TENTATIVE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

TENTATIVE CLEANUP AND ABATEMENT ORDER

NO. R9-~~2010-0002~~2011-0001

NATIONAL STEEL AND SHIPBUILDING COMPANY

BAE SYSTEMS SAN DIEGO SHIP REPAIR, INC.
~~(FORMERLY SOUTHWEST MARINE, INC.)~~

CITY OF SAN DIEGO

~~MARINE CONSTRUCTION AND DESIGN COMPANY~~
~~AND CAMPBELL INDUSTRIES, INC.~~STAR &
CRESCENT BOAT COMPANY

~~SAN DIEGO GAS AND ELECTRIC,~~
~~A SUBSIDIARY OF SEMPRA ENERGY~~
~~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

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

JURISDICTION

1. **WASTE DISCHARGE**. Elevated levels of pollutants above San Diego Bay background conditions exist in the San Diego Bay bottom marine sediment along the eastern shore of central San Diego Bay ~~in an area~~ extending approximately from the Sampson Street Extension to the ~~north~~northwest and Chollas Creek to the ~~south~~southeast, and from the ~~National Steel and Shipbuilding Company Shipyard facility (hereinafter "NASSCO") and the BAE Systems San Diego Ship Repair Facility (hereinafter "BAE Systems")~~ shoreline out to the San Diego Bay main shipping channel to the west. This area is hereinafter collectively referred to as the "Shipyard Sediment Site." The National Steel and Shipbuilding Company Shipyard facility (NASSCO~~;~~), the BAE Systems San Diego Ship Repair~~, Inc.;~~ Facility (BAE Systems), the City of San Diego; ~~Marine Construction and Design~~Star & Crescent Boat Company ~~and~~; Campbell Industries~~, Inc.;~~ (Campbell); San Diego Gas and Electric~~, a subsidiary of Sempra Energy Company; and~~ (SDG&E); the United States Navy, and the San Diego Unified Port District (Port District) have each caused or permitted the discharge of waste to the Shipyard Sediment Site resulting in the accumulation of waste in the marine sediment. The contaminated marine sediment has caused conditions of contamination or nuisance in San Diego Bay that adversely affect~~s~~ aquatic life, aquatic-dependent wildlife, human health, and San Diego Bay beneficial uses. A map of the Shipyard Sediment ~~Site region~~Area is provided in Attachment 1 to this Order.

PERSONS RESPONSIBLE

2. **NATIONAL STEEL AND SHIPBUILDING COMPANY (NASSCO), A SUBSIDIARY OF GENERAL DYNAMICS COMPANY**. The ~~National Steel and Shipbuilding Company, (hereinafter NASSCO) has (1) discharged waste from its shipyard operations into~~ San Diego ~~Bay in violation of waste discharge requirements; and (2)~~ Water Board alleges, but NASSCO denies, that NASSCO has caused or permitted ~~waste~~wastes to be discharged or to be deposited where ~~it was~~ they were discharged into San Diego Bay and created, or ~~threatens~~threatened to create, a condition of pollution or nuisance. These wastes contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH). ~~Based on these considerations NASSCO is referred to as "Discharger(s)" in this Cleanup and Abatement Order.~~

NASSCO, a subsidiary of General Dynamics Company, owns and operates a full service ship construction, modification, repair, and maintenance facility on 126 acres of tidelands property leased from the ~~San Diego Unified~~ Port District ~~(SDUPD)~~ on the eastern waterfront of central San Diego Bay at 2798 Harbor Drive in San Diego. Shipyard

operations have been conducted at this site by NASSCO over San Diego Bay waters or very close to the waterfront since ~~1945~~at least 1960. Shipyard facilities operated by NASSCO over the years at the Site have included concrete platens used for steel fabrication, a graving dock, shipbuilding ways, and berths on piers or land to accommodate the berthing of ships. An assortment of waste is generated at the facility including spent abrasive, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse. Based on these considerations NASSCO is referred to as "Discharger(s)" in this Cleanup and Abatement Order (CAO).

3. **BAE SYSTEMS SAN DIEGO SHIP REPAIR, INC., FORMERLY SOUTHWEST MARINE, INC.** The San Diego Water Board alleges, but BAE Systems ~~San Diego Ship Repair, Inc. has (1) discharged waste from its shipyard operations into San Diego Bay in violation of waste discharge requirements; and (2)~~ denies, that BAE Systems caused or permitted ~~waste~~ wastes to be discharged or to be deposited where ~~it was~~they were discharged into San Diego Bay and created, or ~~threatens~~threatened to create, a condition of pollution or nuisance. These wastes contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, PCBs, PCTs, PAHs, and TPH. ~~Based on these considerations BAE Systems San Diego Ship Repair, Inc. is referred to as "Discharger(s)" in this Cleanup and Abatement Order.~~

From 1979 to the present, Southwest Marine, Inc. and its successor BAE Systems ~~San Diego Ship Repair, Inc., hereinafter collectively referred to as BAE Systems,~~ have owned and operated a ship repair, alteration, and overhaul facility on approximately 39.6 acres of tidelands property on the eastern waterfront of central San Diego Bay. The facility, currently referred to as BAE Systems San Diego Ship Repair, is located on land leased from the ~~San Diego Unified~~ Port District at 2205 East Belt Street, foot of Sampson Street in San Diego, San Diego County, California. Shipyard facilities operated by BAE Systems over the years have included concrete platens used for steel fabrication, two floating dry docks, five piers, and two marine railways. An assortment of waste has been generated at the facility including spent abrasive, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse. Based on these considerations BAE Systems is referred to as "Discharger(s)" in this CAO.

4. **CITY OF SAN DIEGO**. The San Diego Water Board alleges, but the City of San Diego denies, that the City of San Diego caused or permitted wastes to be discharged or to be deposited where they were discharged into San Diego Bay and created, or threatened to create, a condition of pollution or nuisance. From the early 1900s through February 1963, when the relevant tideland areas were transferred from the City of San Diego to the Port District, the City was the trustee of and leased to various operators, all relevant portions of the Shipyard Sediment Site. The wastes the City of San Diego caused or permitted to be discharged, or to be deposited where they were discharged into San Diego Bay through its ownership of the Shipyard Sediment Site contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, PCBs, PCTs, PAHs, and TPH.

The City of San Diego also owns and operates a municipal separate storm sewer system (MS4) through which it discharges waste commonly found in urban runoff to San Diego Bay subject to the terms and conditions of a National Pollutant Discharge Elimination System (NPDES) Storm Water Permit. The San Diego Water Board alleges, but the City of San Diego denies, that the City of San Diego has discharged urban storm water containing waste directly to San Diego Bay at the Shipyard Sediment Site ~~in violation of waste discharge requirements~~. The waste includes metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), total suspended solids, sediment (due to anthropogenic activities), petroleum products, and synthetic organics (pesticides, herbicides, and PCBs) through its SW4 (located on the BAE Systems leasehold) and SW9 (located on the NASSCO leasehold) MS4 conduit pipes.

The San Diego Water Board alleges, but the City of San Diego denies that the City of San Diego has also discharged urban storm water containing waste ~~in violation of waste discharge requirements,~~ through its MS4 to Chollas Creek resulting in the exceedances of chronic and acute California Toxics Rule copper, lead, and zinc criteria for the protection of aquatic life~~, in violation of waste discharge requirements prescribed by the San Diego Water Board~~. Studies indicate that during storm events, storm water plumes toxic to marine life emanate from Chollas Creek up to 1.2 kilometers into San Diego Bay, and contribute to pollutant levels at the Shipyard Sediment Site. The urban storm water containing waste that has discharged from the on-site and off-site MS4 has contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels, that cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on these considerations the City of San Diego is referred to as "Discharger(s)" in this ~~Cleanup and Abatement Order~~CAO.

5. **~~MARINE CONSTRUCTION AND DESIGN~~STAR & CRESCENT BOAT COMPANY ~~AND CAMPBELL INDUSTRIES, INC.~~** ~~Marine Construction and Design Company and Campbell Industries, Inc.~~**.** The San Diego Water Board alleges, but Star & Crescent Boat Company (hereinafter ~~collectively referred to as "SDMC") has (1) discharged pollutants from its shipyard operations into San Diego Bay in violation of waste discharge requirements; and (2)~~"Star & Crescent") denies, that Star & Crescent caused or permitted ~~waste~~wastes to be discharged or to be deposited where ~~it was~~they were discharged into San Diego Bay and created, or ~~threatens~~threatened to create, a condition of pollution or nuisance. These wastes contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, PCBs, PCTs, PAHs, and TPH. ~~Based on these considerations, Marine Construction and Design Company and Campbell Industries, Inc. are referred to as "Discharger(s)" in this Cleanup and Abatement Order.~~

Between 1914 and ~~1979~~1972, San Diego Marine Construction Company ~~and its successor San Diego Marine Construction Corporation, a wholly owned subsidiary of Campbell Industries, Inc., a wholly owned subsidiary of Marine Construction and Design Company (MARCO), collectively referred to as SDMC,~~ operated a ship repair, alteration, and overhaul facility on what is now the BAE Systems leasehold at the foot of Sampson Street in San Diego. Shipyard operations were conducted at this site over San Diego Bay water

or very close to the waterfront. An assortment of waste was generated at the facility, including spent abrasive blast waste, paint, rust, petroleum products, marine growth, sanitary waste and general refuse. In July 1972, San Diego Marine Construction Company sold its shipyard operations to Campbell Industries, and changed its corporate name, effective July 14, 1972, to Star & Crescent Investment Co. On March 19, 1976, Star & Crescent Boat Company was incorporated in California and on April 9, 1976, Star & Crescent Investment Co. (formerly San Diego Marine Construction Company) transferred all of its assets and liabilities to Star & Crescent. Accordingly, Star & Crescent is the corporate successor of and responsible for the conditions of pollution or nuisance caused or permitted by San Diego Marine Construction Company. Based on these considerations, Star & Crescent is referred to as "Discharger(s)" in this CAO.

6. **CAMPBELL INDUSTRIES**. The San Diego Water Board alleges, but Campbell Industries denies, that Campbell caused or permitted wastes to be discharged or to be deposited where they were discharged into San Diego Bay and created, or threatened to create, a condition of pollution or nuisance. These wastes contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, PCBs, PCTs, PAHs, and TPH. From July 1972 through 1979, Campbell's wholly owned subsidiaries MCCSD and later San Diego Marine Construction Corporation operated a ship repair, alteration, and overhaul facility on what is now the BAE Systems leasehold at the foot of Sampson Street in San Diego. Shipyard operations were conducted at this site by ~~SDMC~~Campbell over San Diego Bay waters or very close to the waterfront. An assortment of waste was generated at the facility including spent abrasive blast waste, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse. Based on these considerations, Campbell is referred to as "Discharger(s)" in this CAO.

7. **CHEVRON, A SUBSIDIARY OF CHEVRONTEXACO**. Chevron, a subsidiary of ChevronTexaco (hereinafter, Chevron) owns and operates the Chevron Terminal, a bulk fuel storage facility currently located at 2351 East Harbor Drive in the City of San Diego adjacent to the NASSCO and BAE Systems leaseholds. Fuel products containing petroleum hydrocarbons have been stored at the Chevron Terminal since the early 1900s at both the currently operating 7 million gallon product capacity upper tank farm and the closed 5 million gallon capacity lower tank farm. Based on the information that the San Diego Water Board has reviewed to date, there is insufficient evidence to find that discharges from the Chevron Terminal contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels, which create, or threaten to create, conditions of pollution or nuisance. Accordingly, Chevron is not referred to as "Discharger(s)" in this ~~Cleanup and Abatement Order~~CAO.

8. **BP AS THE PARENT COMPANY AND SUCCESSOR TO ATLANTIC RICHFIELD**. BP owns and operates the Atlantic Richfield Company (ARCO) Terminal, a bulk fuel storage facility with approximately 9 million gallons of capacity located at 2295 East Harbor Drive in the City of San Diego. Fuel products containing petroleum hydrocarbons and related constituents such as PAHs have been stored at ARCO Terminal since the early 1900s. ARCO owned and operated ancillary facilities include a wharf, fuel pier (currently BAE Systems Pier 4), and a marine fueling station used for loading and unloading petroleum products and fueling from 1925 to 1978, and five pipelines connecting the terminal to the pier and wharf in use from 1925 to 1978. Storm water flows from ARCO Terminal enter a City of San Diego MS4 storm drain that terminates in San Diego Bay in the Shipyard Sediment Site approximately 300 feet south of the Sampson Street extension. Based on the information that the San Diego Water Board has reviewed to date, there is insufficient evidence to find that discharges from the ARCO Terminal contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels, which create, or threaten to create, conditions of pollution or nuisance. Accordingly, BP and ARCO are not referred to as "Discharger(s)" in this ~~Cleanup and Abatement Order~~CAO.

9. **SAN DIEGO GAS AND ELECTRIC, A SUBSIDIARY OF SEMPRA ENERGY**. ~~San Diego Gas and Electric, a subsidiary of Sempra Energy (hereinafter,~~ SDG&E~~).~~ owned and operated the Silver Gate Power Plant along the north side of the BAE Systems leasehold from approximately 1943 to the 1990s. SDG&E utilized an easement to San Diego Bay along BAE Systems' north property boundary for the intake and discharge of cooling water via concrete tunnels at flow rates ranging from 120 to 180 million gallons per day. SDG&E operations included discharging waste to holding ponds above the tunnels near the Shipyard Sediment Site~~s.~~

. The San Diego Water Board alleges, but SDG&E ~~has (1) discharged waste from its power plant operations, including metals (copper, nickel, and zinc) into San Diego Bay in violation of waste discharge requirements; and has (2)~~ denies, that it has caused or permitted waste (including metals [chromium, copper, lead, nickel, and zinc], PCBs, PAHs, and total petroleum hydrocarbons [TPH~~--~~d and TPH~~--~~h]) to be discharged or to be deposited where ~~it was~~they were discharged into San Diego Bay and created, or ~~threatens~~threatened to create, a condition of pollution or nuisance. Based on these considerations SDG&E is referred to as "Discharger(s)" in this ~~Cleanup and Abatement Order~~CAO.

10. **UNITED STATES NAVY**. The San Diego Water Board alleges, but the United States Navy (hereinafter "U.S. Navy") denies, that the U.S. Navy caused or permitted wastes to be discharged or to be deposited where they were discharged into San Diego Bay and created, or threatened to create, a condition of pollution or nuisance. The U.S. Navy owns and operates a municipal separate storm sewer system (MS4) at Naval Base San Diego (NBSD), formerly Naval Station ~~(NAVSTA) San Diego~~San Diego or NAVSTA, through which it has caused or permitted the discharge of waste commonly found in urban runoff to Chollas Creek and San Diego Bay, including excessive concentrations of copper, lead, and zinc in violation of waste discharge requirements. Technical reports by the U.S. Navy and others indicate that Chollas Creek outflows during storm events convey elevated

sediment and urban runoff chemical pollutant loading and its associated toxicity up to 1.2 kilometers into San Diego Bay over an area including the Shipyard Sediment Site.

The San Diego Water Board alleges, but the U.S. Navy denies, that the U.S. Navy has caused or permitted marine sediment and associated waste to be resuspended into the water column as a result of shear forces generated by the thrust of propellers during ship movements at ~~NAVSTA San Diego~~NBSD. The resuspended sediment and pollutants can be transported by tidal currents and deposited in other parts of San Diego Bay, including the Shipyard Sediment Site. The above discharges have contributed to the accumulation of pollutants in marine sediment at the Shipyard Sediment Site to levels that cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. ~~Based on the preceding considerations, the U.S. Navy is referred to as "Discharger(s)" in this Cleanup and Abatement Order. From the year~~

Also, from 1921 to the present, the U.S. Navy has provided shore support and pier-side berthing services to U.S. Pacific fleet vessels at ~~NAVSTA San Diego~~NBSD located at 3445 Surface Navy Boulevard in the City of San Diego. ~~NAVSTA San Diego~~NBSD currently occupies 1,029 acres of land and 326 water acres adjacent to San Diego Bay to the west, and Chollas Creek to the north near Pier 1. Between ~~the years~~ 1938 and 1956, the ~~NAVSTA San Diego~~NBSD leasehold included a parcel of land~~,~~ within the Shipyard Sediment Site referred to as the 28th Street Shore Boat Landing Station, located at the south end of the present day NASSCO leasehold at the foot of 28th Street and including the 28th Street Pier. ~~At~~The San Diego Water Board alleges, but the U.S. Navy denies, that the U.S. Navy caused or permitted wastes to be discharged or to be deposited where they were discharged into San Diego Bay and created, or threatened to create, a condition of pollution or nuisance at this location~~, the U.S. Navy~~ when it conducted operations similar in scope to a small boatyard, including solvent cleaning and degreasing of vessel parts and surfaces, abrasive blasting and scraping for paint removal and surface preparations, metal plating, and surface finishing and painting. Prevailing industry-wide boatyard operational practices employed during the 1930s through the 1980s were often not sufficient to adequately control or prevent pollutant discharges, and often led to excessive discharges of pollutants and accumulation of pollutants in marine sediment in San Diego Bay. The types of pollutants found in elevated concentrations at the Shipyard Sediment Site (metals, butyltin species, PCBs, PCTs, PAHs, and TPH) are associated with the characteristics of the waste the U.S. Navy operations generated at the 28th Street Shore Boat Landing Station site. Based on the preceding considerations, the U.S. Navy is referred to as "Discharger(s)" in this CAO.

11. **SAN DIEGO UNIFIED PORT DISTRICT**. The San Diego ~~Unified Port District (~~Water Board alleges, but the Port District~~)~~ denies, that the Port District caused or permitted wastes to be discharged or to be deposited where they were discharged into San Diego Bay and created, or threatened to create, a condition of pollution or nuisance. The Port District is a special government entity ~~that administers~~, created in 1962 by the San Diego Unified Port District Act, California Harbors and Navigation Code Appendix I, in order to manage San Diego Harbor, and administer certain public lands along San Diego Bay. The Port District holds and manages as trust property on behalf of the People of the State of

California the land occupied by ~~the~~ NASSCO ~~Shipyard facility, the,~~ BAE Systems ~~San Diego Ship Repair Facility~~, and the cooling water tunnels for ~~San Diego Gas and Electric Company's~~SDG&E's former Silver Gate Power Plant. The Port District is also the trustee of the land formerly occupied by the ~~San Diego Marine Construction Company Inc. and Southwest Marine Inc.~~Star & Crescent Boat Company and its predecessor, and by Campbell Industries at all times since 1963 during which they conducted shipbuilding and repair activities~~. As the State's designated trustee for these lands, the Port District is responsible for the actions, omissions and operations of its tenants.~~.[1] The Port District's own ordinances, which date back to 1963, prohibit the deposit or discharge of any chemicals or waste to the tidelands or San Diego Bay and make it unlawful to discharge pollutants in non-storm water directly or indirectly into the storm water conveyance system. The San Diego Water Board has the discretion to name the Port District in its capacity as the State's trustee as a "discharger" in the Shipyard Sediment Site ~~Cleanup and Abatement Order. To be~~ CAO and hereby does so, consistent with its responsibility for the actions, omissions and operations of its tenants and to the extent indicated by previous State Water Board and ~~Regional~~San Diego Water Board orders ~~concerning the naming of non-operating public agencies in cleanup and abatement orders, the San Diego Water Board is not now naming the Port of San Diego as a "discharger" in the Cleanup~~

The wastes the Port District caused or permitted to be discharged, or to be deposited where they were discharged into San Diego Bay through its ownership of the Shipyard Sediment Site contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and ~~Abatement order, but may do so in the future if the Port's former~~zinc), butyl tin species, PCBs, PCTs, PAHs, and~~/or current tenants fail to comply with the Order~~ TPH.

