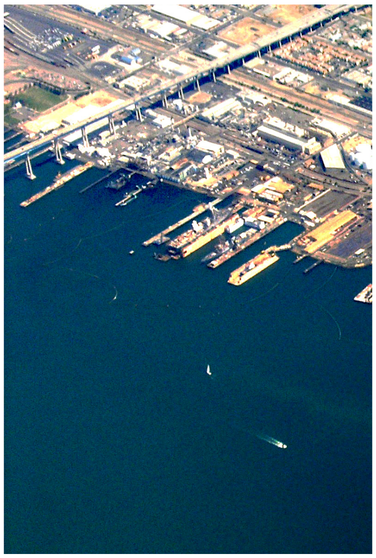 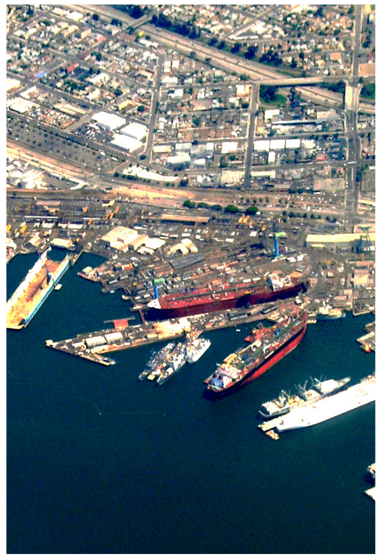 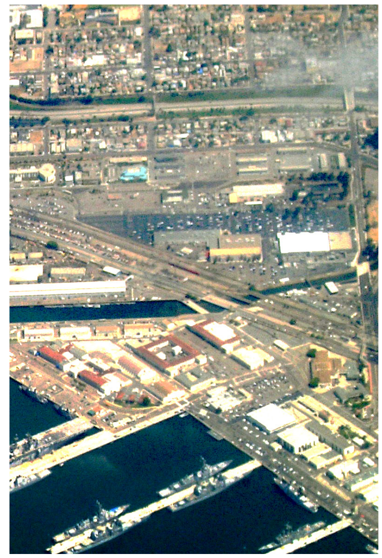

DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2010-0002

For the Shipyard Sediment Site
San Diego Bay, San Diego, CA

Volume II

DECEMBER 2009

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Draft Technical Report for

TENTATIVE
CLEANUP AND ABATEMENT ORDER
NO. R9-2010-0002

For the Shipyard Sediment Site
San Diego Bay, San Diego, CA

Volume 2 of 2

Adopted by the
California Regional Water Quality Control Board
San Diego Region
on _____________, 2010

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Acronyms & Abbreviations

AET Apparent Effects Threshold

AFFF Aqueous Film Forming Foam

ASTM American Society of Testing Material

ANOVA Analysis of Variance

AQUA Aquaculture Beneficial Use

ARCO Atlantic Richfield Company

ASTs Aboveground Storage Tanks

AT & SF Atchison, Topeka, and Santa Fe Railroad

AVS/SEM Acid Volatile Sulfide / Simultaneously Extracted Metals

BAF Biota Accumulation Factor

BAP Benzo[a]pyrene

Bight 98 Southern California Bight 1998 Regional Marine Monitoring Survey

BIOL Preservation of Biological Habitats of Special Significance

BMPs Best Management Practices

BPJ Best Professional Judgment

BRI-E Benthic Response Index for Embayments

BSAFs Biota-to-Sediment Accumulation Factors

BTAG U.S. Navy/U.S. EPA Region 9 Biological Technical Assistance Group

CAD Confined Aquatic Disposal

CCC Criterion Continuous Concentration

CCR California Code of Regulation

CDFs Confined Disposal Facilitys

CEQA California Environmental Quality Act

CMC Criterion Maximum Concentration

CNRSW Commander Navy Region Southwest

COCs Chemicals of Concern

COMM Commercial and Sport Fishing Beneficial Use

CSF Cancer Slope Factor

CTR California Toxics Rule

CWA Clean Water Act

CWC California Water Code

DFG California Department of Fish and Game

DRO Diesel Range Organics

DTSC California Department of Toxic Substances Control

DWQ Division of Water Quality

EC50 Median Effective Concentration

EMC Event Mean Concentration

EqP Equilibrium Partitioning Approach

ERL Effects Range Low

ERM Effects Range Medium

EST Estuarine Habitat Beneficial Use

FACs Fluorescent Aromatic Compounds

FSP Field Sampling Plan

GRO Gasoline Range Organics

HPAH High Molecular Weight Polynuclear Aromatic Hydrocarbons

HQ Hazard Quotient

IND Industrial Service Supply Beneficial Use

IR Ingestion Rate

IRIS Integrated Risk Information System

Kp Partition Coefficients

LAET Lowest Apparent Effects Threshold

LC50 Median Lethal Concentration

LOAELs Low-Adverse-Effects-Levels

LOE Lines of Evidence

LPAH Low Molecular Weight Polynuclear Aromatic Hydrocarbons

LPL Lower Prediction Limit

MAR Marine Habitat Beneficial Use

MARCO Marine Construction and Design Company

MEK Methyl Ethyl Ketone

MIGR Migration of Aquatic Organisms Beneficial Use

MS4 Municipal Separate Storm Sewer System

MTDB	Metropolitan Transit Development Board
NASSCO	National Steel and Shipbuilding Company
NAV	Navigation Beneficial Use
NAVSTA	Naval Station
NOAA	National Oceanic and Atmospheric Administration
NOAELs	No-Adverse-Effects-Levels
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NRTAs	Natural Resource Trustees Agencies
NTR	National Toxics Rule
OHHEA	Office of Environmental Health and Hazard Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCTs	Polychlorinated Terphenyls
PL	Prediction Limit
PPPAH	Priority Pollutant Polynuclear Aromatic Hydrocarbon
PRGs	Preliminary Remediation Goals
PW	Pore Water
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/ Quality Control
RAP	Remedial Action Plan
RARE	Rare, Threatened or Endangered Species Beneficial Use
REC1	Contact Water Recreation Beneficial Use
REC2	Non Contact Water Recreation Beneficial Use
RfD	Reference Dose
RLs	Response Levels
RME	Reasonable Maximum Exposure
RRO	Residual Range Organics
SCCWRP	Southern California Coastal Water Research Project
SDG&E	San Diego Gas and Electric
SDMC	San Diego Marine Construction Company
SDUPD	San Diego Unified Port District
SHELL	Shellfish Harvesting Beneficial Use
SQGs	Sediment Quality Guidelines
SQGQ	Sediment Quality Guideline Quotient
SS-MEQ	Site-Specific Median Effects Quotient
SVOCs	Semi Volatile Organic Compounds
S-W Diversity	Shannon-Weiner Diversity Index
SWAC	Surface-Area Weighted Average Concentration
SWI	Sediment Water Interface
SWM	Southwest Marine, Inc.
SWCS	Storm Water Conveyance System
SWPPP	Storm Water Pollution Prevention Plan
SWPMP	Storm Water Pollution Monitoring Plan
TBT	Tributyltin
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TR	Tissue Residue (biota-water-sediment equilibrium partitioning approach)
TRGs	Tissue Residue Guidelines
TRI	Toxic Release Inventory
Triad	Sediment Quality Triad
TRV	Toxicity Reference Value
TSCA	Toxic Substances Control Act
TSS	Total Suspended Solids
TUc	Toxic Unit Chronic
UPL	Upper Prediction Limit
U.S. EPA	U. S. Environmental Protection Agency
U.S. FWS	U. S. Fish and Wildlife Service
VOCs	Volatile Organic Compounds
WDRs	Waste Discharge Requirements
WILD	Wildlife Habitat Beneficial Use
WOE	Weight of Evidence

34 Finding 34: Alternative Cleanup Levels

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
TBT	110 µg/kg	22 µg/kg

HPAH = high molecular weight polynuclear aromatic hydrocarbon
PCB = polychlorinated biphenyl
TBT = tributyltin

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 (ie, 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 concentrations below the 60%LAET and SS-MEQ thresholds.

34.1 Alternative Cleanup Levels Approach

The alternative cleanup level approach selected for the Shipyard Sediment Site explicitly considers benthic invertebrate community, aquatic-dependent wildlife, and human health beneficial uses by examining multiple, risk-based lines of evidence (Table 34-1).

Table 34-1. Alternative Sediment Cleanup Level Approach

Chemicals of Concern	Present and Anticipated Beneficial Uses		
	Benthic Invertebrate Community	Aquatic-Dependent Wildlife	Human Health
Primary Chemicals			
Copper HPAHs Mercury Total PCB Congeners TBT	Areas with Sediment Quality Triad Data: Sediment Quality Triad Areas with only Chemistry Data: Site-Specific Median Effects Quotient (SS-MEQ) and Site-Specific Lowest Apparent Effects Thresholds	Surface-Area Weighted Average Concentrations (SWACs)	SWACs
Secondary Chemicals			
Arsenic Cadmium Lead Zinc	Due to Correlation with the Primary Pollutants of Concern, Cleanup Approach for Secondary Pollutants are Implicitly Addressed by the Above Approaches for Primary Pollutants		

34.2 Process for Establishing and Confirming Alternative Cleanup Level Approach

The San Diego Water Board established and evaluated the selected alternative cleanup level approach according to the following procedure:

1. Identification of chemicals of concern (COCs);
2. Analysis of potential impacts of COCs to the benthic invertebrate community, aquatic-dependent wildlife, and human health;
3. Confirmation that alternative cleanup levels do not unreasonably affect the benthic invertebrate community, aquatic-dependent wildlife, and human health;
4. Confirmation that alternative cleanup levels are consistent with Water Quality Control Plans and Policies and the maximum benefit to the people of the state.

34.2.1 Identification of Pollutants of Concern

The San Diego Water Board identified the following nine COCs with the potential to affect Benthic invertebrate community, aquatic-dependent wildlife, and human health beneficial uses (Sections 17-30): arsenic, cadmium, copper, HPAHs, lead, mercury, TBT, total PCB congeners, and zinc.[1] The nine COCs were separated into two groups, primary COCs and secondary COCs:

- **Primary COCs** were defined as COCs with a widespread, high degree of association with Shipyard Sediment Site such that an alternate cleanup level approach applied within the geographic site boundaries would maximize the potential for exposure reduction.

- **Secondary COC**s were defined as COCs meeting both of the following criteria:
  - Low degree of association with the Shipyard Sediment Site[2]; and
  - Present in areas (i.e., co-located) such that a high degree of exposure reduction would be achieved by an alternate cleanup approach based on primary COCs.

COCs with a strong Shipyard Sediment Site association were identified via comparison of current surface-area weighted average concentration (SWAC) values to background concentrations. COCs with a SWAC approximately twice that of background were considered to have a high degree of association with the Shipyard Sediment Site, and included copper, TBT, HPAH, and total PCB congeners. Among the other five COCs, arsenic, cadmium, lead, and zinc exhibited a strong positive correlation with copper, TBT, HPAH, and/or total PCB congeners (Table 34-1), suggesting that areas of the Site exhibiting high concentrations of these COCs also contained high concentrations of the Site-associated COCs. Only mercury was not highly correlated with copper, TBT, HPAH, and/or total PCB congeners.

