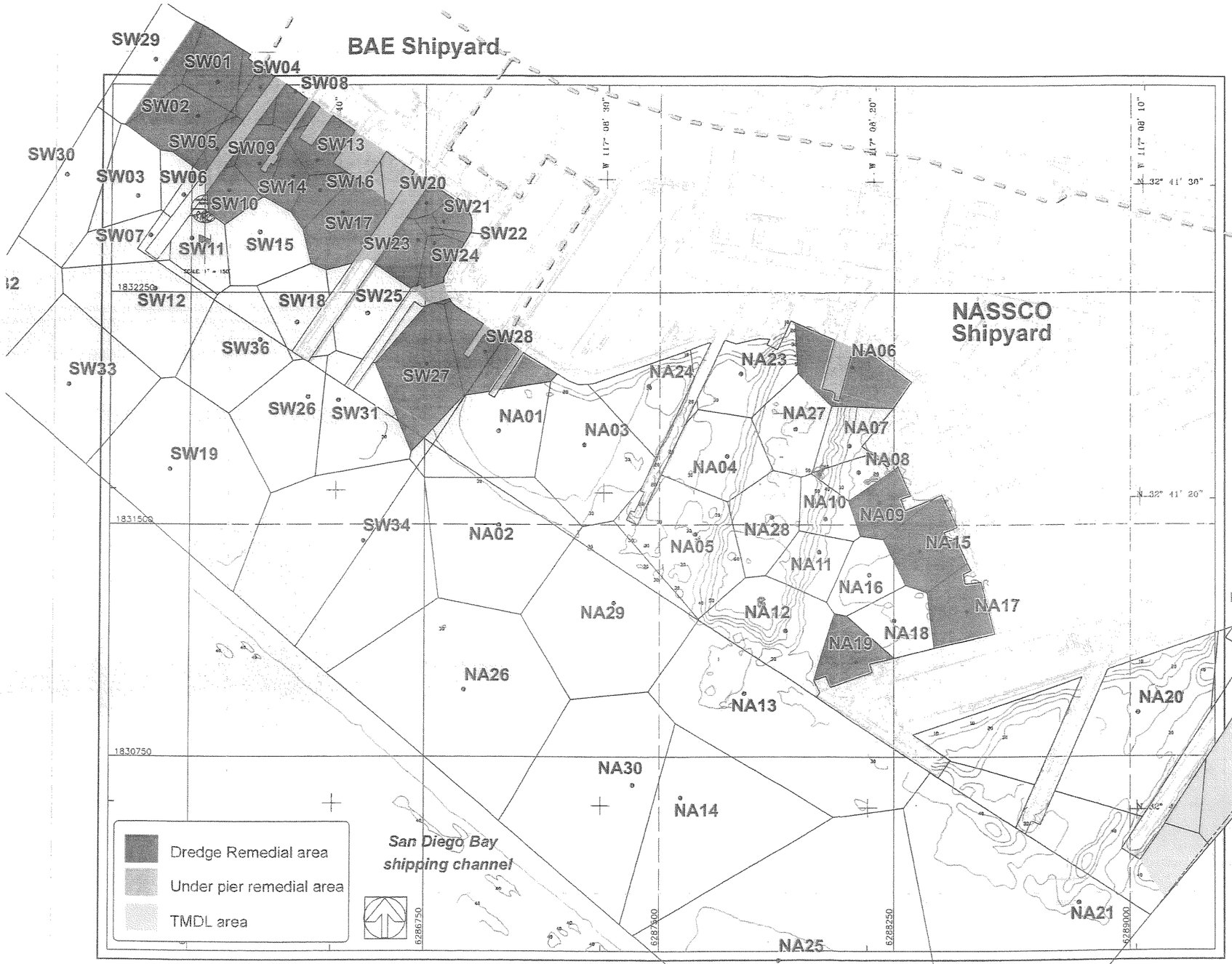
Q. Did you draft the letter?

A. As I recall, I did draft the letter after discussion with some other individuals -- I can't --

Q. At PACO Terminals?

A. I'm sure I did. I wouldn't have responded to the A.P.C.D. like this without some discussions with my superiors.

Q. Did you have knowledge of the contents of this letter?



LEGEND

Bathymetric contours
5 feet interval
Index 10 feet

Northing and Easting coordinates
U.S. Survey Feet

EXHIBIT NO. 1220
jmsteno.com
Barker

SURVEY POSITIONING

GEODETIC DATA

Datum	: NAD83
Projection	: California State Plane Zone 6
Units	: U.S. Survey Feet
False Easting	: 6561666.67 feet
False Northing	: 1640416.67 feet
Standard Parallel	: 33° 53'
Standard Parallel	: 32° 47'

BATHYMETRIC DATA

Vertical Datum : NASSCO Mean Lower Low Water (MLLW)
Tides : NOAA San Diego (Broadway Pier), California (Adjusted +0.43' feet to NASSCO MLLW)

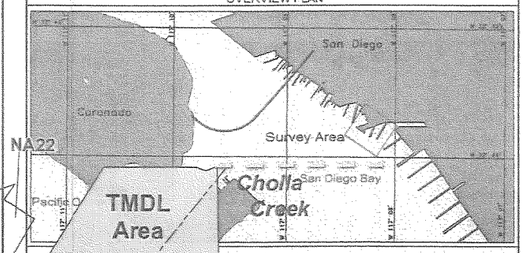
SCALE 1 : 1800

150 0 150 300 450 600 750 Feet

THIS IS A CAD PRODUCED DRAWING AND MUST NOT BE CHANGED MANUALLY

Rev No	Date	By	Checked	Approved	Description
0	11-Jan-2010	EC	JH	WS	ORIGINAL ISSUE

OVERVIEW PLAN



NASSCO BERTH V
O WHOLE YARD BATHYMETRY
SAN DIEGO, CALIFORNIA

NASSCO WHOLE YARD BATHYMETRY

CHART 3 OF 6

SOUTHLAND SURVEYING INC.
11722 SORRENTO VALLEY ROAD
SUITE - F
SAN DIEGO, CALIFORNIA 92121
PHONE: (858) 792-5550

Fugro Pelagos Inc.
3798 Ruffin Road
San Diego, CA 92123
USA
Tel: + 1 (858) 292-8922
Fax: + 1 (858) 292-5308

Fugro Prj No.	: FP6183.004	Client Ref No.	: S-1711
Survey Date	: May 29 2010	Fugro Ref No.	: FP-6183-004-003-NB-1800
Survey Vessel	: M/V Locator	Sheet No.	: 3 OF 6

SOUTHLAND SURVEYING INC.
11722 SORRENTO VALLEY ROAD
SUITE - F
SAN DIEGO, CALIFORNIA 92121
PHONE: (858) 792-5550

GENERAL DYNAMICS/NASSCO
2798 HARBOR DRIVE
SAN DIEGO, CALIFORNIA 92113
P.O. BOX 85278
SAN DIEGO, CALIFORNIA 92186-5278

NASSCO BENCHMARK DESCRIPTION (PRIMAL)
THE ELEVATIONS FOR THIS PROJECT ARE DERIVED FROM NGS BENCHMARK STAMPED SILVER GATE 1944, DESIGNATED AS PID DC0875, LOCATED IN THE SOUTHEAST FACE OF THE SAN DIEGO GAS & ELECTRIC BUILDING ON SAMPSON STREET, 12.5 FEET NORTHEAST OF THE NORTHEAST EDGE OF THE MAIN ENTRANCE.
MARK IS SET VERTICALLY, 2.6 FEET ABOVE THE GROUND.
ELEVATION = 22.580' NAVD88.
NAVD88 ELEVATIONS HAVE BEEN CONVERTED TO HISTORIC NASSCO MLLW DATUM ONSITE BY ADDING 0.86' TO NAVD88 ELEVATION. (REF. SSI JOB# S-1350)

NASSCO BENCHMARK DESCRIPTION (LOCAL)
THE LOCAL BENCHMARK FOR THIS PROJECT IS A 2" BRASS DISC LOCATED AT THE TOP OF QUAYWALL AT BERTH NO.4, PER TOWILL INC., HYDROGRAPHIC SURVEY PLAN JOB# 2214 DATED JANUARY 24, 1990.
HISTORIC NASSCO MLLW ELEVATION = 14.17'. (REF. SSI JOB# S-1133)

BASIS OF COORDINATES:
THE BASIS OF COORDINATES FOR THIS PROJECT IS US COAST GUARD DIFFERENTIAL GPS CORRECTIONS TRANSMITTED FROM STATION ID 302 AT POINT LOMA

DATE OF AERIAL PHOTOGRAPHY LAND FEATURES
DATE OF AERIAL PHOTOGRAPHY: 4-14-01.
AERIAL PHOTOGRAPHY LAND FEATURES ARE TO BE USED FOR GRAPHICAL IDENTIFICATION AND RELATIONSHIP ONLY.

Bathymetry by: Fugro Pelagos, Incorporated

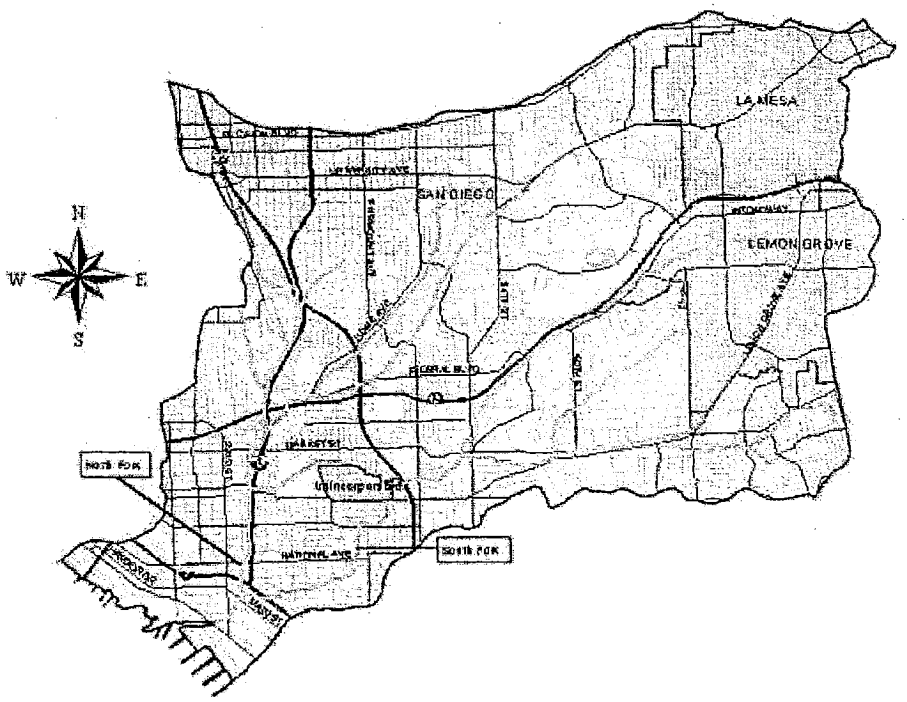
Job Number:	Cont. Intrvl.	Hydro. Survey Dates:	Filename:	Date:
S-1711	5 Feet	5/29/10		June 11, 2010

NASSCO WHOLE YARD BATHYMETRY SURVEY

Sheet 3 of 6

California Regional Water Quality Control Board
San Diego Region

Total Maximum Daily Loads for Dissolved Copper, Lead, and Zinc in Chollas Creek, Tributary to San Diego Bay



Chollas Creek Watershed

Technical Report

May 30, 2007

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION
9174 Sky Park Court, Suite 100, San Diego, California 92123-4340
Phone • (858) 467-2952 • Fax (858) 571-6972
http://www.waterboards.ca.gov/sandiego.

To request copies of the Basin Plan Amendment and Technical Report for Copper, Lead, and Zinc Total Maximum Daily Loads for Chollas Creek, Tributary to San Diego Bay, please contact Benjamin Tobler, Water Resources Control Engineer at (858) 467 – 2736, btobler@waterboards.ca.gov.

Documents also are available at: http://www.waterboards.ca.gov/sandiego.

TOTAL MAXIMUM DAILY LOADS FOR DISSOLVED COPPER, LEAD, AND ZINC IN CHOLLAS CREEK, TRIBUTARY TO SAN DIEGO BAY

Technical Report

Adopted by the
California Regional Water Quality Control Board
San Diego Region
on June 17, 2007
Approved by the
State Water Resources Control Board
on July 15, 2008
and the
Office of Administrative Law
on October 22, 2008
and the
United States Environmental Protection Agency
on December 18, 2008

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION
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San Diego, California 92123-4340

Telephone (858) 467-2952

STATE OF CALIFORNIA

ARNOLD SCHWARZENEGGER, Governor
LINDA S. ADAMS, Agency Secretary, California Environmental Protection Agency

State Water Resources Control Board

Tam Doduc, *Chair*	Civil Engineer
Gary Wolff, *Vice Chair*	Professional Engineer
Charles R. Hoppin	Water Quality
Arthur G. Baggett, Jr.	Attorney
Frances Spivy-Weber	Public

Dorothy Rice, *Executive Director*

California Regional Water Quality Control Board
San Diego Region

Susan Ritschel *Chair*	Public
Richard Wright *Vice Chair*	County Government
Daniel Johnson	Water Quality
Eric Anderson	Irrigated Agriculture
David King	Recreation, Fish or Wildlife
Elizabeth Pearson-Schneider	Municipal Government

John H. Robertus, *Executive Officer*
Arthur L. Coe, *Assistant Executive Officer*

This report was prepared under the direction of

David T. Barker P.E., *Chief, Water Resource Protection Branch*
Julie Chan P.G., *Chief, Water Quality Standards Unit*

by

Benjamin Tobler, *Water Resource Control Engineer*
Jimmy G. Smith , *Environmental Scientist*
Lesley Dobalian, *Environmental Scientist*

with the assistance of

Christina Arias, *Water Resource Control Engineer*
Wayne Chiu, P.E., *Water Resource Control Engineer*
Michelle L. Hurst, *Environmental Engineer, Department of the Navy*
Melissa Swarts, *Chemical Engineer, Department of the Navy*

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Chollas Creek[1] is an urban coastal stream in southern San Diego County, tributary to San Diego Bay. Chollas Creek was placed on the Clean Water Act (CWA) section 303(d) List of Water Quality Limited Segments (List of Water Quality Limited Segments) in 1996 for the metals copper, lead, and zinc. Storm water samples from Chollas Creek collected between 1994 and 2003 periodically exceeded California Toxics Rule (CTR) water quality criteria for copper, lead, and zinc. The existing and potential beneficial uses of Chollas Creek and San Diego Bay described in the Water Quality Control Plan for the San Diego Basin (9) (Basin Plan) are adversely affected by these exceedances. Additionally, toxicity tests show that water quality objectives (WQOs) for toxicity are also violated.

E.1. Problem Statement

While only the lowest 3.5 miles of Chollas Creek comprise the actual listed segment of the water body, all upstream tributaries to this section are considered in this TMDL project. The California Regional Water Quality Control Board, San Diego Region (San Diego Water Board) has established Total Maximum Daily Loads (TMDLs) for copper, lead, and zinc as required by the CWA for water quality limited segments.

Chollas Creek is also listed as impaired for the metal cadmium. The available data suggest that concentrations of dissolved cadmium in Chollas Creek exceed neither acute nor chronic CTR water quality criteria. Consequently, the San Diego Water Board has recommended Chollas Creek for delisting with respect to cadmium to the State Water Resources Control Board (State Water Board). The State Water Board is preparing the latest update of the List of Water Quality Limited Segments.

The purpose of this TMDL project is to attain WQOs for copper, lead, and zinc, and restore and protect the beneficial uses of Chollas Creek. TMDLs represent a strategy for meeting WQOs by allocating quantitative limits for point and nonpoint pollution sources. A TMDL is defined as the sum of the individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background [40 CFR section 130.2] such that the capacity of the waterbody to assimilate pollutant loading (i.e., the loading capacity) is not exceeded. In order to achieve the TMDLs, an Implementation Action Plan is also developed that describes the pollutant reduction actions that must be taken by various responsible persons to meet the wasteload and load allocations. The Implementation Action Plan includes a time schedule for meeting the required allocations and requirements for monitoring to assess the effectiveness of the load reduction activities in attaining water quality objectives and restoring beneficial uses.

Once established, the regulatory provisions of this TMDL project are incorporated into the Basin Plan. Additional requirements of the Basin Plan amendment process also include an evaluation of environmental and economic considerations. As with any Basin

[1] The Chollas Creek Watershed comprises Hydrologic Unit number 908.22.

Plan amendment involving surface waters, a TMDL project will not take effect until it has undergone subsequent agency approvals by the State Water Board, and the Office of Administrative Law (OAL). The U.S. Environmental Protection Agency (USEPA) must also approve the TMDL.

E.2. Numeric Targets

When calculating TMDLs, numeric targets are established to ensure that WQOs are met and beneficial uses are protected. The CTR is the basis of the numeric targets. Specifically, the numeric targets for the Chollas Creek TMDLs were set equal to the CTR's WQOs, which are comprised of hardness-based equations for dissolved copper, lead, and zinc. Equations, rather than numbers comprise the WQOs because the toxicity of dissolved copper, lead, and zinc varies significantly depending on hardness.[2] The CTR was chosen as the basis for these numeric targets because it has the most current, defendable WQOs for dissolved copper, lead, and zinc concentrations in fresh water (USEPA, 2000a). Additionally, the CTR is legally applicable in inland surface waters (e.g., Chollas Creek), enclosed bays and estuaries of California for all purposes and programs under the CWA (USEPA, 2000a).

E.3. Source Analysis

For Chollas Creek, essentially all metals sources (point and nonpoint) are discharged through municipal separate storm sewer systems (MS4) that are regulated under waste discharge requirements (WDRs) prescribed in Order No. R9-2007-0001.[3] Metals sources are thus collectively considered point sources due to their release from channelized, discrete conveyance pipe systems and outfalls. Known point source discharges to the MS4s include stormwater discharges from industrial facilities, construction sites, underground utility vaults, and groundwater discharges from de-watering sites. These discharges are regulated under different statewide and San Diego Water Board orders prescribing general WDRs. Because there are no other known point sources, urban runoff is considered the most significant source of metals to Chollas Creek.

Watershed models were developed by Tetra Tech, Inc. to estimate the magnitude of land uses that generate existing annual metal loadings to the Chollas Creek Watershed during both wet and dry weather conditions of a typical year. Modeling results based on land use category parameters, hydrological characteristics and observed metal concentrations provided estimates of the magnitude of metal loadings. The top two land use categories in Chollas Creek, freeways and commercial/institutional, contribute over 75 percent of the total load for each metal. Significant sources of all three metals to urban runoff are thought to include automobile operation (especially brake pads and tires) and industries with practices that may expose metals to stormwater. Water supply infrastructure

[2] As hardness increases, it competes with metals for binding sites on animals and effectively reduces the toxicity of metals. Therefore, as hardness increases the CTR metals criteria also increase to maintain the same allowable amount of toxicity.

[3] Order No. R9- 2007-0001, *Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, and the San Diego Unified Port District*, NPDES No. CAS0108758 or subsequent superseding NPDES renewal Orders.

Contaminated Sediment Remediation Guidance for Hazardous Waste Sites

APPENDICES

HIGHLIGHTS

Especially where there is some uncertainty regarding the anticipated future uses, the project manager should compare the potential risks associated with several use scenarios.

The identification of appropriate future use assumptions during the baseline risk assessment and the feasibility study should allow the project manager to focus on developing protective, practicable, and cost-effective remedial alternatives. In addition, coordination with stakeholders on land and water body uses leads to opportunities to coordinate Superfund or RCRA remediation in conjunction with local development or habitat restoration projects. For example, at some sites the EPA has worked with port authorities to combine Superfund or RCRA remedial dredging with dredging needed for navigation. Others have combined capping needed for Superfund or RCRA remediation with habitat restoration, allowing PRPs to settle natural resource damage claims in conjunction with the cleanup. However, as noted in Chapter 1, Section 1.5, State, Tribal, and Trustee Involvement, whether remediation and restoration are addressed concurrently is a site-specific decision that involves input from a number of different parties.

2.6 SOURCE CONTROL

Identifying and controlling contaminant sources typically is critical to the effectiveness of any Superfund sediment cleanup. Source control generally is defined for the purposes of this guidance as those efforts are taken to eliminate or reduce, to the extent practicable, the release of contaminants from direct and indirect continuing sources to the water body under investigation. At some sediment sites, the original sources of the contamination have already been controlled, but subsequent sources such as contaminated floodplain soils, storm water discharges, and seeps of ground water or non-aqueous phase liquids (NAPLs) may continue to introduce contamination to a site. At sites with significant sediment mobility, areas of higher contaminant concentration may act as continuing sources for less-contaminated areas.

Some sources, especially those outside the boundaries of the Superfund or RCRA site, may best be handled under another authority, such as the CWA or a state program. These types of sites can present an opportunity for partnering with private industry and other governmental entities to identify and control sources on a watershed basis. Water bodies with sources outside the Superfund site can also present a need to balance the desire for watershed-wide solutions with practical considerations affecting a subset of responsible parties. It can be difficult to determine the proper party to investigate sources outside the Superfund site, but the site RI/FS must be sufficient to determine the extent of contamination coming onto the site and its likely effect on any actions at the site. A critical question often is whether an action in one part of the watershed is likely to result in significant and lasting risk reduction, given the probable timetable for other actions in the watershed.

Source control activities are often broad-ranging in scope. Source control may include application of regulatory mechanisms and remedial technologies to be implemented according to ARARs, including the application of technology-based and water quality-based National Pollutant Discharge Elimination System (NPDES) permitting to achieve and maintain sediment cleanup levels. Source control actions may include, among others, the following:

- Elimination or treatment of contaminated waste water or ground water discharges (e.g., installing additional treatment systems prior to discharge);

- Isolation or containment of sources (e.g., capping of contaminated soil) with attendant engineering controls;
- Pollutant load reductions of point and nonpoint sources based on a TMDL;
- Implementation of best management practices (e.g., reducing chemical releases to a storm drain line); and
- Removal or containment of potentially mobile sediment hot spots.

EPA's Contaminated Sediment Management Strategy (U.S. EPA 1998a) includes some discussion of EPA's strategy for abating and controlling sources of sediment contamination. Source control activities may be implemented by state or local governments using combinations of voluntary and mandatory actions.

The identification of continuing sources and an evaluation of their potential to re-contaminate site sediment are often essential parts of site characterization and the development of an accurate conceptual site model, regardless of source areas within the site. When there are multiple sources, it is often important to prioritize sources to determine the relative significance of continuing sources versus on-site sediment in terms of site risks to determine where to focus resources. Where sources are a part of the site, project managers should develop a source control strategy or approach for the site as early as possible during site characterization. Where sources are outside the site, project managers should encourage the development of source control strategies by other authorities, and understand those strategies. Generally, a source control strategy should include plans for identifying, characterizing, prioritizing, and tracking source control actions, and for evaluating the effectiveness of those actions. It is also useful to establish milestones for source control that can be linked with sediment remedial design and cleanup actions. If sources can be substantially controlled, it is normally very important to reevaluate risk pathways to see if sediment actions are still needed. If sources cannot be substantially controlled, it is typically very important to include these ongoing sources in the evaluation of what sediment actions may or may not be appropriate and what RAOs are achievable for the site.

Generally, significant continuing upland sources (including ground water, NAPL, or upgradient water releases) should be controlled to the greatest extent possible before sediment cleanup. Once these sources are controlled, project managers should evaluate the effectiveness of the actions, and should refine and adjust levels of source control, as warranted. In most cases, before any sediment action is taken, project managers should consider the potential for recontamination and factor that potential into the remedy selection process. If a site includes a source that could result in significant recontamination, source control measures will be likely necessary as part of that response action. However, where sediment remediation is likely to yield significant benefits to human health and/or the environment after considering the risks caused by an unaddressed or ongoing source, it may be appropriate to conduct an action for sediment prior to completing all land-based source control actions.

2.7 PHASED APPROACHES, ADAPTIVE MANAGEMENT, AND EARLY ACTIONS

At some sediment sites, a phased approach to site characterization, remedy selection, or remedy implementation may be the best or only practical option. Phasing site characterization can be especially useful when risks are high, yet some important site-specific factors are unknown. Phasing in remedy

SEDIMENT ASSESSMENT STUDY FOR THE MOUTHS OF CHOLLAS AND PALETA CREEK, SAN DIEGO

PHASE I FINAL REPORT

Prepared by:

Southern California Coastal Water Research Project
Westminster, CA

and

Space and Naval Warfare Systems Center San Diego, U.S. Navy
San Diego, CA

May 2005

A joint study funded by:

San Diego Regional Water Quality Control Board
Commander Navy Region Southwest

EXECUTIVE SUMMARY

This report details an investigation of the nature and extent of impaired sediments at the mouths of Chollas and Paleta Creeks where they enter San Diego Bay. The investigation represents Phase I of a three-phase assessment program which also includes TMDL actions (Phase II), and sediment cleanup actions (Phase III). The investigation was prompted by the designation of these two sites by the San Diego Regional Water Quality Control Board as having contaminated sediments and aquatic life impacts. The study was a cooperative effort of the Toxic Hot Spot Workgroup including the Regional Board, the City of San Diego, the Port of San Diego and the US Navy, and was conducted by personnel from the Space and Naval Warfare Systems Center San Diego and the Southern California Coastal Water Research Project.

Based on a conceptual site model developed for the two sites, the primary beneficial use concern is the impairment to health of benthic organisms (Aquatic Life), focusing on invertebrates such as crustaceans, polychaetes and molluscs that live in and on the sediment. There is also potential for exposure and impact to fish and birds that prey on these benthic organisms (Aquatic Dependent Wildlife) as well as potential exposure to humans that may occur through fishing activities (Human Health). The conceptual approach taken in this study was to use multiple measures of sediment quality including chemistry, toxicity, benthic community composition, and bioaccumulation to assess the potential for impairment to each of these three beneficial uses.

Based on historical data, the contaminants of concern measured were the metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc, and organic compounds: PAHs, PCBs, Chlordanes, and DDTs. Ancillary measures of sediment grain size and total organic carbon were also made. Three measures of sediment toxicity were made including survival of amphipod exposed to whole sediment, normal development of sea urchins exposed to the sediment-water interface, and fertilization of sea urchins exposed to sediment porewater. Benthic community composition was determined by counting the number and kinds of organisms in the sediment. Bioaccumulation of contaminants was measured by exposing clams to sediments and measuring the uptake into their tissues.