The Port District also owns and operates a municipal separate storm sewer system (MS4) through which it discharges waste commonly found in urban runoff to San Diego Bay subject to the terms and conditions of an NPDES Storm Water Permit. The San Diego Water Board alleges, but the Port District denies, that the Port District has discharged urban storm water containing waste directly to San Diego Bay at the Shipyard Sediment Site. The waste includes metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), total suspended solids, sediment (due to anthropogenic activities), petroleum products, and synthetic organics (pesticides, herbicides, and PCBs).

The urban storm water containing waste that has discharged from the on-site and off-site MS4 has contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels, that cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on these considerations the San Diego Unified Port District is referred to as "Discharger(s)" in this CAO.

FACTUAL BACKGROUND

[1] Star & Crescent Boat Company and Campbell Industries owned and operated ship repair and construction facilities in past years prior to BAE Systems San Diego Ship Repair, Inc.'s occupation of the leasehold. See Sections 5 and 6 of the Technical Report.

12. **CLEAN WATER ACT SECTION 303(d) LIST**. ~~Approximately 55 acres of~~ The San Diego Bay shoreline between Sampson and 28th Streets is listed on the Clean Water Act ~~Section~~ section 303(d) List of Water Quality Limited Segments for elevated levels of copper, mercury, zinc, PAHs, and PCBs in the marine sediment. These pollutants are impairing the aquatic life, aquatic-dependent wildlife, and human health beneficial uses designated for San Diego Bay. The Shipyard Sediment Site occupies this shoreline. Issuance of a ~~cleanup and abatement order~~CAO (in lieu of a Total Maximum Daily Load program) is the appropriate regulatory tool to use for correcting the impairment at the Shipyard Sediment Site.

13. **SEDIMENT QUALITY INVESTIGATION.** NASSCO and BAE Systems ~~(formerly Southwest Marine)~~ conducted a detailed sediment investigation at the Shipyard Sediment Site in San Diego Bay within and adjacent to the NASSCO and BAE Systems leaseholds. Two phases of fieldwork were conducted, Phase I in 2001 and Phase II in 2002. The results of the investigation are provided in the Exponent report *NASSCO and Southwest Marine Detailed Sediment Investigation, September 2003 (Shipyard Report, Exponent 2003*). Unless otherwise explicitly stated, the San Diego Water Board's finding and conclusions in this ~~Cleanup and Abatement Order~~CAO are based on the data and other technical information contained in the Shipyard Report prepared by NASSCO's and BAE Systems' consultant, Exponent.

The Shipyard Sediment Site is exempt from the Phase I Sediment Quality Objectives promulgated by the State Water Resources Control Board (State Water Board) because a site assessment (the Shipyard Report) was completed and submitted to the San Diego Water Board on October 15, 2003. See State Water Board, *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality*, II.B.2 (August 25, 2009).

IMPAIRMENT OF AQUATIC LIFE BENEFICIAL ~~USE IMPAIRMENT~~

USES

14. **AQUATIC LIFE IMPAIRMENT**. Aquatic life beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. Aquatic life beneficial uses include: Estuarine Habitat (EST), Marine Habitat (MAR), and Migration of Aquatic Organisms (MIGR). This finding is based on the considerations described below in this *Impairment of Aquatic Life Beneficial Uses* section of the ~~Cleanup and Abatement Order~~CAO.

15. **WEIGHT-OF-EVIDENCE APPROACH**. The San Diego Water Board used a weight-of-evidence approach based upon multiple lines of evidence to evaluate the potential risks to aquatic life beneficial uses from pollutants at the Shipyard Sediment Site. The approach focused on measuring and evaluating exposure and adverse effects to the benthic macroinvertebrate community and to fish using data from multiple lines of evidence and best professional judgment. Pollutant exposure and adverse effects to the benthic macroinvertebrate community were evaluated using sediment quality triad measurements, and bioaccumulation analyses, and interstitial water (i.e., pore water) analyses. The San

Diego Water Board evaluated pollutant exposure and adverse effects to fish using fish histopathology analyses and analyses of PAH breakdown products in fish bile.

16. **SEDIMENT QUALITY TRIAD MEASURES**. The San Diego Water Board used lines of evidence organized into a sediment quality triad, to evaluate potential risks to the benthic community from pollutants present in the Shipyard Sediment Site. The sediment quality triad provides a "weight-of-evidence" approach to sediment quality assessment by integrating synoptic measures of sediment chemistry, toxicity, and benthic community composition. All three measures provide a framework of complementary evidence for assessing the degree of pollutant-induced degradation in the benthic community.

17. **REFERENCE SEDIMENT QUALITY CONDITIONS.** The San Diego Water Board selected a group of reference stations from three independent sediment quality investigations to contrast pollution conditions at the Shipyard Sediment Site with conditions found in other relatively cleaner areas of San Diego Bay not affected by the Shipyard Sediment Site: (1) Southern California Bight 1998 Regional Monitoring Program (Bight 98), (2) 2001 Mouth of Chollas Creek and Mouth of Paleta Creek TMDL studies, and (3) 2001 NASSCO and ~~Southwest Marine (now~~ BAE Systems~~)~~ Detailed Sediment Investigation. Stations from these studies were selected to represent selected physical, chemical, and biological characteristics of San Diego Bay. Criteria for selecting acceptable reference stations included low levels of anthropogenic pollutant concentrations, locations remote from pollution sources, similar biological habitat to the Shipyard Sediment Site, sediment total organic carbon (TOC) and grain size profiles similar to the Shipyard Sediment Site, adequate sample size for statistical analysis, and sediment quality data comparability. The reference stations selected for the Reference Sediment Quality Conditions are identified below.

Reference Stations Used To Establish Reference Sediment Quality Conditions

2001 Chollas/Paleta Reference Station Identification Number	2001 NASSCO/BAE Systems Reference Station Identification Number	1998 Bight'98 Reference Station Identification Number
2231	2231	2235
2243	2243	2241
2433	2433	2242
2441	2441	2243
2238		2256
		2257
		2258
		2260
		2265

18. **SEDIMENT QUALITY TRIAD RESULTS.** The San Diego Water Board categorized 6 of 30 ~~Sediment Quality Triad~~sediment quality triad sampling stations at the Shipyard Sediment Site as having sediment pollutant levels "~~likely~~Likely" to adversely affect the health of the benthic community. The remaining triad stations were classified as "Possible" (13) and "Unlikely" (11). These results are based on the synoptic measures of sediment chemistry, toxicity, and benthic community structure at the Shipyard Sediment Site. ~~In addition, an evaluation of 27 of the sampling stations utilizing the State Water Board's Multiple Lines of Evidence (MLOE) approach in the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality categorizes 9 stations as not meeting and 8 stations as possibly not meeting the narrative sediment quality objective for the protection of aquatic life.~~

19. **BIOACCUMULATION**. The San Diego Water Board evaluated initial laboratory bioaccumulation test data to ascertain the bioaccumulation potential of the sediment chemical pollutants at the Shipyard Sediment Site. Examination of laboratory test data on the chemical pollutant concentrations in tissue of the clam ~~(~~*Macoma nasuta*~~)~~ relative to the pollutant concentrations in sediment indicates that bioaccumulation of chemical pollutants is occurring at the Shipyard Sediment Site. The data indicates for several chemical pollutants that concentrations in *Macoma nasuta* tissue increase ~~in proportion to~~proportionally as chemical pollutant concentrations in sediment increase. Statistically significant relationships were found for arsenic, copper, lead, mercury, zinc, tributyltin (TBT~~, total~~), PCBs, and high molecular weight polynuclear aromatic hydrocarbons (HPAHs). These chemical pollutants have a bioaccumulation potential at the Shipyard Sediment Site and are therefore considered bioavailable to benthic organisms. No statistically significant relationships were found for cadmium, chromium, nickel, selenium, silver, or PCTs.

~~**18. PORE WATER**. The San Diego Water Board evaluated the chemistry of pore water (the water occupying the spaces between sediment particles) at the Shipyard Sediment Site to determine compliance with California Toxics Rule (CTR) water quality criteria and the potential risks to the benthic community from chemical pollutants present in the sediment. Comparisons were made to the CTR saltwater quality criterion continuous concentration, which is the highest concentration of a pollutant to which marine aquatic life can be exposed for an extended period of time without deleterious effects. Of the 12 site stations sampled for pore water (SW02 was excluded due to the presence of some suspended material remaining after centrifugation), 12 stations exceeded the copper CTR value, 6 stations exceeded the lead CTR value, and 12 stations exceeded the total PCBs CTR value. Although the comparisons to the CTR criteria identified several pollutants for which measured pore water concentrations are above levels of concern, the measured pore water concentrations may be biased high due to the possible presence of very fine suspended or colloidal material in the pore water samples that could not be removed by centrifugation.~~

~~19. **FISH HISTOPATHOLOGY**. The San Diego Water Board evaluated fish histopathology data to determine the potential exposure and associated adverse effects on fish from chemical pollutants present within and adjacent to the Shipyard Sediment Site. A total of~~

~~253 spotted sand bass were examined for various histopathological lesions. These spotted sand bass were collected from four discrete assessment units at the Shipyard Sediment Site and at a reference area located across San Diego Bay near Reference Station 2240. The fish histopathology data indicates a total of 70 types of histopathological lesions were found in the spotted sand bass. Of the 70 types of lesions found, five lesions exhibited statistically significant elevations relative to reference conditions. The five lesions are abundant lipofuscin in liver, abundant hemosiderin in liver, cholangitis/biliary hyperplasia (CBH) in liver, nephritis in kidney, and shiny gill foci. A sixth lesion (i.e., foci of cellular alteration in livers) was considered important even though no statistical differences were found because the existence of these lesions indicates a harmful effect strongly linked to PAH exposure. Of the six lesions identified as significantly elevated with respect to reference conditions, two, CBH and foci of cellular alteration, have been identified as being associated with contaminant exposure. Scientific literature describing lesions that are potential biomarkers of environmental stressors in fish does not attribute causation of lipofuscin, hemosiderin, nephritis, and shiny gill foci to pollution-related factors. It is plausible that the lesions could have been caused by naturally occurring environmental factors such as infectious parasites. Based on these considerations the fish histopathology data does not indicate that the fish lesions observed in the data set can be conclusively attributed to contaminant exposure at the Shipyard Sediment Site.~~

~~20. **FISH BILE**. The San Diego Water Board evaluated fish bile sampling results to determine the potential exposure of fish to PAH compounds within and adjacent to the Shipyard Sediment Site. The bile samples were analyzed for fluorescent aromatic compounds (FACs) and total proteins. Three groups of FACs were measured that correspond to metabolites (PAH breakdown products) from naphthalene, phenanthrene, and benzo[a]pyrene. Metabolites were detected in bile of spotted sand bass captured inside and outside of the Shipyard Sediment Site and within a reference area located across the bay from the shipyard sites near Reference Station 2240. Metabolites of two contaminants exhibited elevated levels relative to reference conditions in spotted sand bass collected immediately outside of the Shipyard Sediment Site when their mean concentrations were compared against reference data. No metabolites were significantly elevated relative to reference conditions in spotted sand bass collected inside of the Shipyard Sediment Sites.~~

~~The upper prediction limit (UPL) at the 95 percent confidence interval was also calculated for the metabolites of the reference area fish and compared to replicate fish bile samples from the four areas of the Shipyard Sediment Site (i.e., inside and outside of both NASSCO and BAE Systems leaseholds). The inside and outside areas of NASSCO had samples that exceeded the UPL. Inside NASSCO accounted for six of the 19 UPL exceedances. Two fish bile samples from inside NASSCO exceeded the UPL for naphthalene, phenanthrene, and benzo[a]pyrene metabolites. From Outside NASSCO, 12 of the 13 UPL exceedances came from phenanthrene and benzo[a]pyrene metabolite samples.~~

~~For BAE Systems, all exceedances came from outside BAE Systems of which nine of 11 exceedances were for the benzo [a] pyrene metabolite samples. The remaining two~~

~~exceedances were for the phenanthrene metabolite samples. No exceedances were found from inside BAE Systems; however, the PAH sediment chemistry data from inside BAE Systems showed the highest levels of sediment contamination.~~

~~The inconsistent relationship between the levels of FACs in fish and PAH contaminated sediment indicates that this data is inconclusive and the FAC concentrations observed in the fish cannot be exclusively attributed to contaminant exposure at the Shipyard Sediment Site. The variable nature of the sediment contamination found in bays and the mobility of the fish are confounding factors when attempting to correlate fish sampling results with sediment contamination.~~

20. **INDICATOR SEDIMENT CHEMICALS**. The San Diego Water Board evaluated the relationships between sediment chemical pollutants and biological responses to identify indicator chemical pollutants that may be impacting aquatic life and would therefore be candidates for assignment of cleanup levels or remediation goals. A two-step process was conducted. The first step in the selection of indicator chemicals was to identify chemicals representative of the major classes of sediment pollutants: metals, butyltins, PCBs and PCTs, PAHs, and petroleum hydrocarbons. The second step was the evaluation of relationships between these chemicals and biological responses. Results of the three toxicity tests, benthic community assessment, and bioaccumulation testing conducted in Phase 1 of the Shipyard study were all used to evaluate the potential of such relationships. Chemical pollutants were selected as indicator chemicals if they had any statistically significant relationship with amphipod mortality, echinoderm fertilization, bivalve development, total benthic macroinvertebrate abundance, total benthic macroinvertebrate richness, or tissue chemical concentrations in *Macoma nasuta*. Chemical pollutants selected as indicator chemicals include arsenic, copper, lead, mercury, zinc, TBT, total PCB homologs, diesel range organics (DRO), and residual range organics (RRO).

IMPAIRMENT OF AQUATIC-DEPENDENT WILDLIFE BENEFICIAL USES ~~*IMPAIRMENT*~~

21. **AQUATIC-DEPENDENT WILDLIFE IMPAIRMENT**. Aquatic-dependent wildlife beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. Aquatic-dependent wildlife beneficial uses include: Wildlife Habitat (WILD), Preservation of Biological Habitats of Special Significance (BIOL), and Rare, Threatened, or Endangered Species (RARE). This finding is based on the considerations described below in the *Impairment of Aquatic-Dependent Wildlife Beneficial* Uses section of ~~the Cleanup and Abatement Order.~~ this CAO.

22. **RISK ASSESSMENT APPROACH FOR AQUATIC-DEPENDENT WILDLIFE**. The San Diego Water Board evaluated potential risks to aquatic-dependent wildlife from chemical pollutants present in the sediment at the Shipyard Sediment Site based on a two-tier approach. The Tier I screening level risk assessment was based on tissue data derived from the exposure of the clam *Macoma nasuta* to site sediments for 28 days using the protocols specified by American Society of Testing Material (ASTM). The Tier II baseline comprehensive risk assessment was based on tissue data derived from resident fish and shellfish caught within and adjacent to the Shipyard Sediment Site.

23. **TIER I SCREENING LEVEL RISK ASSESSMENT FOR AQUATIC-DEPENDENT WILDLIFE**. The Tier I risk assessment objectives were to determine whether or not Shipyard Sediment Site conditions pose a potential unacceptable risk to aquatic-dependent wildlife receptors of concern and to identify whether a comprehensive, site-specific risk assessment was warranted (i.e., Tier II baseline risk assessment). The receptors of concern selected for the assessment include: California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus*), Western grebe (*Aechmophorus occidentalis*), Surf scoter (*Melanitta perspicillata*), California sea lion (*Zalophus californianus*), and East Pacific green turtle (*Chelonia mydas agassizii*). Chemical pollutant concentrations measured in clam tissue derived from laboratory bioaccumulation tests were used to estimate chemical exposure to these receptors of concern. Based on the Tier I screening level risk assessment results, there is a potential risk to all receptors of concern ingesting prey caught at the Shipyard Sediment Site. The chemical pollutants in *Macoma* tissue posing a potential risk include arsenic, copper, lead, zinc, benzo[a]pyrene (BAP), and total PCBs. The results of the Tier I risk assessment indicated that a Tier II baseline comprehensive risk assessment was warranted.

24. **TIER II BASELINE COMPREHENSIVE RISK ASSESSMENT FOR AQUATIC-DEPENDENT WILDLIFE**. The Tier II risk assessment objective was to more conclusively determine whether or not Shipyard Sediment Site conditions pose an unacceptable risk to aquatic-dependent wildlife receptors of concern. The receptors of concern selected for the assessment include: California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus*), Western grebe (*Aechmophorus occidentalis*), Surf scoter (*Melanitta perspicillata*), California sea lion (*Zalophus californianus*), and East Pacific green turtle (*Chelonia mydas agassizii*). Based on the Tier I screening level risk assessment results, there is a potential risk to all receptors of concern ingesting prey caught at the Shipyard Sediment Site and so a Tier II assessment was conducted. To focus the risk assessment, prey items were collected within four assessment units at the Shipyard Sediment Site and from a reference area located across the bay from the site. Chemical concentrations measured in fish were used to estimate chemical exposure for the least tern, western grebe, brown pelican, and sea lion and chemical concentrations in benthic mussels and eelgrass were used to estimate chemical pollutant exposure for the surf scoter and green turtle, respectively. Based on the Tier II risk assessment results, ingestion of prey items caught within all four assessment units at the Shipyard Sediment Site poses ~~a~~an increased risk above reference to all receptors of concern (excluding the sea lion). The ~~chemical~~chemicals in prey tissue posing a risk include ~~benzo[a]pyrene, total~~BAP, PCBs, copper, lead, mercury, and zinc.