[1] Tentative CAO No. R9-2005-0126 included alternative cleanup levels for chromium, nickel, and silver. These three chemicals were not included as COCs in this analysis because they did not have a statistically significant relationship with biological effects on benthic invertebrates (Section 22), they did not pose a risk to aquatic dependent wildlife based on the Tier II Baseline Comprehensive Risk Assessment for Aquatic-Dependent Wildlife (Section 26), and they did not pose a cancer or non-cancer human health risk based on the Tier II Baseline Comprehensive Risk Assessment for Human Health (Section 30).

[2] Secondary COCs with a low degree of association with the Site are suggestive of COCs derived from watershed or regional sources, rather than dischargers specific to the Site. The San Diego Water Board has limited authority to order Site cleanup of pollution conditions that has a low degree of association with named dischargers.

Table 34-2. Correlation Coefficients (r values) for COC-by-COC Comparisons of Concentrations in Surface Sediment Samples Collected for the Detailed Sediment Investigation (Exponent, 2003)

COC	As	Cd	Cu	Hg	HPAH	Pb	PCB	TBT	Zn
As	-	0.58	**0.86**	0.31	0.30	**0.93**	0.58	**0.86**	**0.98**
Cd	0.58	-	0.62	0.68	0.35	0.69	**0.85**	0.49	0.59
Cu	**0.86**	0.62	-	0.51	0.39	**0.92**	0.65	**0.89**	**0.89**
Hg	0.31	0.68	0.51	-	0.44	0.52	0.74	0.28	0.32
HPAH	0.30	0.35	0.39	0.44	-	0.38	0.43	0.28	0.26
Pb	**0.93**	0.69	**0.92**	0.52	0.38	-	0.72	**0.84**	**0.93**
PCB	0.58	**0.85**	0.65	0.74	0.43	0.72	-	0.50	0.59
TBT	**0.86**	0.49	**0.89**	0.28	0.28	**0.84**	0.50	-	**0.88**
Zn	**0.98**	0.59	**0.89**	0.32	0.26	**0.93**	0.59	**0.88**	-

Notes: Bolded, shaded values were considered to indicate a strong correlation between COCs ($r \geq 0.8$)

The high degree of correlation between Shipyard Sediment Site-associated COCs (copper, TBT, HPAH, and total PCB congeners) and arsenic, cadmium, and lead suggests that alternate cleanup levels for Shipyard Sediment Site-associated COCs would also achieve a high degree of exposure reduction for arsenic, cadmium, and lead. However, an alternate cleanup approach based on copper, TBT, HPAH, and total PCB congeners would not likely address the highest concentrations of mercury due to the lack of correlation between mercury and any of the four Site-associated COCs. Therefore, mercury was added at a primary COC. The final list of primary COCs includes copper, mercury, TBT, HPAH, and total PCB congeners, as summarized in Table 34-3.

Table 34-3. Identification of Primary Chemicals of Concern

Chemical of Concern	Units (dry weight)	SWAC	Bkgd	Multiple	Site-Associated COCs (Multiple ≥ 2)	Strong Correlation with Site-Associated COCs	Selection as Primary COC
Metals							
Arsenic	mg/kg	9.4	7.5	1.3	**No**	**Yes**	**No**
Cadmium	mg/kg	0.28	0.33	0.8	**No**	**Yes**	**No**
Copper	mg/kg	185	121	**1.5**	**Yes**[1]		**Yes**
Lead	mg/kg	74	53	1.4	**No**	**Yes**	**No**
Mercury	mg/kg	0.74	0.57	1.3	**No**	**No**	**Yes**
Zinc	mg/kg	250	192	1.3	**No**	**Yes**	**No**
Organics							
Tributyltin	µg/kg	160	22	**7.3**	**Yes**		**Yes**
HPAH	µg/kg	3,500	673	**5.2**	**Yes**		**Yes**
Total PCB Congeners	µg/kg	300	84	**3.6**	**Yes**		**Yes**

[1] The multiple of 1.5 was rounded up to 2 to be conservative.

34.3 Analysis of Potential Impact to Aquatic Life Beneficial Uses

Potential impacts to aquatic life were assessed to determine site-specific sediment conditions at individual stations that do not unreasonably affect aquatic life at the Shipyard Sediment Site. The analysis utilized data available from the Shipyard Report (Exponent, 2003) and addressed two situations: the case where full triad data were available (triad stations), and the case where only chemical and biological data were available (non-triad stations). In each case, the goal was to maximize the use of available data to confirm that site-specific alternative cleanup levels would not unreasonably affect aquatic life beneficial uses.

34.3.1 Analysis for Aquatic Life at Triad Stations

For triad stations, the assessment relied primarily on the weight of evidence analysis described in Section 17 of this Technical Report. For each Shipyard Sediment Site triad station, the weight of evidence analysis determined one of three categories to describe the overall likelihood of impairment including: "Unlikely," "Possible," and "Likely." These categories were assigned to each Shipyard Sediment Site station based on the potential combinations of the three principal triad lines of evidence as described in Section 17.

Triad stations with conditions designated as unlikely impaired were interpreted to not unreasonably affect aquatic life beneficial uses. Triad stations with conditions designated as possibly impaired were further reviewed. Triad stations with conditions designated as likely impaired were interpreted to have the potential to impact aquatic life beneficial uses and were targeted for remedial action.

Shipyard Sediment Site stations designated as possibly impaired represent areas of uncertainty in the weight of evidence analysis in Section 17 due to inconsistency among lines of evidence (Figure 34-1). The designation is based on three potential scenarios of the weight of evidence analysis including: (1) elevated chemistry but no toxicity or benthic community effects relative to reference; (2) moderate chemistry and moderate toxicity but no benthic community effects; or (3) moderate chemistry and moderate benthic community effects but no toxicity. Each scenario was considered and interpreted on the basis of the underlying data.

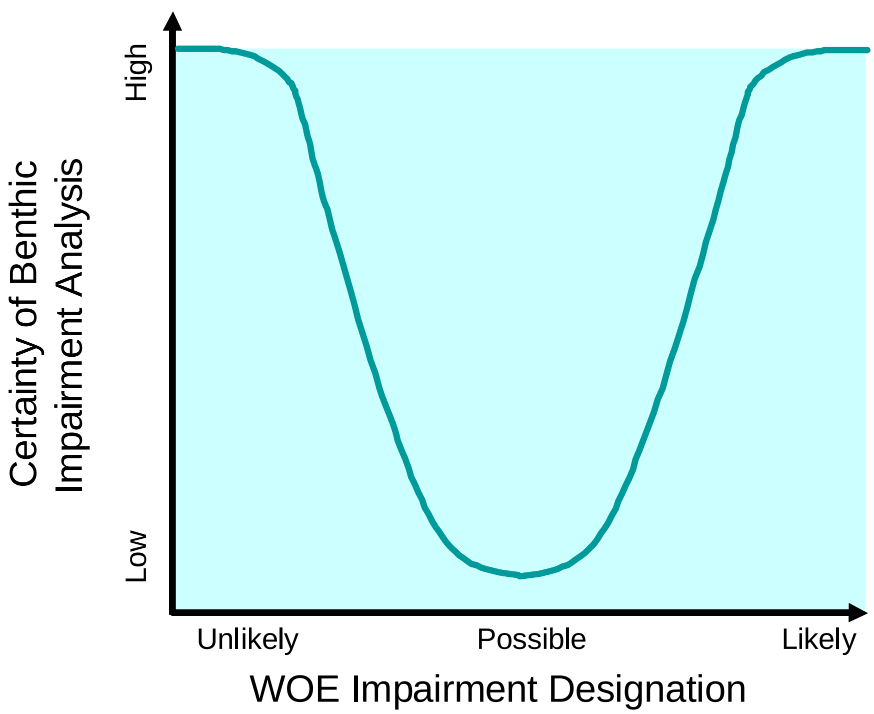


Figure 34-1. Certainty in Aquatic Life Beneficial Use Impairment in Relation to the Weight-Of-Evidence (WOE) Impairment Designation

Scenario 1 - Elevated Chemistry But No Toxicity or Benthic Community Effects

Stations with possible impairment under scenario 1 had high COC concentrations relative to reference and benchmarks, no significant toxicity relative to reference and controls, and benthic community conditions consistent with reference areas. Shipyard Sediment Site stations with this condition included NA17, SW02, SW08, SW09 and SW21. Because multiple biological tests showed no significant impact relative to reference, the interpretation for these stations is that COCs are not sufficiently bioavailable to benthic organisms to cause impairment significantly different from reference areas of the bay. Nevertheless, all of these stations fall within the remediation area required to meet the SWAC alternative cleanup level for human health and wildlife (see Section 34.4), and thus will be included in the remediation.

Scenario 2 - Moderate Chemistry and Moderate Toxicity But No Benthic Community Effects

Stations with possible impairment under scenario 2 had moderate COC concentrations relative to reference and benchmarks, toxicity that exceeded reference and was moderate relative to controls, and benthic community conditions consistent with reference areas. Shipyard Sediment Site stations with this condition included NA09, NA11, NA12, NA16, SW15, SW17, SW25, and SW27. Results for the testing at these stations were further reviewed. Further examination of the biological testing results indicated that in every case, of the seven biological metrics assessed under the toxicity and benthic community lines of evidence, only one exceeded reference conditions (Table 34-4). In every case, the benthic community results indicated communities comparable to reference conditions. Because the predominance of biological tests showed no significant impact relative to reference, the interpretation for these stations is that, even though limited effects were observed in a single toxicity test, healthy benthic community suggests that COC concentrations are not high enough to drive site-specific impairment. Nevertheless, several of these stations including NA09, SW17 and SW27 fall within the remediation footprint to meet the SWAC requirement for human health and wildlife and will thus be included in the remediation.

Table 34-4. Summary of Biological Line-Of-Evidence Results for Toxicity and Benthic Community Endpoints for the Triad Stations Classified as Possibly Impaired Under the Weight-Of-Evidence Analysis

Triad WOE "Possible" Station	Toxicity Relative to Reference			Benthic Community Impact Relative to Reference			
	Amphipod Survival	Urchin Fertiliaztion	Bivalve Development	BRI	Abundance	# Taxa	S-W Diversity
NA09	No	No	Yes	No	No	No	No
NA11	Yes	No	No	No	No	No	No
NA12	No	No	Yes	No	No	No	No
NA16	No	No	Yes	No	No	No	No
NA20	No	No	No	No	Yes	No	No
SW15	No	No	Yes	No	No	No	No
SW17	No	No	Yes	No	No	No	No
SW25	No	No	Yes	No	No	No	No
SW27	No	No	Yes	No	No	No	No

Scenario 3 - Moderate Chemistry and Moderate Benthic Community Effects But No Toxicity

Stations with possible impairment under scenario 3 had moderate COC concentrations relative to reference and benchmarks, no significant toxicity relative to reference and controls, and benthic community moderately impacted compared to reference areas. Shipyard Sediment Site stations with this condition included only NA20. Station NA20 is in an area of potential physical disturbance related to the engine test facility at NASSCO. Further examination of the biological testing results indicated that of the seven biological metrics assessed under the toxicity and benthic community lines of evidence, only one exceeded reference conditions (reduced number of taxa; Table 34-4). Because the predominance of biological tests showed no significant impact relative to reference, the interpretation for this station is that the sediments are unlikely to be impaired due to COCs released at the site, but may have a reduced number of taxa due to physical disturbance. For this reason, NA20 was not designated for remediation.