Sampling was conducted in July and August 2001. Samples were collected from six bay reference stations, 14 stations at the Chollas study site, and 17 stations at the Paleta study site. Surface sediment grabs collected at each station were homogenized and split for use for chemical analyses, bioaccumulation exposures, and two of the three toxicity analyses. Separate core samples were collected for the sediment-water interface toxicity test. A separate grab sample was used in determining benthic community composition. Results of each measurement were evaluated for quality. Results of the amphipod toxicity tests showed high variability that required adjustment for outliers. There was also evidence of ammonia effects in the sediment-water interface test that required adjustment for outliers.

A weight of evidence approach was used to assess the potential impact to the Aquatic Life beneficial use. This approach used lines of evidence derived from measures of sediment chemistry, sediment toxicity, and benthic community composition. Screening level ecological and human health risk assessments were used to assess potential impacts to Aquatic Dependent Wildlife and Human Health beneficial uses, respectively. Contaminant bioaccumulation in clams was used as the primary measurement for the risk screening evaluations. A key requirement in the determination of impairment was that risk must be present at a level greater than that observed at sites in the bay not directly impacted by

contaminant sources. This site-specific evaluation therefore compared conditions at each site to a baseline condition that was defined as the existing ambient condition characterized by a pool of reference stations meeting the requirements of remoteness from source and having similar habitat.
The Baseline Pool used to represent the baseline condition consisted of data from 18 reference stations: five stations from the Chollas/Paleta study, four stations from the Phase I Shipyard study, and nine stations from the Bight'98 study. This pool was designed to provide an unbiased set of reference stations that had comparable measures of sediment quality, similar benthic habitat, and lacked contamination or toxicity from site-specific activities. Data from each study site station were compared to the upper (i.e. for concentration) or lower (i.e. for survival) 95th-percentile prediction limit computed for each parameter from the Baseline Pool to determine if conditions differed from the baseline condition.

Aquatic Life Beneficial Use Impairment
Impairment to the aquatic life beneficial use was determined using the weight of evidence from the chemistry, toxicity, and benthic community measurements. These data were used to assign a level of impairment into three categories of "Likely", "Possible", or "Unlikely".

Mouth of Chollas Creek: Most stations within the Chollas site were classified in the range of likely to possible impairment, indicating that contamination by CoPCs was substantially greater than the baseline condition and at levels of concern to aquatic life. Biological effects at this site were indicated by both the sediment toxicity and benthic community analyses. Two stations near the inner/outer creek boundary (C8 and C11) showed benthic community impacts co-occurring with exceptionally low fines and low contamination levels. Recurring sediment physical disturbance associated with ship engine tests performed at the NASSCO shipyard may contribute to the observed benthic community impacts in this area.

The greatest magnitude of likely impairment was present at the inner creek Chollas stations (C12, 13 and C14). The increasing gradient of impairment toward the inner creek stations was spatially consistent with a source of contaminants entering the site either from Chollas Creek itself, or from the shoreline activities adjacent to the site. The high fines content of the sediments at the inner creek stations indicate that this area is highly depositional, while the enriched TOC levels indicate organic matter loading higher than normal for the bay and most likely related to urban runoff from the creek.

Based on comparison of CoPC levels at likely stations with unlikely and possibly impaired stations, exceedance of SQGs, and correlation between chemistry and toxicity, CoPCs that appear most likely to be responsible for observed aquatic life impairment include PAH, PCB, chlordane and DDT.

Mouth of Paleta Creek: The frequency and magnitude of impairment to aquatic life at the Paleta site was less than at the Chollas site. None of the outer Paleta stations were classified as having likely impairment. The classification of some outer Paleta stations as possibly impaired was driven by the co-occurrence of elevated chemistry and benthic community impacts; sediment toxicity at the outer stations was not elevated relative to the baseline conditions.

The area of likely impairment for aquatic life at the Paleta site was restricted to a subset of four inner creek stations (P11, P15, P16, and P17). The increasing gradient of impairment toward the inner creek stations was spatially consistent with a source of contaminants entering the site either from Paleta Creek itself, or from the shoreline activities adjacent to the site. The high fines content of the sediments at the inner creek stations indicate that this area is highly

depositional, while the enriched TOC levels indicate organic matter loading higher than normal for the bay and most likely related to urban runoff from the creek.

Based on comparison of CoPC levels at likely stations with unlikely and possibly impaired stations, exceedance of SQGs, and correlation between chemistry and toxicity, CoPCs that appear most likely to be responsible for observed aquatic life impairment include lead, PAH, PCB, chlordane and DDT.

Aquatic-Dependent Life Beneficial Use Impairment
The likelihood of aquatic dependent wildlife impairment at the Chollas and Paleta sites was categorized as either "Unlikely" or "Possible" based on a screening-level ecological risk assessment. For this assessment, bioaccumulation of CoPCs in the clam *Macoma nasuta* was used to estimate exposure for representative wildlife receptors including surface feeding birds (Least Tern and Brown Pelican), diving birds (Surf Scoter and Western Grebe), and marine mammals (California Sea Lion).

Mouth of Chollas Creek: Potential for impairment to aquatic dependent wildlife at the Chollas site was categorized as unlikely for all receptors with respect to all CoPCs with the exception of copper for the Least Tern and Brown Pelican. A station-by-station assessment indicted three of the fourteen Chollas stations (C07, C10 and C11) were categorized as possibly impaired. The higher bioaccumulation of copper at C07 and C11 appears to be related to higher bioavailability associated with the low binding (TOC and fines) characteristics of this sediment. The higher bioaccumulation at C10 appears to relate primarily to higher copper concentrations in the sediment. On the basis of this analysis, a limited area of the Chollas site in the regions described above was classified as possibly impaired for potential effects of copper to aquatic dependent wildlife.

Mouth of Paleta Creek: Potential for impairment to aquatic dependent wildlife at the Paleta site was categorized as unlikely for all receptors with respect to all CoPCs.

Human Health Beneficial Use Impairment
The likelihood of human health impairment at the Chollas and Paleta sites was categorized as either "Unlikely" or "Possible" based on a screening level human health risk assessment. For this assessment, bioaccumulation of CoPCs in the clam *Macoma nasuta* was used to estimate exposure for humans from the consumption of fish or shellfish exposed to site sediments.

Mouth of Chollas Creek: Potential for impairment to human health at the Chollas site was categorized as unlikely for all CoPCs with the exception of benzo(a)pyrene (BAP) and TPCB. The possible impairment was related to cancer risk. The estimated risk level for BAP based on the maximum concentration for the site exceeded the TSL by a factor of 21, while the estimated risk level for TPCB exceeded the TSL by a factor of 2.2.

From the station-by-station analysis, all of the fourteen Chollas stations were categorized as possibly impaired for BAP, and twelve of the fourteen were categorized as possibly impaired for TPCB. Spatially, the highest magnitude of impairment related to BAP was found in the mid-inner Creek area (C12-C13) and near the base of Pier 1 (C09-C10). In general, the areas with higher magnitude of impairment related to BAP corresponded closely with high levels in the sediment, but were not strongly related to the distribution of TOC or fines. The highest magnitude of impairment related to TPCB was found near the base of the NASSCO pier (C07) and the end of Pier 1 (C02-C03), while the inner Creek area (C13-C14) had tissue concentrations below the TSL. The higher bioaccumulation of TPCB in at C07 appeared to be related to higher

bioavailability associated with the low binding characteristics of this sediment. Higher bioaccumulation at C02-C03 appears to relate primarily to higher TPCB concentrations in the sediment.

On the basis of this analysis, the entire Chollas site was classified as possibly impaired for potential human health effects related to the consumption of BAP in fish and shellfish, and the majority of the Chollas site, excepting the inner Creek area, was classified as possibly impaired for potential human health effects related to the consumption of PCBs in fish and shellfish.

Mouth of Paleta Creek: Potential for impairment to human health at the Paleta site was categorized as unlikely for all CoPCs with the exception of BAP and TPCB. The possible impairment was related to cancer risk. The estimated risk level for BAP based on the maximum concentration for the site exceeded the TSL by a factor of 16, while the estimated risk level for TPCB exceeded the TSL by a factor of 3.6.

From the station-by-station analysis, all of the seventeen Paleta stations were categorized as possibly impaired for both BAP and TPCB. Spatially, the highest magnitude of impairment related to BAP was found along the northern extent of the inner Creek area (P11, P13, P15 and P17). In general, the higher magnitude of impairment in the inner Creek area related to BAP corresponded with high levels in the sediment, as well as higher levels of TOC. The highest magnitude of impairment related to TPCB along the northern extent of the inner Creek area (P11, P13, P15 and P17) and at station (P05) near the Mole Pier. In general, the areas with higher magnitude of impairment related to TPCB corresponded with high levels in the sediment.

On the basis of this analysis, the entire Paleta site was classified as possibly impaired for potential human health effects related to the consumption of BAP and TPCB in fish and shellfish.

Recommendations

Recommendations were developed based on the findings and conclusions from the Phase I Chollas and Paleta study. The recommendations were made in the context of the existing framework that was developed collaboratively by the Toxic Hot Spot Workgroup. It is recommended that:

- The Phase II TIE work be completed to validate the findings of the Phase I study and guide the TMDL source quantification and control efforts.
- The Phase II source evaluation studies be completed to determine the strength and origin of sources for identified CoPCs that are driving the impairment.
- Following identification and control of sources, the Workgroup develop and conduct Phase III sediment cleanup studies including (1) Refinement of the wildlife risk assessment for copper and the human health risk assessments for BAP and TPCB using tissue concentrations from resident fish and shellfish and site-specific exposure parameters, (2) development of cleanup thresholds based on aquatic life, aquatic-dependent wildlife, and human health related impairments, and (3) delineation of potential cleanup boundaries including vertical and horizontal extent.

Table of Contents

2.0 HISTORICAL BACKGROUND

2.1 THE TOXIC HOT SPOT PROGRAM

The California State legislature established the Bay Protection and Toxic Cleanup Program (BPTCP) in 1989 with four major goals: (1) to provide protection of present and future beneficial uses of the bays and estuarine waters of California; (2) identify and characterize toxic hot spots (THS); (3) plan for THS cleanup or other remedial or mitigation actions; and (4) develop prevention and control strategies for toxic pollutants that will prevent creation of new THS or the perpetuation of existing ones within the bays and estuaries of the State. Subsequent to the legislation the State Water Resources Control Board (SWRCB) adopted a Guidance on the Development of Regional Toxic Hot Spots Cleanup Plan (SWRCB, 1998), which provides definitions, rankings, and suggested contents of the regional cleanup plans. The guidance was used by the SDRWQCB to develop a Regional Toxic Hot Spots Cleanup Plan (SDRWQCB, 1998a) for the San Diego Region which was adopted into the Consolidated Statewide Toxic Hot Spots Cleanup Plan in 1999 (SWRCB, 1999). Using data compiled by Fairey et al., (1996), the regional plan identified five candidate THS sites within the San Diego Bay Region that met the State's designation criteria and were subsequently adopted as known THS in the State's consolidated plan. Two of these sites are at the mouth of Chollas Creek and Paleta Creek where they enter San Diego Bay (Figure 2-1).

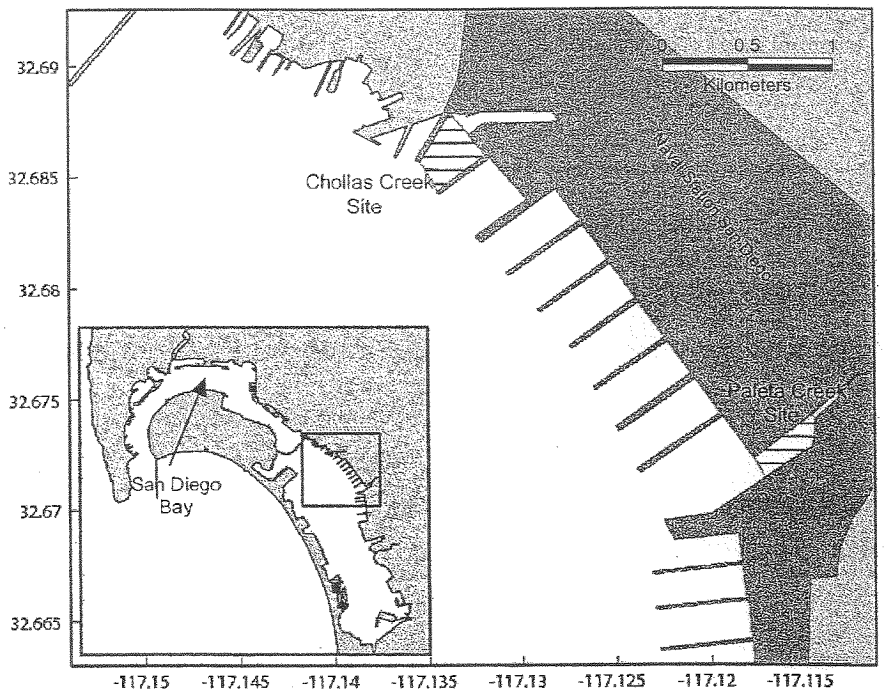


Figure 2-1. Location of mouth of Chollas Creek and Paleta Creek Toxic Hot Spot strata (crosshatch areas) designated under the Bay Protection Toxic Cleanup Program (Fairey et al., 1996).

2.2 FORMATION OF TOXIC HOT SPOT WORK GROUP

The regional cleanup monitoring plan calls for re-testing candidate sites for confirmation of effects. Because these two sites lie at the mouths of creeks and storm drains discharging from the City of San Diego and are adjacent to U.S. Navy property, the City of San Diego and the U. S. Navy formed a Toxic Hot Spot Work Group to fully reassess the two sites. Because two of the other hot spot sites planned for concurrent monitoring were adjacent to San Diego Unified Port District property, the Port also became a member of the work group. (Monitoring plans for the fifth candidate site adjacent to National Steel and Shipbuilding Company and Southwest Marine Inc. property were already underway). Subsequent to the formation of the work group both the Chollas and Paleta sites were listed on the State's 303d list (SWRCB, 1998b) as impaired water bodies, leading to formal requirements for the establishment of TMDL for those sites. Because both the THS and TMDL assessments require a similar comprehensive description of the spatial extent and magnitude of impairment to initiate cleanup and source reduction actions, the SDRWQCB became a member of the working group. As such, the scope of the working group expanded so that information collected could be used for both the THS and TMDL assessments.

2.3 HISTORICAL DATA REVIEW

BPTCP data used to characterize sediments in San Diego Bay are found in Fairey et al., (1996). Six sediment samples were collected and analyzed at the Chollas site. Three samples were collected and analyzed at the Paleta site. The Chollas site was designated as a moderate priority hot spot on the basis of benthic community impacts and elevated chlordane and total chemistry observed at three sampling locations. The Paleta site was designated as a high priority hot spot on the basis of recurring sediment toxicity, benthic community impacts, and elevated chlordane, dichlorodiphenyltrichloroethane (DDT), polynuclear aromatic hydrocarbons (PAH) and total chemistry at three sampling locations. Both sites were characterized as representing between one and ten acres of impaired sediment.

The first step taken by the work group was to compile and review historical sediment and contaminant source data for the two hot spots to provide: (1) a review of chemical and ecological characteristics of the Paleta and Chollas sites based on historical monitoring data (last ten years), and (2) a review of source loading data for potential chemicals of concern at the two sites. Specific goals included:

- Determine the extent of measurement data already available for the two sites
- Determine if the findings of the BPTCP study are consistent with other studies in the area
- Determine if sufficient data are available to evaluate spatial and temporal trends
- Identify contaminants of potential concern (CoPCs) for the two areas
- Determine if continuing sources of CoPCs are present at the sites
- Identify the type and quantity of additional data to complete the assessment of the sites and sources

The historical review was provided to the SDRWQCB in August of 2000 (SSC-SD, 2000). A summary of the report findings is highlighted below.

2.3.1 Chollas

The historical data generally showed slightly elevated sediment chemical concentrations in the mouth of Chollas Creek THS area relative to ambient levels found in a suite of bay wide reference samples (Chadwick et al., 1999). Copper, lead, antimony, and zinc, PAH, and DDT showed elevations above ambient but were below the Effects Range Median (ERM) benchmark. Chlordane was found at highly elevated (4X ERM) levels. There were typically insufficient data to characterize the spatial extent or temporal variability for most chemicals.

The reviewed biological studies findings showed evidence of toxicity, bioaccumulation, and degraded benthic communities. However, the data showed sporadic results and were spatially limited. It could not be ascertained whether toxic effects or physical disturbance was the cause of the degraded benthic community. The inner creek area was most recently dredged in 1997.

Storm water is an ongoing major contributor of copper, lead, and zinc to the mouth of Chollas Creek Toxic Hot Spot. Leaching of ship hull coatings and anodes are a minor contributor for copper and zinc. The storm water source is predominantly from the urban upstream portion of the watershed with less than 6% of the total loading derived from Naval Station outfalls. There are currently no source data on chlordane or antimony.

2.3.2 Paleta

The historical data generally showed elevated sediment chemical concentrations in the Paleta Creek THS area relative to ambient. Contaminant levels at this THS were also generally elevated above levels found at the mouth of Chollas Creek THS. Mercury, lead, zinc, and PAH were elevated above ambient but were below the ERM benchmark. Polychlorinated biphenyls (PCB) and DDT were found above the ERM benchmark but below the 4X ERM level. Chlordane was found at highly elevated (4X ERM) levels. Recent screening data suggest that metal levels from the BPTCP study are fairly representative of the entire mouth of Paleta Creek strata but that PAHs and pesticides show significant heterogeneity. In general, the chemical data were insufficient to characterize the spatial extent or temporal variability for most chemicals. A single core available at the Paleta site showed fairly uniform metal levels to a depth of about 45 cm.

Similar to the Chollas site the reviewed biological studies findings showed evidence of toxicity, bioaccumulation, and degraded benthic communities. However, the data showed sporadic results and were spatially limited. It could not be ascertained whether toxic effects or physical disturbance was the cause of the degraded benthic community. About half the region south of Pier 8 bordering the outer creek was most recently dredged in 1993.

Storm water is also an ongoing major contributor of copper, lead, and zinc to the mouth of Paleta Creek THS. Leaching of ship hull coatings and anodes are a significant contributor for copper (75%) and zinc (60%). While the storm water source is predominantly from the upstream urban portion of the watershed, Navy storm water outfalls were estimated to introduce 14% of the copper, 27% of the lead; and 16% of the zinc. Chlordane, DDT degradation products, and PCBs were detected in one upstream storm event though the limited nature of the data does not confirm an ongoing source of these compounds. There were no antimony or mercury data from which to assess storm water as a potential source of these contaminants.

2.4 SAMPLING PLAN DEVELOPMENT

The historical data were insufficient to fully characterize the spatial extent of contamination, toxicity, benthic community degradation, or degree to which bioaccumulation is occurring at the two THS sites. Further, the data sets were unable to resolve relationships between contaminant levels and deleterious effects. There were also gaps in the historical data with regards to contaminant sources. Given this outcome of the historical review, the work group developed a sampling plan to gather the appropriate data to fully characterize and assess sediment quality in these two hot spots. The sampling plan was designed to address data gaps regarding the present status and spatial extent of impairment to aquatic life at each study site as well as to provide an initial screening of wild life and human health impacts. The sampling study is the first phase of a multi-phased approach to completing requirements under the TMDL and cleanup plans for the study areas (Figure 2-2).

The sampling plan follows the general approach of BPTCP and the Southern California Bight 1998 Regional Marine Monitoring Survey (Bight'98) in measuring multiple indicators of sediment quality and using a weight of evidence approach to identify areas of impaired sediment quality (SCCWRP, 1998). This approach is also similar to ongoing and planned studies at other Toxic Hot Spots in San Diego Bay (Exponent, 2001). Included in this effort are determinations of the spatial distribution of:

- Sediment physical/chemical characteristics (e.g., grain size)
- Sediment chemical contamination
- Sediment and interstitial water toxicity
- Bioaccumulation of contaminants by a marine invertebrate
- Benthic community analysis

The data collected under the Phase I sampling was used to identify areas of greatest concern for detailed investigations in the development of total maximum daily loads (TMDLs) in Phase II. Though not described in detail here, Phase II studies will include laboratory research to identify causes of sediment toxicity (toxicity identification evaluations or TIEs), assessment of temporal patterns in the data, and an evaluation of sources of the contaminants of concern. Results from Phase I and Phase II will be used to help derive numerical cleanup levels and, along with measures of contaminants with depth of sediment, identify clean up boundaries in Phase III. Elements of Phase II and Phase III studies are still evolving under the guidance of the SDRWQCB.

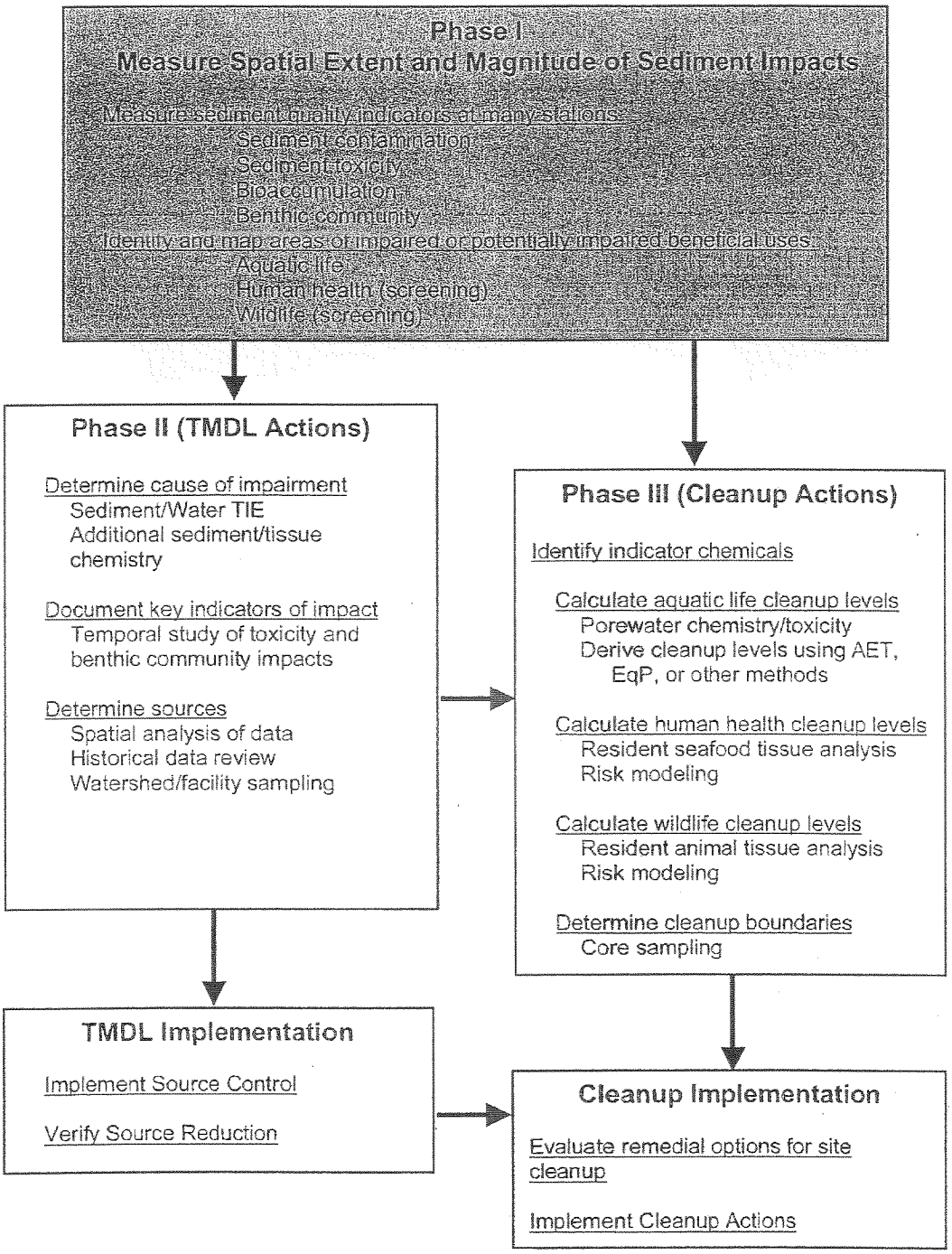
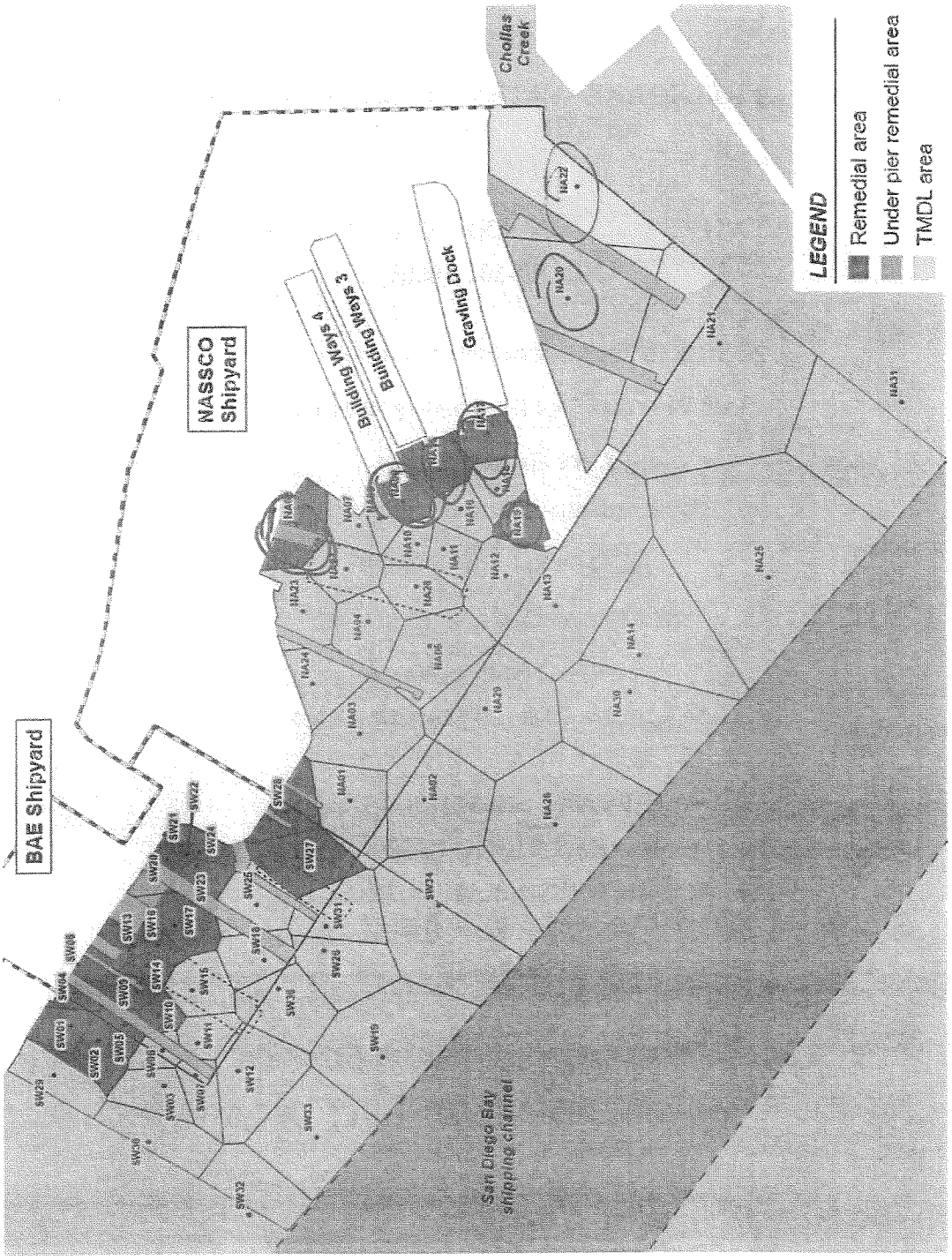


Figure 2-2. Phased sampling and analysis approach showing the relationship of Phase I sampling plan to potential subsequent TMDL and cleanup activities at the study sites.