IMPAIRMENT OF HUMAN HEALTH BENEFICIAL USES ~~IMPAIRMENT~~

25. **HUMAN HEALTH IMPAIRMENT**. Human health beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. Human health beneficial uses include: Contact Water Recreation (REC-1), Non-contact Water Recreation (REC-2), Shellfish Harvesting (SHELL), and Commercial and Sport Fishing (COMM). This finding is based on the considerations described below in this *Impairment of Human Health Beneficial Uses* section of the ~~Cleanup and Abatement Order~~CAO.

26. **RISK ASSESSMENT APPROACH FOR HUMAN HEALTH**. The San Diego Water Board evaluated potential risks to human health from chemical pollutants present in the sediment at the Shipyard Sediment Site based on a two-tier approach. The Tier I screening level risk assessment was based on tissue data derived from the exposure of the clam *Macoma nasuta* to site sediments for 28 days using ~~American Society of Testing Material (~~ASTM~~)~~ protocols. The Tier II baseline comprehensive risk assessment was based on tissue data derived from resident fish and shellfish caught within and adjacent to the Shipyard Sediment Site. Two types of receptors (i.e., members of the population or individuals at risk) were evaluated:

    a. Recreational Anglers – Persons who eat the fish and/or shellfish they catch recreationally; and

    b. Subsistence Anglers – Persons who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in their diet.

27. **TIER I SCREENING LEVEL RISK ASSESSMENT FOR HUMAN HEALTH**. The Tier I risk assessment objectives were to determine whether or not Shipyard Sediment Site conditions potentially pose an unacceptable risk to human health and to identify if a comprehensive, site-specific risk assessment was warranted (i.e., Tier II baseline risk assessment). The receptors of concern identified for Tier I are recreational anglers and subsistence anglers. Recreational anglers represent those who eat the fish and/or shellfish they catch recreationally and subsistence anglers represent those who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in the diet. Chemical concentrations measured in *Macoma nasuta* tissue derived from laboratory bioaccumulation tests were used to estimate chemical exposure for these receptors of concern. Based on the Tier I screening level risk assessment results, there is a potential risk greater than that in reference areas to recreational and subsistence anglers ingesting fish and shellfish caught at the Shipyard Sediment Site. The chemicals in *Macoma* tissue posing a potential risk include arsenic, BAP, PCBs, and TBT.

28. **TIER II BASELINE COMPREHENSIVE RISK ASSESSMENT FOR HUMAN HEALTH**. The Tier II risk assessment objective was to more conclusively determine whether Shipyard Sediment Site conditions pose unacceptable cancer and non-cancer health risks to recreational and subsistence anglers. Fish and shellfish were collected within four assessment units at the Shipyard Sediment Site and from two reference areas located across the bay from the Shipyard Site. Chemical concentrations measured in fish fillets and edible shellfish tissue were used to estimate chemical exposure for recreational anglers and chemical concentrations in fish whole bodies and shellfish whole bodies were used to estimate chemical exposure for subsistence anglers. Based on the Tier II risk assessment results, ingestion of fish and shellfish caught within all four assessment units at the Shipyard Sediment Site poses a theoretical increased cancer and non-cancer risk greater than that in reference areas to recreational and subsistence anglers. The chemicals posing theoretical increased cancer risks include inorganic arsenic and PCBs. The chemicals posing theoretical increased non-cancer risks include cadmium, copper, mercury, and ~~total~~ PCBs.

EVALUATING FEASIBILITY OF CLEANUP TO BACKGROUND SEDIMENT QUALITY CONDITIONS

29. **CHEMICALS OF CONCERN AND BACKGROUND SEDIMENT QUALITY**. The San Diego Water Board derived sediment chemistry levels for use in evaluating the feasibility of cleanup to background sediment quality conditions from the pool of San Diego Bay reference stations described in ~~Finding 16~~Finding 17. The background sediment chemistry levels based on these reference stations are as follows:

Table 1. Background Sediment Chemistry Levels

~~Chemical~~	~~Units (dry weight)~~	~~Background Sediment Chemistry Levels (1)~~
~~*Metals*~~		
~~Arsenic~~	~~mg/kg~~	~~7.5~~
~~Cadmium~~	~~mg/kg~~	~~0.33~~
~~Chromium~~	~~mg/kg~~	~~57~~
~~Copper~~	~~mg/kg~~	~~121~~
~~Lead~~	~~mg/kg~~	~~53~~
~~Mercury~~	~~mg/kg~~	~~0.57~~
~~Nickel~~	~~mg/kg~~	~~15~~
~~Silver~~	~~mg/kg~~	~~1.1~~
~~Zinc~~	~~mg/kg~~	~~192~~

~~*Organics*~~Chemicals of Concern	Units (dry weight)	Background Sediment Chemistry Levels[1]
Primary COCs		
Copper	mg/kg	121
Mercury	mg/kg	0.57
HPAHs[2]	µg/kg	663

~~Chemical~~	~~Units (dry weight)~~	~~Background Sediment Chemistry Levels~~ ~~(1)~~
PCBs[3]	µg/kg	84
Tributyltin	µg/kg	22
Secondary COCs		
Arsenic	mg/kg	7.5
Cadmium	mg/kg	0.33
Lead	mg/kg	53
Zinc	mg/kg	192
~~Dibutyltin~~	~~µg/kg~~	~~21~~
~~Monobutyltin~~	~~µg/kg~~	~~14~~
~~Tributyltin~~	~~µg/kg~~	~~22~~
~~Tetrabutyltin~~	~~µg/kg~~	~~(1.4)~~
~~HPAH~~ ~~(2)~~	~~µg/kg~~	~~673~~
~~PPPAH~~ ~~(3)~~	~~µg/kg~~	~~1,234~~
~~Benzo[a]pyrene~~	~~µg/kg~~	~~202~~
~~Total PCB Congeners~~ ~~(4)~~	~~µg/kg~~	~~84~~
~~Polychlorinated terphenyls~~	~~µg/kg~~	~~(142)~~

~~**Based on**~~

~~1. Equal to~~ the 2005 Reference Pool's 95 ~~percent~~% upper ~~prediction limit (95% UPL) calculated from a pool of reference stations in San Diego Bay. Parentheses ( ) indicates non-detects accounted for more than or equal to half the values.~~

~~2. HPAH = High Molecular Weight Polynuclear Aromatic Hydrocarbons~~

~~3. PPPAH = Priority Pollutant Polynuclear Aromatic Hydrocarbons~~

~~4. PCB = Polychlorinated Biphenyls~~

1. ~~Note: A regression analysis of the grain size:metals relationship is used in establishing background sediment chemistry levels. The background metals concentration is based on the 95% UPL using 50% fine grain sediment. These values are conservative concentrations~~ predictive limits shown in Section 18 of the *Technical Report for Cleanup and Abatement Order No. R9-2011-0001*. The background levels for metals are based on the %fines:metals regression using 50% fines, which is conservative because the mean fine grain sediment at the Shipyard Investigation Site is 70% ~~fine grain sediment. See Appendix for Section 16 of the Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2010-0002 for further details on the regression analysis.~~ fines.
2. HPAHs = sum of 6 PAHs: Fluoranthene, Perylene, Benzo[a]anthracene, Chrysene, Benzo[a]pyrene, and Dibenzo[a,h]anthracene.
3. PCBs = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

The San Diego Water Board identified constituents of primary concern (primary COCs), which are associated with the greatest exceedance of background and highest magnitude of potential risk at the Shipyard Sediment Site. A greater concentration relative to background suggests a stronger association with the Shipyard Sediment Site, and a higher potential for exposure reduction via remediation. Secondary contaminants of concern (secondary COCs) are contaminants with lower concentrations relative to background, and are highly correlated with primary COCs and would be addressed in a common remedial

footprint. Based on these criteria, the primary COCs for the Shipyard Sediment Site are copper, mercury, HPAHs,[2] PCBs, and TBT, and the secondary COCs are arsenic, cadmium, lead, and zinc.

30. **TECHNOLOGICAL FEASIBILITY CONSIDERATIONS**. Although there are complexities and difficulties that would need to be addressed and overcome (e.g. removal and handling of large volume of sediment; obstructions such as piers and ongoing shipyard operations; transportation and disposal of waste), it is technologically feasible to cleanup to the background sediment quality levels utilizing one or more remedial and disposal techniques. Mechanical dredging, subaqueous capping, and natural recovery have been successfully performed at ~~thousands of~~numerous sites, including several in San Diego Bay, and many of these projects have successfully overcome the same types of operational limitations present at the Shipyard Sediment Site, such as piers and other obstructions, ship movements, and limited staging areas. Confined aquatic disposal or near-shore confined disposal facilities have also been employed in San Diego Bay and elsewhere, and ~~are technically feasible alternatives to~~ may be evaluated as project alternatives for the management of sediment removed from the Shipyard Sediment Site.

31. **ECONOMIC FEASIBILITY CONSIDERATIONS**. Under State Water Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*, determining "economic feasibility" requires an objective balancing of the incremental benefit of attaining further reduction in the concentrations of ~~constituents of concern (COCs)~~ primary COCs as compared with the incremental cost of achieving those reductions. Resolution No. 92-49 provides that "[e]conomic feasibility does not refer to the dischargers' ability to finance cleanup." When considering appropriate cleanup levels under Resolution No. 92-49, the San Diego Water Board is charged with evaluating "economic feasibility" by estimating the costs to remediate constituents of concern at a site to background and the costs of implementing other alternative remedial levels. An economically feasible alternative cleanup level is one where the incremental cost of further reductions in primary COCs outweighs the incremental benefits.

The San Diego Water Board evaluated a number of criteria to determine risks, costs, and benefits associated with no action, cleanups to background sediment chemistry levels, and alternative cleanup levels greater than background concentrations. The criteria included factors such as total cost, volume of sediment dredged, exposure pathways of receptors to contaminants, short- and long-term effects on beneficial uses (as they fall into the broader categories of aquatic life, aquatic-dependent wildlife, and human health), effects on shipyards and associated economic activities, effects on local businesses and neighborhood quality of life, and effects on recreational, commercial, or industrial uses of aquatic resources. The San Diego Water Board then compared these cost criteria against the

[2] Petroleum hydrocarbons, including TPH, RRO, DRO, and other PAHs were eliminated as primary and secondary COCs for the following reasons. HPAHs, a primary COC, are considered to be the most recalcitrant, bioavailable, and toxic compounds present in the complex mixture of petroleum hydrocarbons. Other measures of petroleum hydrocarbons are generally correlated with HPAHs such that remedial measures to address HPAHs will also address environmental concerns associated with elevated levels of low molecular weight PAHs (LPAHs), total PAHs, TPH, RRO and DRO.

benefits gained by diminishing exposure to the primary ~~contaminants of concern~~COCs to estimate the incremental benefit gained from reducing exposure based on the incremental costs of doing so. As set forth in detail herein, this comparison revealed that the incremental benefit of cleanup diminishes significantly with additional cost beyond a certain cleanup level, and asymptotically approaches zero as remediation approaches background. Based on these considerations, cleaning up to background sediment chemistry levels is not economically feasible.

ALTERNATIVE SEDIMENT CLEANUP LEVELS

32. **ALTERNATIVE CLEANUP LEVELS**.

~~32. The post-remedial surface-area weighted average concentrations (SWACs) for primary COCs (Table 2) are the alternative cleanup levels for the protection of aquatic-dependent wildlife and human health. SWACs were not developed for secondary COCs because they are highly correlated with the primary COCs. Cleanup of the primary COCs to post-remedial SWACS will address the secondary COCs. Additionally, the remedial footprint discussed in Finding 35 must be cleaned up to background levels (Table 2) to ensure the SWACs are attained on a site-wide basis, and to ensure protection of aquatic life beneficial uses.~~

~~**Table 2. Alternative Cleanup Levels**~~

~~**Primary Contaminant of Concern**~~	~~**Post-Remedial SWACs (site-wide)**~~	~~**Background (within the Remedial Footprint)**~~
~~Copper~~	~~159 mg/kg~~	~~121 mg/kg~~
~~Mercury~~	~~0.67 mg/kg~~	~~0.57 mg/kg~~
~~HPAHs~~	~~2,300 µg/kg~~	~~673µg/kg~~
~~Total PCB congeners~~	~~194 µg/kg~~	~~84 µg/kg~~
~~Tributylin~~	~~110 µg/kg~~	~~22 µg/kg~~

~~SWACs are appropriate as alternative cleanup levels because aquatic-dependent wildlife do not forage or fish over a single station, but range to find an adequate food supply. Data indicates that some aquatic-dependent wildlife are migratory and are infrequent visitors to the Shipyard Sediment Site, with foraging areas that are orders of magnitude larger than the site (i.e., Least Tern, Brown pelican, California sea lion).~~

~~To calculate the SWACs, a geospatial technique (Thiessen polygons) was used to represent the area of the Shipyard Sediment Site represented by each sediment sample. Thiessen polygons are polygons whose boundaries define the area that is closest to each point relative to all other points and are mathematically defined by the perpendicular~~

~~bisectors of the lines between all points. By defining the area most closely associated with each sampling point, a value for that point (e.g., chemical concentration) can be spatially weighted based on the area it represents. Sixty-five polygons were delineated based on the 65 sampling station locations at the Shipyard Sediment Site.~~

~~Cleanup of the remedial footprint to background levels will protect aquatic life beneficial uses because the remedial footprint includes all polygons with stations having a sediment quality triad result of "Likely" impaired. Additionally, the majority of the polygons with "Possibly" impaired triad stations, and all of the polygons with "Possibly" impaired triad stations with high chemistry were included in the footprint. Of the remaining possibly impaired stations, all have healthy benthic communities comparable to reference conditions, and showed biological effects in a maximum of one metric out of the seven that were assessed, with the exception of NA20 which had no toxicity and is in an area where the benthic community is known to be subject to significant physical disturbance.~~

~~For polygons without triad data (i.e., chemistry data only), two chemical thresholds were developed to predict if the polygons would not be "Likely" impaired. These thresholds were 60 percent of the lowest apparent affects threshold (60% LAET), and the site specific mean effects quotient (SS-MEQ). All polygons with stations exceeding the 60%LAET or SS-MEQ threshold of 0.9 were included in the remedial footprint. The sediment profile imaging (SPI) analysis generally indicates that healthy stage III benthic communities are present at Shipyard Sediment Site non-triad stations with CoC~~
Under State Water Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304*, the San Diego Water Board may prescribe alternative cleanup levels less stringent than background sediment chemistry concentrations ~~below the 60%LAET and SS-MEQ thresholds.~~ if attainment of background concentrations is technologically or economically infeasible. Resolution No. 92-49 requires that alternative levels must be set at the lowest levels the discharger demonstrates and the San Diego Water Board finds is technologically and economically achievable. Resolution No. 92-49 further requires that any alternative cleanup level shall: (1) be consistent with maximum benefit to the people of the state; (2) not unreasonably affect present and anticipated beneficial uses of such water; and (3) not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards.

The San Diego Water Board is prescribing the alternative cleanup levels for sediment summarized in the table below to protect aquatic life, aquatic-dependent wildlife, and human health based beneficial uses consistent with the requirements of Resolution No. 92-49. Compliance with alternative cleanup levels will be determined using the monitoring protocols summarized in Finding 34 and described in detail of Section 34 of the Technical Report.

~~33. **PROPOSED REMEDIAL FOOTPRINT AND PRELIMINARY REMEDIAL DESIGN**. Cleanup to background concentration levels in the polygons selected for remediation and achievement of SWACs at the site should ensure that there are no unreasonable effects on aquatic life, aquatic-dependent wildlife, or human health beneficial uses at the Shipyard Sediment Site. The polygons targeted for remediation are~~

~~shown in red and green in Attachment 2. The red areas are where the proposed remedial action is dredging. The areas shown in green represent inaccessible or under-pier areas that will be remediated by one or more methods other than dredging. The polygon containing station NA22 was excluded from the Shipyard Sediment Site area, and instead is being evaluated under the Chollas Creek Mouth TMDL.~~

~~The polygons were ranked based on a number of factors including composite surface area weighted average concentration for the five primary COCs, SS MEQ, and highest concentration of individual primary COCs. Based on these rankings, polygons were selected for remediation on a "worst first" basis.~~

~~In recognition of the methodologies and limitations of traditional mechanical dredging, the irregular polygons were converted into uniform dredge units. Each dredge unit (sediment management unit or "SMU") was then used to develop the dredge footprint. The conversion from irregular polygons to SMUs is shown in Attachments 3 and 4. These figures show the proposed remedial footprint, inclusive of areas to be dredged (red areas) and under-pier areas to be remediated by other means (green areas), most likely by sand capping.~~

~~Upland source control measures in the watershed of municipal separate storm sewer system outfall SW-4 are also needed to eliminate ongoing contamination from this source, and ensure that recontamination of cleaned up areas of the Shipyard Sediment Site from this source do not occur.~~

Table 2. Alternative Cleanup Levels: Shipyard Sediment Site

Aquatic Life	Aquatic Dependent Wildlife and Human Health	
Remediate all areas determined to have sediment pollutant levels likely to adversely affect the health of the benthic community.	Surface Weighted Average Concentrations (site-wide)	
	Copper	159 mg/kg
	Mercury	0.68 mg/kg
	HPAHs[1]	2,451 µg/kg
	PCBs[2]	194 µg/kg
	Tributyltin	110 µg/kg

1. HPAHs = sum of 10 PAHs: Fluoranthene, Pyrene, Benz[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno[1,2,3-c,d]pyrene, Dibenz[a,h]anthracene, and Benzo[g,h,i]perylene.

2. PCBs = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

In approving alternative cleanup levels less stringent than background the San Diego Water Board has considered the factors contained in Resolution No. 92-49 and the California Code of Regulations, Title 23, section 2550.4, subdivision (d~~).~~

a.):

Alternative Cleanup Levels are Appropriate. Cleaning up to background sediment quality levels at the Shipyard Sediment Site is economically infeasible. The ~~overall benefit of remediating the site to the alternative cleanup levels is approximately equal to the overall benefit of cleaning up to background for considerably less cost.~~ alternative cleanup levels established for the Shipyard Sediment Site are the lowest levels that are technologically and economically achievable, as required under the California Code of Regulations Title 23 section 2550.4(e).