Overall, for triad stations at the Shipyard Sediment Site, all stations identified as likely impaired under the weight of evidence analysis in Section 17 were designated for remediation (Figure 34-2). The majority of the possibly impaired stations, and all of the possibly impaired stations with high chemistry were designated for remediation (Figure 34-2). 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. With respect to the triad stations, the current remedial design is considered to be adequate because it conservatively captures all of the likely areas of impairment, and the majority of uncertain areas.

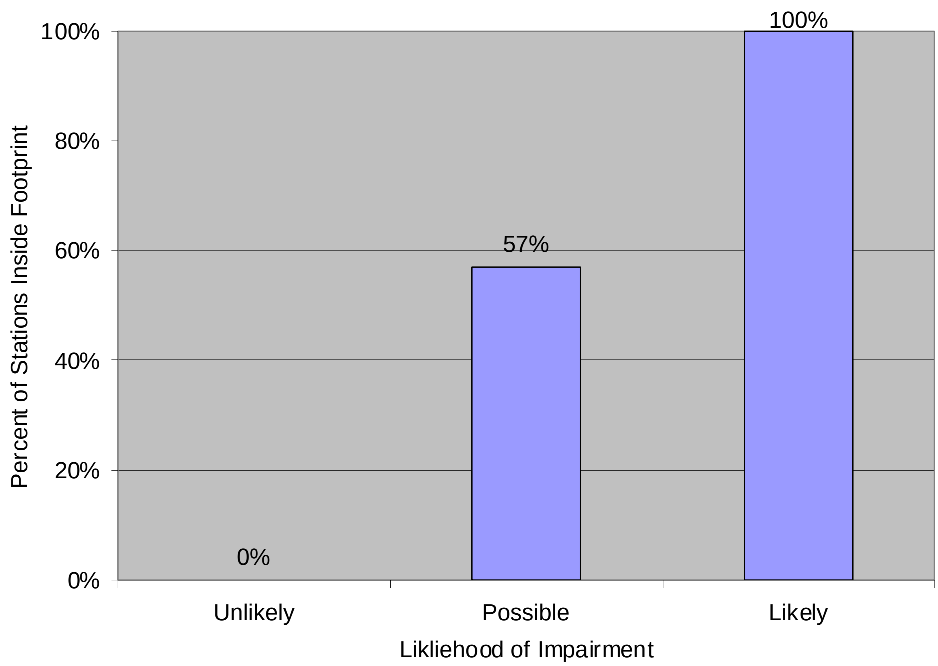


Figure 34-2. Percent of Stations Targeted for Remediation as a Function of the Weight-Of-Evidence Category for Aquatic Life Impairment

34.3.2 Analysis for Aquatic Life at Non-Triad Stations

For non-triad stations only limited data was available to assess potential impacts to aquatic life beneficial uses. This does not indicate a shortcoming of the study, but rather reflects the goal of the data collection at these stations which was primarily to help delineate the nature and extent of contamination. The available data at non-triad stations generally included surface sediment COC concentrations, and proximate Sediment Profile Image (SPI) analysis of benthic community successional stage. The analysis relied upon these available data and site specific chemical thresholds that were developed from the triad station in the Shipyard Report (Exponent, 2003). Chemical thresholds included site-specific Lowest Apparent Effects Thresholds (LAETs) for individual COCs, and a site-specific Median Effects Quotient (SS-MEQ) to address combined effects of multiple COCs.

The Apparent Effects Threshold (AET) is a tool for identifying concentrations of a pollutant in sediment above which adverse biological effects are always expected. When multiple site-specific effects endpoints are measured, several AET values can be combined to derive a single set of AET values by conservatively applying the lowest of any of the individual AET values for each chemical. This is known as the lowest AET or LAET. Development of the site-specific LAETs is described in additional detail in the Shipyard Report (Exponent, 2003). To provide an additional margin of protection, the LAETs derived from the site-specific triad data were reduced to 60 percent of the calculated value (60% LAETs), and these 60% LAETs were used to assess individual chemicals at the non-triad stations. The 60% LAET threshold values are shown in

Table 34-5. All non-triad stations exceeding the 60% LAET were designated for remediation (Table 34-6).

Table 34-5. 60% LAET Values for Primary COCs

Primary COCs	60% LAET Values
Copper	618 mg/kg
Mercury	2.4 mg/kg
HPAH	15.6 mg/kg
Total PCB Congeners	3,270 ug/kg
TBT	1,140 ug/kg

Table 34-6. Site-Specific 60%LAET and SS-MEQ Threshold Exceedences SPI Successional Stage, and Remedial Designations at the Shipyard Sediment Site Non-Triad Stations

Non-Triad Station	Exceeds LAET	Exceeds SS-MEQ	SPI Successional Stage	Designated for Remediation
NA01	No	No	Stage I & III	No
NA02	No	No	Stage I & III	No
NA03	No	No	Stage I & III	No
NA04	No	No	Stage I & III	No
NA05	No	No	Stage I & III	Yes
NA06	No	Yes	Stage I & III	No
NA08	No	No	Stage I & III*	No
NA10	No	No	Stage I & III	No
NA13	No	No	Stage I & III	No
NA14	No	No	NA	No
NA18	No	No	Stage I & III*	No
NA21	No	No	Stage I & III*	No
NA23	No	No	Stage I & III*	No
NA24	No	No	Stage I & III*	No
NA25	No	No	NA	No
NA26	No	No	NA	No
NA27	No	No	NA	No
NA28	No	No	NA	No
NA29	No	No	NA	No
NA30	No	No	NA	No
NA31	No	No	NA	No
SW01	No	Yes	Stage I	Yes
SW05	No	Yes	Stage III*	Yes
SW06	No	No	Stage I & III	No
SW07	No	No	Stage I, II, III	No
SW10	Yes	No	Stage I & III	Yes
SW12	No	No	Stage I & III	No
SW14	No	No	Stage I & III*	Yes
SW16	No	Yes	Stage I & III*	Yes
SW19	No	No	NA	No
SW20	No	Yes	Stage I & III	Yes
SW24	Yes	Yes	Stage I & III*	Yes
SW26	No	No	Stage I & III	No
SW28	Yes	Yes	Stage I & III*	Yes
SW29	No	No	NA	Yes (partial)
SW30	No	No	NA	No
SW31	No	No	Stage III*	No
SW32	No	No	NA	No
SW33	No	No	NA	No
SW34	No	No	NA	No
SW36	No	No	Stage I & III	No

Note: Successional stage marked with * indicates condition taken from an SPI location in proximity to the non-triad station. NA indicates that there was no available SPI station in proximity to the non-triad station. All other SPI stations were co-located with non-triad stations.

To address potential combined impacts of chemicals, an SS-MEQ was also developed from the triad data available in the Shipyard Report (Exponent, 2003). The SS-MEQ was derived by calculating the median concentration of individual COCs at stations identified as likely impaired under the weight of evidence analysis described in Section 17 of this Technical Report (Table 34-7). The SS-MEQ threshold was then established by conservatively optimizing the performance of the quotient in predicting likely effects (true positives) while minimizing false negatives. The optimal threshold was found to be an SS-MEQ of 0.9. The overall reliability for the available data was 73%. The only false negative was at NA22 which had significant evidence of non-COC related impacts from physical disturbance. Performance metrics for this threshold are summarized in Table 34-8. The SS-MEQ was calculated for all non-triad stations as

$$SS-MEQ=\frac{1}{5}\left[\frac{[Cu]}{ME_{Cu}}+\frac{[Hg]}{ME_{Hg}}+\frac{[HPAH]}{ME_{HPAH}}+\frac{[TPCB]}{ME_{TPCB}}+\frac{[TBT]}{ME_{TBT}}\right]$$

where the values in the numerator (e.g. [Cu], [Hg], etc.) are the non-triad station sediment concentration for that COC, and the values in the denominator (e.g. ME_{Cu}, ME_{Hg}, etc.) are the site-specific median effects levels as shown in Table 34-7. All non-triad stations exceeding the SS-MEQ were designated for remediation (Table 34-6).

Table 34-7. Data from Triad Likely Impaired Stations at the Shipyard Sediment Site Used to Develop the SS-MEQ

Station	Sediment COC Concentration				
	Cu	Hg	HPAH	TPCB	TBT
	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg
NA19	266	0.78	2,700	990	570
NA22	150	0.38	3,400	180	120
SW04	1,880	1.19	14,000	4,000	2,800
SW13	799	0.86	12,000	490	790
SW22	262	1.13	12,000	900	190
SW23	282	1.02	11,000	1,000	210
SS-Median	274	0.94	11,500	945	390
CA-LRM	145	1.05	12,500	950	-
ERM	270	0.71	9,600	180	-

Notes: Individual COC site-specific median values (SS-Median) were used in the SS-MEQ equation, above. Individual COC site specific median values are comparable to Effects Range Median (ERM) and California SQO Logistic Regression Model (CA-LRM) values.

Table 34-8. Performance summary for the SS-MEQ

Total Stations	30
Threshold	0.90
Reliability	73%
Non-Toxicity Efficiency	94%
Non-Toxicity Specificity	71%
Toxicity Efficiency	42%
Toxicity Specificity	83%
True Positives	5
True Negatives	17
False Positives	7
False Negatives	1

To further verify protection of aquatic life beneficial uses at non-triad stations, the available SPI data were also evaluated. These results are described in detail in the Shipyard Report (Exponent, 2003). SPI data were not always specifically co-located with non-traid chemistry data, but a large number of sampling stations were assessed and thus, if not co-located, SPI stations were generally in close proximity to non-triad stations, and the SPI data provide the best available generalized assessment of the benthic community health in areas where detailed benthic community assessment was not carried out. While SPI analysis yields a range of metrics, the most relevant measure for this assessment is the infaunal successional stage. Briefly, successional stage measures the degree of development or recolonization of a benthic community following disturbance (physical or chemical). The evolving succession is described in three stages. Stage I occurs soon after sediment has been disturbed and is characterized by colonization of small tube-dwelling polychaetes that feed at the sediment surface. Stage II is characterized by organisms that burrow shallowly into the sediment but nevertheless feed at or near the sediment surface. Stage III is characterized by organisms that burrow well into the anaerobic sediment and feed at depth off of organic matter and microbial decomposers. The three characteristic benthic successional stages can be identified in SPI photographs through the structures that the organisms create (tubes, burrows) and through the modifications they induce in sediment properties. SPI analysis showed that mature Stage III communities are present throughout both shipyards (Figure 34-3). In some limited areas of known physical disturbance only Stage I communities were observed such as the engine test area between Piers 4 and 5, near the southeast end of the NASSCO shipyard. With these exceptions, the SPI analysis generally indicates that healthy stage III benthic communities are present at Shipyard Sediment Site stations with CoC concentrations below the 60%LAET and SS-MEQ thresholds (Table 34-6).