Attachment 2. Polygons Targeted for Remediation



TENTATIVE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

TENTATIVE CLEANUP AND ABATEMENT ORDER
NO. R9-2011-0001

NATIONAL STEEL AND SHIPBUILDING COMPANY

BAE SYSTEMS SAN DIEGO SHIP REPAIR, INC.

CITY OF SAN DIEGO

STAR & CRESCENT BOAT COMPANY

CAMPBELL INDUSTRIES

SAN DIEGO GAS AND ELECTRIC

UNITED STATES NAVY

SAN DIEGO UNIFIED PORT DISTRICT

SHIPYARD SEDIMENT SITE
SAN DIEGO BAY
SAN DIEGO, CALIFORNIA

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

ADDENDUM NO. 3
TO
CLEANUP AND ABATEMENT ORDER NO. 88-79

BAY CITY MARINE, INC.
SAN DIEGO COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Boafd) finds that:

1. On June 30, 1988, the Regional Board Executive Officer issued Cleanup and Abatement Order No. 88-79 for Bay City Marine, Inc. Cleanup and Abatement Order No. 88-79 contains findings alleging that boat repair and maintenance activities at Bay City Marine, Inc. have resulted in waste discharges to Commercial Basin in San Diego Bay. These waste discharges are alleged to have created a condition of pollution. The waste discharges were violations of requirements contained in Order No. 87-49, NPDES No. CA0108006, "Waste Discharge Requirements for Bay City Marine Incorporated, San Diego County."

2. On December 1, 1988, the Regional Board Executive Officer issued Addendum No. 1 to Cleanup and Abatement Order No. 88-79. This addendum revised the compliance dates and directives contained in the cleanup and abatement order.

3. On February 2, 1989, the Regional Board Executive Officer issued Addendum No. 2 to Cleanup and Abatement Order No. 88-79. This addendum further revised the compliance dates and directives contained in the cleanup and abatement order.

4. Cleanup and abatement orders were issued to seven boatyards in Commercial Basin in the period from June, 1988 to March, 1989, for the discharge of boatyard waste causing elevated levels of copper, mercury and tributyltin (TBT) in Commercial Basin sediment. The seven boatyards were Bay City Marine, Driscoll Custom Boats, Eichenlaub Marine, Kettenburg Marine, Koehler Kraft, Mauricio and Sons, and Shelter Island Boatyard. Each boatyard was required, by the cleanup and abatement orders, to prepare a remedial action alternatives analysis report (RAAAR) to evaluate a range of sediment cleanup levels and to recommend a cleanup alternative. Final RAAARs were submitted by October, 1990, which presented information on the extent of contaminated sediment in Commercial Basin and possible cleanup levels.

The table below indicates when each report was submitted and which consulting firm prepared it.

BOATYARD	CONSULTANT	DATE SUBMITTED
Shelter Island	PTI Environmental Services	6-30-89 & 1-90
Koehler Kraft	Dr. William Bretz, Ph. D.	6-8-90
Bay City Marine	Woodward-Clyde Consultants	10-12-90
Eichenlaub Marine	Woodward-Clyde Consultants	10-12-90
Kettenburg Marine	Woodward-Clyde Consultants	10-12-90
Mauricio & Sons	Woodward-Clyde Consultants	10-12-90
Driscoll Custom	ERC Environmental and Energy Services Company	10-17-90

BACKGROUND SEDIMENT CONCENTRATIONS

5. Copper, mercury, and TBT can be discharged to San Diego Bay by many sources in addition to boatyard sources. Sediment background concentrations can be influenced by the continuous leaching of copper and TBT from the antifouling paint on the hulls of vessels moored in Commercial Basin. Additional copper and TBT can be discharged by underwater hull cleaning activities. Discharges from storm drains can contain high concentrations of many pollutants. Background sediment concentrations should be determined for an area with similar sources absent boatyard sources. These background sediment concentrations are used to evaluate which concentrations of copper, mercury, and TBT are due to the boatyard discharges and which are due to discharges from other sources.

6. The Commercial Basin boatyard cleanup and abatement orders established background levels as 63 mg/kg (dry weight) for copper, 0.81 mg/kg (dry weight) for mercury, and 193 ug/kg (dry weight) for TBT. The Regional Board's background stations, designated as stations A, B, CC, and CD, were located in the center of Commercial Basin and near the entrance in an area believed to be uninfluenced by waste discharges from boatyards.

7. The ERCE (ERC Environmental and Energy Services Company) RAAAR for Driscoll Custom Boats states that Shelter Island Yacht Basin experiences conditions similar to those in Commercial Basin except there are no boatyards in Shelter Island Yacht Basin. ERCE conducted a study to determine the background levels in Shelter Island Yacht Basin. The results of 20 samples in Shelter Island Yacht Basin showed that average background sediment concentrations in Shelter Island Yacht Basin were 96.3 mg/kg (dry weight) for copper, 0.64 mg/kg (dry weight) for mercury, and 52.5 ug/kg (dry

weight) for TBT.

8. In June, 1989, the Regional Board conducted a study of the drainage patterns of Shelter Island Drive to determine the discharge point of any boatyard waste discharged to the street. The Regional Board study concluded that wastes potentially discharged to Shelter Island Drive from Mauricio and Sons, Driscoll Custom Boats, Shelter Island Boatyard, and Koehler Kraft could be discharged to Shelter Island Yacht Basin. Therefore, Shelter Island Yacht Basin may have some influence from the boatyards, but this influence is only in the portion of the basin nearest to Shelter Island Drive. The majority of the basin is not affected by waste discharges from the boatyards.

9. The PTI (PTI Environmental Services) RAAAR for Shelter Island Boatyard stated that the Regional Board's background stations were too near the entrance to the basin and would experience too much dynamic tidal influence. This RAAAR contends that the additional tidal influence near the basin entrance could cause a reduction in the concentrations of contaminants present in the sediments there. The PTI RAAAR proposes that a suitable area for determining background concentrations occurs close to the Shelter Island Boatyard, bounded by the central anchorage area on the north-east and the Shelter Island Boatyard docks on the south-west. The copper in this region was found to be between 100 mg/kg (dry weight) and 360 mg/kg (dry weight) with an average of 254 mg/kg (dry weight) for 12 samples. Mercury and TBT were not evaluated to determine background levels due to the lack of analyses for these constituents.

10. PTI's background copper concentrations described in Finding No. 9 above are all higher than both background levels established by the Regional Board for Commercial Basin (see Finding 6 above) and by ERCE for Shelter Island Yacht Basin (see Finding 7 above). The Regional Board believes that the sediment in the area sampled by PTI may have been influenced by boatyard discharges from Shelter Island Boatyard, Mauricio and Sons, and Driscoll Custom Boats, and thus would not provide a suitable indication of background conditions.

11. The Regional Board concurs with the findings of the ERCE RAAAR that Shelter Island Yacht Basin has conditions which are quite similar to those in Commercial Basin. Both are small enclosed basins adjacent to San Diego Bay. Both basins receive rainfall runoff and miscellaneous flows from storm drains in similar areas of San Diego. Both basins also have large boat harboring facilities and considerable boat traffic. The ERCE study of Shelter Island Yacht Basin has a larger sample base of 20 sample stations, compared to

the Regional Board's 4 stations in Commercial Basin and Shelter Island Boatyard's 12 stations in Commercial Basin. Using the information in the ERCE study of Shelter Island Yacht Basin (see Finding 7 above), the Regional Board concludes that the background sediment concentration for Commercial Basin should be 96.3 mg/kg (dry weight) for copper, 0.64 mg/kg (dry weight) for mercury, and 52.5 ug/kg (dry weight) for TBT.

TRIBUTYLTIN (TBT) STUDY RESULTS

12. The Naval Ocean Systems Center (NOSC) has been conducting a large scale series of studies on tributyltin (TBT) contamination and potential environmental impacts associated with TBT in San Diego Bay.

13. One of the reports discussed in the Woodward-Clyde RAAAR is the NOSC report titled, Ecological Evaluation of Organotin-Contaminated Sediment, July 1985, which evaluates the prospects of ocean disposal for organotin-contaminated sediment. The test sediment sample was collected in Commercial Basin off the Shelter Island Boatyard docks. Particulate-phase tests were conducted with the species Acanthomysis sculpta (mysid), Citharichthys stigmaeus (flatfish), and Acartia tonsa (copepod). Solid-phase tests were conducted with the species Acanthomysis sculpta (mysid), Macoma nasuta (clam), and Neanthes arenaceodentata (polychaete worm). These tests all had high survival rates for Commercial Basin sediment containing 780 ug/kg TBT, 210 mg/kg copper, and 2.7 mg/kg mercury. These tests also showed significant bioaccumulation for TBT and copper but not for mercury. The report stated that the environmental significance of the bioaccumulation estimate is unclear, and therefore, concluded that this Commercial Basin sediment should not have significant impact on the marine environment if discharged into ocean waters.

14. The NOSC report titled, Utility of Mussel Growth in Assessing the Environmental Effects of Tributyltin, April 1990, discusses a series of seven juvenile mussel field transplant experiments conducted in San Diego Bay from 1987 through 1989. One site in Shelter Island Yacht Basin and one site in Commercial Basin were among the locations studied. The results at these two sites showed higher mean seawater TBT concentrations in surface waters than in deeper waters. Mussel bioaccumulation of TBT was also greater and growth rates lower for these sites in surface water when compared to deeper water. The data also indicate a decrease in mean seawater TBT concentrations in Shelter Island Yacht Basin from 530 ng/l in 1987 to 59 ng/l in 1989. Limited

data on Commercial Basin appears to indicate the same decreasing trend in mean seawater TBT concentration. The Commercial Basin mean seawater TBT concentration for deeper water was reported as 32 ng/l for August through October, 1989.

15. The California Department of Food and Agriculture adopted regulations for TBT in January of 1988. The California regulations require 1) the use of TBT paints with release rates of 5 ug/cm^2/day or less, 2) the application of TBT paints by certified commercial applicators and 3) the application of TBT paints only on vessels at least 25 meters (82 feet) in length and on aluminum hulls and vessel parts. Federal legislation and regulations came out in June of 1988, and September of 1988 respectively. Federal regulations limit TBT release rates to 4 ug/cm^2/day and the application of TBT antifouling paints to vessels 25 meters (82 feet) in length or larger.

16. The State Water Resources Control Board (State Board) issued a report titled "Tributyltin, a California Water Quality Assessment," dated December 1988. This report quoted studies which showed the TBT half life to be as short as 4 to 20 days in salt water, and 100-200 days in marine sediment. The report also established a water quality criteria of 6 ng/l in the marine water column.

17. TBT levels in Commercial Basin sediments appear to have decreased markedly from February of 1988 when the Regional Board sampled the sediment until the time the boatyards sampled the sediment in early 1989 through early 1990, as shown in the following table.

BOATYARD	REGIONAL BOARD SAMPLE TBT RESULTS (ug/kg)	DATES	BOATYARD SAMPLE TBT RESULTS (ug/kg)	DATES
Shelter Island	273 - 6,187	2-2-88	3.1-7.4	2-89,4-89
Koehler Kraft	70 - 1,752	2-2-88	38-434	2-90
Bay City Marine	375 - 6,029	2-2-88	0.9-22	2-89,4-89
Eichenlaub Marine	827 - 12,910	2-2-88	0.9-1.5	2-89,4-89
Kettenburg Marine	1,102 - 7,177	2-2-88	1.0-11	2-89,4-89
Mauricio & Sons	958 - 9,607	2-2-88	0.7-19	2-89,4-89
Driscoll Custom	907 - 9,871	2-2-88	4.6-590	10-89,11-89

18. Regional Board staff believes that this apparent reduction in TBT concentrations in the sediment is due to the following factors:

a. The application of TBT antifouling paints on boats under 25 meters (82 feet) is now prohibited. A large

proportion of the boats found in Commercial Basin are under 25 meters (82 feet) and are prohibited from using TBT antifouling paints. These small boats should not be releasing TBT into the water through leaching, underwater hull cleaning, or other maintenance activities on these boats. Therefore, a large source of TBT has been eliminated from Commercial Basin.

b. TBT undergoes rapid natural degradation in the environment. Depending on environmental conditions, tributyltin is eventually degraded into dibutyltin, monobutyltin, and ultimately to elemental tin. The half life of TBT has been shown to be as short as 4 to 20 days in salt water, and 100-200 days in marine sediment. Tributyltin is one to two orders of magnitude more toxic than dibutyltin, which is more toxic than monobutyltin. With the prohibition of the use of TBT antifouling paints on small boats, it is believed that natural degradation will reduce TBT levels to acceptable levels in a relatively short period of time.

c. NOSC data indicate that a decrease has occurred in mean seawater TBT concentrations in Shelter Island Yacht Basin from 530 ng/l in 1987 to 59 ng/l in 1989. Limited data on Commercial Basin appears to indicate the same decreasing trend in mean seawater TBT concentration.

19. The Regional Board believes that the TBT contamination in the Commercial Basin sediments has been greatly reduced due to natural degradation processes and the elimination of the use of TBT in paint for small boats such as the size found in Commercial Basin. The water column TBT concentration in Commercial Basin is expected to be below the level which would adversely affect the beneficial uses. The Regional Board believes that it is not necessary to establish a cleanup level for TBT in Commercial Basin.

COPPER AND MERCURY STUDY RESULTS

20. The Woodward-Clyde RAAAR contained a sediment biological effects study prepared by Kinnetic Laboratories, Inc. One sediment station at each client boatyard (Bay City Marine, Kettenburg Marine, Eichenlaub Marine, and Mauricio and Sons Marine) and one reference station in the center of the basin were used in this study. Benthic infaunal counts, an amphipod sediment toxicity test, and a bivalve larvae sediment elutriate test were performed for each station. The amphipod 10-day survival and reburial test used the

species Grandidierella japonica following the test procedures described in Swartz et al. (1985). The 48-hour bivalve larvae survival and shell abnormality test used a 1:4 sediment to water elutriate mixture as described in ASTM Test Method E-724-80. The sediment biological effects study prepared for the Woodward-Clyde RAAAR concluded that there were no significant adverse biological effects associated with sediment containing 530 mg/kg (dry weight) of copper and 4.8 mg/kg (dry weight) of mercury.

21. PTI's RAAAR for Shelter Island Boatyard also performed a sediment biological effects study. PTI's RAAAR used eleven sample stations. A benthic infaunal count, and an amphipod sediment toxicity test were performed for each station. The 10-day survival, avoidance, and reburial test used the species Rhepoxynius abronius following the test procedures described in Swartz et al. (1985) as amended by Chapman and Becker (1986). Only two stations, far removed from the greatest boatyard activities, exhibited any chronic effects in the amphipod tests. Two additional stations exhibited depressed infaunal diversity and numbers near the boatyard activities. The copper and mercury concentrations of the four stations which showed adverse test results are lower than the concentrations at one station which showed no adverse results. It appears that the adverse test results were not caused by copper and mercury concentrations, but resulted from high sand content, low organic content, or other pollutants. PTI's RAAAR reported that high amphipod survival and no depression in infaunal assemblage were found in the sediment from the area adjacent to Shelter Island Boatyard with the sediment metal concentrations of 275 mg/kg (dry weight) for copper, 4.2 mg/kg (dry weight) for mercury, and 23 ug/kg (dry weight) for TBT.

22. The Woodward-Clyde RAAAR addressed bioaccumulation in one water column bivalve, four species of benthic invertebrates, two species of water column fish, and three species of bottom dwelling fish. Specimens were collected at each client boatyard (Bay City Marine, Kettenburg Marine, Eichenlaub Marine, and Mauricio and Sons Marine) and one reference station in the center of the basin. Tissues were then analyzed for copper and mercury. Bioaccumulation of copper was found to be significant only in the bubble snail, but an adverse effect level for tissue burden was not defined. An action level for copper has not been developed by the U.S. Food and Drug Administration (FDA), but the FDA action level for mercury in oysters of 1.0 mg/kg was not exceeded in any of the organisms sampled in Commercial Basin. The major food items of brown pelicans, topsmelt and anchovies, had no detectable levels of mercury in their tissue and appear to pose little if any risk of

bioaccumulation of mercury to these birds. The study concluded that there is little if any risk of copper and mercury bioaccumulation from the Commercial Basin sediments.

23. The ERCE RAAAR for Driscoll Custom Boats analyzed State of California Mussel Watch data from Commercial Basin and Shelter Island Yacht Basin collected from 1977 through 1988. Mussel watch data was then compared to sediment contaminant concentrations. Sediment in Commercial Basin near the mussel watch stations averaged 947 mg/kg copper and 6.75 mg/kg mercury. Sediment in Shelter Island Yacht Basin averaged 96.3 mg/kg copper and 0.64 mg/kg mercury. The report concluded that mussels exposed in Commercial Basin and in Shelter Island Yacht Basin contained similar tissue concentrations of metals despite the much higher sediment metals concentrations in Commercial Basin.

WATER QUALITY STANDARDS

24. Several of the RAAARs examined the sediment concentrations which would not cause the following concentrations to be exceeded in the water column; 3 ug/l for copper, 0.04 ug/l for mercury, and 6 ng/l for TBT. At the time of these reports there were no applicable numerical water quality standards for enclosed bays such as San Diego Bay. Therefore, these water quality standards were taken from the "Water Pollution Control Plan, Ocean Waters of California, 1988" and from the report titled, "Tributyltin a California Water Quality Assessment," December 1988.

25. The State Board adopted the "1991, California Enclosed Bays and Estuaries Plan, Water Quality Control Plan for Enclosed Bays and Estuaries of California" (Enclosed Bays and Estuaries Plan) on April 11, 1991. This Enclosed Bays and Estuaries Plan contains numerical water quality standards which are applicable to San Diego Bay; a 1-hour average of 2.9 ug/l for copper, a 1-hour average of 2.1 ug/l for mercury, a 30-day average of 25 ng/l for mercury, and a 30-day average of 5 ng/l for TBT.

26. The Woodward-Clyde RAAAR, Driscoll Custom Boats RAAAR, and the Shelter Island RAAAR attempted to define a relationship between sediment concentrations and interstitial water concentrations. The results of these analyses are summarized in the table below. Woodward-Clyde and Driscoll Custom Boats developed vastly different numbers for the copper relationship. Woodward-Clyde developed the only mercury relationship, because all of the interstitial water samples for Driscoll Custom Boats were below the detection limit for mercury. The Shelter Island Boatyard RAAAR

reported that, due to the uncertainties and number of variables, a relationship between sediment concentration and interstitial water concentration could not accurately be developed for metals such as copper and mercury. The variables and factors involved in the metal sorption process in sediments are quite complex, and are not entirely understood at this time. The Regional Board believes that an accurate relationship was not developed between sediment concentration and interstitial water concentration for copper or mercury.

	Woodward-Clyde		Driscoll Boats		Shelter Island	
	Sediment mg/kg	Water ug/l	Sediment mg/kg	Water ug/l	Sediment mg/kg	Water ug/l
Copper	378	3	.849	3	none	3
Mercury	3.5	0.04	none	0.04	none	0.04
TBT	none	0.006	0.01	0.006	0.01-0.0229	0.006

APPARENT EFFECTS THRESHOLD (AET)

27. In September of 1988, a report titled "Sediment Quality Values Refinement: Volume I; 1988 Update and Evaluation of Puget Sound AET" was published for the Puget Sound Estuary Program, U.S. Environmental Protection Agency. The report was prepared by PTI Environmental Services with funding from the National Estuary Program, U.S. Environmental Protection Agency. The 1988 AET sediment concentrations in dry weight for copper and mercury are listed below. An AET for TBT was not developed in this report.

Chemical	Amphipod AET Values	Oyster AET Values	Benthic AET Values
Copper	1,300 mg/kg	390 mg/kg	530 mg/kg
Mercury	2.1 mg/kg	0.59 mg/kg	2.1 mg/kg

28. California AETs have now been developed for the State Board and published in a report titled "Evaluation of the AET Approach for Assessing Contamination in Marine Sediments in California, November 1989." These numbers were derived on an experimental basis and have not been adopted by the State Board. Three data sets were used to develop three sets of AET values for 1) "All of California," 2) "Southern California," and 3) "Northern California." Reliability was used in the report to measure the suitability of the AET values with respect to correctly predicting biologically

impacted and non-impacted stations. Reliability for the "All of California" AET was relatively high for the amphipod and bivalve AET, but only moderate for the benthic AET. Reliability for the "Southern California" Benthic AET was relatively low, and reliability for "Southern California" amphipod values could not be determined because all values are preliminary. The "All of California" and the "Southern California" AET sediment concentrations in dry weight for copper and mercury, based on dry weight normalization, are listed below.

SOUTHERN CALIFORNIA

Chemical	Amphipod AET Values	Bivalve* AET Values	Benthic AET Values
Copper	>690 mg/kg	---	310 mg/kg
Mercury	---	---	---

ALL OF CALIFORNIA

Chemical	Amphipod AET Values	Bivalve* AET Values	Benthic AET Values
Copper	>690 mg/kg	66 mg/kg	310 mg/kg
Mercury	1.2 mg/kg	0.51 mg/kg	0.51 mg/kg

Bivalve AET could be calculated only from data collected in Northern California.

"---" indicates AET data could not be calculated with available data.

DETERMINATION OF CLEANUP LEVELS

29. The Regional Board, in determining the appropriate level of cleanup in this matter, is guided by the State Water Resources Control Board's Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California." This policy provides that existing water quality be maintained when it is reasonable to do so. This policy further provides that any change in water quality 1)be consistent with maximum public benefit, 2)will not unreasonably affect beneficial uses, and 3)will not result in water quality less than that prescribed in the policies. The Regional Board has determined that discharges of copper, mercury, and TBT from the seven Commercial Basin Boatyards have resulted in a change in water quality in the affected portion of San Diego Bay; the change in water quality threatens to adversely affect the marine habitat beneficial use of San Diego Bay.

30. The Woodward-Clyde RAAAR provided cost estimates for the removal of contaminated sediment to meet original Regional Board background levels (63 mg/kg copper) and biological effects based levels (530 mg/kg copper). The costs were projected for sediment removal within the leaseholds of Bay City Marine, Eichenlaub Marine, Kettenburg Marine, and Mauricio & Sons, and for removal outside of these leaseholds in the Common Area. Ocean disposal of sediment was assumed in these cost estimates. The costs for the Bay City Marine leasehold and the Common Area are shown in the table below.

	Background (63 mg/kg Cu)		Biological Effects (530 mg/kg Cu)	
	Sediment Volume (CU YDS)	Cost ($)	Sediment Volume (CU YDS)	Cost ($)
Bay City	23,000	1.2M	6,200	620,000
Common	311,000	5.1M	4,400	490,000

The Common Area sediment volume for background includes removing the entire surface of the basin to an average depth of two feet. The Common Area sediment volume for biological effects includes areas of sediment directly adjacent to several of the boatyard leaseholds.

31. The Regional Board, based on the available information, is directing the seven boatyards in Commercial Basin to reduce the sediment copper and mercury concentrations in the affected portion of the San Diego Bay to a sediment copper concentration less than 530 mg/kg (dry weight) and to sediment mercury concentration less than 4.8 mg/kg (dry weight) as recommended by the sediment toxicity and infaunal studies performed for the Woodward-Clyde RAAAR. This cleanup level represents less than 100 percent removal of the affected sediment. The Regional Board has determined that this cleanup level is reasonable, consistent with the maximum public benefit, and should not unreasonably affect beneficial uses. It was not possible to fully determine if these cleanup levels will result in water quality less than that prescribed in the Enclosed Bays and Estuaries Plan. However, these cleanup levels were chosen using biological effects data. The Regional Board believes that the beneficial uses will be protected by these cleanup levels. Post-cleanup sampling is designed to confirm that the beneficial uses will be protected.

32. The Regional Board is also guided by the Environmental Protection Agency's antidegradation policy contained in 40 CFR 131.12. The federal antidegradation policy requires that changes in water quality be consistent with the following three part test:

    a. Existing instream water uses and level of water quality necessary to protect the existing uses shall be maintained and protected.

    b. Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, the quality shall be maintained and protected unless the State finds ... that allowing the lower water quality is necessary to accommodate important economic or social development....

    c. Where high quality waters constitute an outstanding National resource ... that water quality shall be maintained and protected."

    The Regional Board has determined that 1) the cleanup levels established in this order will protect and maintain existing instream water uses, 2) the water quality will not exceed levels necessary to support propagation of fish, shellfish, and wildlife, and recreation in and on the water, and 3) the water quality in the affected area will be improved upon implementation of these cleanup levels.

33. This enforcement action is exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.) in accordance with Section 15321, Chapter 3, Title 14, California Code of Regulations.