Alternative Cleanup Levels ~~Are~~ are Consistent ~~With~~with Water Quality Control Plans ~~And~~and Policies. The alternative cleanup levels provide for the reasonable protection of San Diego Bay beneficial uses and will not result in water quality less than prescribed in water quality control plans and policies adopted by the State Water Board and the San Diego Water Board. ~~***Alternative Cleanup Levels Are Consistent With The Maximum Benefit To The People Of The State.*** The level of water quality that will be attained upon implementation of the alternative cleanup levels at the Shipyard Sediment Site is consistent with the maximum benefit to the people of the state. San Diego Bay is an important and valuable resource to San Diego and the Southern California Region and merits high priority action for cleanup of pollution. The San Diego Bay shoreline between Sampson and 28th Streets is listed on the Clean Water Act 303(d) list for elevated levels of copper, mercury, PAHs, and PCBs at the Shipyard Sediment Site.~~ While it is impossible to determine the precise level of water quality that will be attained given the residual sediment pollutant~~s~~ constituents that will remain at the ~~site~~Site, compliance with the alternative cleanup levels will markedly improve water quality conditions ~~in~~at the Shipyard Sediment Site and result in attainment of water quality standards at the site.~~The shipyards operating in the Shipyard Sediment Site are an important component of Southern California infrastructure, which provide essential services for U.S. Navy vessels, serve as the last remaining new construction shipyard on the West Coast, and employ nearly 6,000 skilled tradespeople and over 1,100 partners and subcontractors. The Shipyard Sediment Site's estimated impact on the local economy is over $3.5 Billion per year. The remedial footprint properly accounts for the role of the shipyards operating at the Shipyard Sediment Site in order to provide the maximum benefit to the people of the state.~~

Alternative Cleanup Levels Will Not Unreasonably Affect Present and Anticipated Beneficial Uses of the Site. The level of water quality that will be attained upon remediation of the required cleanup at the Shipyard Sediment Site will not unreasonably affect ~~the~~San Diego Bay beneficial uses assigned to the Shipyard Sediment Site~~, including~~ represented by aquatic life, aquatic-dependent wildlife, and human health. ~~The Regional Board finds that~~Cleanup of the remedial footprint will restore any injury, destruction, or loss of natural resources.

~~The impacts from cleaning up the remedial footprint compared to cleaning up the entire site to background levels will be significantly less with respect to diesel emissions, greenhouse gas emissions, noise, truck traffic, disruption to the community, barge and crane movement~~

Alternative Cleanup Levels are Consistent with the Maximum Benefit to the People of the State. The proposed alternative cleanup levels are consistent with maximum benefit to the people of the State based on the San Diego Bay resource protection, mass removal and source control, and economic considerations. The Shipyard Sediment Site pollution is located in San Diego Bay, one of the finest natural harbors in the world. San Diego Bay is an important and valuable resource to San Diego and the Southern California Region. The alternative cleanup levels will result in significant contaminant mass removal and therefore risk reduction from San Diego Bay. Remediated areas will approach reference area sediment concentrations for most contaminants. Compared to cleaning up to background cleanup levels, cleaning up to the alternative cleanup levels will cause less diesel emission, less greenhouse gas emission, less noise, less truck traffic, have a lower potential for accidents, and less disruption to the local community. Achieving the alternative cleanup levels also requires less barge and crane movement on San Diego Bay, has a lower risk of re-suspension of contaminated sediments, and ~~risk of accidents. The remedial footprint will also reduce~~reduces the amount of landfill ~~space used for disposal of sediment, result in no long-term loss of discharger(s) use of the site, and allow operation of key shipyard processes.~~capacity required to dispose of the sediment wastes. The alternative cleanup levels properly balance reasonable protection of San Diego Bay beneficial uses with the significant economic and service activities provided by the City of San Diego, the NASSCO and BAE Systems Shipyards and the U.S. Navy.

~~32.~~33. **PROPOSED REMEDIAL FOOTPRINT AND PRELIMINARY REMEDIAL DESIGN**. Polygonal areas were developed around the sampling stations at the Shipyard Sediment Site using the Thiessen Polygon method to facilitate the development of the remedial footprint. The polygons targeted for remediation are shown in red and green in Attachment 2. The red areas are where the proposed remedial action is dredging. The areas shown in green represent inaccessible or under-pier areas that will be remediated by one or more methods other than dredging. Portions of polygons NA20, NA21, and NA22 as shown in Attachment 2 were omitted from this analysis because it falls within an area that is being evaluated as part of the TMDLs for Toxic Pollutants in Sediment at the Mouth of Chollas Creek TMDL and is not considered part of the Shipyard Sediment Site for purposes of the CAO.

The polygons were ranked based on a number of factors including likely impaired stations, composite surface-area weighted average concentration for the five primary COCs, Site-Specific Median Effects Quotient (SS-MEQ)[3] for non-Triad stations, and highest concentration of individual primary COCs. Based on these rankings, polygons were selected for remediation on a "worst first" basis.

In recognition of the methodologies and limitations of traditional mechanical dredging, the irregular polygons were converted into uniform dredge units. Each dredge unit (sediment management unit or "SMU") was then used to develop the dredge footprint. The

[3] The SS-MEQ is a threshold developed to predict likely benthic community impairments based on sediment chemistry at the Shipyard Sediment Site. The development, validation, and application of the SS-MEQ are described in Section 32.5.2 of the Technical Report.

conversion from irregular polygons to SMUs is shown in Attachments 3 and 4. These attachments show the remedial footprint, inclusive of areas to be dredged ("dredge remedial area," in red) and under-pier areas ("under-pier remedial area," in green) to be remediated by other means, most likely by sand cover. Together, the dredge remedial area and the under-pier remedial area constitute the remedial footprint.

Upland source control measures in the watershed of municipal separate storm sewer system outfall SW-4 are also needed to eliminate ongoing contamination from this source, if any, and ensure that recontamination of cleaned up areas of the Shipyard Sediment Site from this source does not occur.

~~33.~~34. **REMEDIAL MONITORING PROGRAM**. Monitoring during remediation activities is needed to document that remedial actions have not caused water quality standards to be violated outside of the remedial footprint, that the target cleanup levels have been reached within the remedial footprint, and to assess sediment for appropriate disposal. This monitoring should include water quality monitoring, sediment monitoring, and disposal monitoring.

Post-remediation monitoring is needed to verify that remaining pollutant concentrations in the sediments will not unreasonably affect San Diego Bay beneficial uses. Post-remediation monitoring should be initiated two years after remedy implementation has been completed and continue for a period of up to 10 years after remediation. For human health and aquatic dependent wildlife beneficial uses, post-remediation monitoring should include sediment chemistry monitoring to ensure that post-remediation SWACs are maintained at the site following cleanup. A subset of samples should undergo bioaccumulation testing using ~~the 28-day *macoma* test.~~ *Macoma*. For aquatic ~~wild~~life beneficial uses, post-remediation monitoring should include sediment chemistry, and toxicity~~, and~~ bioassays to verify that post-remedial conditions have the potential to support a healthy benthic community. In addition, post-remediation monitoring should include benthic community condition assessments to ~~demonstrate the remediation has successfully created conditions to promote~~ evaluate the overall impact of remediation on the benthic community re-colonization ~~of a healthy benthic community~~activities.

Environmental data has natural variability which does not represent a true difference from expected values. Therefore, if remedial monitoring results are within an acceptable range of the expected outcome, the remedial actions ~~should~~will be considered successful.

~~34.~~35. **REMEDIAL ACTION IMPLEMENTATION SCHEDULE**. ~~The dischargers~~ The Dischargers have proposed a remedial action implementation schedule and a description of specific remedial actions they intend to undertake to comply with this ~~Cleanup and Abatement Order (~~CAO~~)~~. The remedial action implementation schedule will begin with the adoption of this CAO and end with the submission of final reports documenting that the alternative sediment cleanup levels have been met. From start to finish, remedial action implementation is expected to take approximately 5 years to complete.

The proposed remedial actions have a substantial likelihood to achieve compliance with the requirements of this CAO within a reasonable time frame. The proposed schedule is as

short as possible, given 1) the scope, size, complexity, and cost of the remediation, 2) industry experience with the time typically required to implement similar remedial actions, 3) the time needed to secure other regulatory agency approvals and permits before remediation can start, and 4) the need to conduct dredging in a phased manner to prevent or reduce adverse effects to the endangered California Least Tern. Therefore, the remedial action implementation schedule proposed by the ~~dischargers~~Dischargers is consistent with the provisions in Resolution No. 92-49 for schedules for cleanup and abatement.

~~35.~~36. **LEGAL AND REGULATORY AUTHORITY**. This Order is based on (1) section 13267 and Chapter 5, Enforcement, of the Porter-Cologne Water Quality Control Act (Division 7 of the Water Code, commencing with section 13000), commencing with section 13300; (2) applicable state and federal regulations; (3) all applicable provisions of statewide Water Quality Control Plans adopted by the State Water Resources Control Board and the *Water Quality Control Plan for the San Diego Basin* (Basin Plan) adopted by the San Diego Water Board including beneficial uses, water quality objectives, and implementation plans; (4) State Water Board policies for water quality control, including State Water Board Resolution No~~.~~. 68-16 ~~(~~, *Statement of Policy with Respect to Maintaining High Quality of Waters in California*~~)~~ and Resolution No. 92-49 ~~(~~, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code section 13304*~~)~~; and (5) relevant standards, criteria, and advisories adopted by other state and federal agencies.

37. **CALIFORNIA ENVIRONMENTAL QUALITY ACT**. In many cases, an enforcement action such as this could be exempt from the provisions of the California Environmental Quality Act ("CEQA"; Public Resources Code, section 21000 et seq.), because it would fall within Classes 7, 8, and 21 of the categorical exemptions for projects that have been determined not to have a significant effect on the environment under section 21084 of CEQA

~~. [14 CCR 15307, 15308, and 15321.] The San Diego Water Board, however, is currently investigating whether special circumstances may apply to this cleanup and abatement order and enforcement action that could render one or all of these categorical exemptions inapplicable. Whether and the extent to which this enforcement action may be exempt from CEQA, and whether and the extent to which it may have the potential to significantly impact the environment, are currently under investigation and analysis by the San Diego Water Board. A public notice of scoping meeting has been issued for January 21.~~[4] In Resolution No. R9-2010-0115 adopted on September 8, 2010, ~~and responsible and trustee agencies have been asked to comment on~~ the ~~proposed project so that these important issues may be fully investigated and analyzed before the San Diego Water Board considers them.~~

~~Before the San Diego Water Board acts on any final cleanup order, an appropriate CEQA determination will need to be made.~~ San Diego Water Board ~~staff has begun CEQA's public process and will present its CEQA analysis and proposed CEQA findings at the time the San Diego Water Board considers a final cleanup order.~~

[4] Title 14 CCR sections 15307, 15308, and 15321

found that because the tentative CAO presents unusual circumstances and there is a reasonable possibility of a significant effect on the environment due to the unusual circumstances, the tentative CAO is not exempt from CEQA and that an EIR analyzing the potential environmental effects of the tentative CAO should be prepared.

As the lead agency for the tentative CAO, the San Diego Water Board prepared an EIR that complies with CEQA. The San Diego Water Board has reviewed and considered the information in the EIR.

~~37.~~38. **PUBLIC NOTICE**. The San Diego Water Board has notified all known interested persons and the public of its intent to adopt this ~~Cleanup and Abatement Order~~CAO, and has provided them with an opportunity to submit written comments and recommendations.

~~38.~~39. **PUBLIC HEARING**. The San Diego Water Board has considered all comments pertaining to this ~~Cleanup and Abatement Order~~CAO submitted to the San Diego Water Board in writing, or by oral presentations at the public hearing held on [date(s) to be inserted]. Responses to relevant comments have been incorporated into the Technical Report for this ~~Cleanup~~CAO. In the event that the San Diego Water Board proposes any changes to the Tentative CAO deemed material by the Dischargers, the Dischargers reserve their right to complete the administrative process delineated in the Final Discovery Plan and ~~Abatement~~Second Amended Order of Proceedings, including the rights to conduct discovery, to cross–examine witnesses, and to submit rebuttal evidence, comments and initial and final briefs, subject to revised deadlines to be set by the San Diego Water Board or its designated Presiding Officer.

~~39.~~40. **TECHNICAL REPORT**. The "*Technical Report for Cleanup and Abatement Order No. R9-~~2010-0002~~2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*" ~~(Attachment 7)~~ is hereby incorporated as a finding in support of this ~~Cleanup and Abatement Order~~CAO as if fully set forth here verbatim.

ORDER DIRECTIVES

IT IS HEREBY ORDERED *that, pursuant to sections 13267 and 13304 of the Water Code, National Steel and Shipbuilding Company; BAE Systems San Diego Ship Repair Inc~~. (formerly Southwest Marine, Inc.);~~ .; the City of San Diego; ~~Marine Construction and Design~~Star & Crescent Boat Company ~~and~~ ; Campbell Industries~~, Inc.~~; San Diego Gas and Electric~~, a subsidiary of Sempra Energy Company; and~~; the United States Navy; and the San Diego Unified Port District (hereinafter Discharger~~(s)~~), shall comply with the following directives*:

A. CLEANUP AND ABATE

1. **Illicit Discharges**. The Discharger~~(s)~~ shall terminate all illicit discharges, if any, to the Shipyard Sediment Site (see Attachment 1) in violation of waste discharge requirements or other order or prohibition issued by the San Diego Water Board.

2. **Corrective Action**. ~~-~~The Discharger~~(~~s~~)~~ shall take all corrective actions necessary to remediate the contaminated marine bay sediment at the Shipyard Sediment Site ~~pursuant to the remediation footprint set forth in Attachments 2 through 4.~~ as described below: Corrective action design details shall be included in the Remedial Action Plan required by Directive B.

   a. ***Dredge Remedial Areas***. The sediments in the dredge remedial areas shown on Attachments 3 and 4 shall be dredged. This dredging shall remediate the sediment in the dredge remedial area to the concentrations in the table below for primary COCs, pursuant to confirmatory testing:

   ~~a. *Dredge Remedial Areas.* The sediments in the dredge remedial areas shown on Attachments 3 and 4 shall be dredged to attain the following background concentrations:~~

~~Constituent of Concern~~Primary COCs	~~Background~~Post-Remedial Dredge Area Concentrations (Background[1])
Copper	121 mg/kg
Mercury	0.57 mg/kg
HPAHs[2]	~~673 u~~663 µg/kg
~~Total PCB Congeners~~PCBs[3]	84 ~~u~~µg/kg
Tributyltin	22 ~~u~~µg/kg

1. See Finding 29, Table 1.
2. HPAHs = High Molecular Weight Polynuclear Aromatic Hydrocarbons, sum of 6 PAHs: Fluoranthene, Perylene, Benzo(a)anthracene, Chrysene, Benzo(a)pyrene, and Dibenzo(a,h)anthracene.
3. PCBs = Polychlorinated Biphenyls, sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

If concentrations of ~~Constituents of Concern (~~primary COCs~~)~~ in subsurface sediments (deeper than the upper ~~2~~5 cm) are above 120 percent of ~~background~~ post-remedial dredge area concentrations after completion of initial dredging, then additional sediments shall be dredged by performing an additional "pass" with the equipment. If concentrations of primary COCs in subsurface sediments are below 120 percent of ~~background~~ post-remedial dredge area concentrations, then the dredging is sufficient and may stop. ~~A sand cover cap will be placed on the sediment surface, if necessary. If no sample can be collected because the~~

~~equipment cannot penetrate a hard substrate, than this area shall be evaluated to determine whether sand cover is required.~~

b. ~~c.~~ ***Under-Pier Remedial Areas***. ~~The Dischargers may propose alternatives to dredging under pier areas~~ The sediments in the under pier areas shown on Attachments 3 and 4 and other locations where significant impacts to infrastructure ~~(e.g., piers, wharves and bulkheads) are likely~~ may occur shall be remediated by dredging, sand covering or other means.~~For these undredged areas, the Dischargers shall adjust remedial footprint to include an equivalent surface area of dredging outside of and in addition to the dredge areas. These additional areas shall be dredged to attain the background concentrations indicated in Directive A.2.a above.~~

c. ~~b.~~ ***~~Shipyard Sediment Site~~ Post Remedial Surface-Area Weighted Average Concentrations*.** The Shipyard Sediment Site as shown in Attachment 2 shall be remediated to attain the following post remedial surface-area weighted average concentrations ("SWACs"):

~~Constituent~~ **Primary COCs**	**Predicted Post-Remedial SWACs**
Copper	159 mg/kg
Mercury	~~0.67~~ 0.68 mg/kg
HPAHs[1]	~~2,300~~ 2,451 ~~u~~µg/kg
~~Total PCB Congeners~~PCBs[2]	194 ~~u~~µg/kg
Tributyltin	110 ~~u~~µg/kg

1. HPAHs = sum of 10 PAHs: Fluoranthene, Pyrene, Benz[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, indeno[1,2,3-c,d]pyrene, Dibenz[a,h]anthracene, Benzo[g,h,i]perylene.

2. PCBs = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

3. **MS4 Interim Mitigation Measures**. Immediately after adoption of the CAO, the City of San Diego San Diego Unified Port District within the tideland area shall take interim remedial actions, as necessary, to abate or correct the actual or potential effects of releases from the MS4 system that drains to outfall SW4. Interim remedial actions can occur concurrently with any phase of corrective action. Before taking interim remedial actions, the City and the Port District shall notify the San Diego Water Board of the proposed action and shall comply with any requirements that the San Diego Water Board sets.

~~o~~4. ~~3.~~ **MS4 Investigation and Mitigation Plan**. The City of San Diego ~~(City)~~ and the San Diego Unified Port District within the tideland area shall prepare and submit a municipal separate storm sewer system (MS4) Investigation and Mitigation Plan (Plan) within 90 days after adoption of the ~~Cleanup and Abatement Order~~CAO. The Plan shall be designed to identify, characterize, and mitigate pollutants and pollutant sources in the watershed that drains to the MS4 outfall SW-4 at the Shipyard Sediment Site and contain, at a minimum, the following information:

a. ***Site Conceptual Model***. The Plan shall contain a site conceptual model showing all of the current and former potential pollutant sources and pathways for pollutants to potentially enter the watershed that drains to the MS4 outfall SW-4.

b. ***Map***. A detailed map to scale showing the location and all elements of, and potential pollutant sources within, the MS4 system within the watershed that drains to the outfall SW-4.

c. ***Sampling and Analyses***. The Plan shall include sampling and analysis of the residual sediments within the MS4 system at key locations sufficient to characterize the sediments that will potentially be discharged to the Shipyard Sediment Site. The suite of chemical analyses must be adequate to identify the full range of site-specific waste constituents including, at a minimum, total PCB congeners, copper, mercury, lead, zinc, TPH, and HPAHs.

d. ***Sample Locations.*** At a minimum, samples must be collected within all catch basins and similar junctions where accessible, and at intervals ~~of~~adequate to detect potential sources and no greater than approximately 500 feet within the streets in the storm water infrastructure within the SW-4 watershed. In addition, samples must be collected at locations designed to assess contributions from potential pollutant sources such as businesses with industrial activities or other pollutant-generating activities within the current SW-4 watershed. The Plan shall identify the number and location of the proposed sampling locations~~.~~, and provide justification for the sampling intervals within the streets.

e. ***Sampling Protocols and Quality Assurance Project Plan (QAPP)***. The Plan shall include the planned sampling protocols and a Quality Assurance Project Plan (QAPP) to assure that all environmental data generated scientifically valid and of acceptable quality to meet the Plan's objectives.

f. ***Mitigation.*** The Plan shall include, at a minimum, the following mitigation activities:

1. Removal and characterization of residual sediments in the MS4 system.

2. Installation of structural treatment control best management practices (BMPs), where necessary and feasible, in the MS4 system to prevent or mitigate the entry of pollutants into the storm drains to the maximum extent practicable ~~practicable~~.