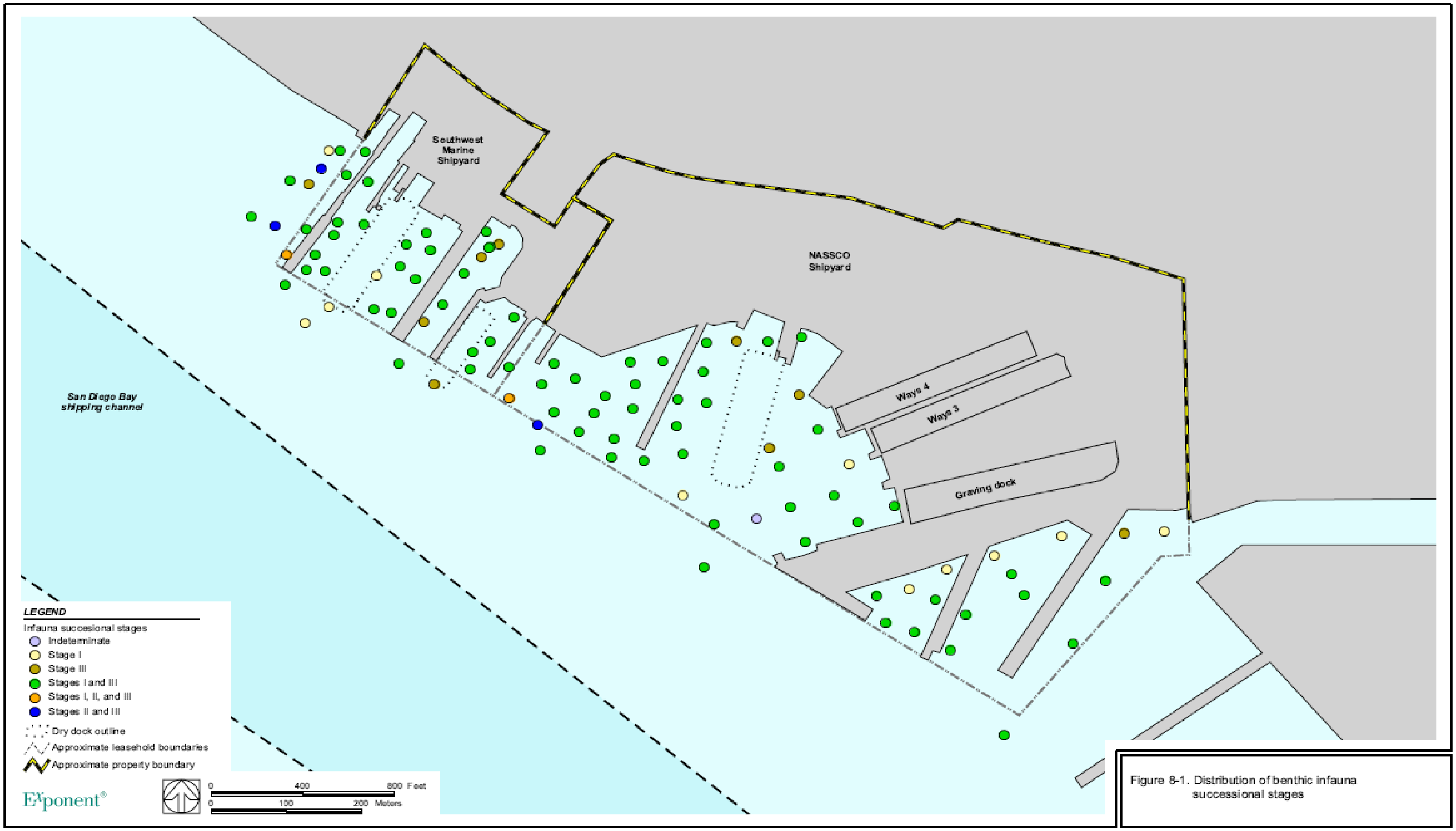


Figure 34-3. Distribution of Benthic Infuana Successional Stage at the Shipyard Sediment Site (Figure 8-1; Exponent, 2003)

34.3.3 Alternative Cleanup Levels Protect Aquatic Life Beneficial Uses

In summary, the analysis above provides confirmation that alternative cleanup levels will be protective of aquatic life beneficial uses at the Shipyard Sediment Site. Under the analysis, all triad stations at the Shipyard Sediment Site identified as likely impaired under the weight of evidence analysis were designated for remediation. The majority of the possibly impaired stations, and all of the possibly impaired triad stations with high chemistry were designated for remediation. 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. All non-triad stations exceeding the 60%LAET or SS-MEQ were designated for remediation. The SPI analysis generally indicates that healthy stage III benthic communities are present at Shipyard Sediment Site non-triad stations with CoC concentrations below the 60%LAET and SS-MEQ thresholds.

34.4 Analysis of Potential Impact to Human Health and Wildlife Beneficial Uses

34.4.1 Basis for the Surface-Area Weighted Average Concentration

The overall goal of the remediation is to be reasonably protective of beneficial uses. Beneficial uses are largely represented by risks to aquatic-dependent wildlife and risks to humans, and effects on benthic fauna. Due to the spatial heterogeneity associated with concentrations in Shipyard Sediment Site sediment and mobility of aquatic-dependent wildlife and fisher-targeted game species such as fish and lobster, an approach using Surface Area-Weighted Concentration (SWAC) was used to assess potential impacts to human health and aquatic-dependent wildlife, as detailed below.

The evaluation of risks to aquatic dependent wildlife is based on 6 species known to frequent San Diego Bay. The California Wildlife Biology, Exposure Factor, and Toxicity Database (Cal/Ecotox) is a compilation of physiological and ecological parameters and toxicity data for a number of California fish and wildlife. [3] Table 34-9 shows foraging areas that have been used by Cal/Ecotox for estimating chemical exposure via ecological risk assessment. Where Cal/EcoTox information was not available, notes have been made regarding typical migration or ranging habits.

[3] The database has been created by the Office of Environmental Health Hazard Assessment, in collaboration with the University of California at Davis, to provide an information resource for risk assessors conducting ecological risk assessments in California.

Table 34-9. Foraging Ranges for Aquatic Dependent Wildlife Receptors

Species	Published Foraging Area (Acres)	Site Area Without NA22[1] (Acres)	Ratio of Foraging Area to Site Area	Notes
Surf Scoter	N/A	143	N/A	Migratory waterfowl - foraging range during feeding dependent on food abundance
Western Grebe	N/A	143	N/A	Migratory waterfowl - foraging range during feeding dependent on food abundance
Least Tern	8,053	143	56	Cal/Ecotox foraging area
Brown Pelican	685,709	143	4,798	Cal/Ecotox foraging area
California Sea Lion	725,906	143	5,080	Cal/Ecotox foraging area
Pacific Green Sea Turtle	N/A	143	N/A	Migratory species

[1] The polygon associated with sample station NA22 is to be addressed during implementation of the Mouth of Chollas Creek TMDL. See Section 34.4.2 for discussion of polygons.
N/A = not applicable

Since these species have foraging ranges many times larger than the Shipyard Sediment Site, it is unlikely that they would be exposed to concentrations found at the Shipyard Sediment Site for an extended period of time. Exposure to sediment chemicals at the Site is likely to be averaged across the entirety of the Site. Thus, evaluating risks to aquatic-dependent wildlife based on a SWAC is appropriate and protective of beneficial uses represented by aquatic dependent wildlife. In fact, based on the foraging ranges in Table 34-8, using SWACs retains conservatism since the amount of time most species are likely to spend foraging at the site is expected to be low.

The same is true of fish and lobster harvested by fishers. Target species consumed by recreational or subsistence fishers are known to forage over areas near or greater than the size of the Site, depending on the species. Fish and lobster do not limit their movement to the small area represented by a single sediment sample, but range among a much larger area and would be exposed to sediments of varying chemical concentrations throughout the Site and greater San Diego Bay. Based on this, a SWAC for sediment is a more appropriate method for evaluating the exposure to chemicals that fish and lobsters incur during foraging. In turn, this approach allows a much more accurate and realistic estimation of the bioaccumulation of chemicals from Site sediments and prey items. Improvements in the ability to quantify bioaccumulation in fish and lobster facilitate an accurate and realistic estimation of chemical exposure for hypothetical fishers consuming species harvested from the Site, and allow the prediction of potential human health risks associated with chemical concentrations in sediment.

With respect to fish and lobster consumption, the likelihood that fishers will consume fish caught from the same location every day for 30 or more years is low since fishers are likely to utilize different fishing locations from time to time based on fish abundance, which can be seasonal or vary year to year. Therefore, using a SWAC is expected to be conservative with respect to human consumption patterns that would be anticipated.

In conclusion, site-specific SWACs are used to evaluate the remedy protectiveness of beneficial uses represented by aquatic dependent wildlife and human seafood consumption.

34.4.2 Calculation of the Surface-Area Weighted Average Concentration

There are 65 sediment sample stations at the Shipyard Sediment Site. These stations are not equidistant from each other, but were established based on historical activities and the presence of elevated contaminant concentrations detected in earlier phases of investigations. Therefore, some areas of the Site, primarily near the shoreline and toward the north, have a higher density of sampling stations. To calculate the SWAC, a geospatial technique (Thiessen polygons) was used to represent the area 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. This technique is well established and in use throughout a broad range of sciences, and is being used at many nationally known sediment remedial investigation sites including the Portland Harbor Cleanup, the Duwamish River Cleanup, the Lower Passaic River Cleanup, Fort Ord, and others. Application of this method resulted in 65 polygons of differing sizes as shown in Figure 34-4.

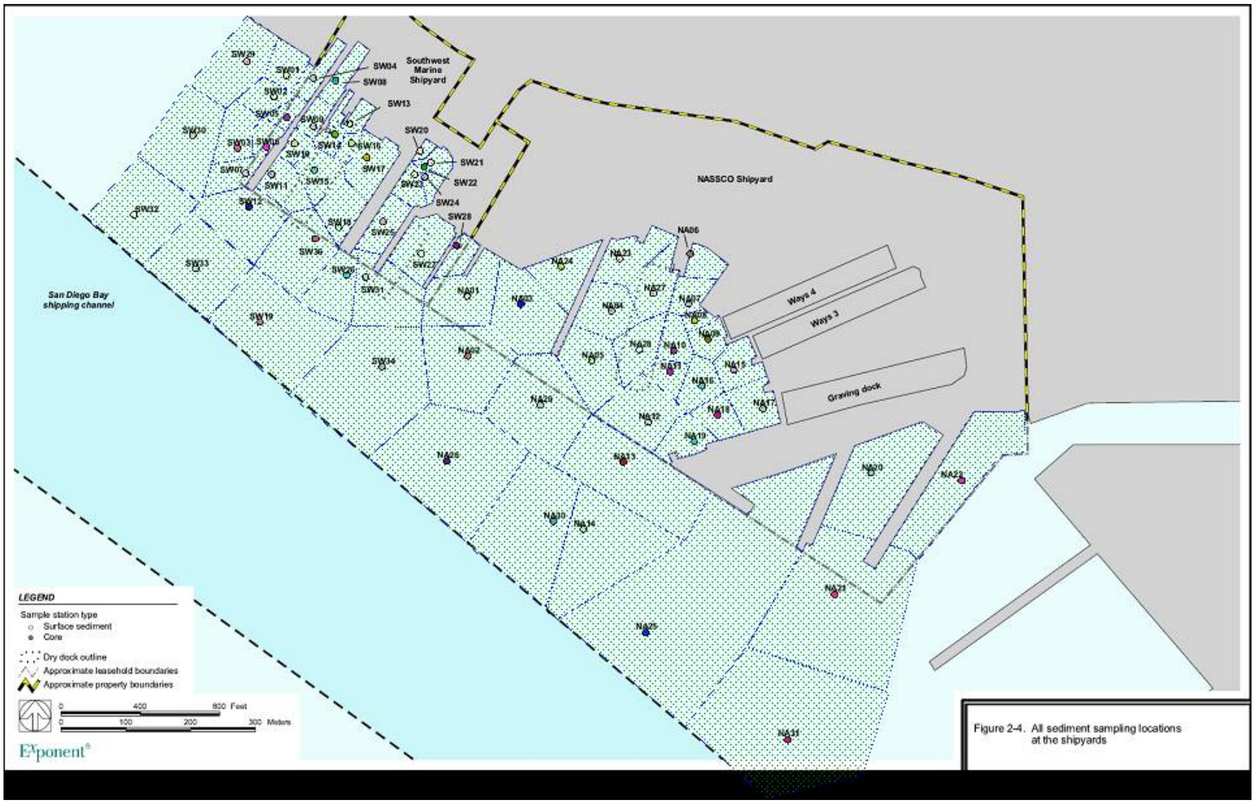


Figure 34-4. Map of Thiessen Polygons at Shipyard Sediment Site Leaseholds

The concentration of a COC in each polygon was assumed to be the same as the concentration of COC in the sampling station inside that polygon. This approach allowed for calculating a SWAC for the site. Polygon areas and concentrations were used to calculate the SWAC for the Site, as shown in following equation:

$$\mathrm{SWAC} = \frac{\sum_{i=1}^{i=65} A_i C_i}{\sum_{i=1}^{i=65} A_i}$$

Each polygon area is multiplied by the concentration of COC in the sampling station in that polygon. The area concentration products are then summed. This sum is divided by the total Site area (sum of the site's 65 polygons).

34.4.3 Surface-Area Weighted Average Concentration Approach

Once the pre-remedial SWAC was calculated as noted in Section 34.4.2, the development of a remedial footprint protective of human health and aquatic dependent wildlife beneficial uses could be completed. Polygons were identified for inclusion into the remedial footprint sequentially based on the degree of contamination they represented. The degree of contamination was determined by ranking each polygon according to the polygon's concentration of primary COCs (PCBs, HPAHs, TBT, Hg, and Cu), weighted evenly by relative COC concentration. This was accomplished by the following procedure: 1) the relative concentration of each primary COC as compared to the SWAC for that COC was calculated; 2) the five primary pollutants of concern relative concentrations to SWAC ratios were summed for each polygon; and 3) the polygons where ranked from high to low. The calculation is shown in the following equation:

$$\text{Rank} = \sum_{\text{COCs}} \frac{C_{polygon}}{\text{SWAC}}$$

The rank equation is used below to show sample calculations for polygons SW04 and NA17.

$$\begin{array}{lccccc} & \text{Cu} & \text{Hg} & \text{HPAH} & \text{PCB} & \text{TBT} \end{array}$$

$$\text{Rank}_{SW04} = \frac{1500}{185} + \frac{1.75}{0.74} + \frac{14000}{3503} + \frac{4000}{303} + \frac{3250}{163} = 47.6$$

$$\text{Rank}_{NA17} = \frac{510}{185} + \frac{0.85}{0.74} + \frac{2950}{3503} + \frac{550}{303} + \frac{1350}{163} = 14.8$$

Using this ranking approach, the highest ranked polygons were sequentially considered for inclusion into the remedial footprint.

Protectiveness of the beneficial uses represented by aquatic-dependent wildlife and human health was assessed via estimation of post-remedial SWAC values of the remedial footprint. Post-remedial SWAC calculations were completed with the assumption that each polygon inside the footprint would be remediated to background concentrations derived in Section 16 of this Technical Report. In reality, they may be cleaned up to lower concentrations; however, background concentrations were assumed to incorporate conservatism in the analysis. Protectiveness was evaluated in terms of degree of exposure reduction (Section 34.4.4) and comparison to human health and aquatic-dependent wildlife risk assessments (Sections 34.5 and 34.6).

34.4.4 Quantifying Exposure Reduction of Proposed Remedial Footprint

As chemical concentrations are reduced and mass removed, the SWAC for each COC decreases, which is equivalent to an expected exposure reduction for aquatic dependent wildlife and humans. The following equation represents the relationship of exposure reduction to post-remedy SWAC.

$$\text{Exposure Reduction} = \text{SWAC}_{\text{current}} - \text{SWAC}_{\text{post-remedy}}$$

To estimate the relative exposure reduction of a remedial action, it is appropriate to normalize the exposure reduction to background. For example, current conditions represent 0 percent exposure reduction, whereas as post-remedial SWAC equal to background represents 100 percent exposure reduction. This equation is the calculation of the percent of exposure reduction relative to background.

$$\%\ \text{Exposure Reduction} = \frac{\text{SWAC}_{\text{current}} - \text{SWAC}_{\text{final}}}{\text{SWAC}_{\text{current}} - \text{Background}} \times 100$$

The following equation is an example of quantifying exposure reduction. This example assumes a current SWAC of 10 ppm for COC_1 and a final SWAC of 2 ppm. The background concentration used in this example is 1 ppm for COC_1.

$$\frac{10\ \text{ppm} - 2\ \text{ppm}}{2\ \text{ppm} - 1\ \text{ppm}} \times 100 = 89\%$$

In this example, the exposure reduction relative to background when cleaning up a current SWAC of 10 ppm to a post-remedial SWAC of 2 ppm is 89 percent.

Exposure reduction was used to evaluate the protectiveness of human health and aquatic-dependent wildlife risks afforded by the remdial action, and was also used to evaluate the incremental increases in protectiveness associated with additional remedial effort. This was applied to the different remedial footprints to quantify exposure reduction. The analysis concluded that adding additional polygons to the proposed remedial footprint represented diminishing marginal return associated with additional remedial actions (Section 33).

34.5 Alternative Cleanup Levels Protect Aquatic-Dependent Wildlife Beneficial Uses

The following analysis was conducted to confirm that the alternative cleanup levels protect aquatic-dependent wildlife beneficial uses. Six aquatic-dependent wildlife receptors were selected to evaluate the protection of beneficial uses. The species 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 (*Cheloniamydas agassizii*). The primary chemicals of concern (COCs) identified at the shipyard site that could potentially affect aquatic-dependant wildlife beneficial uses include PCBs, HPAHs, mercury, copper, and TBT. Secondary COCs included zinc, cadmium, lead, and arsenic.

Expected improvements in the protection of beneficial uses following remediation were estimated by modeling future exposure conditions (principally ingestion of prey) using the series of equations described below.

Future prey tissue concentrations (Ct) were calculated using the following equation:

$$\mathrm{Ct} = \mathrm{BAF} \times \mathrm{SWAC}$$

Where:
BAF = site-specific bioaccumulation factor
SWAC = post remedial surface-area weighted average sediment concentration

Site-specific bioaccumulation factors (BAFs) were estimated using current surface-area weighted average concentrations (SWACs) for sediment and the average COC concentrations in prey species tissue (see Table 34-10 for prey items):

$$\mathrm{BAF} = \frac{\mathrm{C}}{\mathrm{SWAC}}$$

Where:
SWAC = current spatially weighted average sediment concentration
C = average chemical concentration in a receptors prey tissue based on data reported in Exponent (2003).

Table 34-10. Prey Items Used in Risk Estimates

Receptor of concern	Prey Item(s)
CA Brown Pelican	Spotted sand bass
CA Least Tern	Topsmelt and Anchovies
Western Grebe	Topsmelt and Anchovies
Surf Scoter	Benthic mussels
CA Sea Lion	Spotted sand bass
Green Turtle	Eelgrass

Note: Source of information is Table 26-3

Current and predicted post-remedial SWACs used in this analysis have been presented elsewhere in this document and are repeated in Table 34-11 for convenience.

Table 34-11. Current and Post-Remedial SWACs

Primary COC	Units	Pre-remedy SWAC	Post-remedy SWAC
Copper	mg/kg	187	159
Mercury	mg/kg	0.75	0.67
HPAH	mg/kg	3.3	2.3
PCB	µg/kg	308	194
TBT	µg/kg	163	110

COC – chemical of concern
SWAC – spatially weighted average concentration
HPAH – high molecular weight polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
TBT – tributyltin

Exposure estimates for each of the receptors were developed using the daily intake equation presented in Section 26. The equation accounts for exposure to COCs that may occur through the ingestion of prey as well as through the incidental ingestion of sediment:

$$\text{Daily Intake}_{chemical} = \frac{\left[(CM * IR * FI * AE)_{prey} + (CM * IR * FI * AE)_{sediment}\right]}{BW}$$

Where:

CM = post-remedial concentration of the chemical in prey tissue or sediment (mg/kg). Prey tissue concentrations used in this equation were derived using the equation described above, while the sediment concentration was based on the predicted post-remediation SWAC for the COC

IR = ingestion rate of prey or sediment (kg/day)

FI = fraction of the daily intake of prey or sediment derived from the site (unitless area-use factor)

AE = relative gastrointestinal absorption efficiency for the chemical in a given prey or sediment (fraction)

BW = body weight of receptor species (kg)

Table 34-12 presents the exposure parameters used for this analysis. The parameters are the same ones used to evaluate current conditions, and are more fully discussed in Section 25.

Table 34-12. Exposure Parameters

Receptor of concern	Estimated Post-Remedial Prey Tissue Concentration (mg/kg dw)	Estimated Post-Remedial Sediment chemical concentration (mg/kg dw)	Body Weight (kg)[1]	Food Ingestion Rate (kg/day dw)[1]	Sediment Ingestion Rate (kg/day dw)[1]	Area Use Factor[1]	Absorption Efficiency[1]
CA Brown Pelican	chemical specific	chemical specific SWAC	2.845	0.23	0.005	1	1
CA Least Tern	chemical specific	chemical specific SWAC	0.036	0.0044	0.0011	1	1
Western Grebe	chemical specific	chemical specific SWAC	0.808	0.046	0.0031	1	1
Surf Scoter	chemical specific	chemical specific SWAC	0.859	0.048	0.0028	1	1
CA Sea Lion	chemical specific	chemical specific SWAC	45	0.99	0.0308	1	1
Green Turtle	chemical specific	chemical specific SWAC	95	0.31	0.0186	1	1

[1] Source of information is Table 26-4.

Finally, improvement in the protection of beneficial uses for aquatic-dependant wildlife was evaluated by calculating hazard quotients (HQs):

$$HQ = \frac{DI_{chemical}}{TRV}$$

Where:

DI = total daily intake rate of the chemical (mg/kg body weight-day)

TRV = Geometric mean toxicity reference value (mg/kg body weight-day)

The toxicity reference values (TRVs) are presented in the Appendix for Section 34 (Zeeman 2004) and are repeated here in Table 34-13 for convenience. The BTAG TRVs were selected for all chemicals except mercury in which the no observed adverse effect levels (NOAELs) were used as recommended by USFWS (Zeeman 2004). The geometric mean of the low and high TRVs was used in the HQ calculation and represents an estimate between the NOAEL and a threshold value above which adverse effects are likely to occur. The geometric mean was used to determine a TRV that represents a value between the NOAEL and the threshold value and provides an added level of protection below the lowest observed adverse effect level. An HQ value less than 1.0 indicates that the chemical is unlikely to cause adverse ecological effects to the receptor of concern. An HQ value greater than 1.0 indicates that the receptor's exposure to the chemical pollutant has exceeded the TRV, which could indicate that there is a potential that some fraction of the population may experience an adverse effect. HQs for all receptors evaluated at the shipyard site had a value less than 1.0 (Table 34-14), indicating that the COCs are unlikely to cause adverse ecological effects and that the post-remedial sediment chemistry conditions are protective of aquatic dependent wildlife and their associated beneficial uses.