IT IS HEREBY ORDERED that, pursuant to California Water Code Section 13304, Cleanup and Abatement Order No. 88-79 is amended to include the following directives:

1. Bay City Marine, Inc. shall reduce the sediment copper and mercury concentrations in Commercial Basin, including the Common Area, attributable to waste discharges from Bay City Marine, Inc. to a sediment copper concentration less than 530 mg/kg (dry weight) and to a sediment mercury concentration less than 4.8 mg/kg (dry weight) by April 30, 1993.

2. Bay City Marine, Inc. shall achieve compliance with Directive No. 1 of this Order in accordance with the following time schedule:

	REQUIREMENT	COMPLETION DATE
a.	Submit a plan for cleanup of contaminated sediment to the indicated level. The cleanup plan shall include a description of all dredging and other cleanup or remediation activities to be conducted, a map depicting the area to be dredged and the project depth, the permits and other governmental approvals needed, and a time schedule for completion of each task. The plan shall be subject to the approval of the Regional Board Executive Officer.	March 1, 1992
b.	Submit a plan for testing to the Environmental Protection Agency (EPA) and the Army Corps of Engineers (COE) for their review and concurrence to determine the suitability of the contaminated sediment for untreated ocean disposal or disposal at a suitable construction site. A copy of this plan shall also be submitted to the Regional Board.	May 1, 1992
c.	Upon approval of the plan described in Directive 2.b above, the Plan shall be implemented and a report of the results shall be submitted to EPA, COE, and the Regional Board. An application for the permit to ocean dispose without treatment or to dispose at a suitable construction site, and other information reasonably necessary for processing and approval of the disposal permits, shall accompany the report to EPA, COE, and the Regional Board.	October 1, 1992
d.	Submit a post-cleanup sampling plan to verify the attainment of the prescribed cleanup standards in the area of sediment contamination defined in the remedial action alternatives analyses report submitted for this facility.	November 15, 1992

	REQUIREMENT	COMPLETION DATE
e.	Upon the approval of the cleanup plan by the Regional Board Executive Officer, complete the cleanup or remediation of the contaminated bay sediment to the level prescribed in Directive No. 1 of this Order.	April 30, 1993
f.	Upon the approval of the post-cleanup sampling plan by the Regional Board Executive Officer, implement the plan and submit the sampling results.	June 30, 1993

3. Bay City Marine, Inc. shall, upon adoption of this addendum, submit progress reports to the Regional Board on a quarterly basis until, in the opinion of the Regional Board Executive Officer, the cleanup of the contaminated sediment has been completed. The reports shall contain information discussing the progress made toward attaining the final selected cleanup criteria for the bay sediment. The reports shall be submitted in accordance with the following reporting schedule:

REPORTING SCHEDULE	REPORT DUE
January 1 through March 31	April 30
April 1 through June 30	July 31
July 1 through September 30	October 31
October 1 through December 31	January 31

4. In addition to the cleanup alternative described in Directives 1 and 2, Bay City Marine, Inc. may submit by December 1, 1992, information supporting alternative cleanup levels and/or additional cost data for consideration by the Regional Board. Upon request of a public hearing on this information by December 1, 1992, a hearing shall be scheduled by the Regional Board Executive Officer for the first regular Board meeting in 1993. This information shall specify the alternative cleanup levels, and shall include a description of the remediation activities to be conducted and a time schedule for completion of each task. If information from sites which are not in Commercial Basin is used in determining these alternate cleanup levels, site-

specific data must also be included to establish the relevancy of data from another site. Any alternative cleanup levels must also comply, to the satisfaction of the Regional Board, with the following criteria:

a. The proposed copper and mercury concentrations to be attained in the contaminated sediment in San Diego Bay will not alter the water quality of San Diego Bay to a degree which unreasonably affects the beneficial uses of San Diego Bay.

b. The proposed copper and mercury concentrations to be attained in the contaminated sediment in San Diego Bay will comply with State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California" and the U.S. Environmental Protection Agency's Antidegradation Policy contained in 40 CFR 131.12.

c. The proposed copper and mercury concentrations to be attained in the contaminated sediment in San Diego Bay will comply with State Water Resources Control Board's "Water Quality Control Policy for the Enclosed Bays and Estuaries of California, May 1974," and the "1991, California Enclosed Bays and Estuaries Plan, Water Quality Control Plan for Enclosed Bays and Estuaries of California."

PROVISION

1. Bay City Marine, Inc. shall submit, to the Regional Board, on or before each compliance date contained in this Addendum, a Report of Compliance or Noncompliance with the specified task.

NOTIFICATION

1. Pursuant to Section 13304 of the Water Code, Bay City Marine, Inc. is hereby notified that the Regional Board is entitled to, and will, seek reimbursement for all reasonable costs actually incurred by the Regional Board to investigate unauthorized discharges of waste and to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action, required by Cleanup and Abatement Order No. 88-79 and Addenda thereto. Reimbursable costs are costs incurred by the Regional Board following December 9, 1991.

Upon receipt of a billing statement for such costs Bay City Marine, Inc. shall reimburse the Regional Board.

I, Arthur L. Coe, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Addendum adopted by the California Regional Water Quality Control Board, San Diego Region, on December 9, 1991.

ARTHUR L. COE
Executive Officer

Linda S. Adams
Secretary for
Environmental Protection

State Water Resources Control Board

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Arnold Schwarzenegger
Governor

REVISED

DRAFT

UST Case Closure Summary
Former Rocco's Freestone Corners (Jed Wallach Trust)
12750 Bodega Highway, Sebastopol

Summary
The release from the subject site was discovered during underground storage tank (UST) removals in 1989. The residual contaminants impact only shallow soil and groundwater in the immediate vicinity of the site. The Sonoma County Local Oversight Program (County) recommended case closure and requested concurrence from North Coast Regional Water Quality Control (Regional Board) staff. Regional Board staff did not concur with the County and recommended that additional groundwater monitoring be conducted, especially during the dry season when groundwater is at its lowest elevation. Regional Board staff indicated that additional data is needed to determine trends that show that water quality objectives (WQOs) will be reached within a reasonable period for the constituents of concern and that impacts to current and future beneficial uses of water will be prevented.

Groundwater fluctuates seasonally between 2 to 10 feet below ground surface (bgs) and residual petroleum hydrocarbons appear limited to between 6 and 10 feet bgs. The mass of remaining residual petroleum hydrocarbons is adsorbed to shallow fine grain soil and dissolved petroleum constituents are degrading. There is a septic tank leach field down gradient of the former UST but it is unclear if the associated leach field dissolved contaminant plume in groundwater is commingling with and contributing to biodegradation of the dissolved petroleum hydrocarbon plume. Although monitoring wells screened in the source area have consistently had elevated concentrations of residual petroleum hydrocarbons in groundwater, after over 20 years the groundwater plume does not extend more than approximately 120 feet from the UST excavation. Analytical data from the two monitoring wells located farther than approximately 120 feet down gradient from the former USTs have had non-detect results for all sampling events conducted over the past 12 years. Trend lines for down gradient monitoring well MW-8 located approximately 90 feet from the source area show that WQOs will be reached in several decades:

The site is located in an unincorporated area of Sonoma County that is served by a public water supply although many properties have individual drinking water wells. An onsite irrigation water supply well is located down gradient approximately 230 feet from the UST excavation, an offsite water supply well is located down gradient approximately

280 feet from the UST excavation, and Salmon Creek is located approximately 370 feet from the former USTs. All groundwater analytical results for water supply wells and Salmon Creek have been non-detect for chemicals of concern. The affected shallow groundwater (less than 10 feet bgs) is not used as a source of water supply nor is it likely to be used as a source of water supply in the future. Based on facts in the record and the hydrologic and geologic conditions at the site, the limited residual petroleum hydrocarbons that remain in shallow soil and groundwater pose a low risk to public health, safety and the environment. For these reasons, case closure is appropriate.

Background

This UST Case Closure Summary has been prepared in response to a petition to the State Water Resources Control Board (State Water Board) for closure of the Former Rocco's Freestone Corners' UST case located at 12750 Bodega Highway, Freestone. All record owners of fee title for this site as well as adjacent property owners and other interested parties have been notified of the recommendation for closure and were given an opportunity to comment.

The site operated as an automotive repair and fueling facility from circa 1950 to 1979 and is currently occupied by three buildings that are used as a souvenir store, bakery, and a residence. Land use in the vicinity of the site is primarily rural residential. Individual wells provide water for the area residents and a leach field for septic tanks is used for wastewater disposal.

Regional Board staff rejected the County's October 30, 2008 recommendation for UST case closure. Regional Board staff asserted that additional groundwater monitoring be conducted during dry seasons when groundwater is at its lowest elevation because a spike of total petroleum hydrocarbons as gasoline (TPHg) with a concentration of 6,100 µg/L was reported in monitoring well MW-8 during a seasonally low groundwater sampling event on August 1, 2007. Regional Board staff indicated that additional data is needed to determine trends that WQOs will be reached within a reasonable period for the constituents of concern and impacts to the current and future beneficial uses of water will be prevented.

Petitioner information

Jed Wallach Trust, Rocco's Freestone Corners	12750 Bodega Highway Sebastopol, CA 95472
Global ID No: T0609700197	Petition Date: January 28, 2009
USTCUF Claim No: 7880	USTCUF expenditures: $362,663

Agency Information

North Coast Regional Water Quality Control Board	Address: 5550 Skylane Blvd., Suite A Santa Rosa, CA 95403
Regional Board Case No. 1TSO260	SCDHS Case No:00001518
Years case open: 20	

Release Information:
USTs:

Tank No.	Size in Gallons	Contents	Status	Date
1	250	Waste oil	Removed	May 1989
2	500	Gasoline	Removed	May 1989
3	1,000	Gasoline	Removed	May 1989
4	1,000	Gasoline	Removed	May 1989

- Source of Release: UST system.
- Release Discovery Date: May 1989.
- Affected Media: Shallow soil and groundwater.
- Free Product: None reported.
- Corrective Actions:
  - May 1989 - UST removal.
  - June 1995 - Soil and groundwater investigation.
  - September 1996 - Soil and groundwater investigation.
  - August 1997 - Soil and groundwater investigation.
  - July 1998 - Soil and groundwater investigation.
  - July 2002 through December 2004 - Ozone injection.
  - May 2005 through March 2008 - Verification monitoring.

Site Information/ Description/ Conditions:
- GW Basin: Salmon Creek Hydrologic Unit.
- Beneficial Uses: MUN, AGR, IND, PRO.
- Land Use: Residential, Commercial.
- Distance to Nearest Supply Well[1]:
  - 230 feet southwest - Irrigation well.
  - 280 feet south - Domestic well.
- Minimum Groundwater Depth: ~1 foot (wet season) and ~10 feet (dry season).
- Distance to Nearest Surface Water: ~370 feet southwest.
- Sanitary System: Two onsite septic tanks and associated leach field located between former USTs and the two supply wells.
- Groundwater Flow Direction: Southwest to south.
- Geology: Boring logs show that the site is underlain by silty sand and clayey alluvial fan deposits with low permeability to depths of greater then 20 feet.

[1] Groundwater from each of these wells has been tested four times between November 2003 and January 2008. Each sample analysis reported non-detects for all constituents of concern.

- Hydrology: Depth to groundwater varies seasonally from a foot or two in the spring to six to ten feet in the fall. Groundwater is recharged from rainfall infiltration and septic tank leach field discharges. Groundwater discharge is via evapotranspiration and lateral flow to Salmon Creek.
- Estimate of Remaining Mass in Soil: Small – shallow and limited to immediate vicinity of former USTs.
- Time to Meet WQOs: Several decades.

Site History:
The case was opened as a Regional Board UST case in May 1989 when elevated concentrations of gasoline constituents were reported in shallow soil and groundwater samples within the UST excavation. The UST case was transferred to the County in July 1993.

Between April 1995 and January 2009, corrective actions undertaken by petitioner include advancing over 15 borings to multiple depths down to 20 feet bgs, collecting and analyzing over 40 soil samples, installing 9 monitoring wells and performing in-situ ozone injection.

The UST system including two 1,000-gallons, one 550-gallon and one 250-gallon USTs were removed in May 1989. The site was remediated between July 2002 and December 2004 using an in-situ ozone injection system.

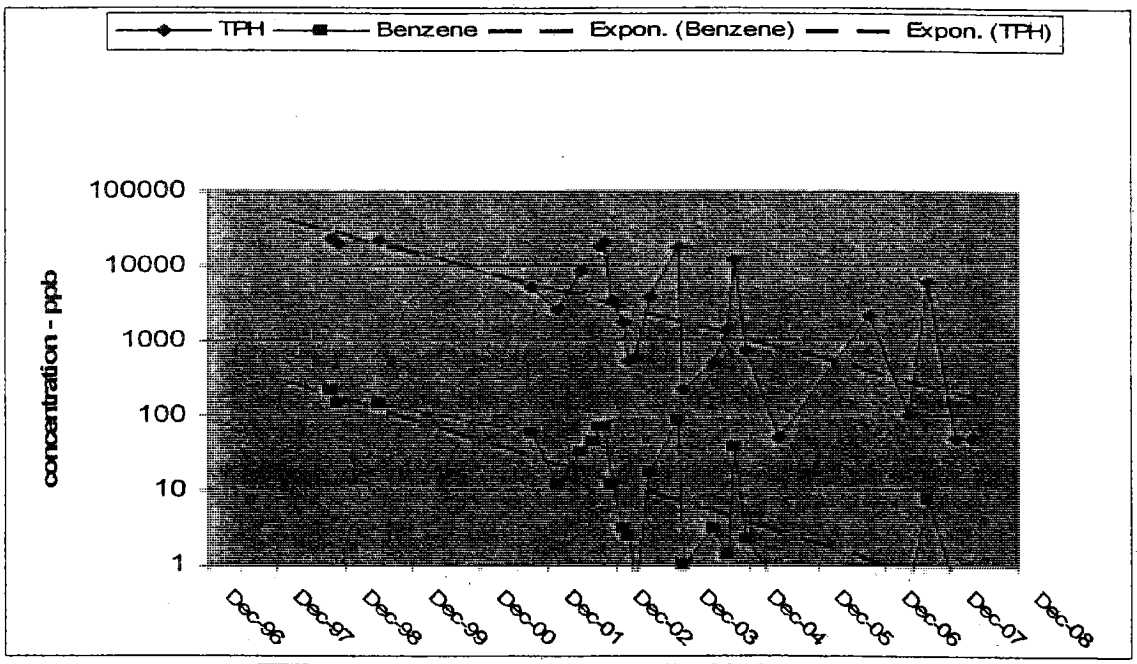
In December 2004, in-situ ozone injection operations were shut down when it was found that sparge points were short-circuiting. The system was shut down for safety reasons and post remedial verification monitoring was initiated. Groundwater contamination was observed in post remedial monitoring but closure was recommended to Regional Board staff based on declining trend analyses of all chemicals of concern.

In October 2008, the County referred the case to the Regional Board staff for concurrence with its recommendation for case closure. The Regional Board did not concur with this recommendation. In January 2009, Petitioner petitioned the State Water Board for case closure.

Contaminant Concentrations in Groundwater:
Monitoring well MW-8, which is located approximately 90 feet down gradient of the source area, has reported the highest post-remedial contaminant concentrations. The following graph shows that this well has consistently shown overall decreasing concentrations of petroleum constituents in groundwater, despite seasonal fluctuations. This decrease in down gradient concentrations is consistent with a zone of robust biodegradation.

Because source area contamination impacts shallow soil and groundwater in the immediate vicinity of the site, the mass of remaining residual petroleum hydrocarbons is limited and dissolved petroleum constituents are degrading. The rate of biodegradation of the remaining mass is dissolution limited and the natural biodegradation in groundwater is effectively limiting the length of the dissolved plume to less than approximately 120 feet from the source area for the past 20 years.

Groundwater Concentrations and Trends
MW-8



WQOs	TPHg – 5 ppb	benzene – 0.15 ppb

Objections to closure and response:
The Regional Board staff did not concur with the County's recommendation for case closure because of the following concerns;

- Additional dry season groundwater monitoring data is needed to determine trends that show that WQOs will be met within a reasonable period.

In response to the Regional Board's January 2, 2008 non-concurrence letter, the petitioners' consultant prepared and submitted graphs of trend analysis of low-groundwater sampling results collected since 1998 for well MW-8. The analyses for MW-8 showed that groundwater would reach the benzene WQO (0.15 µg/L) by 2014, ethyl benzene WQO (29 µg/L) by 2019 and TPG as gasoline WQO (50 µg/L) by 2034. Trend lines for down gradient monitoring well MW-8 located approximately 90 feet from the source area show that WQOs will be reached in several decades.

- Additional dry season groundwater monitoring data is needed to determine trends that show that impacts to current and future beneficial uses of water will be prevented.

The site is located in an unincorporated area of Sonoma County that is served by a public water supply although many properties have individual drinking water wells. Samples from water supply wells and Salmon Creek located within 400 feet of the former USTs have been non-detect for chemicals of concern. The affected shallow groundwater (less than 10 feet bgs) is not used as a source of water supply nor is it likely to be used as a source of water supply in the future.

Based on facts in the record and the hydrologic and geologic conditions at the site, the limited residual petroleum hydrocarbons that remain in shallow soil and groundwater pose a low risk to public health, safety and the environment. Therefore, the impact to water quality is limited and localized as discussed above.

Closure:
Does corrective action performed to date ensure the protection of human health, safety, and the environment? Yes

Is corrective action and UST case closure consistent with State Water Board Resolution 92-49? Yes
Is achieving background water quality feasible? No.

To remove all traces of residual petroleum constituents at the site would require significant effort and cost. If complete removal of detectable traces of petroleum constituents becomes the standard for UST corrective actions, however, the statewide technical and economic implications will be enormous. For example, disposal of soils from comparable areas of excavation throughout the state would greatly impact already limited landfill space. In light of the precedent that would be set by requiring additional excavation at this site and the fact that beneficial uses are not threatened, attaining background water quality at this site is not feasible.

If achieving background water quality is not feasible,
Is the alternative cleanup level consistent with the maximum benefit to the people of the state? Yes

It is impossible to determine the precise level of water quality that will be attained given the limited residual petroleum hydrocarbons that remain at the site, but in light of all the factors discussed above, and the fact that the residual petroleum constituents will not unreasonably affect present and anticipated beneficial uses of groundwater, a level of water quality will be attained that is consistent with the maximum benefit to the people of the state.

Will the alternative cleanup level unreasonably affect present and anticipated beneficial uses of water? No.

Impacted groundwater is not used as a source of drinking water or for any other beneficial use currently and it is highly unlikely that the impacted groundwater will be used as a source of drinking water or for any other beneficial use in the foreseeable future.

Will the alternative level of water quality exceed water quality prescribed in applicable Basin Plans? No

The final step in determining whether cleanup to a level of water quality less stringent than background is appropriate for this site requires a determination that the alternative level of water quality will not result in water quality less than that prescribed in the relevant basin plan. Pursuant to SWRCB Resolution 92-49, a site may be closed if the basin plan requirements will be met within a reasonable time frame.

Have factors contained in Title 23 of the California Code of Regulations, Section 2550.4 been considered? Yes.

In approving an alternative level of water quality less stringent than background, the State Water Board has also considered the factors contained in California Code of Regulations, title 23, section 2550.4, subdivision (d). As discussed earlier, the adverse effect on shallow groundwater will be minimal and localized, and there will be no adverse effect on the groundwater contained in deeper aquifers, given the physical and chemical characteristics of petroleum constituents, the hydrogeological characteristics of the site and surrounding land, and the quantity of the groundwater and direction of the groundwater flow. In addition, the potential for adverse effects on beneficial uses of groundwater is low, in light of the proximity of the groundwater supply wells, the current and potential future uses of groundwater in the area, the existing quality of groundwater, the potential for health risks caused by human exposure, the potential damage to wildlife, crops, vegetation, and physical structures, and the persistence and permanence of potential effects. Finally, a level of water quality less stringent than background is unlikely to have any impact on surface water

quality, in light of the volume and physical and chemical characteristics of petroleum constituents; the hydrogeological characteristics of the site and surrounding land; the quantity and quality of groundwater and direction of groundwater flow, the patterns of precipitation in the region, and the proximity of residual petroleum to surface waters.

Has the requisite level of water quality been met? No
If no, the approximate time period in which the requisite level of water quality will be met:

The approximate time period in which the requisite level of water quality for dissolved petroleum hydrocarbons will be met is estimated to be several decades.

Though the requisite level of water quality has not been met, water quality objectives will be achieved via natural attenuation within three decades. This is a reasonable period in which to meet the requisite level of water quality because the affected groundwater is not currently being used as a source of drinking water and it is highly unlikely that the affected groundwater will be used as a source of drinking water in the future. Other designated beneficial uses of water are not adversely impacted and it is highly unlikely that they will be.

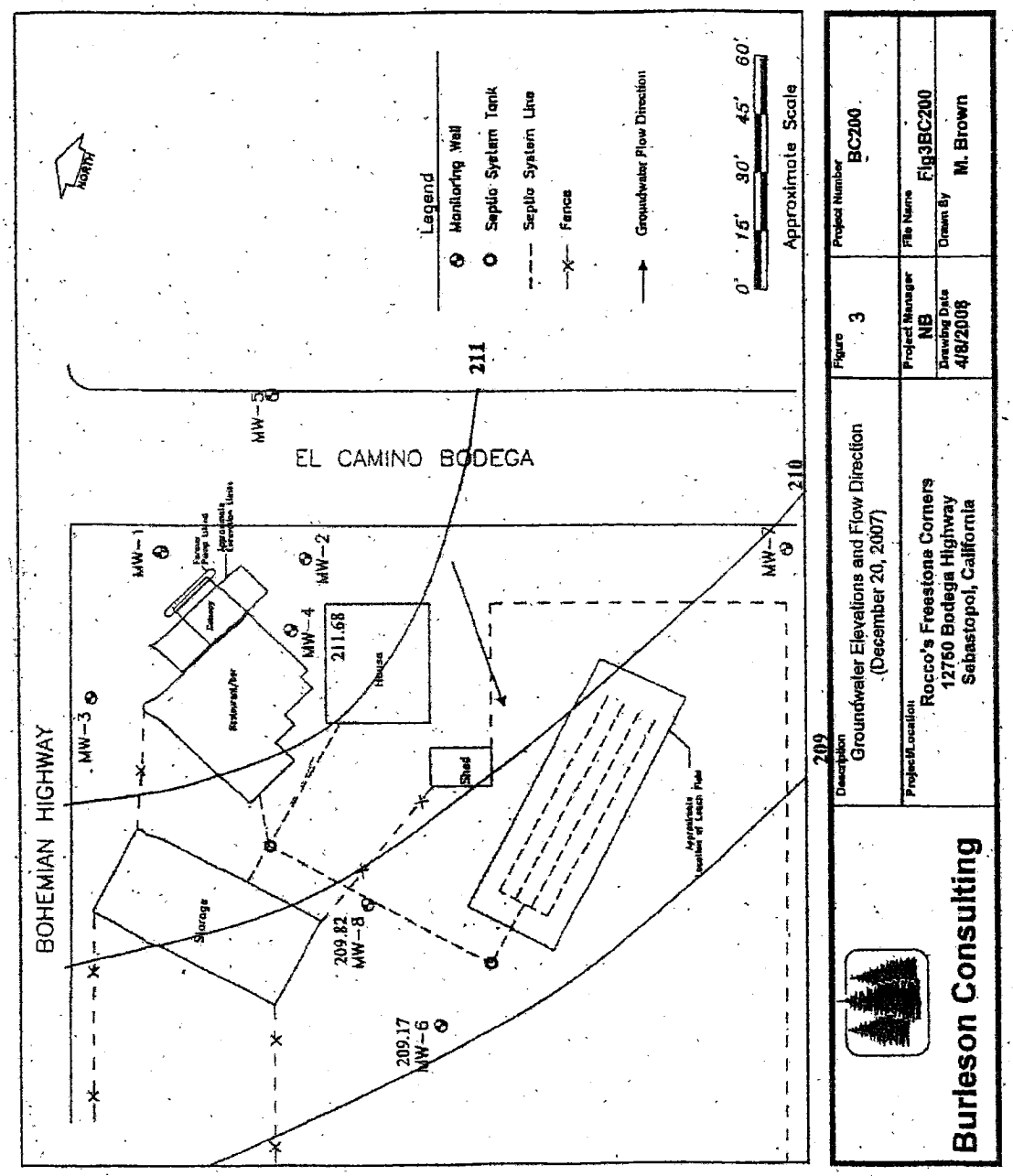
Summary and Conclusion

Based on the hydrology, geology, and other factors at and in the vicinity of the site, shallow affected groundwater does not represent a threat to public health and safety, or the environment. The dissolved petroleum hydrocarbon plume is decreasing and concentrations of petroleum hydrocarbons are decreasing; residual petroleum hydrocarbons dissolved in groundwater and absorbed to shallow soil are localized and limited in extent and will continue to naturally degrade and attenuate. Shallow groundwater is not used as a source of drinking water or for any other designated beneficial use nor is it likely to be beneficially used in the foreseeable future. Case closure is appropriate.