3. Maintenance of BMPs, as necessary, to prevent degradation of their performance.

g. ***Activity Completion Schedule***: The Plan shall include a reasonable schedule for completion of all activities and submission of a final MS4 Investigation and Mitigation Report described in DirectiveA.5.

5. ~~4.~~ **MS4 Investigation and Mitigation Implementation and Report**

a. ***Implementation.*** ~~Implementation~~The City of San Diego and the San Diego Unified Port District within the tideland area shall implement the MS4 Investigation and Mitigation Plan ~~shall begin no later than October 1, 2010. Where possible, all mitigation activities should begin immediately after adoption of the Cleanup and Abatement Order~~according to the Activity Completion Schedule described in Directive 4.g.

b. ***MS4 Investigation and Mitigation Report.*** The MS4 Investigation and Mitigation Report shall ~~be submitted no later than February 1, 2011. The Report shall~~ include the following:

1. Sampling protocols implemented.

2. Location, type, and number of samples shown on detailed site maps and tables.

3. Concentration and interpreted lateral extent of each constituent.

4. Mass of residual sediments removed from the MS4 system.

5. Interpretations regarding the potential for the pollutants within the MS4 system to contaminate or re-contaminate the Shipyard Sediment Site during or after the remedial activities.

6. Evaluation of the effectiveness of the mitigation activities implemented.

7. Recommendations for additional investigation and mitigation activities.

B. REMEDIAL ACTION PLAN AND IMPLEMENTATION

1. **Remedial Action Plan ~~(RAP)~~.** The Discharger~~(s)~~ shall prepare and submit a Remedial Action Plan (RAP) to the San Diego Water Board ~~within~~ no later than 90 days after adoption of the ~~Cleanup and Abatement Order.~~ CAO. The RAP shall be complete and contain the following information

~~a. **Implementation Activities**. A detailed description of all activities planned to implement the corrective actions necessary to attain all cleanup levels and comply with all the directives herein.~~

~~b. **Schedule**. A schedule detailing the sequence of events and time frame for each activity. The schedule shall comply with the activity durations indicated in Attachment 6.~~

~~c. **Short-Term Effectiveness Monitoring Activities**. A monitoring program as described in Directive C, Cleanup and Abatement Verification, to demonstrate the effectiveness of the RAP. The monitoring program shall be effective in determining compliance with the cleanup levels and in determining the success of the remedial action measures.~~

~~d. **Construction Quality Assurance Plan (CQAP)**. A Construction Quality Assurance Plan (CQAP), which describes activities to be taken during construction to ensure that the cleanup is meeting design specifications, the objectives of the cleanup, and the requirements set forth in the Section 401 Water Quality Certification. The CQAP will explain how short-term environmental monitoring activities will be conducted, the rationale for such activities, and how modifications to the construction procedures will be made, as necessary, in response to the results of such environmental monitoring.~~

a. *Introduction*. A brief description of the Shipyard Sediment Site and Site History.

b. *Selected Remedy*. A detailed description of all of the remedial activities selected to attain all cleanup levels in Directive A.2.

c. *Health and Safety Plan*. A Health and Safety Plan including employee training, protective equipment, medical surveillance requirements, standard operating procedures and contingency plans.

d. *Community Relations Plan.* A Community Relations Plan for informing the public about (i) activities related to the final remedial design, (ii) the schedule for the remedial action, (iii) the activities to be expected during construction and remediation, (iv) provisions for responding to emergency releases and spills during remediation, and (v) any potential inconveniences such as excess traffic and noise that may affect the community during the remedial action.

e. *Quality Assurance Project Plan.* A Quality Assurance Project plan (QAPP) shall be included describing the project objectives and organization, functional activities, and quality assurance/quality control protocols as they relate to the remedial action

f. *Sampling and Analysis Plan.* A Sampling and Analysis Plan defining (i) sample and data collection methods to be used for the project, (ii) a description of the media and parameters to be monitored or sampled during the remedial action, and (iii) a description of the analytical methods to be utilized and an appropriate reference for each.

g. *Wastes Generated*. A description of the plans for management, treatment, storage and disposal of all wastes generated by the remedial action.

h. *Pilot Testing.* The results of bench scale or pilot scale studies or other data collected to provide sizing and operations criteria to optimize the remedial design.

i. *Design Criteria Report.* A Design Criteria Report that defines in detail the technical parameters upon which the remedial design will be based. Specifically, the Design Criteria Report shall include the preliminary design assumptions and parameters, including (i) waste characterization; (ii) volume and types of each medium requiring removal or containment; (iii) removal or containment schemes and rates, (iv) required qualities of waste streams (i.e., input and output rates to stockpiles, influent and effluent qualities of any liquid waste streams such as dredge spoil return water, potential air emissions, and so forth): (v) performance standards; (v) compliance with applicable local, State and federal regulations; (vi) technical factors of importance to the design, construction, and implementation of the selected remedy including use of currently accepted environmental control measures, constructability of the design, and use of currently acceptable construction practices and techniques.

j. *Equipment, Services, and Utilities.* A list of any elements or components of the selected remedial action that will require custom fabrication or long lead time for procurement. The list shall state the basis for such need, and the recognized sources of such procurement.

k. *Regulatory Permits and Approvals*. A list of required federal, State and local permits or approvals to conduct the remedial action.

l. *Remediation Monitoring Plan*. A Remediation Monitoring Plan consisting of (i) water quality monitoring, (ii) sediment monitoring, and (iii) disposal monitoring consistent with Section 34.2 of the Technical Report. The water quality monitoring must be sufficient to demonstrate that implementation of the selected remedial activities do not result in violations of water quality standards outside the construction area. The sediment monitoring must be sufficient to confirm that the selected remedial activities have achieved target cleanup levels within the remedial footprint specified in Directive A.2 The disposal monitoring must be sufficient to adequately characterize the dredged sediments in order to identify appropriate disposal options.

m. *Site Map.* A site map showing the location of buildings, roads, property boundaries, remedial equipment locations and other information pertinent to the remedial action.

n. *Contingencies.* A description of any additional items necessary to complete the RAP.

o. *Remediation Schedule***.** A schedule detailing the sequence of events and time frame for each activity based on the shortest practicable time required to complete each activity. The initiation and completion of each activity must be no longer than the durations described in Attachment 5.

~~**2. Modify or Suspend Cleanup Activities.** The Discharger(s) shall modify or suspend cleanup activities when directed to do so by the San Diego Water Board.~~

2.~~3.~~ **RAP Implementation.** In the interest of promoting prompt cleanup, the Discharger may begin implementation of the RAP 60 calendar days after submittal to the ~~Regional~~San Diego Water Board, unless otherwise directed in writing by the ~~Regional~~San Diego Water Board. The Dischargers shall complete implementation of the RAP based on the schedule in the RAP. Before beginning RAP implementation activities, the Dischargers shall:

a. Notify the ~~Regional~~San Diego Water Board of its intention to begin cleanup; and

b. Comply with any conditions set by the ~~Regional~~San Diego Water Board, including mitigation of adverse consequences from cleanup activities.

c. The Dischargers shall modify or suspend cleanup activities when directed to do so by the San Diego Water Board.

C. CLEANUP AND ABATEMENT COMPLETION VERIFICATION

Final Cleanup and Abatement Completion Report. The Discharger~~(s)~~ shall submit a final Cleanup and Abatement Completion Report verifying completion of the ~~Remedial Action Plan (~~RAP~~)~~ activities for the Shipyard Sediment Site ~~by December 31, 2014~~within 90 days of completion of remediation. The report shall provide a demonstration, based on a sound technical analysis, that ~~alternative~~ sediment quality cleanup levels in ~~accordance with~~ Directive A.2 have been achieved.

D. POST REMEDIAL MONITORING

1. **Post Remedial Monitoring Plan**. The Discharger~~(s)~~ shall prepare and submit a Post Remedial Monitoring Plan to the ~~Regional~~San Diego Water Board ~~within~~no later than 90 days of adoption of this ~~Cleanup and Abatement Order~~CAO. The Post Remedial Monitoring Plan shall be designed to ~~confirm that the remediation was effective in reducing the pollutants in the sediment and~~ verify that the remaining pollutant concentrations ~~do~~in the sediments will not unreasonably affect San Diego Bay beneficial uses ~~and~~ . At a minimum the Post Remedial Monitoring Plan shall include the following elements:

   a. *Quality Assurance Project Plan.* A Quality Assurance Project plan (QAPP) describing the project objectives and organization, functional activities, and quality assurance/quality control protocols for the post remediation monitoring.

   b. *Sampling and Analysis Plan.* A Sampling and Analysis Plan defining (i) sample and data collection methods to be used for the post radiation monitoring, (ii) a description of the media and parameters to be monitored or sampled, and (iii) a

description of the analytical methods to be utilized and an appropriate reference for each.

c. ~~a.~~ ***Sediment Chemistry*****.** Site-wide post-remedial SWACs for the five primary ~~COPCs~~COCs (copper, mercury, TBT, PCBs, and HPAH) shall be confirmed through composite sampling of the entire Shipyard Sediment Site. Samples shall be collected at all 65 sampling stations used to develop Thiessen polygons and composited on a surface area weighted basis into 6 polygon groups as shown in Attachment ~~5.~~ 6.

1. To prepare the composite samples, the 65 station locations within the six polygon groups shall be sampled. The volume of the sample at each station shall be proportional to the area of the polygon the station represents. These samples shall be collected from the 0-2 cm depth interval. Two (2) grab samples shall be composited in the field at each station.

2. The ~~composite~~individual samples shall be ~~separated into six (6) pools and composited~~combined into six (6) composite samples representing the ~~areas noted above.~~six (6) polygon groups as shown in Attachment 6. Three (3) replicates shall be taken from each of these six (6) composite samples and analyzed for PCBs, copper, mercury, HPAHs, and TBT, and sediment conventional parameters (e.g., grain size, TOC, ammonia). ~~-~~See Attachment 7 for the required list of PCB and HPAH analytes.

3. The average concentration of each of the six (6) composites shall be calculated from the analytical results of the replicates for each COC. The average concentrations represent SWACs for each of the six (6) polygon groups.

4. The three replicate sub-samples of composite samples provide an estimate of variances in the compositing process. Sample material from the 65 station-specific composite samples shall be archived for potential future analysis.

5. The mean concentration for each of the six (6) composite groups shall be used to calculate Site-Wide SWACs for each COC.

6. ~~5.~~ SWAC trigger concentrations shall be used to evaluate whether ~~SWAC cleanup levels have been met, or~~Site-Wide SWACs exceed the Predicted Post-Remedial SWACs, and whether further action is needed. These concentrations represent the surface-area weighted average concentration expected after cleanup, accounting for the variability in measured concentrations throughout the area. If the Site-Wide SWAC after remediation is below the trigger concentration then remediation shall be considered successful. Exceedance of the trigger concentration shall result in further evaluation of the site-specific conditions to determine if the remedy was successful as detailed in Directive D.3. The trigger concentrations for the primary COCs are listed below.

Primary COCs	Trigger Concentrations
Copper	185 ~~-~~mg/kg
Mercury	0.78 ~~-~~mg/kg
HPAHs[1]	3~~.0 m~~,208 µg/kg
~~Total PCB Congeners~~PCBs[2]	253 ~~(~~µg/kg
~~TBT~~Tributyltin	156 µg/kg

1. HPAHs = sum of 6 PAHs: Fluoranthene, Perylene, Benzo[a]anthracene, Chrysene, Benzo[a]pyrene, and Dibenzo[a,h]anthracene.
2. PCBs = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

~~b.~~d. ***Bioaccumulation Testing.*** Nine (9) sediment samples shall undergo bioaccumulation testing using the 28-day ~~*macoma*~~*Macoma nasuta* test. The samples selected for bioaccumulation testing shall be from stations SW04, SW08, SW13, SW21, SW28, and NA06, NA11, NA12, and NA20. Tissue samples shall be analyzed for arsenic, cadmium, copper, lead, mercury, zinc, HPAHs, and PCBs. See Attachment 7 for the required list of PCB and HPAH analytes.

~~c.~~e. ***Sediment Chemistry for Benthic Exposure.*** Samples shall be collected for chemical ~~analysis~~ analyses at the following five station locations~~, all characterized as "Likely" impaired in the sediment triad analysis~~: SW04, SW13, SW22, SW23 and NA19. ~~No individual sample shall exceed the 60% LAETs or have an SS-MEQ value greater than 0.9, in order to protect benthic beneficial uses.~~. Sediments shall be analyzed for sediment conventional parameters (e.g., grain size, TOC, ammonia) and the following: arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, TBT, PCBs, and PAHs. See Attachment 7 for the required list of PCB and PAH analytes. Results from the chemical analyses shall be evaluated in accordance with the flow diagram in Attachment 8 to determine if further evaluation or action is necessary based on benthic effects indicators. SS-MEQ values shall be determined for each station and compared to the 0.9 SS-MEQ threshold. The sediment chemistry results shall be compared to the 60% LAET thresholds.

~~d.~~f. ***Sediment Toxicity.*** ~~Samples~~Sediment samples shall be collected for toxicity ~~testing~~analyses at the following five station locations~~, all characterized as "Likely" impaired in the sediment triad analysis~~: SW04, SW13, SW22, SW23, and NA19. ~~Amphipod and bivalve larval bioassays shall be performed on these samples~~ Two types of sediment toxicity tests shall be conducted in accordance with protocols recommended by the San Diego Water Board: (1) 10-day amphipod survival test using *Eohaustorius estuarius* exposed to whole sediment, and (2) 48-hour bivalve

larva development test using the mussel *Mytilus galloprovincialis* exposed to whole sediment at the sediment-water interface. Results from the toxicity analyses shall be evaluated in accordance with the flow diagram in Attachment 9 to determine if further evaluation or action is necessary based on benthic effects indicators.

~~e.~~g. ***Benthic Community Assessment.*** Samples shall be collected to evaluate benthic communities at five randomly selected stations within the remediation footprint, excluding stations NA19, SW04, SW13, SW22, and SW23, at years 3 and 4 following completion of remediation activities. The random samples shall be stratified to assure two to three samples are collected from each of the NASSCO and BAE Systems areas. The benthic community analyses shall consist of full taxonomic analyses at the lowest feasible taxa level. This sampling shall be conducted only to evaluate the development of the benthic community following remediation.

f.h. ~~***Schedule.*** The frequency of sediment sampling and analyses (chemical, physical, and~~ ***Schedule.*** Sampling and analyses for sediment chemistry and toxicity, and for bioaccumulation~~)~~ assessment shall occur at two and five years post-remediation ~~and, depending on the results at year five post-remediation, may~~. If the remedial goals described in Directive D.1.g.2 are not met, the sampling and analyses shall also occur at ten years post remediation. ~~A~~The Post Remedial Monitoring Plan shall include a schedule ~~shall be prepared~~ detailing the sequence of sampling events and time frame for each activity. The schedule shall also include the dates for submittal of the Post-Cleanup Monitoring annual progress reports and final report as detailed in Directive D.2. below.

~~g. ***Mass Removal Goals.*** The preliminary contaminant mass removal goals are set forth below. The progress on attainment of these goals shall be described.~~

~~**Preliminary Estimate of Contaminant Mass Permanently Removed from San Diego Bay**~~

~~Constituent of Concern~~	~~Estimated Mass Removed (Kg)~~	~~Estimated Percent Mass Removal~~
~~Total PCBs (as homologs)~~	~~370~~	~~59%~~
~~Mercury~~	~~239~~	~~29%~~
~~Copper~~	~~50,966~~	~~42%~~
~~HPAH~~	~~1,344~~	~~41%~~
~~TBT~~	~~95~~	~~60%~~

h. Exposure Reduction Goals. The exposure reduction goals of the remediation are set forth below. The progress on attainment of these goals shall be described:

1. Confirm remedial goals met at year 2

- Composite site-wide SWACs below the 95% UPLs identified in D.1. above; and
- Chemistry below SS-MEQ and 60% LAET thresholds; and
- Toxicity not significantly different from Phase 1 study reference conditions as defined in the Technical Report; and
- The average of stations sampled shows bioaccumulation levels below what was measured in the Shipyard Report (Exponent, 2003).

2. Confirm remedial goals are maintained at year 5

- Composite site-wide SWACs below the 95% UPLs identified in D.1. above; and
- Chemistry below SS-MEQ and 60% LAET thresholds; and
- Toxicity not significantly different from Phase 1 study reference conditions as defined in the Technical Report; and
- The average of stations sampled shows bioaccumulation levels continuing to decrease below what was measured in the Shipyard Report (Exponent, 2003).

3. Confirm remedial goals are maintained at year 10 (if goals were not met in year 5

- Composite site-wide SWACs below the 95% UPLs identified in D.1. above; and
- Chemistry below SS-MEQ and 60% LAET thresholds; and
- Toxicity not significantly different from Phase 1 study reference conditions as defined in the Technical Report; and
- The average of stations sampled shows bioaccumulation levels continuing to decrease below what was measured in the Shipyard Report (Exponent, 2003).

i. Interpretations and Conclusions. Interpretations and conclusions regarding the potential presence and chemical characteristics of any newly deposited sediment within the cleanup areas, and interpretations and conclusions regarding the health and recovery of the benthic communities

i.***Exposure Reduction Goals.*** The exposure reduction goals of the remediation are set forth below**Post Remedial Monitoring Plan Implementation.** The progress on attainment of these goals shall be described: Dischargers shall implement the Post Remedial Monitoring Plan in accordance with the schedule contained in the Post Remedial Monitoring Plan unless otherwise directed in writing by the San Diego Water Board. Before beginning sample collection activities, the Dischargers shall:

1. **Confirm remedial goals met at year 2**

Composite site-wide SWACs below the 95% UPLsNotify the San Diego Water Board in advance of the beginning of sample collection activities in accordance with Provision G.6.; and

Comply with any conditions set by the San Diego Water Board with respect to sample collection methods such as providing split samples.

Post Remedial Monitoring Reports. The Dischargers shall submit Post Remedial Monitoring Reports containing the following information:

An evaluation, interpretation and tabulation of monitoring data including interpretations and conclusions regarding the potential presence and chemical characteristics of any newly deposited sediment within the cleanup areas, and interpretations and conclusions regarding the health and recovery of the benthic communities.

a.The locations, type, and number of samples shall be identified in D.1. above; andand shown on a site map.