Table 34-13. Geometric Mean TRVs

Primary COC	Bird Geometric Mean TRV (mg/kg-day)[a]	Mammal Geometric Mean TRV (mg/kg-day)[a]
Copper	10.9	41.1
Mercury	0.035[b]	0.070
	0.061[b]	
HPAH[c]	na	na
PCB	0.34	0.68
TBT[c]	na	na

[a] Source of TRVs is from Zeeman (2004). See Appendix for Section 34.
[b] Two values are recommended for avian receptors, one for piscivorous birds (0.061), such as terns and pelicans, and the other for non-piscivorous birds (0.035) such as scoter (Zeeman 2004). See Appendix for Section 34.
[c] HPAH and TBT are not wildlife risk drivers and therefore geometric mean TRVs were not calculated.
HPAH – high molecular weight polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
TBT – tributyltin

Table 34-14. Hazard Quotient (HQ) Results

Receptor of concern	Copper	Mercury	HPAH[a]	PCB	TBT[a]
Brown Pelican	0.066	0.69	na	0.59	na
Least Tern	0.51	0.49	na	0.45	na
Western Grebe	0.0865	0.11	na	0.20	na
Surf Scoter	0.29	0.21	na	0.078	na
CA Sea Lion	0.0056	0.17	na	0.079	na
Green Turtle	0.054	0.019	na	0.0006	na

[a] HPAH and TBT are not wildlife risk drivers and therefore HQs were not calculated.
HPAH – high molecular weight polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
TBT – tributyltin

34.6 Alternative Cleanup Levels Protect Human Health Beneficial Uses

Recreational and subsistence fish and lobster consumption scenarios were used to evaluate the protectiveness of the alternative cleanup levels. In general, the relationships between sediment concentrations, fish and lobster tissue concentrations, and human health risk were used for this evaluation. The analysis incorporated the following parameters and assumptions:

- Site-specific biota accumulation factors (BAFs);
- Receptor and species specific consumption rates; and
- Receptor specific site use rates.

Average site-specific BAFs for each chemical of concern are calculated as the ratio between biological tissue and sediment concentrations:

$$\mathrm{BAF} = \frac{\mathrm{C}}{\mathrm{SWAC}}$$

Where:
C = Shipyard-wide Average Tissue Concentration
SWAC = Surface Weighted Average Sediment Concentration

Total PCBs is the chemical used in the following calculations. BAFs and calculation input values are presented in Table 34-15.

Table 34-15. Biota Accumulation Factors for Total PCBs

Scenario	Species	Tissue	Tissue Concentration (ppb)	Pre-Remedial Sediment SWAC (ppb)	BAF
recreational	sand bass	fillet	106.7	308	0.346
subsistence	sand bass	whole	569.5	308	1.85
recreational	lobster	edible	7.9	308	0.0256
subsistence	lobster	whole	43.6	308	0.142

The cleanup remedy is expected to result in a sediment SWAC of approximately 194 ppb for total PCBs. Although BAFs may vary in part due to changes in sediment concentration, it is assumed that the concentration change of 308 to 194 ppb does not result in different rates of PCB accumulation. To meet the determination of acceptable human health, cancer risks should not exceed 1×10^{-5} and non-cancer risks should not exceed 1.0.

The equations for calculating cancer and non-cancer risk are the same with the exception of the calculation of the exposure. Differences in these exposure calculations (Threshold Exposure Point variable) are described in the Carcinogenic Exposure Equation and the Non-carcinogenic Exposure Equation, below.

Equation for Threshold Exposure Point for Carcinogenic Exposure

$$\text{TEP} = \frac{\text{Risk}}{\text{CSF}}$$

Where:
TEP = Threshold Exposure Point (mg/kg-day)
Risk = 0.00001
CSF = Oral Carcinogenic Slope Factor (risk/(mg/kg-day))

<u>Equation for Threshold Exposure Point for Non-Carcinogenic Exposure</u>

$$\text{TEP} = RfD$$

Where:
TEP = Threshold Exposure Point (mg/kg-day)
RfD = Oral Reference Dose (mg/kg-day)

Continuing with the example of total PCB exposures specifically, the CSF is 2 risk/mg/kg-day resulting in a cancer TEP of 0.000005 mg/kg-day and the RfD and, therefore, non-cancer TEP is 0.00002 mg/kg-day.

Once threshold acceptable exposure concentrations are known, acceptable tissue concentrations in biota can be calculated using the equation below and the variable values specified in Table 34-16.

$$\text{C} = \text{TEP} \times \frac{\text{BW} \times \text{AT}}{\text{CR} \times \text{FI} \times \text{ED}}$$

Where:
C = Tissue Concentration (mg/kg)
TEP = threshold exposure point (mg/kg-day)
BW = body weight (kg)
AT = Averaging time (days)
CR = Consumption Rate (kg/week)
FI = Fractional Intake (weeks/year)
ED = Exposure Duration (years)

Table 34-16. Variable Values for Risk Scenarios

Variable	Scenario	Value
BW	All	70
AT	Cancer	70
	Non-cancer	30
CR	Recreational	0.02104
	Subsistence	1.61
FI	All	1.0
ED	All	30

Continuing with our example of total PCBs, tissue concentrations for the various scenarios evaluated are presented in Table 34-17.

Table 34-17. Total PCBs Tissue Concentrations

Scenario	C (mg/kg)
Recreational consumption cancer risk	0.0388
Recreational consumption non-cancer risk	0.0665
Subsistence consumption cancer risk	0.0051
Subsistence consumption non-cancer risk	0.0087

Once tissue concentrations have been calculated, acceptable SWAC concentrations can be determined using the BAFs presented in Table 34-15 and by rearranging Equation 1 to solve for SWAC. Acceptable SWACs for Total PCBs for specific human health risk scenarios are presented in Table 34-18.

Table 34-18. Total PCBs SWACs Acceptable for Human Health

Scenario	SWAC (ppb)	
	Cancer	Non-cancer
Recreational consumption of bass fillets	112.3	192.4
Subsistence consumption of whole bass	2.7	4.7
Recreational consumption of edible lobster	1,516.2	2,599.2
Subsistence consumption of whole lobster	35.8	61.4

Comparing the results in Table 34-18 to the post-remedial SWAC of 194 ppb indicates that the alternative cleanup level for total PCBs is protective of recreational anglers that consume lobster, but not for cancer risk to recreational anglers that consume bass fillets. The SWAC of 194 ppb is not protective of any scenarios for subsistence users of the site. Acceptable risk levels for subsistence fishers are not obtained even at background levels and cleanup to background has been determined to be economically infeasible.

The above analysis is based on a fractional intake (FI) of 100 percent, which assumes the angler intake is entirely from the Shipyard Sediment Site. In addition, these results assume a cancer risk of 1 x 10^{-5}, which is in the center of the range of 10^{-4} to 10^{-6} that the U.S. EPA accepts under the National Contingency Plan.

Various acceptable SWACs for recreational anglers were developed by varying the fractional intake to identify the post-remedial SWACs for total PCBs associated with three different cancer risk levels in Table 34-19. The shaded cells indicate where the post-remedial SWAC is below the calculated “acceptable” SWAC associated with that fractional intake and cancer risk level.

Table 34-19. Total PCB SWACs for Recreational Anglers Assuming Varying Risk Levels and Fractional Intake

Fractional Intake (%)	PCB SWAC (ppb)								
	DTR Background	Post-Remedial SWAC	Cancer Risk Level						
			10^{-6}		10^{-5}		10^{-4}		
			Fish	Lobster	Fish	Lobster	Fish	Lobster
25	84	194	44.9	606.5	448.7	6,064.8	4,487	60,648
40			28.1	379.1	280.5	3,790.5	2,805	37,905
75			15.0	202.2	149.6	2,021.6	1,496	20,216
100			11.2	151.6	112.3	1,516.2	1,123	15,162

Note: Shaded SWACs indicate where the projected post remedy SWAC is acceptable.

The approach shown above in this section was used for all COCs. The results are summarized in Table 34-20.

Table 34-20. Protectiveness of Human Health Beneficial Uses of Post Remedial SWACs

Beneficial Use	COC	Post Remedial SWAC	Basis
Human Health	Cu (mg/kg)	159	Protective of human health at 100% recreational consumption (FI) of Site species.
			Protective of human health at 100% subsistence consumption (FI) of Site whole sand bass.
	Hg (mg/kg)	0.67	Protective of human health at 100% recreational consumption (FI) of Site sand bass fillet and edible lobster.
			Protective of human health at 100% for subsistence consumption of Site whole lobster.
	HPAH (mg/kg)	2.3	Protective of human health at 100% of consumption (FI) of Site species.
	PCBs (µg/kg)	194	Protective of human health at recreational at 100% consumption (FI) of Site edible lobster.
			Protective of human health at 40% recreational consumption (FI) of Site sand bass fillet.
	TBT (µg/kg)	110	Protective of human health at 100% of consumption (FI) of Site species.

35 Finding 35: 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.

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.

b. ***Alternative Cleanup Levels Are Consistent With Water Quality Control Plans And Policies.*** The alternative cleanup levels 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.

c. ***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. 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 pollutants constituents that will remain at the site, compliance with the alternative cleanup levels will markedly improve water quality conditions in 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.

d. **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 beneficial uses assigned to the Shipyard Sediment Site, including aquatic life, aquatic-dependent wildlife, and human health. The Regional Board finds that 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 in San Diego Bay, risk of re-suspension of contaminated sediments, and risk of accidents. The remedial footprint will also reduce 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.

35.1 Proposed Remedial Footprint

The proposed remedial footprint was developed based on the Thiessen Polygons determined to require remediation, as presented in Chapter 34. These polygons were used to estimate surface-area weighted average sediment concentrations at the site by associating a specific area (the area within a polygon) with the sediment sampling station within the polygon. The sediment chemistry concentrations at the sampling station were assumed to be constant over the entire area of the polygon. The vertical horizon for each polygon targeted for remediation was then evaluated to determine the depth necessary to remediate each of those selected polygons to background sediment levels. Once remediation is completed, the average surface concentration within the remedial footprint should be at or below background levels.

The polygons targeted for remediated are shown in red and green in Figure 35-1. 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, as described in Section 32 Technological Feasibility Considerations.