_____ _____

Benjamin Heningburg
Engineering Geologist
Professional Geologist No. 8130

Date


NORTH
Legend
Monitoring Well
Septic System Tank
Septic System Line
Fence
Groundwater Flow Direction
0' 15' 30' 45' 60'
Approximate Scale
EL CAMINO BODEGA
BOHEMIAN HIGHWAY
211
210
209
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
211.68
209.82
209.17
Former Pump Island
Approximate Excavation Limits
Driveway
Restaurant/Bar
House
Shed
Storage
Approximate location of Leach Field
Description
Groundwater Elevations and Flow Direction
(December 20, 2007)
Project/Location
Rocco's Freestone Corners
12760 Bodega Highway
Sebastopol, California
Figure
3
Project Number
BC200
Project Manager
NB
File Name
Fig3BC200
Drawing Date
4/8/2008
Drawn By
M. Brown
Burleson Consulting

Survey Station	Area (m^2)	Copper (mg/kg dry)					Mercury (mg/kg dry)					Tributyltin (µg/kg dry)					Total PCB Congeners (ng/g dry)					Total HPAH (µg/kg dry)				
		2001/2002 Data		2009 Data		RPD (%)	2001/2002 Data		2009 Data		RPD (%)	2001/2002 Data		2009 Data		RPD (%)	2001/2002 Data		2009 Data		RPD (%)	2001/2002 Data		2009 Data		RPD (%)
		Conc.	Conc. X Area	Conc.	Conc. X Area		Conc.	Conc. X Area	Conc.	Conc. X Area		Conc.	Conc. X Area	Conc.	Conc. X Area		Conc.	Conc. X Area	Conc.	Conc. X Area		Conc.	Conc. X Area	Conc.	Conc. X Area	
NA23	6,269.48	350	2,194,301	258	1,617,513	-26.3%	1.10	6,896	1.13	7,084	2.7%	120	752,332	7.4	46,394	-93.8%	510	3,197,409	840	5,266,321	64.7%	3,400	21,316,062	4,800	30,093,264	41.2%
NA24	5,933.83	200	1,186,766	250	1,483,458	25.0%	0.88	5,222	1.18	7,002	34.1%	59	350,096	31.0	183,949	-47.5%	290	1,720,811	110	652,721	-62.1%	2,100	12,461,043	3,600	21,361,788	71.4%
SW06	2,392.36	170	406,701	229	547,850	34.7%	0.75	1,794	0.86	2,057	14.7%	100	239,236	120.0	287,083	20.0%	380	909,097	210	502,396	-44.7%	12,000	28,708,320	7,300	17,464,228	-39.2%
SW19	20,190.77	110	2,220,985	100	2,019,077	-9.1%	2.10	42,401	0.50	10,095	-76.2%	37	747,058	5.6	113,068	-84.9%	94	1,897,932	26	524,960	-72.3%	1,100	22,209,847	600	12,114,462	-45.5%
SW30	6,511.23	240	1,562,695	194	1,263,179	-19.2%	1.10	7,162	0.94	6,121	-14.5%	200	1,302,246	51.0	332,073	-74.5%	380	2,474,267	130	846,460	-65.8%	4,900	31,905,027	2,100	13,673,583	-57.1%
Totals	41,297.6		7,571,447.6		6,931,076.5			63,475.4		32,359.7			3,390,968.1		962,566.8			10,199,515.6		7,792,858.0			116,600,299.0		94,707,325.0	
	SWAC	183.3		167.8		-8.5%	1.5		0.8		-49.0%	82.1		23.3		-71.6%	247.0		188.7		-23.6%	2823.4		2293.3		-18.8%

Polygon	Copper (mg/kg dry)		
	2001/2002	2009	
NA23	350	258	
NA24	200	250	
SW06	170	229	
SW19	110	100	
SW30	240	194	
			% Change
SWAC	**183.3**	**167.8**	**-8.5%**

Polygon	Mercury (mg/kg dry)		
	2001/2002	2009	
NA23	1.10	1.13	
NA24	0.88	1.18	
SW06	0.75	0.86	
SW19	2.10	0.50	
SW30	1.10	0.94	
			% Change
SWAC	**1.5**	**0.8**	**-49.0%**

Polygon	Total HPAH (µg/kg dry)		
	2001/2002	2009	
NA23	3,400	4,800	
NA24	2,100	3,600	
SW06	12,000	7,300	
SW19	1,100	600	
SW30	4,900	2,100	
			% Change
SWAC	**2,823.4**	**2,293.3**	**-18.8%**

C

Polygon	Total PCBs (ng/g dry)		
	2001/2002	2009	
NA23	510	840	
NA24	290	110	
SW06	380	210	
SW19	94	26	
SW30	380	130	
			% Change
SWAC	**247.0**	**188.7**	**-23.6%**

Polygon	Tributyltin (µg/kg dry)		
	2001/2002	2009	
NA23	120	7.4	
NA24	59	31.0	
SW06	100	120.0	
SW19	37	5.6	
SW30	200	51.0	
			% Change
SWAC	**82.1**	**23.3**	**-71.6%**

CONCEPTUAL WORK PLAN

CAMPBELL SHIPYARD

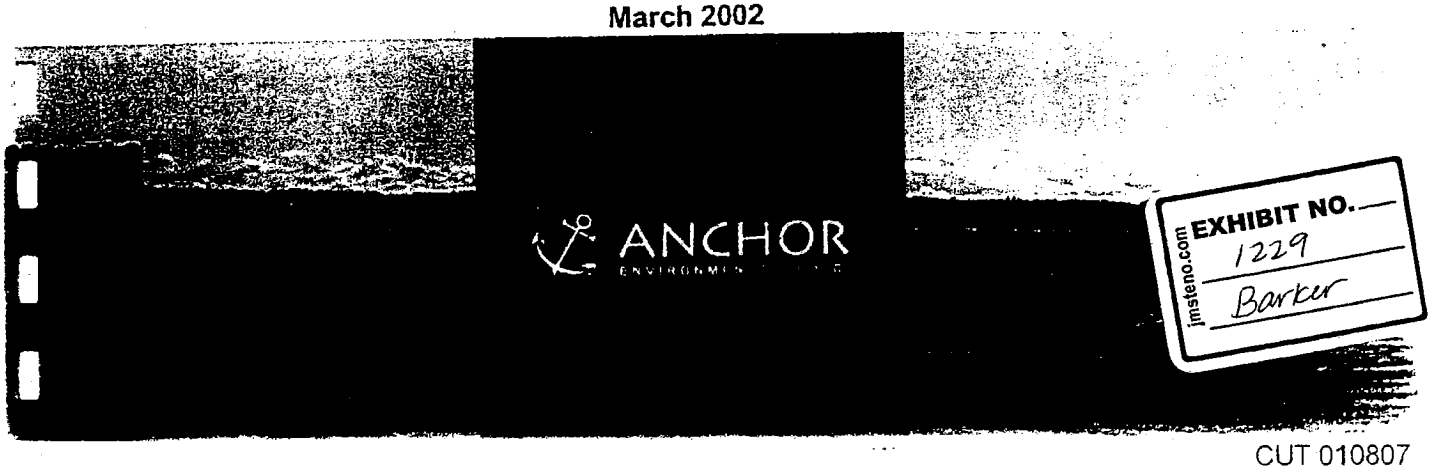
Prepared for

San Diego Unified Port District
3165 Pacific Highway
San Diego, California 92101

Prepared by

Anchor Environmental
1411 4th Avenue, Suite 1210
Seattle, Washington 98101
and
One Park Plaza, Suite 600
Irvine, California 92614

March 2002



CUT 010807

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March 2002

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1 INTRODUCTION

Anchor Environmental, L.L.C. (Anchor) has prepared this Work Plan to identify technical studies that may be necessary to evaluate the technical feasibility and effectiveness of the preferred remedial alternative for the remediation of bay sediments within the waterside boundaries of the former Campbell Shipyard leasehold. The project area consists of approximately 12.9 acres of submerged tidelands and shipways, located at the foot of 8th Avenue in San Diego, California (Figures 1 and 2). Previous assessment work at the former Campbell Shipyard site indicated the presence of contaminants in the bay sediments (PTI, 1993). Based on this assessment work, the San Diego Regional Water Quality Control Board (RWQCB) issued Cleanup and Abatement Order (CAO) No. 95-21. The CAO requires, in part, cleanup of the bay sediments at the former Campbell Shipyard site to meet specific levels for constituents of concern (COC).

1.1 Purpose

This Work Plan will identify data needs, investigation methods, and test methods needed to obtain the necessary data for developing design criteria, evaluating the environmental impacts and predicting effectiveness of the preferred remediation alternative for the Campbell Shipyard leasehold. Information generated from the proposed investigations would be used to address regulatory and public review, including the California Environmental Quality Act (CEQA) process.

1.2 Cleanup and Abatement Order

In June 1995, the RWQCB issued CAO No. 95-21 to Campbell Industries Marine Construction and Design Company, establishing cleanup levels at the Campbell Shipyard for upland soils, groundwater, and offshore bay sediments that were adjacent to the Campbell Shipyard wharves and boat ways (June 1995). The COC and respective sediment cleanup levels were based on previous limited site assessment work performed at the former Campbell Shipyard by other consultants (RWQCB, 1995). The COC and cleanup levels established in CAO No. 95-21 for offshore bay sediments included: copper, lead, zinc, total petroleum hydrocarbons (TPH), high-molecular-weight polynuclear aromatic hydrocarbons (HPAHs), polychlorinated biphenyls (PCBs), and tributyltin (TBT). Elevated levels of these COC were identified in bay sediments and were attributed to past and present waste management practices of the Campbell Shipyard.

In general, the CAO indicated that concentrations of copper, zinc, TBT, HPAHs, and TPH were highest along the shoreline and adjacent to the drydocks, with concentrations decreasing away from the shipyard. Concentrations of lead were identified adjacent to four storm drains at the site suggesting that these drains may have also contributed lead to bay sediments. Concentrations of PCBs in sediments were greatest in the area where shipyard activities were conducted. Table 1 presents the RWQCB sediment cleanup levels as indicated in CAO No. 95-21.

Table 1
RWQCB CAO No. 95-21 Sediment Cleanup Levels

Constituent	Cleanup Level (mg/kg) (Dry Weight)
Copper	810
Zinc	820
Lead	231
TPH	4,300
HPAHs	44
PCBs	0.95
TBT	5.75

Note:
mg/kg = milligrams per kilogram

1.3 Previous Investigations

Environmental site assessment activities associated with characterizing the bay sediments within the leasehold boundary of the former Campbell Shipyard were performed by several consultants both prior and subsequent to RWQCB CAO No. 95-21. A chronological list of site assessment activities performed is provided below. A brief summary of these assessments is included in Appendix B of the draft Sediment Remediation Alternatives Evaluation technical memorandum (Ninyo & Moore *et al.*, 2001).

- RWQCB, *Results of Sediment Sampling in the Vicinity of Campbell Industries*, unpublished data collected by the San Diego Regional Water Quality Control Board, 1989.
- Environmental and Energy Services Co., *Chemical Characterization of Marine Sediments, Campbell Industries, San Diego, California*, September 1989.
- PTI Environmental Services, *Study Proposal, Campbell Shipyards Sediment Characterization-Phase 2*, July 1990.

- PTI Environmental Services, *Data Report, Campbell Shipyards Sediment Characterization Volumes and II*, June 1991.
- PTI Environmental Services, *Remedial Action Alternatives and Analysis Report, Review Draft*, October 1993.
- PTI Environmental Services, *Preliminary Design Plan, Bay Sediment, Upland Soil, and Groundwater Remediation*, September 1995.
- OHM Remediation Services Corporation, *Draft Post Cleanup Sampling Plan, Campbell Industries, Eight Avenue at Harbor Drive, San Diego, California, 92112*, August 1998.
- Hart Crowser, Inc., Sample and Analysis Plan for Dredged Sediment Characterization, Campbell Shipyard, San Diego, California, Case # 1999-153-03. October 1999.
- Hart Crowser, Inc., Sediment Characterization Report Campbell Shipyard, San Diego, California, March 2000.
- Hart Crowser, Inc., Phase II Sediment Sampling and Analysis Work Plan, May 2000.
- Hart Crowser, Inc., Final Phase II Sediment Characterization Report, Campbell Shipyard, San Diego, California, Volumes I and II, draft version, April 2001.

1.4 Existing Conditions

The marine habitat adjacent to the former Campbell Shipyard consists of approximately 12.9 acres of open-water areas with depths down to about -33 feet MLLW. Bathymetry at the site varies significantly due to the former presence of shipways and berths. Under current National Marine Fisheries Service operational definitions, the entire area below the high tide line (+7.8 feet MLLW) is considered Essential Fish Habitat.

As of April 16, 2001, Campbell Shipyard completed demolition of piers. Old timber piles from the subtidal zone and debris on the waterfront have been removed. A concrete bulkhead borders the waterfront and the land along the shoreline supports little vegetation.

A summary of acreage of habitat types (determined by depth relative to the tidal prism), as defined in the San Diego Bay Integrated Natural Resources Management Plan (United States Department of the Navy [U.S. Navy], Southwest Division, and Port District, 2000), is presented in Table 2 below. A concrete ship launchway in the central part of the waterfront, provides a sloping habitat with a hard substrate consisting of rocks and concrete.

Dive surveys of the entire area (Littoral, 2000a and 2000b) reported that the substrate consists mostly of soft sediments comprised of predominately fine, sandy-silt. However, waters of about -10 feet MLLW and shallower supported either eelgrass (*Zostera marina*) or various species of red algae. Scattered debris in the subtidal zone provides a limited amount of hard substrate.

Table 2
Summary of Acreage of Habitat Types Under Existing Conditions

	Habitat (acres)				
	Intertidal -2.2 to +7.8 ft MLLW	Shallow Subtidal -12 to -2.2 ft MLLW	Moderately Deep Subtidal -20 to -12 ft MLLW	Deep Subtidal > - 20 ft MLLW	Total
Existing Conditions	1.25	1.65	2.62	7.33	12.86

Note:
MLLW = Mean Lower Low Water datum in feet

The following habitats have been identified within the former Campbell Shipyard leasehold:

- Eelgrass beds
- Soft-Bottom Invertebrate Community
- Piling, Bulkhead, and Concrete Debris Invertebrate Communities
- Fish
- Birds
- Marine Mammals

Further discussion of these habitats and the associated biological communities is provided in Appendix C of the draft Sediment Remediation Alternatives Evaluation technical memorandum (Ninyo & Moore *et al.*, 2001).

1.5 Preferred Alternative

The draft Sediment Remediation Alternatives Evaluation technical memorandum (Ninyo & Moore *et al.*, 2002) prepared for the Port District identified several remedial alternatives. Removal of contaminated sediment by dredging or isolating the contaminated sediment by placing a clean cap were the primary methods considered feasible to address CAO cleanup objectives. A comparative analysis was performed for each remedial alternative. The evaluation criteria included:

- Technical effectiveness in achieving CAO cleanup objectives.
- Implementability in terms of constructability and regulatory acceptability.
- Environmental impacts in terms of short term water quality effects and habitat impacts.
- Estimated costs.

The preferred alternative is Alternative 5 (i.e., Cap in Place Affected Sediment and Create Intertidal Habitat and a Recreational Beach). This alternative involves placing a clean cap over contaminated sediment that contains COC concentrations greater than cleanup levels. The majority of the cap would be very thick (up to 20 feet in places) to provide clean habitat for other flora and fauna. The top of cap elevation would be at water depths suitable to recreate shallow subtidal and intertidal habitat that have been lost over the years. The top of the cap would be relatively flat with the outer portions of the cap (the slope from the bay bottom to the top of the cap) will be armored with stone to protect against erosion from propeller wash and wind and ship waves. The thick cap is anticipated to consist of clean dredged material from a maintenance dredging project or new work project. Approximately 90,000 cubic yards (cy) of clean imported material would be required for the habitat cap and 26,500 cy of material for the retaining berm. The habitat cap would serve as an isolation cap by containing and isolating contaminants from the marine environment.

Up to approximately 11,500 cy of material located just outside of the new leasehold area but inside the old leasehold area would be dredged and hauled to an upland landfill. Portions of the site located near the 10th Avenue Marine Terminal (within approximately 200 feet) would have an engineered cap that would include layers of gravel and sand. The sand layer would isolate the contaminants below from the marine environment. The gravel layer would provide a barrier to prevent bioturbation from deep burrowing marine species (such as ghost shrimp) and would provide erosion control from vessels maneuvering at the Terminal.

This alternative also features a recreational beach that could be accessed by the public. The beach would be created from within the adjacent uplands to avoid converting aquatic habitat to upland habitat. To create the beach, approximately 4,000 cy of upland soil would

be regraded on the site and incorporated into the upland site grading. Approximately 7,250 cy of clean sand would be imported to create a 4-foot thick sand beach.

Alternative 5 was selected as the preferred alternative, for the following reasons:

- Capping is technically effective at isolating sediment contamination.
- Capping minimizes the disturbance to the affected sediment, thereby minimizing releases to the water column and reducing risk to human health, the environment, and water quality.
- The cap is easily constructed.
- Creating a recreational beach from areas that are currently upland would yield a net gain of aquatic habitat.
- Placement of a thick habitat cap would increase shallow subtidal and intertidal habitats by 2.5 acres and 1.1 acres, respectively.
- The cost is less than the other alternatives evaluated, except the cap only alternative.

2 DATA NEEDS

Based on a review of data obtained through previous investigations, key data gaps were identified in the draft Sediment Remediation Alternatives Evaluation technical memorandum (Ninyo & Moore *et al.*, 2002). The key data gap identified is the entire extent and depth of affected bay sediments. However, to address the implementability and long-term effectiveness of the preferred alternative, and to develop design criteria, this section identifies anticipated data needs. Information obtained during these investigations would be used during environmental review and design of the preferred alternative. This work plan discusses the various methods of investigation and why each needs to be performed. However, this document is not intended to address specific sampling and analyses elements (i.e., number of samples, location of samples, etc.) since those elements will need to be developed based on review of the previous studies and regulatory and public concerns.

2.1 Future Uses

The future use of the upland portion of the site will be a hotel that will serve the Convention Center and the new baseball stadium located across Harbor Drive. The uplands will also feature a waterfront park and plaza, which will allow for public access to the waterfront and keep view corridors intact. Under the preferred alternative, a portion of the uplands will also be excavated to create a recreational beach that would be approximately 1 acre in size. The offshore portions of the site would be used to recreate some of the shallow subtidal and intertidal aquatic habitat that have been lost over the years. Additionally, the portion of the site that lies between the new and old leasehold boundaries will not have the habitat cap placed there which will allow for greater access and maneuverability for ships calling on the 10th Avenue Marine Terminal. Instead, the contaminated sediments from this area will either be dredged or isolated from the environment by an engineered cap of clean sediments.

Finalization of the recreational beach configuration is necessary to determine final volumes and to assess beach slope stability to wind and ship generated waves.

2.2 Extent of Contamination

Sediment analytical data are limited for areas outside the Campbell Shipyard leasehold. The limited data indicate that bay sediment have been impacted in areas that extend beyond and outside the leasehold. This work plan assumes that bay sediment remediation would be limited to the Campbell Shipyard leasehold and will not extend past this leasehold boundary. In addition, insufficient sampling at locations within the leasehold boundary results in uncertainty regarding the vertical extent of contaminated sediments. Areas located outside of the proposed cap area would be sampled to ensure that all contaminants is adequately isolated by the cap. Sediment samples would be collected and analyzed for the COC as described in Section 3.1.

2.3 Potential for Contamination Under Shipway

There is a general absence of data under the shipway and piers. The volume of sediment under the shipway was estimated by interpolation by Hart Crowser (Hart Crowser, 2001). Depending on the final layout of the preferred alternative, a portion of the concrete shipway may need to be removed. If a partial removal of the shipway is required, then the nature and extent of contamination under the shipway will need to be determined for offsite disposal characterization. This data gap would be addressed by the collection of surface and subsurface sediment samples under the shipways as described in Section 3.2.

2.4 Recontamination Potential From Switzer Creek and Offsite Sources

Potential recontamination to the clean cap from three potential sources (including Switzer Creek outfall discharges, resuspension of adjacent sediments located in the berthing areas of the 10th Avenue Marine Terminal, and resuspension of sediments in San Diego Bay) was not addressed in the remediation alternatives evaluation (Ninyo & Moore *et al.*, 2002). Switzer Creek located between the Campbell Shipyard leasehold and the 10th Avenue Marine Terminal. In order to address this potential data gap, a tiered approach would be implemented. The initial step would evaluate existing data to assess whether the creek (which is channelized and has storm water input) is a potential source. If the creek is identified as a potential recontamination source, further investigations may be is necessary to assess the long-term impacts to the clean cap. Subsequent tiers may involve additional sample collection and analysis and subsequent data evaluation. For this work plan, no additional investigations are assumed.

2.5 Hydrogeologic Conditions

Groundwater flow through the contaminated sediment is the primary mechanism for release and movement of contaminants through an isolation cap. There is an absence of on-site groundwater and hydrogeologic information such as groundwater elevation range and effect of the tidal prism; hydraulic conductivity; hydrogeologic parameters and permeability; and groundwater flux. In order to address this data gap, groundwater samples will need to be collected from both existing upland monitoring wells and at least two locations nearshore as described in Section 3.4 to assess the effects of groundwater contaminants mobility.

2.6 Contaminant Mobility Characteristics of Existing Sediments

For this work plan, contaminant mobility refers to the short-term release of contaminants during dredging and/or capping operations, and the long-term movement of contaminants through the isolation cap. Short-term effects generally are due to the release of contaminants during construction activities. Release of contaminants occurs through pore water or disassociation of particulate bound contaminants. Long-term effects generally are due to movement of contaminants through various pathways to the water/sediment interface. The contaminant mobility evaluation will consist of a tiered approach as discussed in Section 3.4.

2.7 Cap Stability Evaluation

Cap stability refers to the cap's ability to maintain its function (i.e., isolating contaminated sediment) under various external forces. External forces include seismic events, wind and ship generated waves, active and passive groundwater pressures, bioturbation, human activity, etc. An evaluation of cap stability for the site has not been conducted. Several cap stability factors the settlement and/or the consolidation potential of the capping material, the in place contaminated sediments, and the native or substrate sediments (foundation); static and dynamic stability; bioturbation potential and erosional potential of the capping material as discussed in Section 3.5.

2.8 Geotechnical Properties of Existing Sediments

Geotechnical data is critical to evaluate cap stability, contaminant mobility, and the hydrogeologic conditions of the site. As identified in the remediation alternatives report (Ninyo & Moore *et al.*, 2002), there is an absence of geotechnical data for the on-site bay sediment. Moisture contents, settling rates and consolidation; grain size and Atterberg limits; specific gravity; and other parameters would be measured as described in Section 3.6.

2.9 Design Level Bathymetry

A recent bathymetric survey is necessary to evaluate potential habitat impact acreages and develop design level volumes and cost estimates. The Port may already have recent bathymetry that satisfies this data need.

2.10 Site Hydrodynamics

Placement of the thick (approximately 20 feet) habitat cap will change the site hydrodynamics (i.e., circulation and flow velocities). Site hydrodynamics will be evaluated as described in Section 3.8.

2.11 Integration with Environmental Review Processes

The design and construction of the preferred alternative would be subject to the guidelines of various environmental regulations, including CEQA, Endangered Species Act (ESA), and California Coastal Act (CCA). Mitigation measures, best management practices, or other environmental requirements from the environmental review and permitting processes would be incorporated into the final design.

3 INVESTIGATION AND TEST METHODS TO FILL DATA GAPS

This section describes the investigation and test methods needed to fill the data gaps identified previously in Section 2. Available and existing data would be reviewed to avoid duplication of effort and to focus each investigation prior to performing the investigations listed in this section. Based on results from cap stability and contaminant mobility assessments, additional sampling outside of the cap boundaries would be collected to ensure that all contaminated sediment is adequately isolated.

3.1 Extent of Sediment Contamination

The extent of sediment contamination would be evaluated by collecting surface and subsurface sediment samples to better delineate the horizontal and vertical extent of contaminated sediments within the Campbell Shipyard leasehold boundary. All surface and subsurface sediment samples would be submitted to a qualified and California State-certified analytical laboratory for total solids, grain size, total organic carbon, copper, lead, zinc, TPH, HPAHs, PCBs, and TBT.

3.1.1 Surface Sediment Sampling

Surface sediment samples from the biologically active zone of 0 to 10-centimeters (cm) would be collected using a sediment grab sampler (e.g., van Veen) to confirm that areas outside the proposed cap area are clean. Sediment samples would be collected and processed in accordance with standard sediment collection techniques established by the United States Environmental Protection Agency (EPA) Region 10 Puget Sound Estuary Program (PSEP) guidelines (EPA, 1997). In addition, additional surface sediment may be collected for sediment porewater analysis for the contaminant mobility evaluation discussed in Section 3.4.

3.1.2 Subsurface Sediment Sampling

Subsurface sediment samples would be collected using a vibracore or similar collection device to better determine the vertical extent of contaminated sediments in areas outside the proposed cap limits. Subsurface sediments would be collected and processed in accordance with standard sediment collection techniques established by the EPA Region 10 PSEP guidelines (EPA, 1997).

3.2 Potential for Contamination Under Shipway

If required, the potential for contamination under the shipway would be evaluated for offsite disposal characterization in the same manner as assessing the spatial extent of contamination as discussed in Section 3.1, by the collection and analysis of surface and subsurface sediments. Portions of the concrete shipway may need to be removed to provide access to those sediments.

3.3 Contaminant Mobility – Short-Term Impacts

Short-term construction impacts during capping include water quality impacts (e.g., increased turbidity and reduced dissolved oxygen) and resuspension of contaminated sediment. Short-term impacts from dredging include the standard water quality impacts plus potential release of contaminants. The evaluation of short-term construction impacts for the placement of capping material would include predictive modeling of total suspended solids (TSS) concentrations and dilution mixing zone boundaries. The evaluation of short-term construction impacts for the dredging of contaminated sediment would include dredging elutriate testing (DRET) to determine potential contaminant releases to the water column and potential modeling of dilution zone mixing boundaries if elutriate test results indicate initial water quality standard exceedances.

3.3.1 Modified/Dredging Elutriate Testing

Depending upon anticipated project conditions and agency concern, either or both the modified and dredging elutriate tests would need to be conducted.

The procedures described by the USACE (DiGiano *et al.*, 1995) would be used to conduct the DRET and modified elutriate test (MET). The DRET is used to assess potential water quality impacts at the point of dredging for dissolved contaminants and is intended to simulate mechanical dredging. A slurry is made of 10 grams (g) of sediment per liter of site seawater. The slurry is then aerated for 1 hour with compressed air and allowed to settle for 1 hour. An aliquot of water is withdrawn and sent to a laboratory for chemical analysis. The MET is typically used to evaluate water quality impacts at the point of disposal and is intended to simulate hydraulic pipeline dredging. Because hydraulic dredging is not anticipated, it is unlikely that a MET would be required.

3.3.2 *Predictive Modeling*

Modeling would be performed to predict potential water quality impacts during construction. For cap placement, the USACE Waterways Experiment Station (WES) models STFATE and MDFATE would be used to predict cap material loss and placement accuracy. For dredging, the WES model DREDGE would be used to assess dilution zones if the elutriate test results indicate a need for a dilution zone.