ChemistryAn analysis of whether or not the remedial goals described below have been attained:

Year 2 Remedial Goals

Composite site-wide SWACs below the Trigger Concentrations identified in D.6. above; and

b.Sediment chemistry below SS-MEQ and 60% LAET thresholds; and

c.Toxicity not significantly different from Phase 1 studyconditions at the reference conditions as definedstations described in Finding 17 and in the *Technical Report. for Cleanup and Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*; and

d.The average of stations sampled shows bioaccumulation levels below what was measured in the Shipyard Report (Exponent, 2003)the pre-remedial levels.

2.**Confirm remedial goals are maintained at year****Year 5 Remedial Goals**

e.Composite site-wide SWACs below the 95% UPLsTrigger Concentrations identified in D.16. above; and

f.ChemistrySediment chemistry below SS-MEQ and 60% LAET thresholds; and

g.Toxicity not significantly different from Phase 1 studyconditions at the reference conditions stations described in Finding 17 and as defined in the *Technical Report for Cleanup and Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*; and

h.The average of stations sampled shows bioaccumulation levels continuing to decrease below what was measured in the Shipyard Report (Exponent, 2003)the pre-remedial levels and equal to or below the Year 2 post-remedial monitoring sampling event levels.

3.**Confirm remedial goals are maintained at year 10 (if goals were not met in year 5**

i.Composite site-wide SWACs below the 95% UPLsTrigger Concentrations identified in D.1.c.6. above; and

j.ChemistrySediment chemistry below SS-MEQ and 60% LAET thresholds; and

k.Toxicity not significantly different from Phase 1 study reference conditions as at the reference stations described in Finding 17 and defined in the *Technical Report*; *for Cleanup* and *Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*; and

- The average of stations sampled shows bioaccumulation levels continuing to decrease below what was measured in the Shipyard Report (Exponent, 2003).

***Interpretations and Conclusions*.** Interpretations and conclusions regarding the potential presencethe pre-remedial levels and chemical characteristics of any newly deposited sediment within the cleanup areas, and interpretations and conclusions regardingequal to or below the health and recovery of the benthic communitiesYear 5 post-remedial monitoring sampling event levels.

2. **Post Remedial Monitoring Plan Implementation.** The Dischargers shall implement the Post Remedial Monitoring Plan in accordance with the schedule contained in the Post Remedial Monitoring Plan unless otherwise directed in writing by the San Diego Water Board. Before beginning sample collection activities, the Dischargers shall:

a. Notify the San Diego Water Board in advance of the beginning of sample collection activities in accordance with Provision G.6.; and

b. Comply with any conditions set by the San Diego Water Board with respect to sample collection methods such as providing split samples.

3. **Post Remedial Monitoring Reports.** The Dischargers shall submit Post Remedial Monitoring Reports containing the following information:

a. An evaluation, interpretation and tabulation of monitoring data including interpretations and conclusions regarding the potential presence and chemical characteristics of any newly deposited sediment within the cleanup areas, and interpretations and conclusions regarding the health and recovery of the benthic communities.

b. The locations, type, and number of samples shall be identified and shown on a site map.

c. An analysis of whether or not the remedial goals described below have been attained:

1. **Year 2 Remedial Goals**

- Composite site-wide SWACs below the Trigger Concentrations identified in D.6. above; and
- Sediment chemistry below SS-MEQ and 60%LAET thresholds; and
- Toxicity not significantly different from conditions at the reference stations described in Finding 17 and in the *Technical Report. for Cleanup and Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*; and
- The average of stations sampled shows bioaccumulation levels below the pre-remedial levels.

2. **Year 5 Remedial Goals**

- Composite site-wide SWACs below the Trigger Concentrations identified in D.6. above; and
- Sediment chemistry below SS-MEQ and 60%LAET thresholds; and
- Toxicity not significantly different from conditions at the reference stations described in Finding 17 and as defined in the *Technical Report for Cleanup and Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*; and

- The average of stations sampled shows bioaccumulation levels continuing to decrease below the pre-remedial levels and equal to or below the Year 2 post-remedial monitoring sampling event levels.

3. **Confirm remedial goals are maintained at year 10 (if goals were not met in year 5**

- Composite site-wide SWACs below the Trigger Concentrations identified in D.1.c.6. above; and

- Sediment chemistry below SS-MEQ and 60%LAET thresholds; and

- Toxicity not significantly different from conditions at the reference stations described in Finding 17 and defined in the *Technical Report for Cleanup and Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*; and

- The average of stations sampled shows bioaccumulation levels below the pre-remedial levels and equal to or below the Year 5 post-remedial monitoring sampling event levels.

~~2.~~4. **Trigger Exceedance Investigation and Characterization.** ~~-~~Post remediation monitoring may indicate exceedance of one or more of the post-remediation Site-Wide SWAC trigger concentrations. In that event the Dischargers shall ~~investigate and characterize~~conduct a Trigger Exceedance Investigation and Characterization study to determine the cause(s) of the exceedance. There are several lines of investigation that may be pursued, individually or in combination, depending upon the scope and scale of the exceedance(s) and site-specific conditions. The following approaches may be considered and implemented for the investigation and characterization effort:

a. Recalculation of the 95% UCL incorporating more recent sampling data (e.g. the dredge performance monitoring data, pre-remediation monitoring data from July, 2009, the most recent post remediation verification monitoring data etc.).

b. Identification of the specific subarea(s) that caused the excursion(s) using surrounding post remediation monitoring data and historical data as appropriate.

c. Evaluation of changes in site conditions as a result of disturbances since the previous sampling event from spills, major storm events, construction activities, newly discovered pollutant sources or other causes.

d. Analysis of the archived samples used to comprise the composite sample for the specific ~~CPOC~~COC(s) exceeding the 95% UCL as a basis to understand which polygons have higher concentrations than expected. The data from this analysis could be used as a basis for spatial weighting of the data before recalculating 95% UCLs using interpolation methods such as inverse distance weighting.

~~3.~~5. **Trigger Exceedance Investigation and Characterization Report.** The Dischargers shall prepare and submit an adequate Trigger Exceedance Investigation and Characterization Report describing the final results of the investigation and characterization study to the ~~Regional~~San Diego Water Board. If the exceedances are found to be significant, the Report shall include a recommended approach, or combination of approaches, for addressing the exceedance(s) by additional sampling of the affected area, re-dredging, natural recovery, reanalysis following the next scheduled monitoring event, or other appropriate methods. The Report shall be due within 90 days of discovery of the exceedance or as otherwise directed by the San Diego Water Board.

E. QUARTERLY PROGRESS REPORTS

Quarterly Progress Reports. The Dischargers shall prepare and provide written quarterly progress reports which: (1) describe the actions which have been taken toward achieving compliance with this ~~Cleanup and Abatement Order~~CAO during the previous quarter; (2) include all results of sampling, tests, and all other verified or validated data received or generated by or on behalf of the Dischargers during the previous quarter in the implementation of the remedial actions required by this ~~Cleanup and Abatement Order~~CAO; (3) describe all activities including, data collection and other field activities which are scheduled for the next two quarters and provide other information relating to the progress of work, including, but not limited to, a graphical depiction of the progress of the remedial actions; (4) identify any modifications to the Remedial Action Plan or other work plan(s) that the Dischargers proposed to the San Diego Water Board or that have been approved by San Diego Water Board during the previous quarter; and (5) include information regarding all delays encountered or anticipated that may affect the future schedule for completion of the remedial actions required , and a description of all efforts made to mitigate those delays or anticipated delays. These progress reports shall be submitted to the San Diego Water Board by the (15th) day of March, June, September, and December of each year following the effective date of this ~~Cleanup and Abatement Order~~CAO. Submission of these progress reports shall continue until submittal of the final Cleanup and Abatement Completion Report verifying completion of the Remedial Action Plan (RAP) for the Shipyard Sediment Site (see Directive C).

~~F. San Diego Water Board Concurrence.~~ NO FURTHER ACTION

Upon ~~concurrence with the findings~~ approval by the San Diego Water Board of the Final Cleanup and Abatement Completion Report (Directive C.~~1~~) and the Post Remedial Monitoring Reports (Directive D.~~2) that~~ 3) remedial actions and monitoring ~~are~~will be complete and ~~that~~ compliance with this ~~Cleanup and Abatement Order is~~CAO will be achieved~~,~~. At that time the San Diego Water Board will inform the Discharger~~(~~s~~)~~ and other interested persons in writing that, based on available information, no further remedial work is required ~~at this time, based on available information. This written notice shall constitute San Diego Water Board concurrence with the completed remedial actions~~.

G. PROVISIONS

1. **Cost Recovery**. The Discharger~~(s)~~ shall reimburse the State of California for all reasonable costs actually incurred by the San Diego Water Board to investigate, oversee, and monitor cleanup and abatement actions required by this ~~Cleanup and Abatement Order,~~CAO, including the cost to prepare CEQA documents according to billing statements prepared from time to time by the State Water Board. If the Discharger~~(s) is~~s are enrolled in a reimbursement program managed by the State Water Board for the discharge addressed by this ~~Cleanup and Abatement Order~~CAO, reimbursement shall be made pursuant to the procedures established in that program.

2. **Waste Management**. The Discharger~~(s)~~ shall properly manage, store, treat, and dispose of contaminated soils and ground water in accordance with applicable federal, state, and local laws and regulations. The storage, handling, treatment, or disposal of contaminated marine sediment and associated waste shall not create conditions of pollution, contamination or nuisance as defined in Water Code section 13050. The Discharger~~(s)~~ shall, as required by the San Diego Water Board, obtain, or apply for coverage under, waste discharge requirements or a conditional waiver of waste discharge requirements for the removal of waste from the immediate place of release and discharge of the waste to (a) land for treatment, storage, or disposal or (b) waters of the state. No waste discharge requirements or conditional waiver of waste discharge requirements shall be required for disposal of marine sediment and associated waste in a landfill regulated under existing waste discharge requirements.

3. **Request to Provide Information**. The Discharger~~(s)~~ may present characterization data, preliminary interpretations and conclusions as they become available, rather than waiting until a final report is prepared. This type of on-going reporting can facilitate a consensus being reached between the Discharger~~(s)~~ and the San Diego Water Board and may result in overall reduction of the time necessary for regulatory approval.

~~H.~~ **4. Waste Constituent Analysis**. Unless otherwise permitted by the San Diego Water Board, all analyses shall be conducted at a laboratory certified for such analyses by the State Department of Health Services. Specific methods of analysis must be identified. If the Discharger~~(s) proposes~~s propose to use methods or test procedures other than those included in the most current version of "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846" (U.S. Environmental Protection Agency) or 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants; Procedures for Detection and Quantification", the exact methodology must be submitted for review and must be approved by the San Diego Water Board prior to use. The director of the laboratory whose name appears on the certification shall supervise all analytical work in his/her laboratory and shall sign all reports submitted to the San Diego Water Board.

Any report presenting new analytical data is required to include the complete Laboratory Analytical Report(s). The Laboratory Analytical Report(s) must be signed by the laboratory director and contain:

- A complete sample analytical report.

- **A complete laboratory quality assurance/quality control (QA/QC) report.**
- **A discussion of the sample and QA/QC data.**
- **A transmittal letter that must indicate whether or not all the analytical work was supervised by the director of the laboratory, and contain the following statement, "All analyses were conducted at a laboratory certified for such analyses by the California Department of Health Services in accordance with current USEPA procedures."**

~~1.~~5. **Duty to Operate and Maintain**. The Discharger~~(s)~~ shall, at all times, properly operate and maintain all facilities and systems of treatment, control, storage, disposal and monitoring (and related appurtenances) which are installed or used by the Discharger~~(s)~~ to achieve compliance with this ~~Cleanup and Abatement Order~~CAO. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities, which are installed by the Discharger~~(s)~~ only when the operation is necessary to achieve compliance the conditions of this ~~Cleanup and Abatement Order~~CAO.

~~2.~~6. **Field Work Notice**. The Discharger~~(s)~~ shall give the San Diego Water Board at least fourteen (14) days advance notice of all field work or field activities to be performed by the Discharger~~(s)~~ pursuant to this ~~Cleanup and Abatement Order~~CAO; provided, however, that in a given instance, if it is impossible for the Discharger~~(s)~~ to provide such notice, the Discharger~~(s)~~ shall provide notice to the San Diego Water Board of all such field work or activities as far in advance of such work as is possible. In any event, any notification pursuant to this Provision shall be given at least twenty-four (24) hours prior to the given field activities, unless the San Diego Water Board agrees otherwise.

~~3.~~7. **Duty to Use Registered Professionals**. The Discharger~~(s)~~ shall provide documentation that plans and reports required under this ~~Cleanup and Abatement Order~~CAO are prepared under the direction of appropriately qualified professionals. California Business and Professions Code sections 6735, 7835 and 7835.1 require that engineering and geologic evaluations and judgments be performed by or under the direction of registered professionals. A statement of qualifications and registration numbers of the responsible lead professionals shall be included in all plans and reports submitted by the Discharger~~(s)~~. The lead professional shall sign and affix their registration stamp to the report, plan or document.

~~4.~~8. **Corporate Signatory Requirements**. All reports required under this Order shall be signed and certified by a responsible corporate officer~~(s)~~ of the Discharger~~(s)~~ described in paragraph 5.a. of this provision or by a duly authorized representative of that person as described in paragraph 5.b.of this provision.

a. ***Responsible Corporate Officer(s).*** For the purposes of this provision, a responsible corporate officer means: (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy - or decision-making functions for the

corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

b. ***Duly Authorized Representative***. A person is a duly authorized representative only if

1. The authorization is made in writing by a person described in paragraph (a) of this provision;

2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

3. The written authorization is submitted to the San Diego Water Board.

c. ***Changes to Authorization***. If an authorization under paragraph (b) of this provision is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph (b) of this provision must be submitted to the San Diego Water Board prior to or together with any reports or information to be signed by an authorized representative.

d. ***Certification Statement***. Any person signing a document under paragraph a. or b. of this provision shall make the following certification:

”I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

~~5.~~9.**Duty to Submit Other Information**. When the Discharger~~(s) becomes~~s become aware that it failed to submit any relevant facts in any report required under this ~~Cleanup and~~

~~Abatement Order~~CAO, or submitted incorrect information in any such report, the Discharger~~(s)~~ shall promptly submit such facts or information to the San Diego Water Board.

~~6.~~10. **Electronic and Paper Media Reporting Requirements**. The Discharger~~(s)~~ shall submit both electronic and paper copies of all reports required under this ~~Cleanup and Abatement Order~~CAO including work plans, technical reports, and monitoring reports.

~~7.~~11. **Report Submittals**. All monitoring and technical reports required under this ~~Cleanup and Abatement Order~~CAO shall be submitted to

Executive Officer
California Regional Water Quality Control Board
San Diego Region
9174 Sky Park Court, Suite 100
San Diego, CA 92123-4340

~~8. **Identify Documents Using Code Number**. In order to assist the San Diego Water Board in the processing of correspondence and reports submitted in compliance with this Cleanup and Abatement Order, the Discharger(s) shall include the following code number in the header or subject line portion of all correspondence or reports submitted to the San Diego Water Board:~~

~~For all correspondences: Shipyards CAO: 03-0284.05~~
~~For all reports: Shipyards CAO: 03-0284.051~~

~~11.~~12. **Amendment.** This ~~Cleanup and Abatement Order~~CAO in no way limits the authority of this San Diego Water Board to institute additional enforcement actions or to require additional investigation and cleanup consistent with the California Water Code. This ~~Cleanup and Abatement Order~~CAO may be revised by the San Diego Water Board as additional information becomes available.

~~12.~~13. **Time Extensions.** If, for any reason, the Dischargers are unable to perform any activity or submit any documentation in compliance with requirements in this ~~Cleanup and Abatement Order~~CAO, including the RAP, or in compliance with associated implementation schedules, including the RAP implementation schedule, the Dischargers may request, in writing, an extension of time. The written extension request shall include justification for the delay and shall be received by the San Diego Water Board reasonably (but not less than 15 calendar days) in advance of the deadline sought to be extended. An extension may be granted for good cause, in which case this ~~Cleanup and Abatement Order~~CAO will be accordingly amended.

~~13.~~14. **Community Relations.** The Dischargers shall cooperate with the San Diego Water Board in providing information regarding the remediation of the Shipyard Sediment Site to the public. If requested by the San Diego Water Board, the Discharger~~(s)~~ shall participate in the preparation of such information for distribution to the public and in public meetings which may be held or sponsored by the San Diego Water Board to explain activities at or relating to the Shipyard Sediment Site.

~~I.~~ H. NOTIFICATIONS

1. **Enforcement Discretion**. The San Diego Water Board reserves its right to take any enforcement action authorized by law for violations of the terms and conditions of this ~~Cleanup and Abatement Order~~CAO.

2. **Enforcement Notification**. The Porter-Cologne Water Quality Control Act commencing with Chapter 5, Enforcement and Implementation, section 13308, provides that if there is a threatened or continuing violation of a ~~cleanup and abatement order~~CAO, the San Diego Water Board may issue a Time Schedule Order prescribing a civil penalty in an amount not to exceed $10,000 per day for each day compliance is not achieved in accordance with that time schedule. Section 13350 provides that any person may be assessed administrative civil liability by the San Diego Water Board for violating a ~~cleanup and abatement order~~CAO in an amount not to exceed $5,000 for each day the violation occurs, or on a per gallon basis, not to exceed $10 for each gallon of waste discharged. Alternatively the court may impose civil liability in an amount not to exceed $15,000 for each day the violation occurs, or on a per gallon basis, not to exceed $20 for each gallon of waste discharged. Section 13385 provides that any person may be assessed administrative civil liability by the San Diego Water Board for violating a ~~cleanup and abatement order~~CAO for an activity subject to regulation under Division 7, Chapter 5.5 of the Water Code, in an amount not to exceed the sum of both of the following: (1) $10,000 for each day in which the violation occurs; and (2) where there is a discharge, any portion of which is not susceptible to cleanup or is not cleaned up, and the volume discharged but not cleaned up exceeds 1,000 gallons, an additional liability not to exceed $10 multiplied by the number of gallons by which the volume discharged but not cleaned up exceeds 1,000 gallons. Alternatively the civil liability may be imposed by the court in an amount not to exceed the sum of both of the following: (1) $25,000 for each day in which the violation occurs; and (2) where there is a discharge, any portion of which is not susceptible to cleanup or is not cleaned up, and the volume discharged but not cleaned up exceeds 1,000 gallons, an additional liability not to exceed $25 multiplied by the number of gallons by which the volume discharged but not cleaned up exceeds 1,000 gallons.