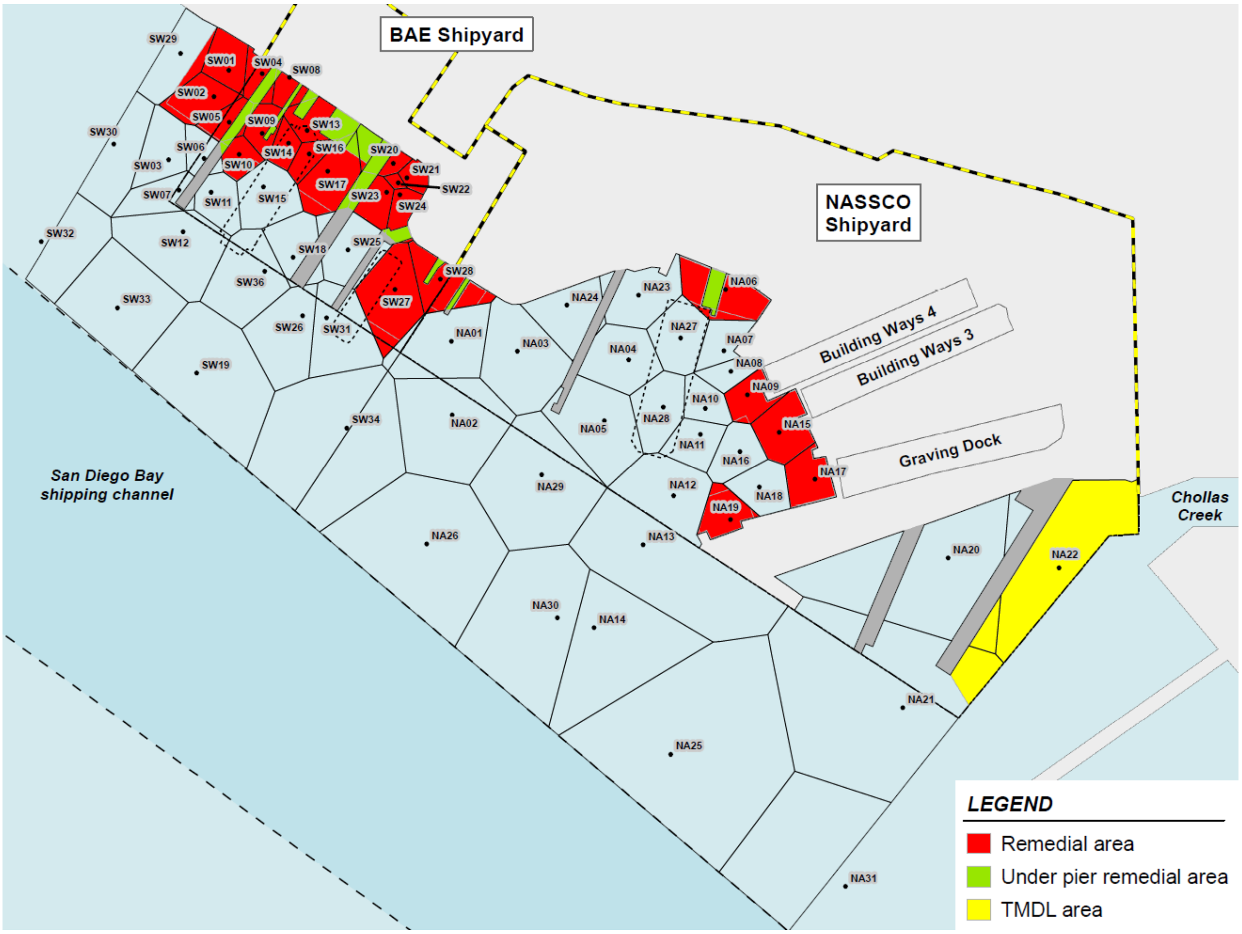
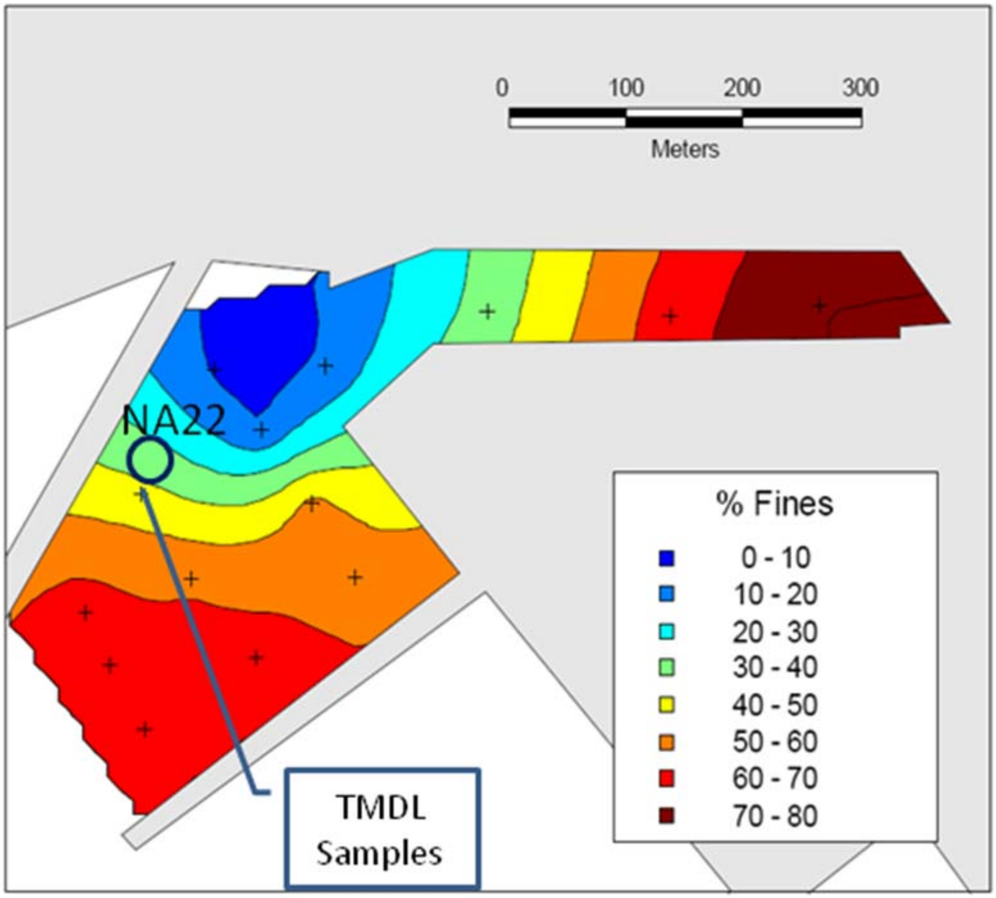


Figure 35-1. Polygons Targeted for Remediation

35.1.1 Addition of Station NA22 to the Mouth of Chollas Creek TMDL

A Total Maximum Daily Load (TMDL) is being developed for the mouth of Chollas Creek, which encompasses one station (NA22) of the Shipyard Sediment Site study area. This TMDL will apply to sediments as well as to water quality in the mouth of Chollas Creek. Figure 35-2 shows the Chollas Creek Mouth study area and the location of the NA22 sample station.



Spatial distribution of fines for the Chollas site.

Figure 35-2. Chollas Creek Mouth Study Area and Shipyard Sediment Site Sample Location, NA22

During the TMDL study, over a dozen sediment samples were collected in the mouth of Chollas Creek (sample locations notated by a cross in Figure 35-2). These samples have been analyzed for physical parameters, chemistry, toxicity, and benthic communities. There is substantially more data collected in the Chollas Creek Mouth area as part of the TMDL than was collected during the Shipyards sediment study, in which one sample was collected at Station NA22. Therefore, substantially more data is available for decision making in the mouth of Chollas Creek at the completion of the TMDL than is available now.

The triad analysis weight-of-evidence catergory for Station NA 22, the station in the Chollas Creek Mouth area, was "Likely" impaired based on "high" sediment chemistry, "moderate" toxicity, and "moderate" benthic community results for the three legs of the triad (see Table 17-1). NA22 is in an area where propeller testing occurs routinely, suggesting that physical impacts could be causing the impaired benthic condition. The additional samples from the TMDL will allow a better assessment of the causes of potential impairment in the mouth of Chollas Creek area, which will allow a more effective decision to be made.

Additionally, the TMDL study area overlaps with the Shipyards study area and having two separate remedial decisions being made for the same over-lapping area would pose implementation challenges. Making one remedial decision for the mouth of Chollas Creek using a much larger data set will result in a better decision that is likely to be equally or more protective of the beneficial uses and maximize the benefits to the citizens of the state of California. Therefore, the polygon represented by the station NA22 was excluded from the Shipyard Sediment Site area. That area is being evaluated under the Chollas Creek Mouth TMDL.

35.1.2 Remedial Footprint Stations Ranked by SWAC

The composite surface-area weighted average concentration (SWAC) for each polygon was given a value and ranked to identify which polygons should be removed on a "worst-first" basis. The composite value accounts for all the COC concentrations at the station. The values and ranking are shown Table 35-1 which includes the top 23 polygons having the highest composite score.

Table 35-1. Remedial Footprint Stations Ranked by SWAC

Station	Composite SWAC Ranking Value	Numerical Ranking
SW04	47.1	1
SW08	33.3	2
SW02	31.5	3
SW24	23.1	4
SW09	17.5	5
SW13	15.2	6
SW28	15.2	7
SW21	14.8	8
SW01	14.8	9
NA17	14.7	10
SW16	13.3	11
SW20	12.0	12
SW05	11.1	13
SW23	10.5	14
SW22	10.4	15
SW17	10.0	16
NA19	10.0	17
NA06	9.8	19
SW10	9.7	20
SW14	9.3	21
NA15	8.8	22
SW27	7.6	23
NA09	5.5	38

35.1.3 Remedial Footprint Stations Ranked by SS-MEQ

For stations without triad data (ie, chemistry data only), each polygon was evaluated using the SS-MEQ threshold value of 0.9 to predict “likely” impacted stations. This ranking also was ordered “worst-first”, as identified in Table 35-2. There are more non-triad stations proposed for remediation than would otherwise be targeted using SS-MEQ alone, as five of the stations had SS-MEQ values less than the 0.9 threshold (Table 35-2).

Table 35-2. Remedial Footprint Stations Ranked by SS-MEQ

Station	SS-MEQ	Ranking
SW04	4.22	1
SW08	2.99	2
SW02	2.80	3
SW24	1.81	4
SW09	1.6	5
SW13	1.48	6
NA17	1.41	7
SW01	1.40	8
SW16	1.28	9
SW21	1.25	10
SW28	1.20	11
NA06	1.11	12
SW20	1.02	13
SW05	0.94	14
SW23	0.93	15
SW22	0.92	16
SW17	0.92	17
NA19	0.92	18
SW14	0.88	20
NA15	0.86	21
SW10	0.78	22
SW27	0.68	30
NA09	0.62	37

Note: SS-MEQ Threshold = 0.9

35.1.4 Remedial Footprint Generally Includes Areas with Highest Concentrations of COCs

To ensure that the polygons with the highest individual COC concentration are remediated, each polygon was rank-ordered independently for each of the COCs. This rank order is presented in Tables 35-3a through 35-3c.