3.4 Contaminant Mobility – Long-Term Impacts

The desired function of the cap is to physically isolate the in-place contaminants. In order to determine the appropriate cap design to effectively isolate the contaminated material, both advective and diffusive processes should be considered. For example, if groundwater/surface water interactions indicate that advection is not significant at the site, then the cap design may only need to address diffusion and the physical isolation of the contaminated sediments (ignoring dissolved and/or colloid facilitated transport due to advection). However, if groundwater/surface water contaminant release pathways are significant at the site, the hydrogeologic properties and chemical characteristics of the cap would need to be factored in to the design. In order to evaluate these processes, a tiered approach would be used as discussed below.

3.4.1 *Sediment Porewater Analysis*

Sediment porewater would be collected and analyzed as discussed in Section 3.1 from the surface contaminated sediments to determine the potential concentrations of contaminants that could be "squeezed out" of the contaminated sediment layer into the cap due to the weight of the overlying cap.

3.4.2 *Groundwater Investigation*

If existing information on the hydrogeology does not exist, a groundwater investigation may need to be conducted to fill the data gap identified in Section 2.5 and to determine whether there is an upward groundwater gradient acting below the contaminated sediments within the capping area. The groundwater investigation would include the determination of the groundwater elevation range and effect of the tidal prism; hydraulic conductivity; hydrogeologic parameters and permeability; and groundwater flux.

If the results of the groundwater investigation indicate that there is no evidence of an upward groundwater gradient below the contaminated sediments, then only diffusion and physical isolation of the contaminated sediments would need to be considered in designing the cap. However, if the results of the groundwater investigation indicate that there is sufficient flow to transport dissolved contaminants then further investigations such as thin-layer column leach testing and groundwater modeling may be necessary.

3.4.3 Thin-Layer Column Leach Testing

Thin-layer column leach tests (TCLT) are designed as laboratory-based physical models of contaminant leaching in a confined disposal facility or under a cap and are designed to show leachate concentration as a function of pore volumes eluted. Unlike freshwater sediment leaching, where maximum leachate contaminant concentrations occur at the beginning of leaching, estuarine sediment leaching yields maximum leachate contaminant concentrations after a number of pore volumes have been leached. This occurs as a result of the release of colloids as ionic strength decreases. The number of pore volumes required to reach the peak on contaminant elution curves can be used to estimate the time to reach maximum contaminant concentrations. The test would be performed under anaerobic conditions using the procedures outlined in Myers, et al. (1996 with modifications).

The TCLT sample would be collected from core locations representative of the contaminated sediments to simulate the conditions within the site. The TCLT test results can provide a conservative estimate of the maximum contaminant concentrations that may be migrating from the contaminated sediment layer upward into the cap, if there is evidence of an upward groundwater gradient below or through the contaminated sediment.

3.4.4 Contaminant Mobility Modeling

Models that may be used to assess contaminant mobility may include Boudreau (Boudreau, 1997), RECOVERY (Boyer *et al.*, 1994), or MODFLOW (MacDonald and Harbaugh, 1988).

The following phased approach to address long-term water quality issues would be utilized:

1. Compare peak TCLT leachate concentrations directly to federal marine acute surface water quality standards. For fine grained dredge material with relatively low concentrations of contaminants, TCLT tests performed carefully under anaerobic conditions are not expected to result in leachate concentrations that exceed federal marine acute surface water quality standards. In this case, no further evaluation beyond a simple comparison is warranted. Even if peak leachate concentrations slightly exceed acute surface water standards, a narrative consideration of attenuation and tidal mixing processes may be adequate to obtain acceptance.

2. If TCLT leachate concentrations exceed surface water quality, perform a simplified steady-state model (1-D) to simulate some of more basic contaminant transport processes including groundwater advection and tidal mixing processes. Using conservative model parameter values (no site-specific data), a reasonable worst-case estimate of potential contaminant flux through the containment structure may need to be performed. By considering these attenuation processes, this approach considers the mechanisms that act to reduce chemical concentrations along the transport pathway to surface waters.

3. Perform detailed groundwater model of flow through CDF. If the simplified steady-state model discussed above is not accepted by the agencies or if leachate concentrations are significantly above surface water standards, then a more detailed modeling effort that incorporates site specific data may be necessary. A detailed groundwater flow model through the CDF linked to a geochemical transport model would require site-specific data. These data include groundwater data collected as described in Section 3.4.2. Model efforts would include detailed simulations of contaminant movement over various time periods.

3.5 Cap Stability

In designing the cap, stability criteria would be evaluated to determine the effectiveness of the cap against erosional factors such as propeller wash, wind and ship waves, and bioturbation. Static and dynamic slope stability would also be evaluated.

3.5.1 Propeller Wash

Propeller wash from vessels can cause erosion of the capping material, thus it is important to evaluate the potential effects of prop wash prior to placing a cap. Several models for propeller wash scour could be used for this evaluation, such as Blaauw and van de Kaa (1978), Fuehrer et al. (1987), Hamill (1988), and Verhey (1983).

3.5.2 Wind and Ship Waves

Passing vessels and storm-generated waves could result in erosion of the capping material. A detailed analysis of cap material stability against wave attack would be conducted using one or a combination of the following models. The USACE Automated Coastal Engineering System (ACES) program would be used to model wind wave growth and propagation due to winds (CERC, 1994). Vessel waves would be modeled using methods described by Sorenson (1993).

3.5.3 Bioturbation

Consistent with Palermo et al. (1998), cap thickness design should include a component thickness that is sufficient to allow bioturbation of the top layer of the cap without affecting the cap's function. In soft bottom marine substrates, bioturbation is the mixing and overturning of sediments caused by organisms residing in the sediments (called benthic organisms) and typically occurs within the top 10 to 30 cm of the bed surface. Because the cap thickness is estimated to be approximately 20 feet thick, bioturbation of sediments underlying the cap would not be an issue. However, if the contaminated sediments between the new and old leasehold areas are dredged and capped (or capped only), then the cap design in that location would incorporate an evaluation of bioturbation.

3.5.4 Settlement and Consolidation

Settlement and/or consolidation of the contaminated material, and underlying native sediments may occur over a period of time following cap placement. Significant consolidation of the cap material is not expected since the cap material would primarily be sand. If any of the sediments (cap, contaminated, or native sediments) are compressible, a prediction of consolidation is important in interpreting monitoring data to differentiate between changes in surface elevation due to consolidation as opposed to those potentially due to erosion. Settlement and consolidation are also important design criteria for habitat creation; if significant settlement occurs, the design elevation for habitat would be lowered over time.

3.5.5 Slope Stability (Static)

Slope stability of the overall area should be evaluated to estimate the risk for static failure (i.e., shallow or deep failure, impact to nearby structures, etc.). Placing an approximate 20-foot cap may impact the area's overall stability. Geotechnical data collected in Section 3.6 would be used in this investigation. Modeling programs may include XSTABL or UTEXAS3.

3.5.6 Seismic Performance (Dynamic)

For this conceptual Work Plan, a seismic evaluation will not be discussed, because seismic concerns are typically related to the ability of the containment berm to contain contaminated sediments. Because the preferred alternative does not involve containing contaminated sediments behind a containment structure, the seismic issue relates to failure of the cap (i.e. slope sloughing), which could impact navigation and berthing. If required by local regulatory authorities, a seismic performance evaluation of the isolation cap and structural berm would be conducted in accordance with local and State seismic construction standards.

3.6 Geotechnical Investigation and Testing

The physical characteristics of the contaminated sediment are of importance in predicting the behavior of the foundation during and following placement of the cap. In addition, the physical characteristics of the capping material are important to ensure that the capping sediment is compatible with the contaminated sediment. Physical parameters to be

measured may include visual classification, in situ water content/solids concentration, plasticity indices (Atterberg limits), organic content, grain size distribution, and specific gravity. Additional geotechnical parameters may include discrete particle settling rates, consolidation tests, and shear strengths. Deep borings may be required to address area slope stability and to evaluate foundation settlement.

3.7 Bathymetric Survey

Site bathymetry influences the degree of spread during placement of the capping material. As mentioned in Section 2.9, recent, detailed bathymetry is necessary to evaluate potential habitat impact acreages and develop design level volumes and cost estimates. The Port may already have recent bathymetry that would satisfy this data need.

3.8 Site Hydrodynamic Impacts

In order to evaluate potential hydrodynamic changes, a tiered approach would be used. First, a review of site physical oceanographic data (i.e., currents and tidal exchange) would be performed to assess current conditions. If current conditions demonstrate no significant circulation, modeling the changed condition may not be required. If modeling is determined to be necessary, the 2-dimensional (2-D) hydrodynamic model (e.g., Surfacewater Modeling System [SMS]) would be run. In order to calibrate the hydrodynamic model, site specific physical oceanographic data would need to be collected (e.g., current meter deployments, tidal elevations, and extended bathymetry measurements).

3.9 Environmental Regulatory Requirements

Environmental regulatory requirements from the CEQA, ESA, or CCA processes, including mitigation measures, best management practices, or construction methods would be reviewed and incorporated in the design documents, where applicable.

4 CONCLUSION

Data gaps exist that need to be filled prior to design and permitting for the preferred alternative. For several of these data gaps, a tiered approach has been suggested that would allow for initial results to be obtained and evaluated prior to making a decision about whether additional tests and evaluations are required.

In summary, the investigations and methods identified in this Work Plan are anticipated to fill data needs required for developing design criteria and to evaluate potential short and long-term environmental impacts. Investigation results would also address the effectiveness of the preferred alternative to remediate the Campbell Shipyard site.

Evaluation results can be used in regulatory and permitting review and documentation (i.e., CEQA), however the level of evaluation discussed within this Work Plan is typically much greater than required for an Environmental Impact Report (EIR). The EIR evaluation provides a lower degree of detail for several alternatives.

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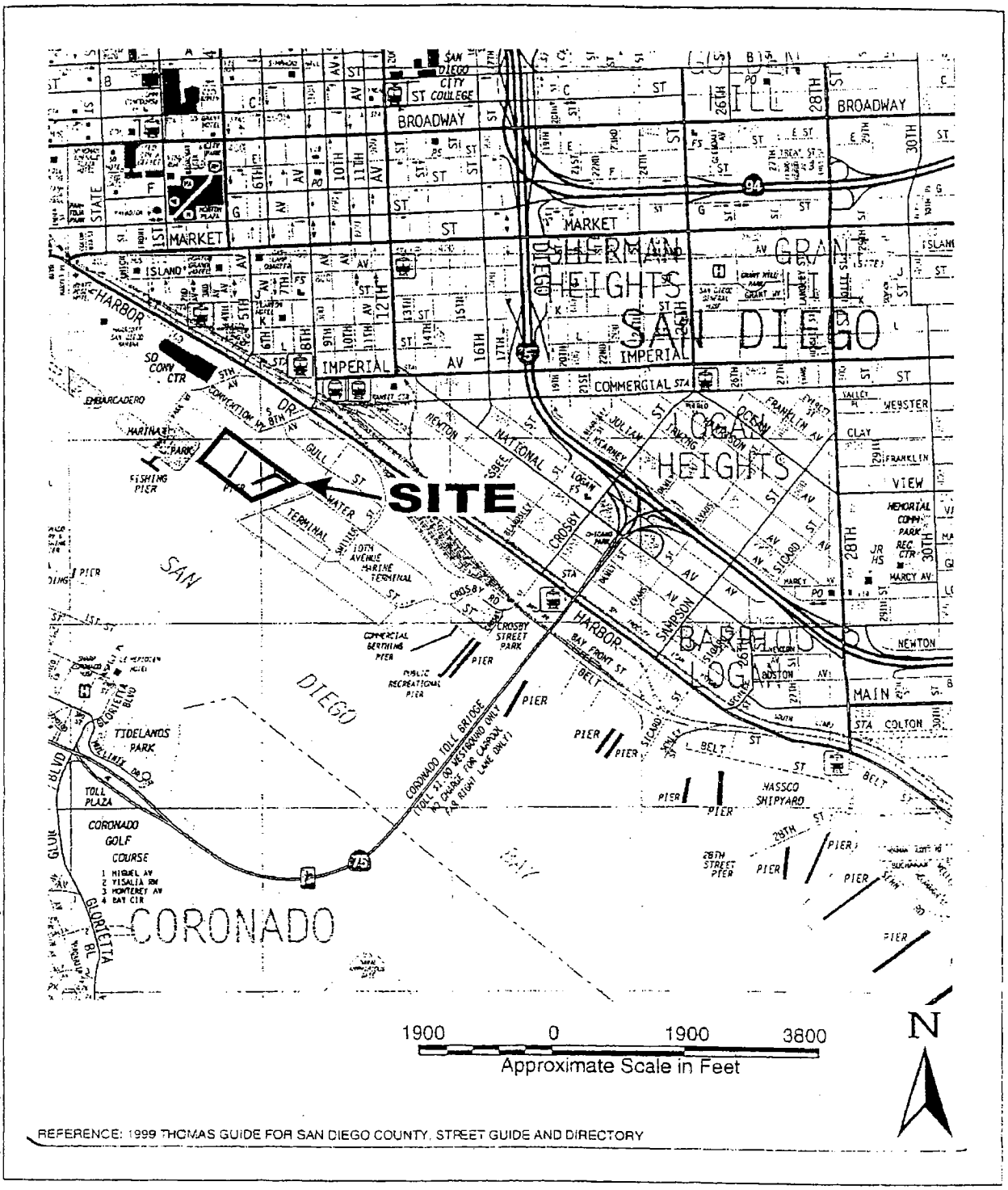

REFERENCE: 1999 THOMAS GUIDE FOR SAN DIEGO COUNTY, STREET GUIDE AND DIRECTORY

Prepared by Ninyo & Moore, February 2002

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1
Site Location Map
Campbell Shipyard

CUT 010832

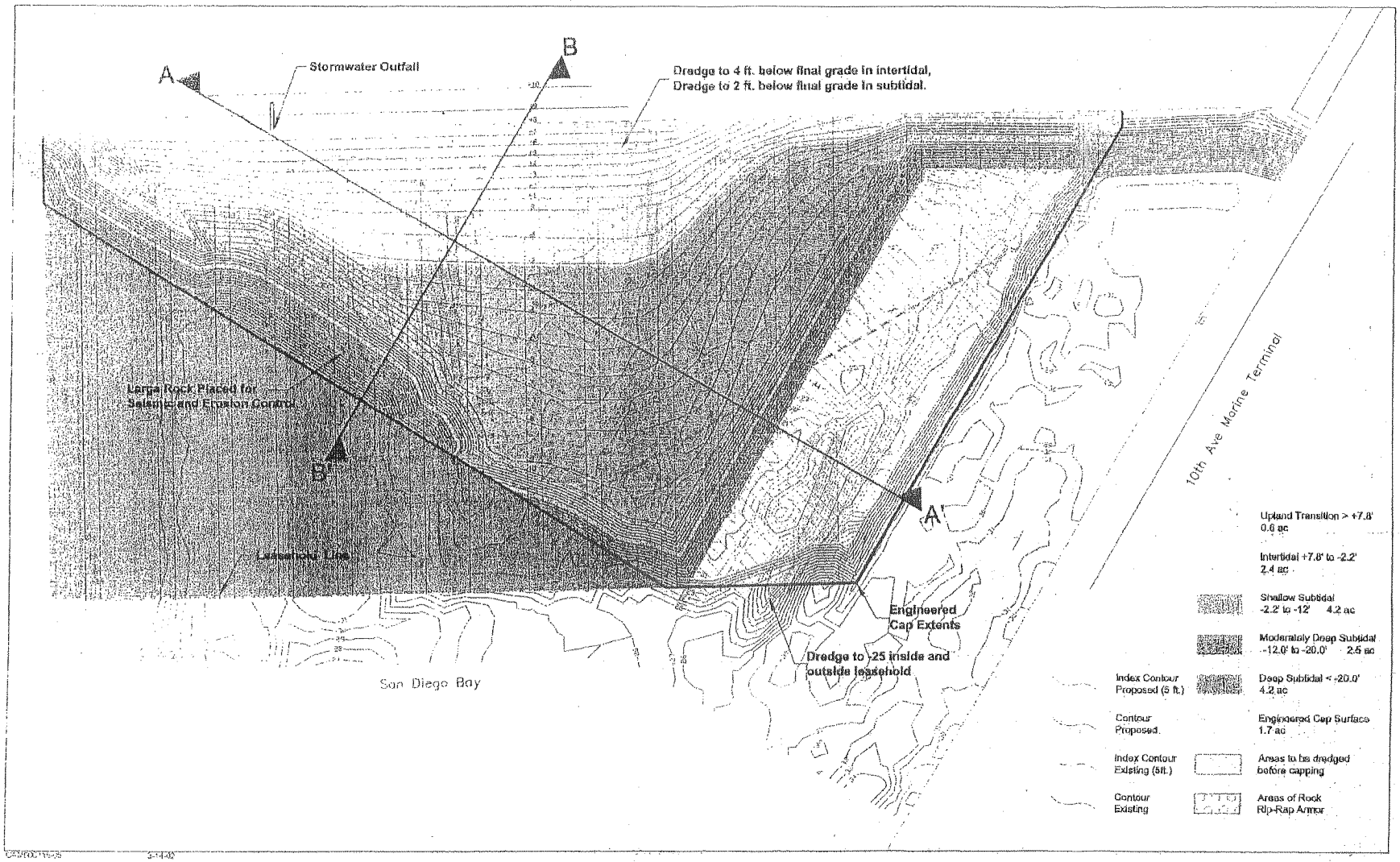

Figure 2
Alternative 5
Cap in Place Affected Sediment and Create Intertidal Habitat and Recreational Beach
Campbell Shipyard

CUT 010833

California Regional Water Quality Control Board
San Diego Region

Staff Report on the
Establishment of Shipyard Sediment Cleanup Levels
for
National Steel and Shipbuilding Company
and Southwest Marine, Inc.
February 17, 1999

Issue

There are elevated levels of pollutants in the bay bottom sediment adjacent to several shipyards in San Diego Bay. The concentration of these pollutants causes or threatens to cause a condition of pollution in San Diego Bay by impairing the benthic organisms which are protected by the Marine Habitat Beneficial Use. National Steel and Shipbuilding Company (NASSCO) and Southwest Marine, Inc. (Southwest Marine) are engaged in a process of assessment and removal of sediments which have high concentrations of pollutants adjacent to their facilities. The Regional Board must establish cleanup levels for NASSCO and Southwest Marine which protect the beneficial uses and abate the threat of pollution in San Diego Bay.

Conclusion

The Regional Board should adopt tentative Resolution No. 99-12, *A Resolution Establishing Shipyard Sediment Cleanup Levels for Southwest Marine, Inc., San Diego County* and tentative Resolution No. 99-20, *A Resolution Establishing Shipyard Sediment Cleanup Levels for National Steel and Shipbuilding Company, San Diego County*. These resolutions designate the following cleanup levels and indicator chemicals for cleanup of bay bottom sediments at NASSCO and Southwest Marine as indicated below:

CONSTITUENT	CLEANUP LEVEL FOR BAY SEDIMENT (mg/kg) Dry Weight	NASSCO CLEANUP INDICATOR CHEMICALS	SOUTHWEST MARINE CLEANUP INDICATOR CHEMICALS
Copper	810	X	X
Zinc	820	X	X

CONSTITUENT	CLEANUP LEVEL FOR BAY SEDIMENT (mg/kg) Dry Weight	NASSCO CLEANUP INDICATOR CHEMICALS	SOUTHWEST MARINE CLEANUP INDICATOR CHEMICALS
Lead	231		X
Mercury	4.2	X	X
PCBs	0.95		X

These cleanup levels for NASSCO and Southwest Marine are based on cleanup levels for Campbell Industries Marine Construction and Design Company (Campbell Industries) and the mercury cleanup level for Shelter Island Boatyard. These cleanup levels are appropriate for NASSCO and Southwest Marine because the wastes at NASSCO and Southwest Marine are similar to the wastes at Campbell Industries and Shelter Island Boatyard and the cleanup levels will protect the beneficial uses and abate the threat of pollution in San Diego Bay.

Background

The Regional Board has been working, since October, 1994, on a project for assessing the chemical quality of sediments in San Diego Bay immediately off-shore of two shipyards - Southwest Marine, and National Steel and Shipbuilding Company (NASSCO). This project was initiated because of data dating to the late 1980's indicating elevated levels of contaminants in sediments immediately offshore of the shipyards. These contaminants are consistent with those produced as a result of shipyard operations. Since 1994 NASSCO and Southwest Marine began actively working on a voluntary, cooperative basis with the Regional Board to expedite the assessment and cleanup of the polluted sediments. The shipyards have worked cooperatively to perform a sediment study and a remedial action alternatives analysis report in accordance with Regional Board guidelines. It has not been necessary to issue cleanup and abatement orders to the shipyards because of the good faith shown by the shipyards and the excellent progress that has been made to date.

By letter dated February 14, 1997, the Regional Board issued sediment investigation requirements to NASSCO for elevated concentrations of copper and zinc in the San Diego Bay sediment. At a meeting on March 11, 1998, the Regional Board directed NASSCO to also investigate mercury at a small area of NASSCOs leasehold just east of the floating drydock near shore. A similar sediment investigation letter was issued to Southwest Marine on October 22, 1997 for elevated concentrations of copper, zinc, lead, and mercury. By letter dated April 27, 1998, the Regional Board directed Southwest Marine to also investigate PCBs in the sediment. For both shipyards, sediment investigations were required to determine the areal extent and location of sediments

containing chemical concentrations in excess of the Campbell Industries shipyard cleanup levels or the Shelter Island Boatyard mercury apparent effects threshold level.

NASSCO submitted a Site Characterization and Remedial Action Plan in November, 1997 as required. This report contains the results of NASSCO's site characterization sampling. Four remediation areas are identified which contain elevated sediment metal concentrations. Based on Regional Board comments, additional sampling for copper and zinc was conducted in one area outside NASSCO's leasehold which could be influenced by NASSCO's work. Mercury samples were also be collected from an area identified from recent NPDES sediment sampling results. The results of the supplemental sampling, dated September 14, 1998, confirmed that the original four remediation areas are satisfactory.

Southwest Marine submitted a Preliminary Report Sediment Characterization Study and Remediation Plan on July 30, 1997 as required. This report contains the results of Southwest Marine's site characterization sampling and also recommends some additional characterization work. Additional samples were collected and analyzed as necessary to fully delineate the pollution. Some archived samples were also reanalyzed. Southwest Marine submitted a Report of Waste Discharge for dredging dated November 19, 1998 and the Final Report Sediment Characterization Study and Remediation Plan dated December 1998. Five remediation areas are identified in the reports for Southwest Marine.

NASSCO and Southwest Marine have concluded their sediment characterization studies and are now proposing removal of polluted sediment.

Basis for NASSCO and Southwest Marine Shipyard Cleanup Levels

The proposed cleanup levels for NASSCO and Southwest Marine are based on the previously established cleanup levels for Campbell Industries and the mercury cleanup level for Shelter Island Boatyard.

Campbell Cleanup Levels

On June 8, 1995, the Regional Board issued Cleanup and Abatement Order No. 95-21 to Campbell Industries Marine Construction and Design Company (Campbell). Order No. 95-21 established sediment cleanup levels for Campbell Industries as specified below:

CONSTITUENT	BAY SEDIMENT (mg/kg) Dry Weight
Copper	810
Zinc	820
Lead	231
PCB's	0.95

These cleanup levels were developed in a report by PTI Environmental Services titled "Campbell Shipyards Remedial Action Alternatives Analysis Report" (Campbell RAAAR) dated October 1993. These Campbell cleanup levels were derived as site-specific sediment quality objectives using the Apparent Effects Threshold (AET) approach. An AET is defined as the sediment concentration of a given chemical above which statistically significant biological effects (e.g., depressions in the abundance of local benthic infuana) are always observed in the data used to generate AET values. If any chemical exceeds its AET for a particular biological indicator, a measurable (although potentially minor) adverse biological effect is predicted for that indicator. The AET approach uses observed relationships between biological data and chemical data. Biological data for 15 stations were evaluated using the following tests: amphipod mortality, polychaete growth, total benthic infauna abundance (in situ), and amphipod abundance (in situ). The 10-day amphipod survival, avoidance, and reburial test used the species Rhepoxynius abronius following the test procedures described in Swartz et al. (1985), ASTM (1990), and PSEP (1991). The 20-day juvenile polychaete test use the species Neanthes arenaceodentata following the test procedures described in PSEP (1991).

It is appropriate to apply cleanup levels developed for the Campbell site to the NASSCO and Southwest Marine sites. This is based on similarities between physical, biological, and chemical conditions at the Campbell, NASSCO, and Southwest Marine shipyards and the fact that Campbell shipyard is physically located in San Diego Bay just north of the NASSCO and Southwest Marine facilities. Particularly important similarities include the following:

- Campbell, NASSCO, and Southwest Marine are comparable in terms of site activities, waste materials, and matrices (i.e. paint)
- Campbell, NASSCO, and Southwest Marine are in the same hydrodynamic and biogeographic zones
- Campbell, NASSCO, and Southwest Marine are influenced by a similar suite of pollutants from off-site.

Shelter Island Boatyard Mercury Cleanup Level

Because there is no cleanup level for mercury at Campbell, the mercury level from Shelter Island Boatyard is proposed for NASSCO and Southwest Marine. Shelter Island Boatyard is located in America's Cup Harbor in San Diego Bay. Shelter Island Boatyard submitted a Remedial Action Alternatives Analysis Report (RAAAR) by PTI Environmental Services dated June 30, 1989 and a supplement dated January 1990. PTI performed a sediment biological effects study similar to the biological effects study performed for Campbell Industries. PTI's study included eleven sample stations. A benthic infaunal count, and an amphipod sediment toxicity test were performed for each station. The 10-day survival, avoidance, and reburial test used the species Rhepoxynius abronius following the test procedures described in Swartz et al. (1985) as amended by Chapman and Becker (1986). PTI reported that high amphipod survival and no depression in infaunal assemblage were found in the sediment from the area adjacent to Shelter Island Boatyard with the sediment mercury concentration of 4.2 mg/kg (dry weight). This established a 4.2 mg/kg (dry weight) AET mercury level for Shelter Island Boatyard. This Shelter Island Boatyard mercury level was not adopted as a cleanup level in the Shelter Island Boatyard cleanup and abatement order. However, the Regional Board decided that no cleanup was necessary for Shelter Island Boatyard's sediment which contained mercury at this 4.2 mg/kg level in Order No. 91-91, "Rescinding Cleanup and Abatement Order No. 88-70 for Shelter Island Boatyard, San Diego County," which was adopted on October 28, 1991. It is appropriate to apply the Shelter Island Boatyard mercury cleanup level of 4.2 mg/kg to the NASSCO and Southwest Marine shipyards because:

- The boatyards are similar to the shipyards in terms of site activities, waste materials, and matrices (i.e. paint).
- The boatyards and shipyards are both in San Diego Bay.
- Data from eleven stations was used to derive the Shelter Island Boatyard mercury level which is comparable to the fifteen stations used to derive the Campbell cleanup levels.