I, David W. Gibson, Executive Officer, do hereby certify the forgoing is a full, true, and correct copy of a ~~Cleanup and Abatement Order~~CAO issued on ***[Insert Date].***

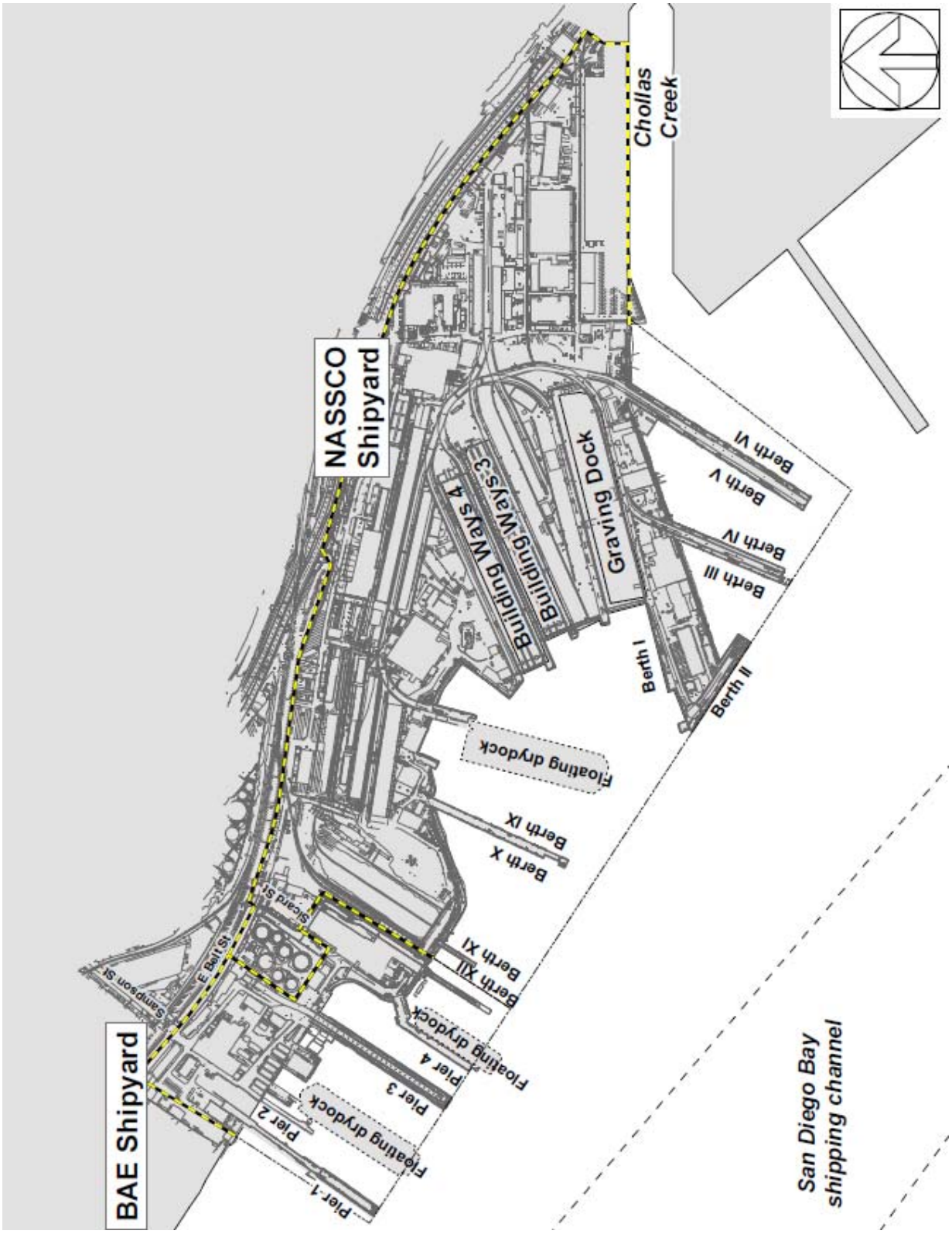
_____

David W. Gibson

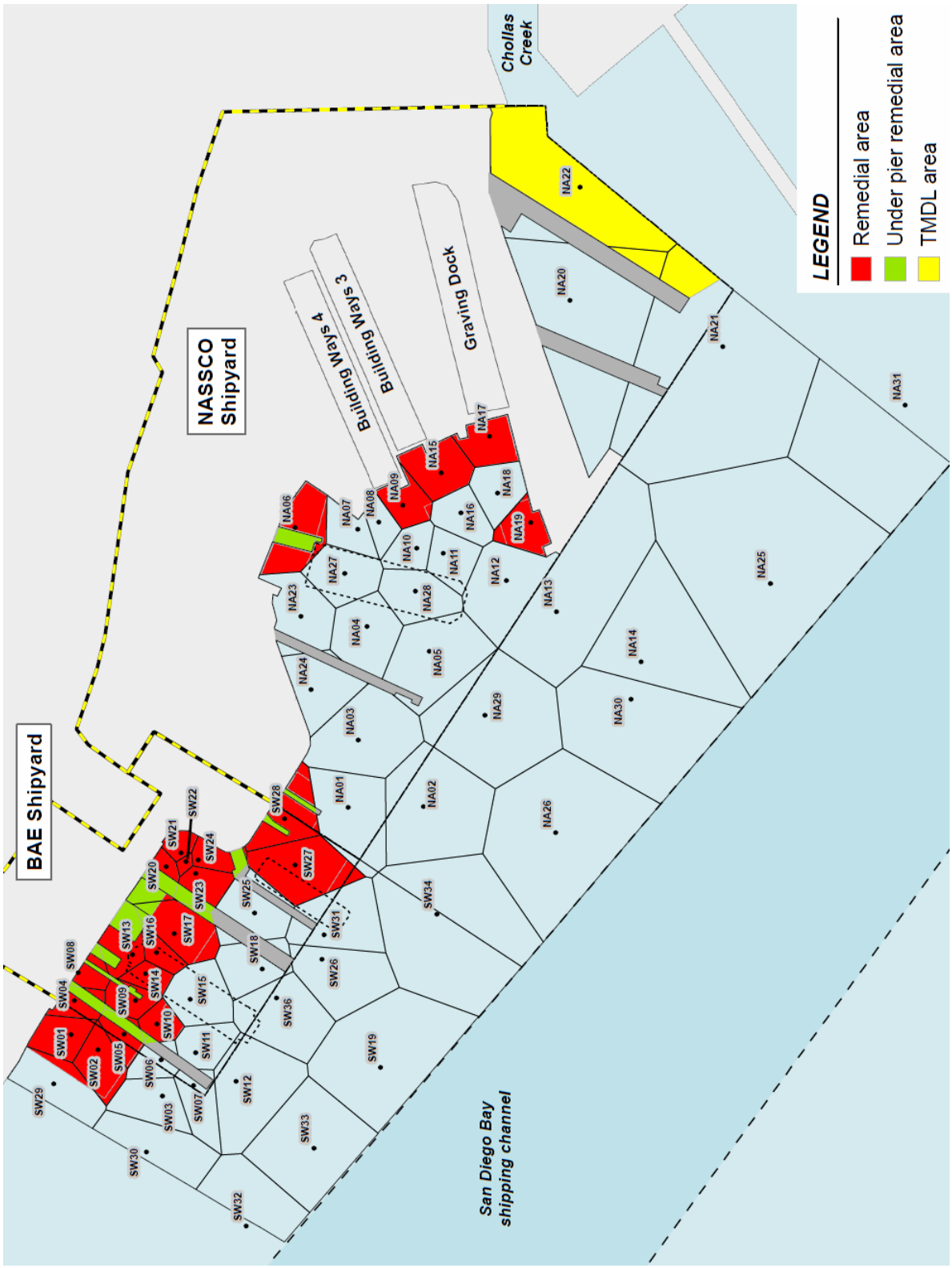
Executive Officer

Attachment 1. ~~Map of~~ Shipyard Sediment ~~Site~~

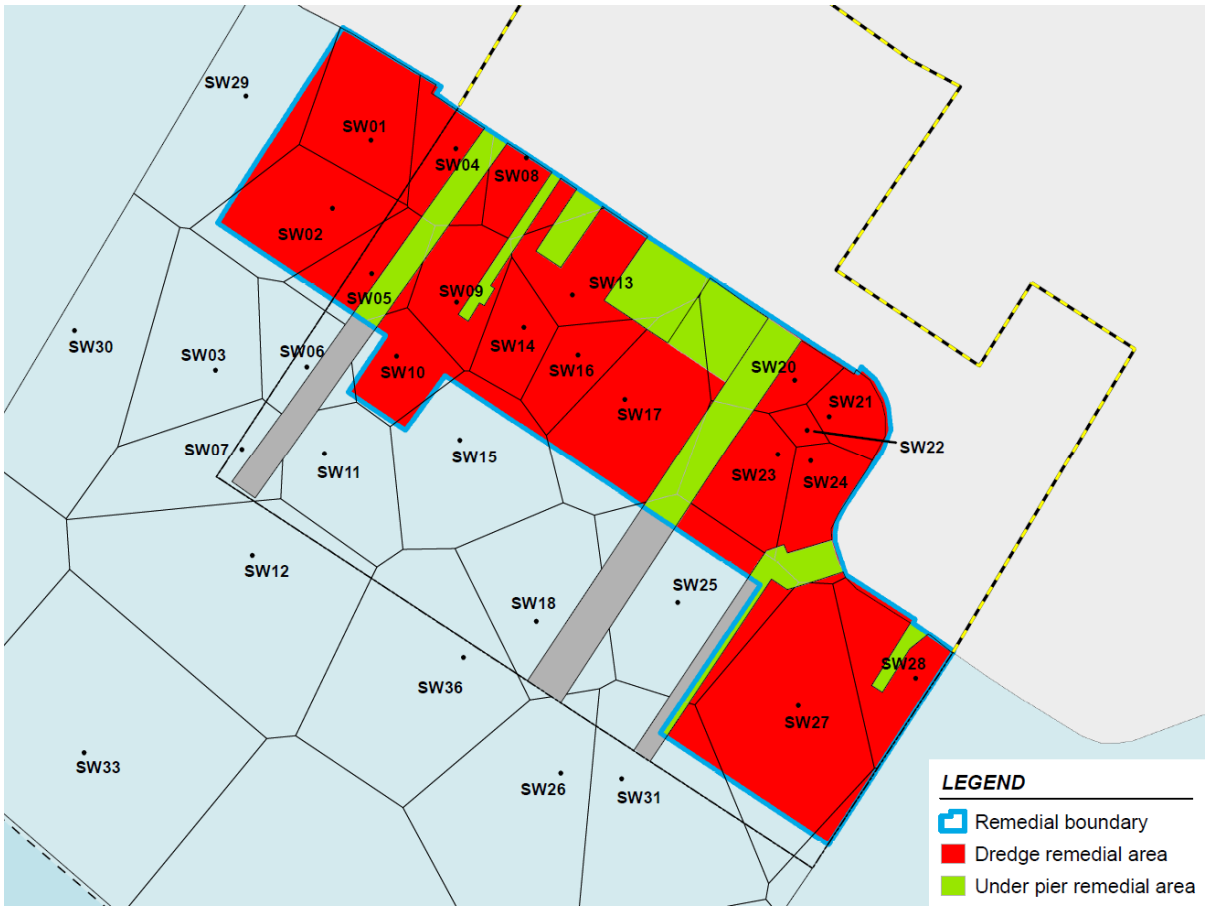
Area



Attachment 2. ~~**Map of Shipyard Sediment Site Optimized Remedial Footprint to Achieve Goals**~~**Polygons Targeted** **for** ~~**Protection of Beneficial Uses**~~**Remediation**

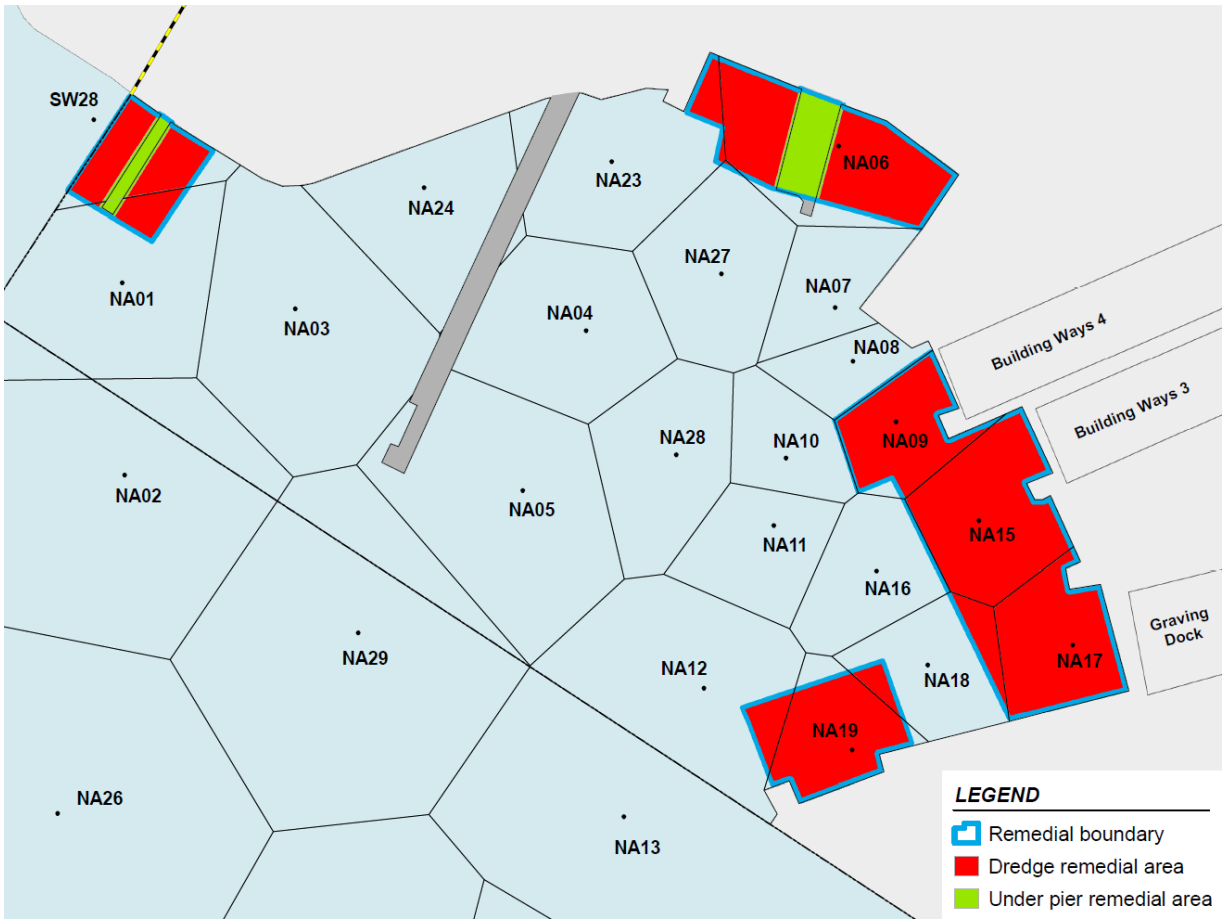


Attachment 3. Remedial Footprint Based on Sediment Management Units for BAE Shipyard



Remedial Site (North)	
Dredge remedial Area (ft^2)	~~444,032~~ 438,300
Under pier remedial area (ft^2)	~~88,477~~ 89,980
Total Remedial Area (ft^2)	~~532,509~~ 528,295
Dredge Volume (yd^3)	~~87,835~~ 90,800
Note: Presumed remedy within the remedial boundary is dredging, except for under pier remedial areas.	

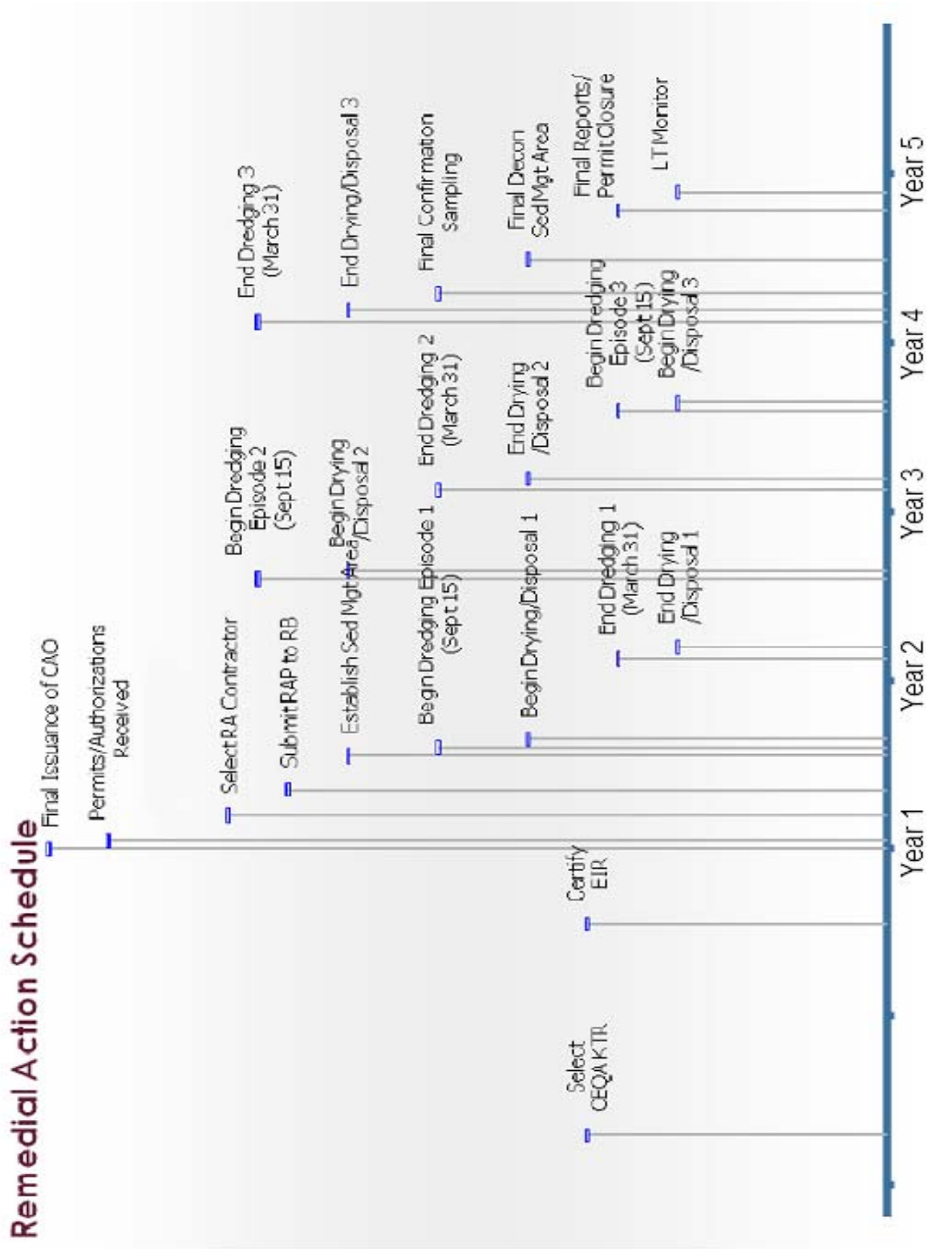
Attachment 4. Remedial Footprint Based on Sediment Management Units for NASSCO Shipyard