Background Sediment Levels in San Diego Bay

The NPDES permits for the shipyards in San Diego Bay require semiannual sediment monitoring. As part of this NPDES sediment monitoring program, three reference stations in San Diego Bay are monitored. Reference Station REF-01 is located at the west side of San Diego Bay off the Naval Ocean Systems Center pier. Reference Station REF-02 is located at the north side of San Diego Bay at the Marina Cortez Marina in Harbor Island's west basin. Reference Station REF-03 is located at the north east side of San Diego Bay at the end of the Broadway Pier. The results of eleven rounds of sediment

Sediment quality data from the NPDES biannual monitoring program and from the BPTCP were evaluated for each shipyard to determine appropriate indicator chemicals for each shipyard. Copper and zinc were identified as indicator chemicals for NASSCO. Mercury was also added later for a small area of NASSCO. Copper, zinc, lead, mercury, and PCBs were identified as indicator chemicals for Southwest Marine. Although only the indicator chemicals will be analyzed for, it is expected that any other pollutants at elevated concentrations will be removed with the indicator chemicals.

Cleanup Levels for NASSCO and Southwest Marine

In setting cleanup levels at any site, the Regional Board must consider the terms and conditions of State Board Resolution No. 92-49 (Policies and Procedures for Investigation and Cleanup and Abatement of Discharges). These conditions include 1) site-specific characteristics, 2) applicable state and federal statutes and regulations, 3) the Basin Plan, and 4) State Board Resolution 68-16 (Statement of Policy with Respect to Maintaining High Quality Waters in California). Section II.A.9 of Resolution 92-49 directs Regional Boards to "prescribe cleanup levels which are consistent with appropriate levels set by the Regional Board for analogous discharges that involve similar wastes, site characteristics, and water quality considerations." The proposed shipyard cleanup levels for NASSCO and Southwest Marine are in conformance with Resolution No. 92-49.

Site-specific characteristics were considered by selecting cleanup levels which were established for San Diego Bay at similar facilities that involve similar wastes, site characteristics, and water quality conditions. The BPTCP, as discussed above, is an applicable state statute which was considered in establishing these cleanup levels.

The *Water Quality Control Plan, San Diego Basin (9)* (Basin Plan) was adopted by this Regional Board on September 8, 1994 and subsequently approved by the State Water Resources Control Board (State Board) on December 13, 1994. Subsequent revisions to the Basin Plan have also been adopted by the Regional Board and approved by the State Board. The Basin Plan designates beneficial uses and narrative and numerical water quality objective, and prohibitions which are applicable to the discharges regulated under this Order. The Basin Plan identifies the following beneficial uses of the waters of San Diego Bay: industrial service supply; navigation; water contact recreation; non-contact water recreation; ocean commercial and sport fishing; estuarine habitat; preservation of biological habitats of special significance; wildlife habitat; preservation of rare and endangered species; marine habitat; fish migration; and shellfish harvesting.

Beneficial uses established in the Basin Plan will be protected by these cleanup levels. The sediment adjacent to NASSCO and Southwest Marine contains pollutant concentrations which have been shown to be harmful to the benthic organisms in San Diego Bay. The Marine Habitat Beneficial Use (MAR) which has been designated for San Diego Bay includes uses of water that support marine ecosystems. These benthic

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

FINAL

REGIONAL BOARD REPORT
SHIPYARD SEDIMENT CLEANUP LEVELS
NASSCO & SOUTHWEST MARINE SHIPYARDS
SAN DIEGO BAY

February 16, 2001

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Winston H. Hickox, Secretary, Environmental Protection Agency

State Water Resources Control Board

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Gary Stephany	Undesignated (Public)
Vacant	Water Supply
Vacant	Irrigation Agriculture
Vacant	County Government

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Tables continued

LIST OF ACRONYMS

AET	Apparent Effects Threshold
BCF	Bioconcentration Factor
BPTCP	Bay Protection and Toxic Cleanup Program
CAO	Cleanup and Abatement Order
CTR	California Toxics Rule
ERM	Effects Range Median
HHC	Human Health Criteria
MAR	Marine Habitat Beneficial Use
NASSCO	National Steel and Shipbuilding Company
NOAA	Nation Oceanic and Atmospheric Administration
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCTs	Polychlorinated Terphenyls
SDCDHS	San Diego County Department of Health Services
TBT	Tributyltin
WDR	Waste Discharge Requirements

EXECUTIVE SUMMARY

Issue

National Steel and Shipbuilding Company (NASSCO), Southwest Marine, Inc. (Southwest Marine) and Campbell Industries Marine Construction and Design Company (Campbell Industries) are shipyards located along the northeast side of San Diego Bay. Shelter Island Boatyard is located in America's Cup Harbor in San Diego Bay.

Elevated levels of pollutants exist in the bay bottom sediment adjacent to NASSCO and Southwest Marine. The concentration of these pollutants causes or threatens to cause a condition of pollution that harms the beneficial uses designated for San Diego Bay. NASSCO and Southwest Marine have performed assessment activities to delineate the extent of pollutants adjacent to their facilities. The Regional Board has given preliminary approval to use the sediment cleanup levels derived from Campbell Shipyard and Shelter Island Boatyard for NASSCO and Southwest Marine.

The Regional Board must establish final sediment cleanup levels for NASSCO and Southwest Marine in accordance with State Water Resources Control Board – Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304*. Resolution No. 92-49 provides in Section III.G that cleanup levels must ensure the"... attainment of either background water quality, or the best water quality, which is reasonable if background levels of water quality cannot be restored, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible...".

History

In January 1991, Regional Board staff requested NASSCO and Southwest Marine to participate in a sediment study to determine if sediment cleanup was required within their bay leasehold. From October 1994 to present, NASSCO and Southwest Marine have been actively working with Regional Board staff to assess and cleanup contaminated bay sediments.

In an August 3, 1995 letter, the Regional Board Executive Officer directed the shipyards to conduct a detailed site-specific analysis conforming to the Regional Board document titled "*Sediment Assessment Criteria*" to determine sediment cleanup levels. NASSCO and Southwest Marine noted that the cost of the required sediment assessment was excessive. Subsequent to the August 3 letter, the use of marine sediment studies conducted at Campbell Shipyard was determined to be potentially suitable for cleanup levels at NASSCO and Southwest Marine. NASSCO and Southwest Marine began

working with the Regional Board to determine the nature and extent of contaminated sediments within their bay leasehold that required cleanup. The site assessments were directed towards determining the extent of sediments containing pollutants exceeding the Campbell Shipyard Apparent Effects Threshold (AET) cleanup levels.

Basis for Interim Cleanup Levels

In March 1999, the Regional Board adopted Resolutions 99-12 and 99-20. These resolutions established the interim use of cleanup levels derived from marine sediment studies conducted at Campbell Shipyard and Shelter Island Boatyard at NASSCO and Southwest Marine. The Resolutions were adopted on an interim basis to encourage the immediate process of dredging contaminated sediments within the NASSCO and Southwest Marine bay leaseholds. The Board also directed staff to send out the February 17, 1999 staff report (Establishment of Shipyard Sediment Cleanup Levels for NASSCO and Southwest Marine) on the interim cleanup levels to a peer review panel to assist in determining if the cleanup levels should be adopted as final cleanup levels.

The interim sediment cleanup levels for NASSCO and Southwest Marine, as adopted by the Regional Board in Resolution Nos. 99-12 and 99-20, are based on the previously established cleanup levels for Campbell Shipyard (copper, zinc, lead, and PCBs) and Shelter Island Boatyard (mercury). These sediment cleanup levels were developed using the Apparent Effects Threshold (AET) approach.

The removal of sediments under the March 1999 interim cleanup levels has not occurred. The shipyards do not want to duplicate an effort of mobilizing resources for an interim cleanup and then again for a final cleanup.

Peer Review Panel

As a follow-up to the March 10, 1999 Regional Board meeting, the Executive Officer sent a letter on December 15, 1999 to three candidates nominated for an informal peer review due to their professional experience and reputation concerning bay sediment analysis, and benthic chemistry and toxicity. The objective of the informal peer review was to consider the scientific validity of using the sediment cleanup levels (based on the AET approach) derived for Campbell shipyards at NASSCO and Southwest Marine. The peer review panel was instructed by Regional Board staff to not include Shelter Island Boatyard as part of their assessment. The peer review panel consists of Mr. Steven Bay of Southern California Coastal Water Research Project, Mr. Russell Fairey of Moss Landing Marine Laboratories, and Mr. Todd Thornburg of Hart Crowser, Inc.

Regional Board Peer Review Follow-Up

Earlier this year the Regional Board received three reports from the peer review panel discussing the use of interim levels as final cleanup levels. There are some statements in

the peer review reports that staff agrees with and others that staff disagrees with. The peer review comments are addressed in detail in the staff report.

Evaluation of Most Sensitive Beneficial Use

A fundamental step in the development of cleanup levels is the identification of the most sensitive beneficial use to be protected. The Regional Board is making the assumption that the benthic community covered under the marine habitat beneficial use (MAR) represents the most sensitive beneficial use needing protection from contaminated sediment at NASSCO and Southwest Marine shipyards. This assumption is based on the intimate contact and long duration of contact (in some cases entire life cycles). The Regional Board also recognizes that there is a potential threat to human health through three principal pathways of exposure. The primary and by far the most significant being the consumption of fish and shellfish contaminated by chemicals in the sediment through the processes of bioaccumulation and biomagnification.

Cleanup Level Options

Regional Board staff has considered six options for establishing final sediment cleanup levels at NASSCO and Southwest Marine. The six options consist of the following:

- Option 1 – Background Reference Station
- Option 2 – Effects Range Median
- Option 3 – Campbell Shipyard & Shelter Island Boatyard AET Levels – 20% Safety Factor (Pre-Sampling Program)
- Option 4 - Campbell Shipyard & Shelter Island Boatyard AET Levels (Pre-Sampling Program)
- Option 5 – Site-Specific AET Levels (Comprehensive Chemical Analysis)
- Option 6 – No Action

Each option was evaluated based on the degree of environmental protection provided by the cleanup levels, costs associated with cleanup activities, dredge volume, percentage of leasehold dredged, pros/cons associated with dredging to the respective cleanup levels, and the outcome for selecting each proposed option.

Tables 1 and 2 outline six cleanup options at NASSCO and Southwest Marine for consideration by the Regional Board. Options 1 through 4 entail Regional Board adoption of specific cleanup levels (see Figure 1). Under Option 5, the Regional Board would require a detailed site-specific analysis to determine cleanup levels at a future date. Option 6 is a no-action alternative where the contaminated sediments would be left in place. The cost of the cleanup options varies from approximately $1.7 to $29 million at each site. The options are evaluated in detail in the attached staff report.

Regional Board Public Hearing

At the October 11, 2000 Regional Board meeting, the Regional Board received public comments and testimony regarding the selection of sediment cleanup levels at NASSCO and Southwest Marine shipyards. Staff presented the six cleanup options contained in this report for consideration by the Regional Board.

At the conclusion of the October 11 hearing the Regional Board elected to extend the time for submission of written comments from the public to October 19, 2000. Following the October 11 Board meeting staff received an October 16, 2000 letter from Mr. David L. Mulliken, legal counsel for NASSCO and Southwest Marine, requesting that the deadline for submission of written comments be further extended to a date three weeks following receipt of the written transcript of the October 11 Board meeting. Mr. Mulliken requested the extension to allow NASSCO and Southwest Marine sufficient time to provide meaningful comments on the various issues raised at the October 11 Regional Board meeting. Based on this consideration, Mr. John Robertus, Executive Officer, extended the deadline for submission of written comments from interested persons to November 8, 2000.

Public Comments

The Regional Board received a considerable volume of written comments from interested persons by the November 8 deadline. The Regional Board's written response to these comments is in a February 16, 2001, report titled "Response to Comments, Shipyard Sediment Cleanup Levels, NASSCO & Southwest Marine Shipyards, San Diego Bay".

The positions of the various interested parties who submitted comments on this issue are summarized below.

- NASSCO and Southwest Marine Shipyards:

1. Governing legal standards allow RWQCB approval of an AET-based clean-up standard and do not compel adoption of a background standard.
2. Water Code Section 13304 and Resolution 92-49 directly relate to water quality standards, not sediment contamination/ cleanup resulting from past discharges.
3. Neither statutes nor regulations mandate background level clean up of sediments, and both contemplate consideration of cost-effectiveness.
4. Requiring clean-up to background would set unwarranted precedent
5. Clean up to background has not been investigated and therefore cannot be imposed.
6. Good science supports use of the AET-based cleanup standard; No scientific support exists to support application of a background standard to sediment cleanup.
7. Imposition of a background cleanup standard to sediment dredging of the shipyard's facilities may have significant operation impacts on the shipyards.

8. Economic considerations weigh heavily in favor of the use of the AET based approach to sediment cleanup.
9. Past precedent, fundamental fairness and the benefits of expeditious implementation of sediment remediation all support use of the AET approach.

- San Diego BayKeeper and the Environmental Health Coalition:

  San Diego BayKeeper and the Environmental Health Coalition urge the Regional Board to adopt Option 1 – Background Reference Levels as the sediment cleanup levels for NASSCO and Southwest Marine for the following reasons:

1. Option 1 will allow NASSCO and Southwest Marine to remediate the contamination they are responsible for.
2. State Board Resolution No. 92-49 requires dischargers to cleanup to background levels unless background levels are not attainable. There is not evidence showing why background levels are not technically and economically feasible at the shipyards.
3. The other alternatives (Campbell AET, Campbell AET + 20%, and ERMs) considered by staff are flawed and will not sufficiently provide the protection of beneficial uses and public health.

Final Recommendation

Staff recommends that the Regional Board direct the Executive Officer to issue Water Code Section 13267 letters to NASSCO and Southwest Marine requiring the submission of a site-specific study to develop sediment cleanup levels and identify sediment cleanup alternatives. The Site Specific Study should include at a minimum the information described below.

- Site Specific Study to Develop Cleanup Levels

1. NASSCO and Southwest Marine shall submit a work plan and time schedule to complete a site assessment; develop sediment cleanup levels, including an adequate margin of safety, for constituents of concern identified through on-site chemical screening

2. NASSCO and Southwest Marine shall develop cleanup alternatives with projected cleanup costs.

3. NASSCO and Southwest Marine shall determine cleanup level(s) through scientifically defensible methods and designed to provide adequate protection for the most sensitive beneficial use of San Diego Bay. This requires that an extremely broad group of organisms that are affected by water quality conditions be considered. These include benthic (living in sediments) and epibenthic (living on the surface of sediments) organisms, organisms living in the water, waterfowl and shorebirds, and terrestrial animals (including humans) which eat aquatic organisms.

4. NASSCO and Southwest Marine shall determine cleanup levels for each constituent of concern by several complimentary methods as determined by Regional Board staff. There is no single method that measures the effects of contaminated sediments at all times and to all organisms. The selection of complementary allow for the integration of empirical data developed for Apparent Effects Thresholds (AET), theoretical information used in Equilibrium Partitioning (EqP), and cause and effect relationships established by spiked bioassays. The methods used to determine cleanup levels shall at minimum include the following:

   a) Equilibrium Partitioning (EqP) Approach – Cleanup levels will be established at chemical concentrations in sediment that ensure interstitial water concentrations do not exceed adopted water quality objectives or USEPA water quality criteria (in the absence of adopted water quality objectives)

   b) Apparent Effects Threshold - The Apparent Effects Threshold (AET) approach is the sediment concentration of a contaminant above which statistically significant biological effects (e.g. amphipod mortality in bioassays, depressions in the

abundance of benthic infauna) would always be expected. The method applies the triad of chemical, toxicological, and benthic community field survey measures to determine a concentration in sediments above which adverse effects are always expected.

c) Spiked Sediment Toxicity – Dose response measurements are established by exposing test organisms to sediments that have been spiked with known amounts of chemicals or mixtures of chemicals.

4. NASSCO and Southwest Marine shall access the potential health risk to humans from exposure to pollutants through the food chain attributable to the contaminated sediment. If preliminary screening indicates an unacceptable risk to human health, a detailed human health risk assessment shall be conducted.

5. NASSCO and Southwest Marine shall submit other additional information on cleanup costs, alternatives and methods as determined by Regional board staff. In determining this information staff will review and update the August 3, 1995 letter in Appendix F, from the Regional Board to NASSCO and Southwest Marine describing the minimum criteria for contaminated sediment assessment.

Based on the information provided by NASSCO and Southwest Marine staff will develop specific cleanup recommendations for sediment cleanup levels at NASSCO and Southwest Marine and bring the matter back for Regional Board consideration at a future date.

TABLE 1

COST ANALYSIS FOR CLEANUP LEVEL OPTIONS
NATIONAL STEEL AND AND SHIPBUILDING COMPANY
SAN DIEGO BAY

FINAL
(Revised by NASSCO: 1/25/01)

CONSTITUENT	Option 1 Background Reference Station	Option 2 Effects Range Median	Option 3 Campbell & Shelter Island AET Levels - 20% Safety Factor (Pre-Sampling Program)	Option 4 Campbell & Shelter Island AET Levels (Pre-Sampling Program)	[3]Option 5 Site-Specific AET Levels (Comprehensive Chemical Analysis)	Option 6 No Action Alternative
Copper	87.5 mg/kg	270 mg/kg	648 mg/kg	810 mg/kg	Unknown	1,154 mg/kg
Zinc	139 mg/kg	410 mg/kg	656 mg/kg	820 mg/kg	Unknown	1,707 mg/kg
Lead	41 mg/kg	218 mg/kg	185 mg/kg	231mg/kg	Unknown	4,286 mg/kg
PCBs	0.12 mg/kg	0.18 mg/kg	0.76 mg/kg	0.95 mg/kg	Unknown	17.1 mg/kg
Mercury	0.57 mg/kg	0.70 mg/kg	3.36 mg/kg	4.2 mg/kg	Unknown	3.36 mg/kg
DREDGE VOLUME (yd^3)	318,816	186,306	30,202	11,400	Unknown	--
DREDGE AREA (acres)	50.67	29.61	6.24	4.40	Unknown	--
% OF LEASEHOLD	110.0%	61.7%	13.0%	9.1%	Unknown	--
DREDGE COSTS	$4,782,240	$2,794,590	$453,024	$171,000	Unknown	--
DISPOSAL COSTS	$23,911,200	$13,972,950	$2,265,120	$855,000	Unknown	--
PERMITS/LICENSE	$7,500	$7,500	$7,500	$7,500	Unknown	--
[1]SITE ASSESSMENT	$270,000	$228,000	$143,000	$128,000	$128,000	--
[2]ADD'L ASSESSMENT		$100,000	Dependent on Pre-sampling Program	Dependent on Pre-sampling Program	$110,000	--
BIOASSAY COSTS	--	--	$332,000	$332,000	$640,000	--
ENGR. FEASIBILITY STUDY	$196,490	$196,490	$196,490	$196,490	$196,490	
TOTAL	**$29,167,430**	**$17,299,530**	**$3,397,134**	**$1,689,990**	> $1,074,490	--

[1]Includes costs incurred to date plus additional site characterization and post remediation confirmation report.

[2]Additional characterization costs.

[3]Option 5 is based on 32 samples.

TABLE 2

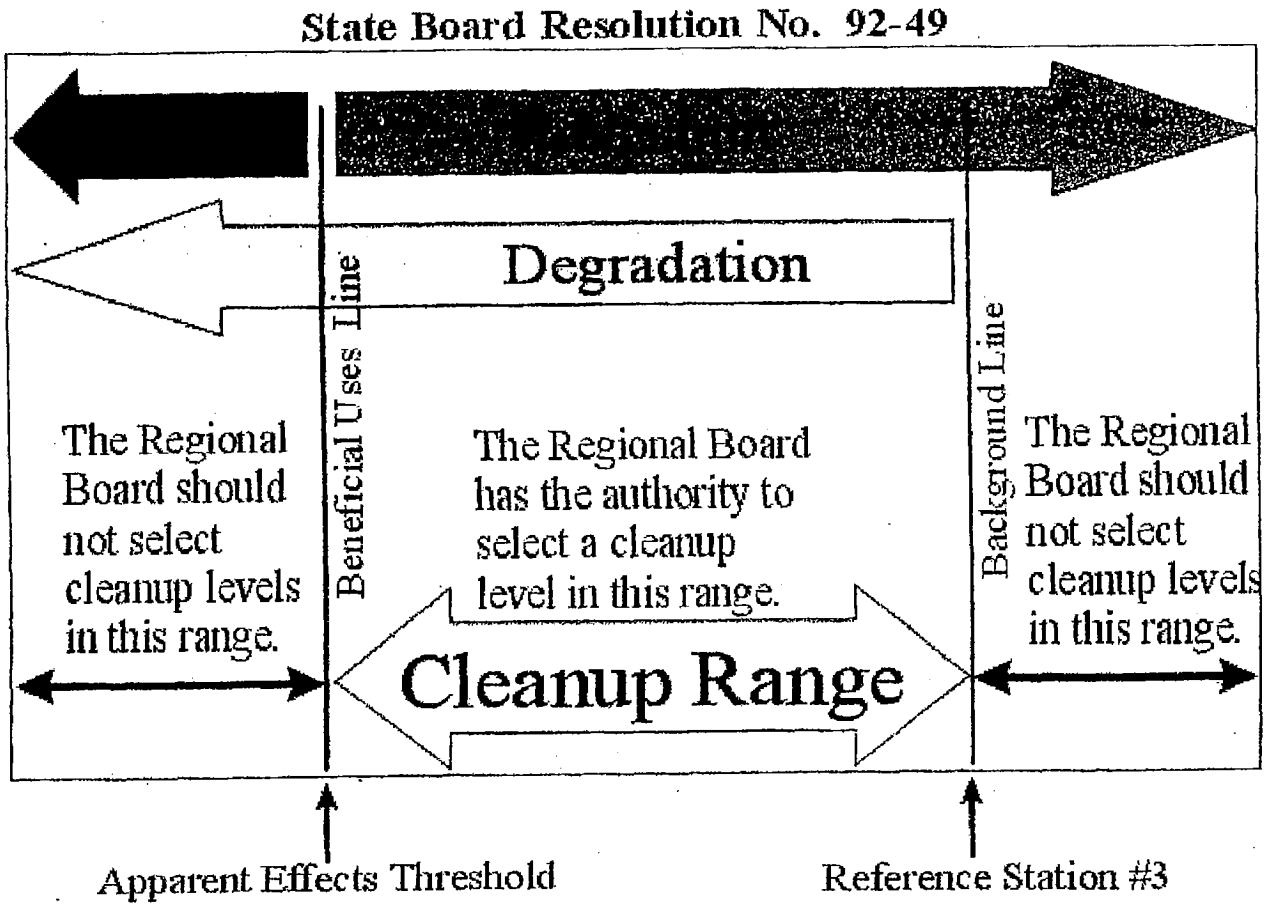
COST ANALYSIS FOR CLEANUP LEVEL OPTIONS
SOUTHWEST MARINE, INC.
SAN DIEGO BAY

FINAL
(Revised by Southwest Marine: 1/26/01)

CONSTITUENT	Option 1 Background Reference Station	Option 2 Effects Range Median	Option 3 Campbell & Shelter Island AET Levels - 20 % Safety Factor (Pre-Sampling Program)	Option 4 Campbell & Shelter Island AET Levels (Pre-Sampling Program)	[3]Option 5 Site-Specific AET Levels (Comprehensive Chemical Analysis)	Option 6 No Action Alternative
Copper	87.5 mg/kg	270 mg/kg	648 mg/kg	810 mg/kg	unknown	1,154 mg/kg
Zinc	139 mg/kg	410 mg/kg	656 mg/kg	820 mg/kg	unknown	1,707 mg/kg
Lead	41 mg/kg	218 mg/kg	185 mg/kg	231mg/kg	unknown	4,286 mg/kg
PCBs	0.12 mg/kg	0.18 mg/kg	0.76 mg/kg	0.95 mg/kg	unknown	17.1 mg/kg
Mercury	0.57 mg/kg	0.70 mg/kg	3.36 mg/kg	4.2 mg/kg	unknown	3.36 mg/kg
DREDGE VOLUME (yd^3)	91,248	88,918	23,100	19,119	unknown	--
DREDGE AREA (acres)	16.90	16.42	2.90	2.34	unknown	--
% OF LEASEHOLD	103%	100%	18.0%	15.0%	unknown	--
DREDGE COSTS	$1,368,720	$1,333,770	$346,500	$286,785	unknown	--
DISPOSAL COSTS	$6,843,600	$6,668,925	$1,732,500	$1,433,925	unknown	--
PERMITS/LICENSE	$24,500	$24,500	$10,000	$8,250	unknown	--
[1]SITE ASSESSMENT	$361,000	$361,000	$256,000	$239,000	$239,000	--
[2]ADD'L ASSESSMENT	$127,000	$120,650	$110,000	$110,000	$110,000	--
BIOASSAY COSTS	--	--	$360,000	$360,000	$640,000	--
TOTAL	**$8,724,820**	**$8,508,845**	**$2,815,000**	**$2,437,960**	**> 989,000**	**$0**

[1]Includes costs incurred to date plus post remediation confirmation report.
[2]Additional characterization costs.
[3]Option 5 is based on 32 samples.

Figure 1


State Board Resolution No. 92-49
Degradation
Beneficial Uses Line
Background Line
The Regional Board should not select cleanup levels in this range.
The Regional Board has the authority to select a cleanup level in this range.
The Regional Board should not select cleanup levels in this range.
Cleanup Range
Apparent Effects Threshold
Reference Station #3

ISSUE

Elevated levels of pollutants exist in the bay bottom sediment adjacent to several shipyards in San Diego Bay. The concentration of these pollutants causes or threatens to cause a condition of pollution that harms the beneficial uses designated for San Diego Bay. National Steel and Shipbuilding Company (NASSCO) and Southwest Marine, Inc. (Southwest Marine) have performed assessment activities to delineate the extent of pollutants adjacent to their facilities. The Regional Board has given preliminary approval to use the sediment cleanup levels derived from Campbell Shipyard and Shelter Island Boatyard for NASSCO and Southwest Marine.

The Regional Board must establish final sediment cleanup levels for NASSCO and Southwest Marine in accordance with State Water Resources Control Board – Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304*. Resolution No. 92-49 provides in Section III.G that cleanup levels must ensure the"... attainment of either background water quality, or the best water quality, which is reasonable if background levels of water quality cannot be restored, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible..."

HISTORY

In January 1991, Regional Board staff requested NASSCO and Southwest Marine to participate in a sediment study to determine if sediment cleanup was required within their bay leasehold. From October 1994 to present, NASSCO and Southwest Marine have been actively working with Regional Board staff to assess and cleanup contaminated[1] bay sediments.

I. NASSCO

Site Location/Plan

NASSCO is located along the eastern shore of San Diego Bay at 28th Street and Harbor Drive in San Diego, California. NASSCO's primary business has historically been ship repair, construction, and maintenance capabilities for the U.S. Navy and commercial customers. The facility covers approximately 127 acres of tidelands property leased from the San Diego Unified Port District. The land portion and offshore area of the lease includes approximately 80 acres and 47 acres, respectively. Site improvements include offices, shops, warehouses, concrete

[1]The term contaminated sediment, as used in this report, is defined as sediments that contain chemical concentrations above background reference concentrations.

platens for steel fabrication, a floating dry dock, a graving dock, two shipbuilding ways, and 12 berths.

Site Investigations

In February and March 1997, the Regional Board required NASSCO to conduct sediment investigations adjacent to their facility for elevated concentrations of copper, zinc, and mercury. These indicator chemicals were selected based on the chemicals of concern for Campbell Shipyard, NASSCO's NPDES monitoring program, and the Bay Protection and Toxic Cleanup Program (BPTCP) (six stations within NASSCO's leasehold). Four remediation areas were identified which contained copper, zinc, and mercury concentrations that exceeded the Campbell Shipyard and Shelter Island Boatyard cleanup levels. These remediation areas are located within NASSCO's inner leasehold. Generally, concentrations decrease when moving away from the four identified areas of concern.

II. Southwest Marine

Site Location/Plan

Southwest Marine is located along the eastern shore of San Diego Bay, at the foot of Sampson Street in San Diego, California. Southwest Marine's primary business has historically been ship repair and maintenance capabilities for the U.S. Navy and commercial customers. The facility covers approximately 27 acres of tidelands property leased from the San Diego Unified Port District. The land portion and offshore area of the lease includes approximately 10 acres and 17 acres, respectively. Site improvements include offices, shops, warehouses, two floating dry docks, two marine railways, and five piers.

Site Investigations

In October 1997 and April 1998, the Regional Board required Southwest Marine to conduct sediment investigations adjacent to their facility for elevated concentrations of copper, lead, mercury, zinc, and PCBs. These indicator chemicals were selected based on the chemicals of concern for Campbell Shipyard, Southwest Marine's NPDES monitoring program, and the BPTCP (six stations within Southwest Marine's leasehold). Five remediation areas were identified which contained copper, lead, mercury, zinc, and PCB concentrations that exceeded the Campbell Shipyard and Shelter Island Boatyard cleanup levels. These remediation areas are located within Southwest Marine's inner leasehold. Generally, concentrations decrease when moving away from the five identified areas of concern.

III. Timeline

The objectives of the timeline are to provide a historical background of NASSCO's and Southwest Marine's effort towards the delineation and remediation of waste discharges within their bay leaseholds and to summarize Regional Board activities.

- November & December 1990
  Regional Board staff held individual **meetings** with NASSCO, Southwest Marine, and Continental Maritime (collectively termed the "Shipyards") to discuss the results of the sediment data collected by the Regional Board in 1988.

- January 10, 1991
  Regional Board **letter** to the Shipyards requesting the shipyards to conduct a sediment study to determine if sediment cleanup is required within their bay leasehold.

- March 1, 1991
  Regional Board **letter** to the shipyards granting the extension of the sediment studies requested by the Shipyards.

- April 1, 1991
  Southwest Marine **letter** to Regional Board indicating that a sediment study is not necessary for Southwest Marine.

- July 19, 1991
  Regional Board **letter** to the Southwest Marine indicating that a sediment study is necessary for Southwest Marine.

- September 3, 1991
  Regional Board staff had a **meeting** with the Shipyards to discuss the request to not conduct sediment studies.

- September 17, 1991
  NASSCO **letter** to Regional Board discussing the agreement that the Shipyards will act as a group and cooperate, cooperate with the Regional Board, and develop an approach for the sediment studies.

- October 17, 1991
  Shipyards **letter** to Regional Board detailing the approach outline for the sediment study.

- October 19, 1994

Regional Board **letter** to the Shipyards accepting the approach outline for the sediment study.

- November 2, 1994
  Shipyards **letter** to Regional Board requesting a postponement of the sediment study until February 1995 to allow the Shipyards time to assimilate changed circumstances (personnel and management).

- April 7, 1995
  Shipyards **letter** to Regional Board discussing the technical approach for the sediment study.

- June 8, 1995
  At the Regional Board **meeting,** the Regional Board affirmed the issuance of Cleanup and Abatement Order No. 95-21 to Campbell Industries by the Executive Officer on May 24, 1995.

- August 3, 1995
  Regional Board **letter** to the Shipyards discussing detailed written guidelines to perform a complete site assessment and develop alternate cleanup strategies.

- November 1, 1995
  Shipyards **letter** to Regional Board discussing the participation of the Shipyards in the bay wide approach and requesting a delay in proceeding with the site assessments. Discussions between the Shipyards have left only NASSCO as an active participant in the bay wide approach.

- November 9, 1995
  At the Regional Board **meeting,** the Regional Board discussed sediment cleanup and postponed a decision until the next meeting.

- December 14, 1995
  At the Regional Board **meeting** the Board agreed with the option of performing cleanup activities immediately (i.e., dredging) and subsequently conduct a post sampling effort. There was some discussion on the use of Campbell cleanup levels; however, the Board Members selected no cleanup levels at the meeting.

- August 1996
  Letters from NASSCO's consultant to the Regional Board discussing site assessment activities.

- February 14, 1997

Regional Board **letter** to NASSCO regarding sediment investigation requirements for elevated concentrations of copper and zinc. Sediment investigations were required to determine the areal extent and location of sediments containing chemical concentrations in excess of the Campbell Shipyard and the Shelter Island Boatyard cleanup levels.

- October 22, 1997
  Regional Board **letter** to Southwest Marine regarding sediment investigation requirements for elevated concentrations of copper, zinc, lead, and mercury. Sediment investigations were required to determine the areal extent and location of sediments containing chemical concentrations in excess of the Campbell Shipyard and the Shelter Island Boatyard cleanup levels.

- March 11, 1998
  At a staff **meeting**, Regional Board directed NASSCO to also investigate mercury at a small area of NASSCO's leasehold just east of the floating drydock near shore.

- April 27, 1998
  Regional Board **letter** to Southwest Marine directing Southwest Marine to also investigate PCBs in the sediment.

- March 10, 1999
  At the Regional Board **meeting,** the Regional Board adopted Resolution No. 99-12 establishing interim sediment cleanup levels for Southwest Marine, WDR Order No. 99-14 establishing dredging requirements for Southwest Marine, and Resolution No. 99-20 establishing interim sediment cleanup levels for NASSCO. Resolution No. 99-12 and Resolution No. 99-20 are provided in Appendix A. The Regional Board directed the Executive Officer to establish an informal peer review panel to determine the appropriateness of using the Campbell AET cleanup levels at the other two shipyards as interim cleanup levels.

- December 1999
  Peer Review Started

- March 2000
  Results of Peer Review

- June 2, 2000
  A **workshop** was held at the Regional Board office to discuss the working draft Regional Board report.

- September 13, 2000
  At the Regional Board **meeting**, staff provided a status report for sediment investigation and cleanup at NASSCO and Southwest Marine.

- October 11, 2000
  At the Regional Board meeting, a public hearing was held for consideration of adopting final bay bottom sediment cleanup levels for NASSCO and Southwest Marine.

BASIS FOR INTERIM CLEANUP LEVELS

The interim sediment cleanup levels for NASSCO and Southwest Marine, as adopted by the Regional Board in Resolution Nos. 99-12 and 99-20, are based on the previously established cleanup levels for Campbell Shipyard (copper, zinc, lead, and PCBs) and Shelter Island Boatyard (mercury). These sediment cleanup levels were developed using the Apparent Effects Threshold (AET) approach.

I. Campbell Shipyard Cleanup Levels

Campbell Shipyard has been located on the northeastern shore of San Diego Bay since 1926. The Regional Board has regulated Campbell Shipyards for numerous years under an NPDES Permit (currently Order No. 97-36). Campbell Industries leased the Campbell Shipyards site from the San Diego Unified Port District. Historical site operations included the construction of commercial fishing vessels and the repair of naval ships. As a result of market changes, Campbell Industries has been focusing its attention on developing land uses compatible with those on the northwest boundary of the site, where public and commercial recreational areas already exist or are being developed. Currently, shipyard operations have ceased and existing structures have been removed and demolished.

Cleanup and Abatement Order (CAO) No. 95-21 was issued by the Executive Officer on May 24, 1995 and was adopted by the Regional Board on June 8, 1995. CAO No. 95-21 establishes soil, groundwater, and sediment cleanup levels for Campbell Shipyards. Furthermore, CAO No. 95-21 establishes a deadline date of June 1, 2000 for complete cleanup of soil containing wastes, polluted groundwater, and bay sediment containing wastes at the Campbell Shipyard site. Cleanup activities, however, have not begun at the site.

The sediment cleanup levels for Campbell Shipyard (dry weight) are as follows:

- Copper = 810 mg/kg
- Zinc = 820 mg/kg
- Lead = 231 mg/kg

- PCBs = 0.95 mg/kg

The sediment cleanup levels were derived from 15 stations at Campbell Shipyard using the AET approach. The AET approach uses observed relationships between biological data and chemical data to identify concentrations of chemicals in sediments that are expected (based on field evidence or theoretical predictions) to represent the threshold above which statistically significant biological effects are expected to occur. The AET sediment cleanup levels for Campbell Shipyard were established using four biological tests:

- 10-day amphipod mortality and reburial– *Rhepoxynius abronius.* Toxicity was determined using the following endpoints: (1) Primary endpoint - Percent amphipod mortality at the shipyard (Survival $\geq$ 75%) was significantly higher ($p \leq 0.05$) than the percent amphipod mortality at reference station REF-01 (REF-01 is located on the west side of San Diego Bay, near Silver Strand), and (2) Secondary endpoint – Percent reburial of surviving amphipods in clean sediment was significantly lower ($p \leq 0.05$) than the percent reburial of reference amphipods in clean sediment.
- Depression in total benthic infauna abundance (in-situ).
- Depression in amphipod abundance (in-situ).
- 20-day Juvenile polychaete growth and survival depression – *Neanthes arenaceodentata.* Toxicity was determined using the following endpoints: (1) Primary endpoint – Polychaete growth in the shipyard sediment was significantly lower ($p \leq 0.05$) than the growth at reference station REF-01, and (2) Secondary endpoint – Percent polychaete survival at the shipyard was significantly lower ($p \leq 0.05$) than the percent polychaete survival at reference station REF-01.

Each biological test identified an AET value for copper, zinc, lead, and PCBs. The AET values derived from each test represent the highest "no observed" effect level (i.e. highest chemical concentration at which no significant adverse biological effects were observed). The lowest AET values for copper, zinc, lead, and PCBs were then identified from the four tests and established as the sediment cleanup levels for Campbell Shipyard.

In addition to conducting the four biological tests, a bioaccumulation study was performed to assess the potential human health risks and environmental hazards posed by the Campbell shipyard sediments. Chemical concentrations in a shellfish, a crustacean, and several different species of fish were analyzed. Human health hazards were assessed by evaluating chemical concentrations in fish and shellfish from sites relative to the following: (1) Concentrations in fish and shellfish in other areas of San Diego Bay based on historical data, and (2) Guidelines derived from risk assessment models.

One demersal fish species (black croaker), two pelagic fish species (pacific mackerel and pacific sardine), mussels, and spiny lobsters were collected in the Campbell shipyard area. Muscle tissue from black croaker and spiny lobster, and wholebody samples of mackerel, sardines, and mussels were analyzed for the following constituents: nine metals (arsenic, cadmium, chromium, copper, lead, zinc, mercury, nickel, and silver), butyltin species, PCBs, and PCTs.

Based on the analytical results, concentrations of arsenic, mercury, butyltin species, and PCBs were detected in black croaker, mussels, and spiny lobster (PTI 1991). These concentrations exceeded theoretical, risk-based concentrations (developed by San Diego County Department of Health Services [SDCDHS]), which indicate potential levels of concern. Concentrations of all other chemicals that were detected in black croaker, mussels and lobster were below the risk-based concentrations. Although arsenic, mercury, butyltin species, and PCBs concentrations exceeded SDCDHS risk-based concentrations in a few cases, these concentrations were within the range of concentrations reported in demersal fish and shellfish collected from other locations in San Diego Bay. From the results presented in the Campbell Shipyard study, it appears that the health risks posed by Campbell Shipyards sediment to fish and shellfish is no greater than other locations within San Diego Bay.

II. Shelter Island Boatyard Cleanup Level

Shelter Island Boatyard is located at America's Cup Harbor in San Diego Bay. A sediment biological effects study somewhat similar to the Campbell Shipyard AET study was performed at Shelter Island Boatyard. Biological data from 11 stations were evaluated using two biological tests:

- 10-day amphipod mortality and reburial– *Rhepoxynius abronius*. Toxicity was determined using the following endpoints: (1) Primary endpoint - Percent amphipod mortality at the shipyard was significantly higher ($p \leq 0.05$) than the percent amphipod mortality in the control samples, and (2) Secondary endpoint – Percent reburial of surviving amphipods in clean sediment was significantly lower ($p \leq 0.05$) than the percent reburial of amphipods in the control samples.
- Depression in total benthic infauna abundance (in-situ).

Based on the results of the study, the highest mercury concentration detected in the Shelter Island Boatyard sediment was 4.2 mg/kg (dry weight). High amphipod survival and no depression in infaunal assemblage were observed at this concentration. Consequently, an AET mercury level of 4.2 mg/kg (dry weight) was developed for Shelter Island Boatyard.

III. NASSCO/Southwest Marine Interim Cleanup Levels

At the March 10, 1999 Regional Board meeting, Staff presented a report dated February 24, 1999 that recommended adoption of the cleanup levels based on using the cleanup levels developed for Campbell Shipyard (copper, zinc, lead, and PCBs) and Shelter Island Boatyard (mercury). Based on Staff's report and the public hearing, the Regional Board adopted Resolution No. 99-12, *A Resolution Establishing Interim Shipyard Sediment Cleanup Levels for Southwest Marine, Inc., San Diego County*, and Resolution No. 99-20, *A Resolution Establishing Interim Shipyard Sediment Cleanup Levels for NASSCO, San Diego County,* and directed the Executive Officer to establish an informal peer review panel to determine the appropriateness of using the Campbell AET cleanup levels at the other two shipyards.

The Regional Board found that the use of these interim cleanup levels at NASSCO and Southwest Marine were considered appropriate based on the following:

- Campbell Shipyard is located in San Diego Bay to the north of NASSCO and Southwest Marine (within 1-mile).
- Campbell Shipyard, NASSCO, and Southwest Marine are comparable in terms of site activities, waste materials, and matrices (i.e. paint blast material).
- Campbell Shipyard, NASSCO, and Southwest Marine are in the same hydrodynamic and biogeographic zones.
- Campbell Shipyard, NASSCO, and Southwest Marine are influenced by a similar suite of pollutants from off-site sources.
- Shelter Island Boatyard is similar to NASSCO and Southwest Marine in terms of site activities, waste materials, and matrices (i.e. paint blast material).
- Shelter Island Boatyard, NASSCO, and Southwest Marine are located in San Diego Bay.

PEER REVIEW PANEL

As a follow-up to the March 10, 1999 Regional Board meeting, the Executive Officer sent a letter on December 15, 1999 to three candidates nominated for an informal peer review due to their professional experience and reputation concerning bay sediment analysis, and benthic chemistry and toxicity. The objective of the informal peer review was to consider the scientific validity of using the sediment cleanup levels (based on the AET approach) derived for Campbell shipyards at NASSCO and Southwest Marine. The peer review panel was instructed by Regional Board staff to not include Shelter Island Boatyard as part of their assessment. The peer review panel consists of Mr. Steven Bay of Southern California Coastal Water Research Project, Mr. Russell Fairey of Moss Landing Marine Laboratories, and Mr. Todd Thornburg of Hart Crowser, Inc. The peer review reports from each panel member are provided in Appendix B.

I. Southern California Coastal Water Research Project

S. Bay stated that the AET cleanup values developed for Campbell Shipyard are not appropriate to apply at NASSCO and Southwest Marine. S. Bay's opinion is primarily based on two conclusions:

- Contamination patterns differ among the shipyard sites, which indicate that the relationship between adverse biological impacts and indicator chemicals may differ between sites.
- Insufficient data are available to support the assumption that the Campbell Shipyard AETs are sufficiently reliable to allow their application at other locations.

II. Moss Landing Marine Laboratories

R. Fairey stated that the AET cleanup values developed for Campbell Shipyard are not appropriate to apply at NASSCO and Southwest Marine. R. Fairey's opinion is primarily based on three conclusions:

- Data collected at Campbell Shipyard is insufficient and unsuitable for the application of the AET approach.
- Physical, chemical, and biological data are not similar enough among shipyards to apply AETs developed in one area to other areas.
- Cleanup levels developed using an AET approach do not provide the level of environmental protection necessary to meet management objectives in the management area.

III. Hart Crowser, Inc.

T. Thornburg stated that the AET cleanup values developed for Campbell Shipyard are appropriate to apply at NASSCO and Southwest Marine. T. Thornburg's opinion is primarily based on five conclusions:

- Campbell Shipyard, NASSCO, and Southwest Marine processes, discharges, and sediment characteristics are similar.
- Sediments at NASSCO and Southwest Marine exhibit relatively low toxicity based on the BPTCP.
- Campbell Shipyard AET values are consistent with sediment management standards.
- NASSCO and Southwest Marine are planning to dredge down to AET values, thereby providing long-term protection to San Diego Bay.
- Campbell Shipyard AET values will address a majority of site risks at NASSCO and Southwest Marine.

REGIONAL BOARD PEER REVIEW FOLLOW-UP

After reviewing the peer review reports, Regional Board staff decided to meet with each reviewer individually for further explanation and clarification of specific issues. In addition to meeting with the peer review panel, Mr. Tom Gries from Washington State Department of Ecology was consulted on the development and implementation of AETs for Puget Sound. The following are the issues considered and the conclusions made by Regional Board staff.

Issue: ***R. Fairey and S. Bay stated that 15 stations at Campbell Shipyard was not sufficient for developing AET cleanup levels.***

Staff disagrees. The 15 stations are sufficient for developing AET cleanup levels at a single location such as Campbell Shipyard. In developing AET levels, it is suggested that a biased sampling plan should always be used when developing AET values, especially when using a small data set, to ensure that a wide range of contaminant concentrations is represented rather than a completely random sampling of the sediment. The 15 stations at Campbell Shipyard were strategically placed in locations throughout the leasehold in order to develop AET levels.

It was also noted that a minimum of 50 sampling locations with matched chemical and biological-effects data is necessary to establish reliable AET values. This is true for establishing "watershed-wide" or "region-wide" cleanup levels when using the AET approach.

Issue: ***It was noted in the follow-up meeting by S. Bay and R. Fairey, and conference calls with T. Gries, that the amphipod and polychaete tests are typically not as sensitive as other bioassays available in establishing AETs.***

Staff agrees. The amphipod and polychaete solid phase (SP) or whole sediment tests used in the Campbell Shipyard study are standard bioassay tests that are widely used to determine toxic effects. It is suggested, however, that an additional test such as an echinoderm or bivalve development solid phase or suspended particulate phase test be conducted to develop more robust AET values. Both the echinoderm and bivalve tests are considered more sensitive to chemical contamination therefore these tests should give a more accurate AET.

The justification for an additional test is to assist in the decision process for developing an AET. The concern was that the amphipod or polychaete tests may produce inconclusive responses to sediment leaving the toxicity issue up for interpretation. With the additional test, a conclusion can be reached by the weight of the evidence of the tests.

Issue: S. Bay and R. Fairey questioned whether the physical, chemical, and biological characteristics are similar among the shipyards. T. Thornburg stated the three shipyard activities are very similar, within close proximity, and share the same watershed. He stated the shipyards "...share the same sedimentary and ecological environments within the bay."

Physical (grain size) and chemical data from the three shipyards NPDES monitoring program were compiled and statistically compared against one another using the Student's t-test to check for significant differences. Statistical analyses of the biological characteristics at the three shipyards were not conducted since biological data are currently not available for NASSCO and Southwest Marine. A summary of the grain size and chemical analyses are provided in Appendix C.

Based on the grain size results, no statistically significant differences could be found between the three shipyards. When comparing the grain size (fine and course sediment) from the NPDES monitoring programs, no significant differences were found when comparing Campbell Shipyard, Southwest Marine, and NASSCO.

Similar statistical comparisons were conducted using five metals (copper, zinc, mercury, lead and TBT) and five PAHs (pyrene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perlyene, and chrysene) from stormwater sediment data (1992-1999) using the Students t-test and NPDES (1992-2000) sediment data using a single factor analysis of variance test (ANOVA). Data used was from Campbell, NASSCO, and Southwest Marine shipyard monitoring reports. The results of the comparison are contained in following two tables. Table 3 is a comparison of stormwater sediment data from the three shipyards and Table 4 is a comparison of NPDES sediment data.

Table 3
Comparison of Stormwater Sediment Data from the Shipyards

Chemical	Comparison of Stormwater Data		
	Campbell vs NASSCO	Campbell vs Southwest Marine	NASSCO vs Southwest Marine
Copper		X	X
Zinc		X	X
Mercury			
Lead			
TBT			
Pyrene			
Benzo(a)pyrene			
Benzo(b)fluoranthene			
Benzo(ghi)perlyene			
Chrysene			
Total Number of Significant Differences	0	2	2
Percent Significantly Different	**0**	**20%**	**20%**
Average Percent Difference	**6.7%**	**Standard Deviation**	**11.5%**

X = Statistically significant difference observed between the two shipyards. alpha = 0.05.

The comparison of the stormwater data using a Students t-test showed few significant differences. Of the ten chemicals used in the comparison, only copper and zinc showed significant differences in the analysis of Campbell against Southwest Marine and NASSCO against Southwest Marine. No differences were observed in any of the ten chemicals when Campbell Shipyard data was compared against NASSCO.

Table 4
Comparison of NPDES Data from the Shipyards

Chemical	Comparison of NPDES Data		
	Campbell vs NASSCO	Campbell vs Southwest Marine	NASSCO vs Southwest Marine
Copper	X		X
Zinc	X	X	X
Mercury	X		X
Lead		X	
TBT	X		X
Pyrene	X	X	
Benzo(a)pyrene	X		X
Benzo(b)fluoranthene	X	X	X
Benzo(ghi)perlyene	X		X
Chrysene	X	X	
Total Number of Significant Differences	9	6	7
Percent Significantly Different	**90%**	**60%**	**70%**
Average Percent Difference	**73.3%**	**Standard Deviation**	**15.3%**

X = Statistically significant difference observed between the two shipyards. alpha = 0.05.

The comparison of the NPDES data using a single factor ANOVA from the three shipyards showed numerous significant differences. Overall, statistically significant differences were observed in 73.3 percent (22 of the 30) of the analyses. The analysis of the NPDES data implies that the composition of the three shipyard sediments may have enough differences to question whether the chemical compositions are similar. Because of the high percentages (60%-90%) of significant differences observed in the analyses, the use of Campbell Shipyard's AET values as sediment cleanup values at NASSCO and Southwest Marine may not be appropriate.

Issue: S. Bay and R. Fairey questions the protection of San Diego beneficial uses provided by the AET approach.

Staff disagrees. As discussed elsewhere in this report the Regional Board is making the assumption that the benthic community covered under the marine habitat beneficial use (MAR) represents the most sensitive beneficial use needing protection from contaminated sediment at NASSCO and Southwest Marine shipyards. Cleanup levels derived using the

AET Approach would provide for protection of the MAR.

A wide range of physical, chemical and biological factors influence the bioavailability of sediment contaminants and their potential to cause adverse biological effects on the benthic community. These factors include aquaeous solubility, pH, affinity for sediment organic carbon, sediment grain size, sediment mineral constituents (oxides of iron, manganese and aluminum), and the quantity of acid volatile sulfides in the sediment. The AET approach provides a relatively simple means of addressing the complexity of the biological-chemical interrelationships based on measures of sediment chemistry, sediment toxicity, and benthic community structure.

The overall objective of the AET approach is to measure sediment chemical constituents, sediment toxicity and adverse benthic community alterations; and then use the weight of evidence from these measurements to identify sediment contaminant concentrations which may cause adverse effects to the benthic community. The chemical data provides data on which chemicals are present in the sediment at the highest concentrations as well as potential sources. The sediment toxicity test provides direct evidence of adverse biological effects on test organisms. If the contaminants are toxic it can be assumed that the contaminants are bioavailable to the organisms. The sediment toxicity can also be used to determine the degree and nature of the toxicity. The analyses of the benthic community can be used to determine adverse effects to the diversity and abundance of the in-situ benthic community caused by the contaminant.

The AET is defined as the sediment concentration of a given chemical above which statistically significant biological effects are always observed in the sediment chemistry, sediment toxicity and benthic community data set used to generate the AET. For a given chemical, sediment concentrations can be as high as the AET value and not be associated with statistically significant biological effects. If a chemical exceeds its AET for a particular biological indicator, then an adverse effect is predicted for that biological indicator (although the exact chemical concentration where the effect would occur is not known.)

The AET approach has been used throughout the country as a basis for regulatory agency decisions on sediment cleanup and disposal at specific sites. The AET can serve as a viable basis for determining sediment cleanup levels because it can be used to predict where statistically significant biological effects are expected at a point with a known chemical concentration. Cleanup levels can be set either at the AET or to more stringent levels using a safety factor to account for uncertainties in the data or to ensure that other discharges in the vicinity do not cause the AET sediment contaminant values to be exceeded following the cleanup.