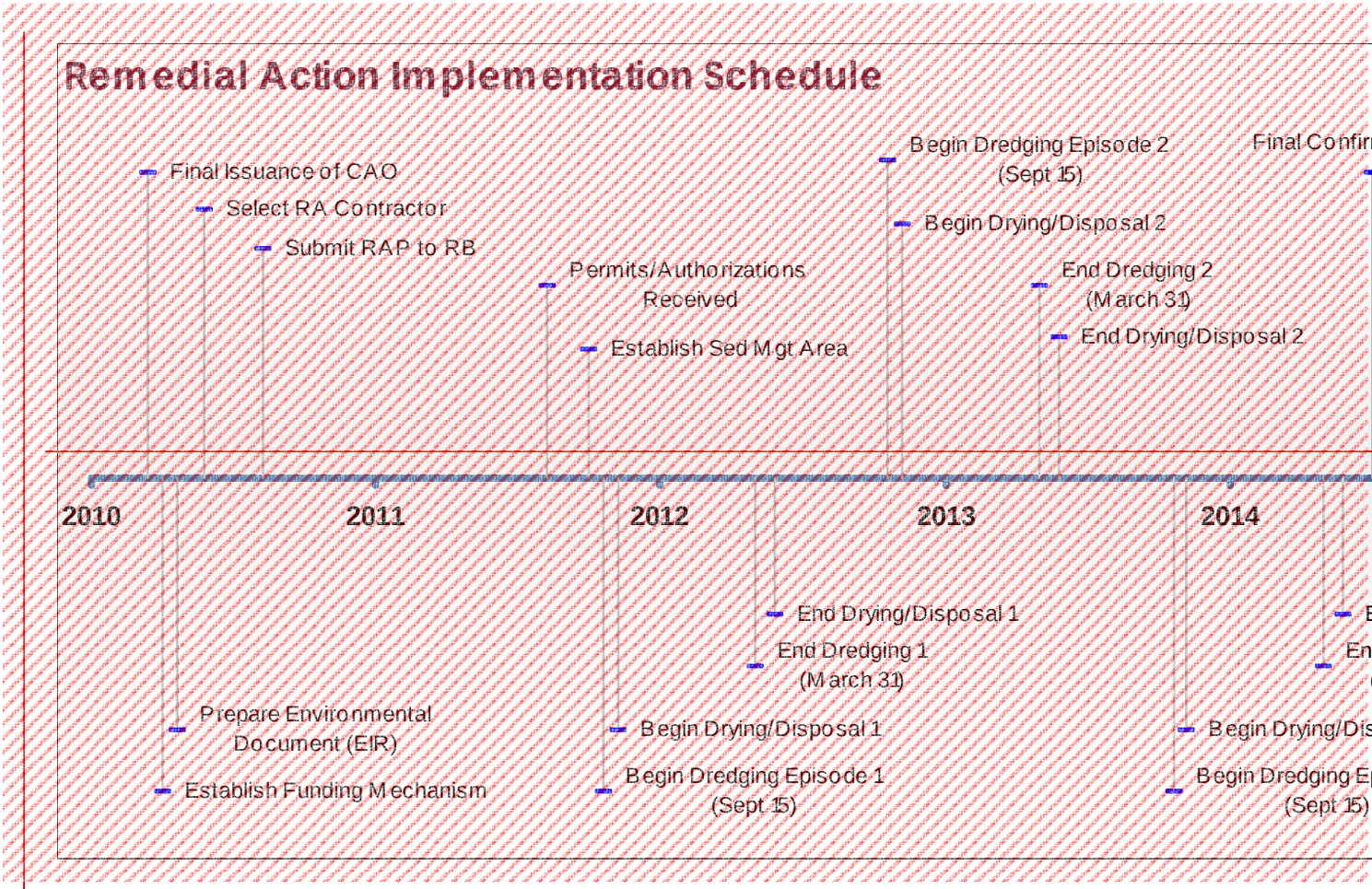


Remedial Site (South)	
Dredge remedial Area (ft^2)	217,800
Under pier remedial area (ft^2)	13,725
Total Remedial Area (ft^2)	~~231,525~~ 231,495
Volume (yd^3)	~~53,000~~ 52,600
TMDL area (ft^2)	218,060

Note: Presumed remedy within the remedial boundary is dredging, except for under pier remedial areas.

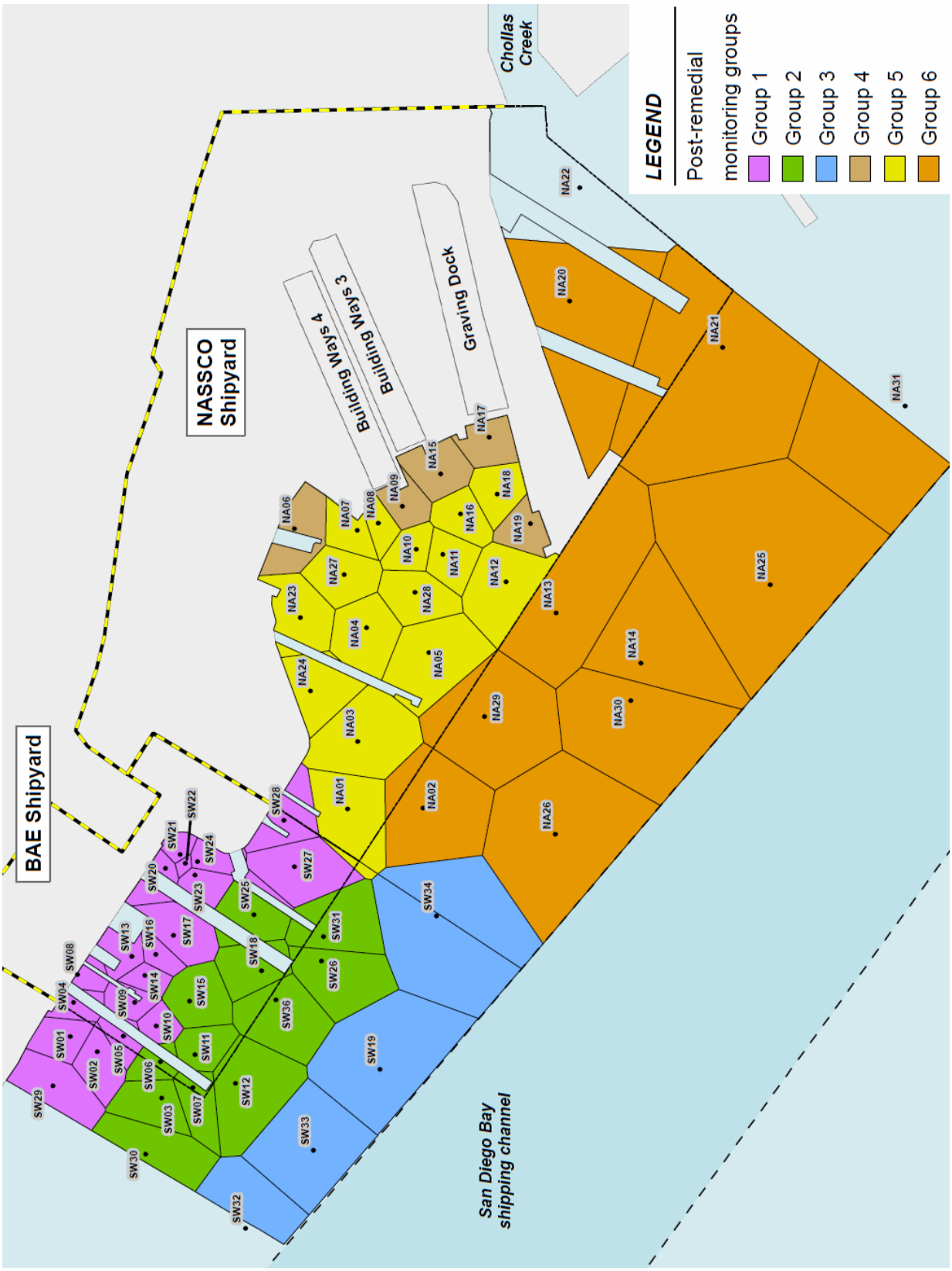
Attachment 5. **Remedial Action Implementation Schedule**





~~Attachment 6. Remedial Action Implementation Schedule~~

Attachment 6. Composite Sampling Area for Post-Remedial Monitoring



Attachment 7. Summed list of PCB and PAH analytes measured in bulk sediments.

PAH	Identifier	PAH	Identifier
Naphthalene	C0N	Pyrene	PYR
C1-Naphthalenes	C1N	C1-Fluoranthenes/pyrenes	C1F/P
C2-Naphthalenes	C2N	C2-Fluoranthenes/pyrenes	C2F/P
C3-Naphthalenes	C3N	C3-Fluoranthenes/pyrenes	C3F/P
C4-Naphthalenes	C4N	Benzo[a]anthracene	BAA
Acenaphthylene	ACEY	Chrysene	C0C
Acenaphthene	ACE	C1-Chrysenes	C1C
Biphenyl	BIP	C2-Chrysenes	C2C
Fluorene	C0F	C3-Chrysenes	C3C
C1-Fluorenes	C1F	C4-Chrysenes	C4C
C2-Fluorenes	C2F	Benzo[b]fluoranthene	BBF
C3-Fluorenes	C3F	Benzo[k]fluoranthene	BKF
Anthracene	C0A	Benzo[e]pyrene	BEP
Phenanthrene	C0P	Benzo[a]pyrene	BAP
C1-Phenanthrenes/anthracenes	C1P/A	Perylene	PER
C2-Phenanthrenes/anthracenes	C2P/A	Indeno[1,2,3,-c,d]pyrene	INDENO
C3-Phenanthrenes/anthracenes	C3P/A	Dibenzo[a,h]anthracene	DAH
C4-Phenanthrenes/anthracenes	C4P/A	Benzo[g,h,i]perylene	BGP
Dibenzothiophene	C0D	Total PAH[1]	TPAH
C1-Dibenzothiophenes	C1D	Priority Pollutant PAH[2]	PPPAH
C2-Dibenzothiophenes	C2D	Low Molecular Weight PAH[3]	LMWPAH
C3-Dibenzothiophenes	C3D	High Molecular Weight PAH[4]	HMWPAH
Fluoranthene	FLANT		

SCCWRP and U.S. Navy, 2005b

[1]Total PAH = sum of all listed PAH analytes

[2]Priority pollutant PAH = sum of C0N, ACEY, ACE, C0F, C0A, C0P, FLANT, PYR, BAA, C0C, BBF, BKF, BAP, INDENO, DAH, BGP

[3]Low Molecular Weight PAH = sum of C0N, C2N, ACEY, ACE, C0F, C0A, C0P

[4]High Molecular Weight PAH = sum of FLANT, PYR, BAA, C0C, BAP, DAH

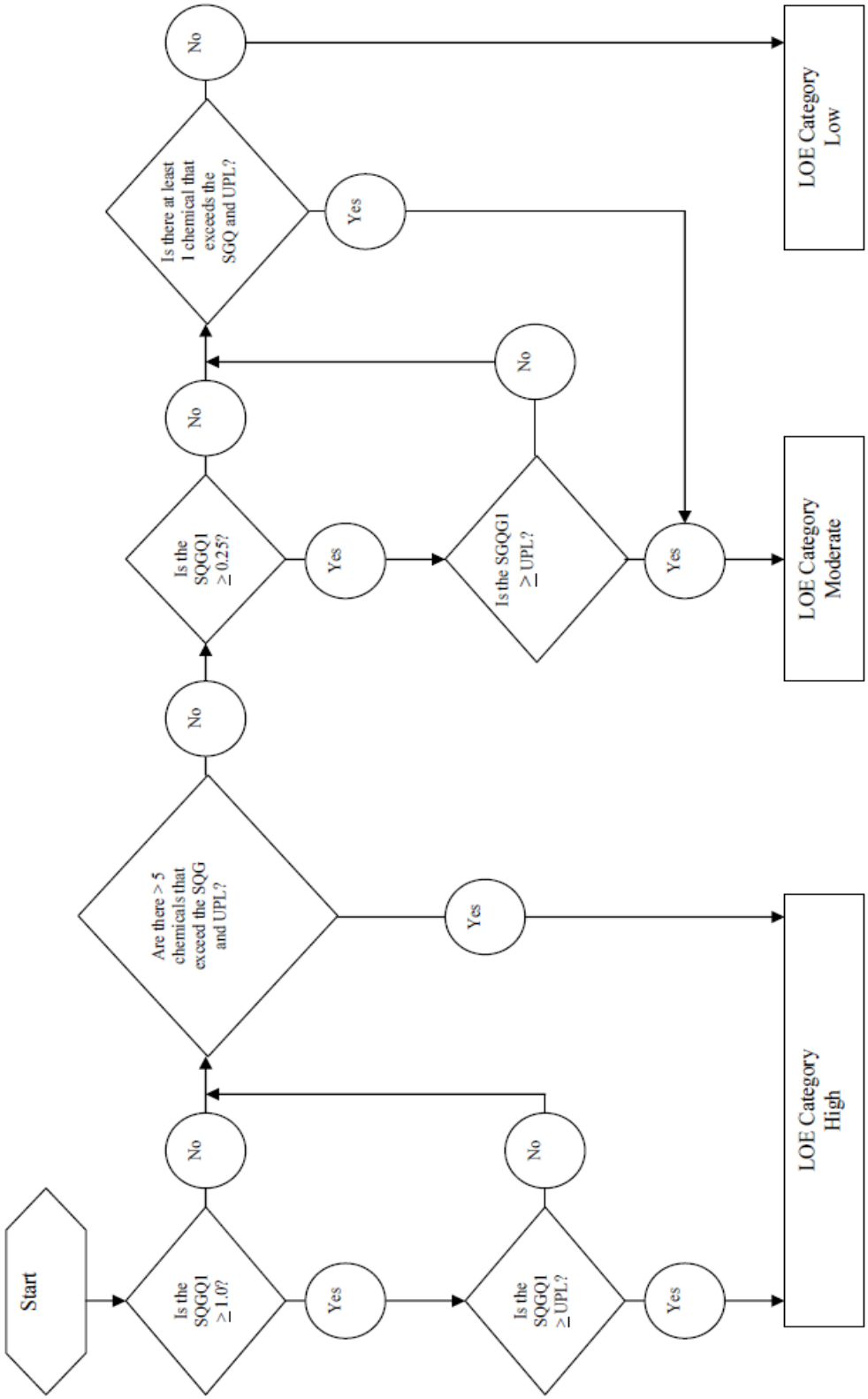
Attachment 7 (continued). Summed list of PCB and PAH analytes measured in bulk sediments.

PCB Congener	Congener Number	PCB Congener	Congener Number
2,2',5-Trichlorobiphenyl (Cl3)	18	2,2',3,3',4,4'-Hexachlorobiphenyl (Cl6)	128
2,4,4'-Trichlorobiphenyl (Cl3)	28	2,2',3,4,4',5'-Hexachlorobiphenyl (Cl6)	138
3,4,4'-Trichlorobiphenyl (Cl3)	37	2,2',3,4',5',6-Hexachlorobiphenyl (Cl6)	149
2,2',3,5'-Tetrachlorobiphenyl (Cl4)	44	2,2',3,5,5',6-Hexachlorobiphenyl (Cl6)	151
2,4,4',5'-Tetrachlorobiphenyl (Cl4)	49	2,2',4,4',5,5'-Hexachlorobiphenyl (Cl6)	153
2,2',5,5'-Tetrachlorobiphenyl (Cl4)	52	2,3,3',4,4',5-Hexachlorobiphenyl (Cl6)	156
2,3',4,4'-Tetrachlorobiphenyl (Cl4)	66	2,3,3',4,4',5'-Hexachlorobiphenyl (Cl6)	157
2,3',4',5 - Tetrachlorobiphenyl (Cl4)	70	2,3,3',4,4',6-Hexachlorobiphenyl (Cl6)	158
2,4,4',5 -Tetrachlorobiphenyl (Cl4)	74	2,3',4,4',5,5'-Hexachlorobiphenyl (Cl6)	167
3,4,4',5 -Tetrachlorobiphenyl (Cl4)	81	2,3',4,4',5',6-Hexachlorobiphenyl (Cl6)	168
3,3',4,4'-Tetrachlorobiphenyl (Cl4)	77	3,3',4,4',5,5'-Hexachlorobiphenyl (Cl6)	169
2,2'3,4,5'-Pentachlorobiphenyl (Cl5)	87	2,2',3,3',4,4',5-Heptachlorobiphenyl (Cl7)	170
2,2',4,4',5-Pentachlorobiphenyl (Cl5)	99	2,2',3,3',4,5',6'-Heptachlorobiphenyl (Cl7)	177
2,2',4,5,5'-Pentachlorobiphenyl (Cl5)	101	2,2',3,4,4',5,5'-Heptachlorobiphenyl (Cl7)	180
2,3,3',4,4'-Pentachlorobiphenyl (Cl5)	105	2,2',3,4,4',5',6-Heptachlorobiphenyl (Cl7)	183
2,3,3',4',6-Pentachlorobiphenyl (Cl5)	110	2,2',3,4',5,5',6-Heptachlorobiphenyl (Cl7)	187
2,3,4,4',5-Pentachlorobiphenyl (Cl5)	114	2,3,3',4,4',5,5'-Heptachlorobiphenyl (Cl7)	189
2,3',4,4',5-Pentachlorobiphenyl (Cl5)	118	2,2',3,3',4,4',5,5'-Octachlorobiphenyl (Cl8)	194
2,3',4,4',6-Pentachlorobiphenyl (Cl5)	119	2,2',3,3',4,5',6,6'-Octachlorobiphenyl (Cl8)	201
2,3',4,4',5'-Pentachlorobiphenyl (Cl5)	123	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (Cl9)	206
3,3',4,4',5-Pentachlorobiphenyl (Cl5)	126	Total PCB[1]	TPCB

SCCWRP and U.S. Navy, 2005b

[1]Total PCB = sum of all listed PCB congeners.

Attachment 8. Flow Diagram for the Sediment Chemistry Ranking Criteria (Low, Moderate, and High)



Attachment 9. Flow Diagram for the Toxicity Ranking Criteria (Low, Moderate, and High)