Table 35-3a. Polygons with Highest Individual COCs

Station	Total HPAH
SW24	52,000
SW08	25,500
SW09	17,000
SW28	17,000
SW10	16,000
NA07*	15,850
SW02	14,333
SW04	14,000
SW05	13,000
SW22	12,000

Station	PCB Congeners
SW02	5,450
SW04	4,000
SW21	2,400
SW08	2,100
SW28	2,100
SW20	1,600
SW01	1,600
SW05	1,200
SW23	1,000
NA19	990

Station	Tributyltin
SW04	3,250
SW08	1,850
NA17	1,350
SW16	1,100
SW09	910
SW13	790
NA15	670
NA19	570
SW14	450
SW01	450

Table 35-3b. Polygons with Highest Individual COCs

Station	Copper
SW04	1,500
SW08	920
SW13	800
SW09	660
SW02	570
SW01	560
NA17	510
SW16	430
NA06	395
NA27*	390

Station	Mercury
SW02	4.3
NA06	2.4
SW08	2.3
SW19*	2.1
SW24	1.9
SW04	1.8
SW01	1.5
NA07*	1.5
SW21	1.4
NA09	1.2

Station	Lead
SW04	430
SW08	225
SW09	220
SW02	180
SW01	145
NA06	130
NA23*	120
SW05	120
SW21	120
NA17	115

Table 35-3c. Polygons with Highest Individual COCs

Station	Arsenic
SW04	73
SW09	27
SW08	24
NA08*	18
SW13	15
SW06*	15
SW23	15
NA17	15
SW28	14
SW20	14

Station	Zinc
SW04	3,450
SW09	1,200
SW08	830
NA17	620
SW02	585
SW13	580
SW01	520
NA27*	500
NA19	450
NA23	430

Station	Cadmium
SW02	3.8
SW04	1.5
SW09	0.9
SW16	0.9
SW03*	0.8
SW06*	0.8
SW10	0.8
SW08	0.8
SW05	0.7
SW13	0.7

*Polygons not within the remedial footprint

Each of the polygons excluded from the remedial footprint, as identified Table 35-3, was independently evaluated to determine consistency with the SWAC and SS-MEQ ranking of stations. Table 35-4 identifies the rational for exclusion of these seven polygons from the remedial footprint.

Table 35-4. Rational for Exclusion of Polygon from Remedial Footprint

Station	Rationale for Exclusion
NA07	• Triad station – not “likely” impaired • All COCs below 60% LAET values • Low toxicity and low benthic impacts • All COCs less than 3x background, except HPAH • Technical infeasibility
NA08	• All COCs below 60% LAET and SS-MEQ values • All COCs less than 3x background • Technical infeasibility
NA23	• All COCs below 60% LAET and SS-MEQ values • All COCs less than 3x background • Technical infeasibility to cleanup to background
NA27	• All COCs below 60% LAET and SS-MEQ values • All COCs less than 4x background • Technical infeasibility
SW03	• Triad station - Low toxicity and low benthic impacts • All COCs below 60% LAET and SS-MEQ values • All COCs less than 5x background • Technical infeasibility
SW06	• All COCs below 60% LAET and SS-MEQ values • All COCs less than 5x background • Technical infeasibility
SW19	• All COCs below 60% LAET and SS-MEQ values • All COCs less than 5x background • Technical infeasibility

35.2 Evaluation of Estimated Post-Remedial SWACs Relative to Background

Following remediation of all areas identified above, the estimated post-remedial SWAC concentrations in sediment at the site are shown in Figure 34-3. The SWAC for cadmium will be below the estimate background concentration, while the SWACs for arsenic, lead, zinc, copper, and mercury will be less than 1.5 times background. None of the post-remedial SWACs will exceed five times the background concentration.

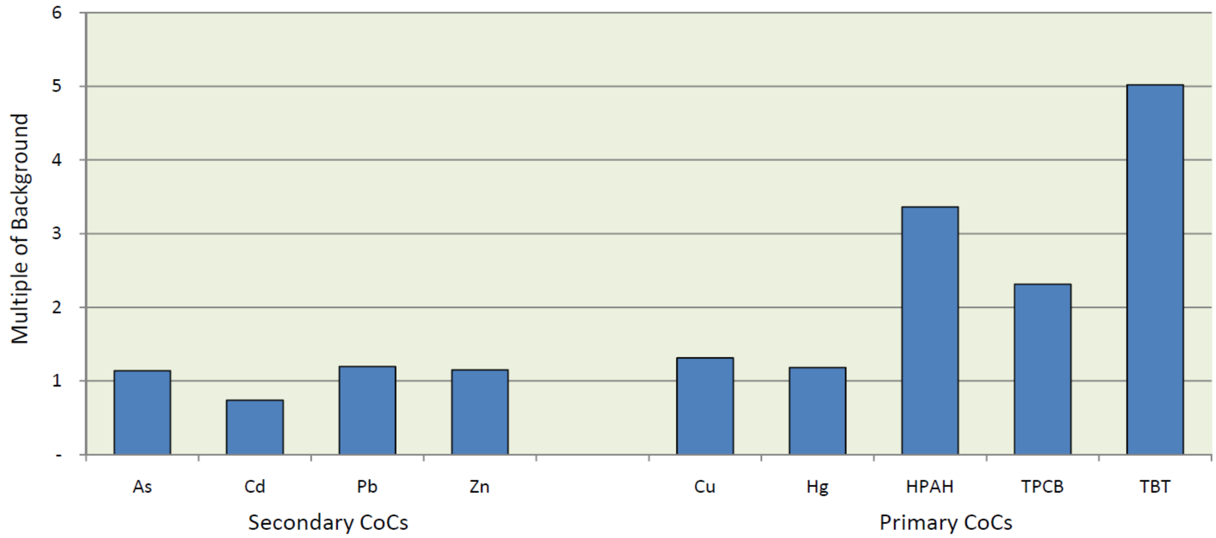


Figure 35-3. Comparison of Post-Remedial SWACs to DTR Background

35.3 Preliminary Remedial Design

In recognition of the methodologies and limitations of traditional mechanical dredging, the irregular polygons were converted into uniform dredge units. Uniform dredge units allow the dredge operator to develop transects of linear, but regular, proportions, e.g., straight lines and 90 degree angles. As a practical matter, uniform dredge units also allow planners to create dredge boxes (units) that contain the same volume of dredge material represented by a given polygon. Each dredge box (sediment management unit or "SMU") is then used to develop the dredge footprint. The details of the area and volume of dredging and under pier areas are identified in Table 35-5.

Table 35-5. Remedial Footprint Details

Activity	North	South
Dredge Remedial Area (Square Feet)	444,032	217,800
Under Pier Remedial Area (Square Feet)	88,477	13,725
Total Remedial Area (Square Feet)	532,509	231,525
Dredge Volume (Cubic Yards)	87,835	53,000

The conversion from irregular polygons to SMUs is shown in Figures 35-4 and 35-5. 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).

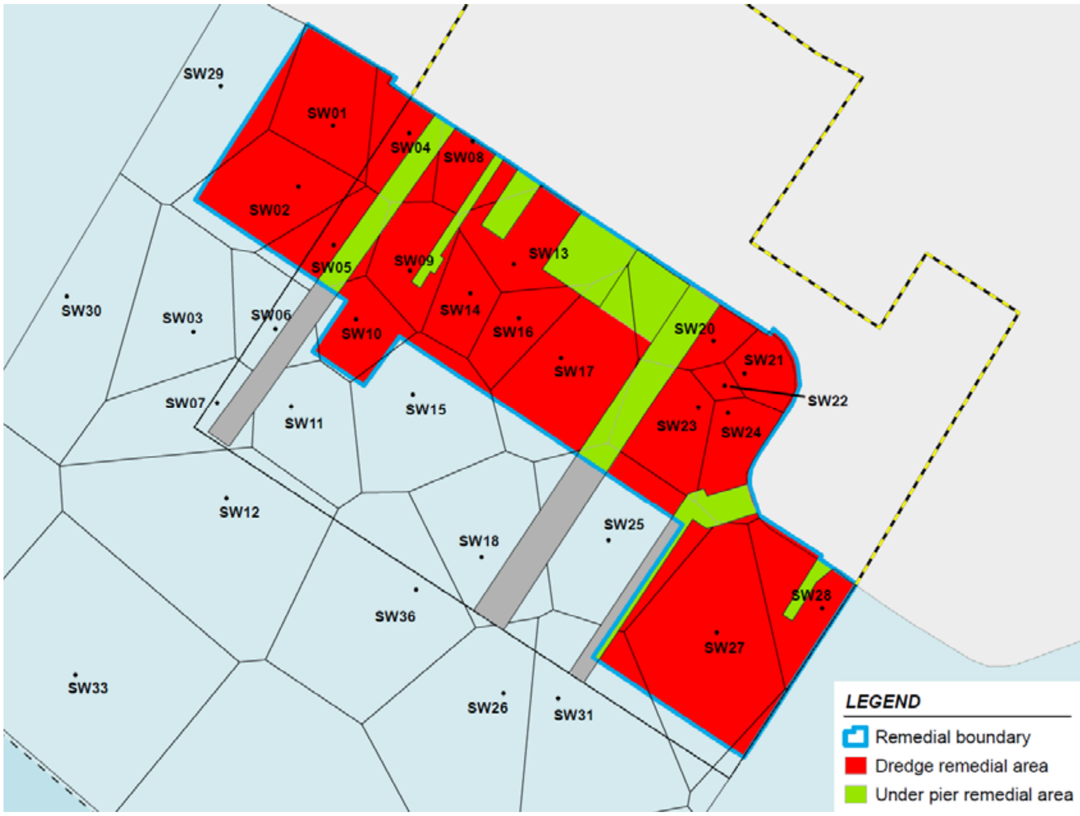


Figure 35-4. Dredge Footprint (BAE Leasehold) based on SMUs

As discussed in Section 32, remedial measures may include dredging (with or without backfill), capping, and thin-layer covers. The presumed remedial measure in accessible areas is dredging. For under-pier areas and other locations, where significant impacts to infrastructure e.g., piers, wharves and bulkheads are likely, alternatives to dredging are proposed.

For areas immediately adjacent to sheet pile bulkheads and along piers, the remedial footprint has been adjusted to include an equivalent surface area of dredging outside of (in addition to) the remedial area calculated based on polygons. In those areas, along bulkheads and piers, sand capping is proposed. Where necessary, rock or gravel may also be used to fortify or stabilize the sand capping in these set-back areas. Inaccessible areas under piers will be remediated using technically feasible techniques such as placement of a sand layer, nominally 1 to 2 feet in thickness, on top of existing sediment. Design details of the remedial action will be specified in the Remedial Action Plan (“RAP”) to be submitted following issuance of a final Order.

Dredge material is currently proposed for upland landfill as daily cover or fill. Local landfills have accepted dredge material for use in daily cover from other dredge projects in San Diego Bay where ocean disposal or beneficial reuse was not appropriate. Alternatives for local landfill disposal include other landfill locations in Southern California or out of state disposal. Upland disposal requires that dredge material be dewatered prior to disposal. This is necessary for at least two reasons. First, landfills will not accept waste that exceeds a specific moisture content. Generally this includes passing a "paint filter test." Second, transportation of excessively moist material can cause spillage or leaks during transportation. Currently, no site has been identified for the off-load, drying, stockpiling, and transportation of dredged sediment. In addition to identifying a site for sediment management, there are logistical impacts related to traffic, as well as concerns by the local community who may be impacted by the significant number of trucks that would be required to transport the dredged sediment to its ultimate disposal location.

Alternatives to upland disposal, as identified in Section 32 include in-Bay confined aquatic disposal ("CAD") or near-shore confined disposal facility ("CDF"). And, while these alternatives themselves have many challenges, they should be considered as alternatives to upland disposal as part of the RAP.

35.3.1 Proposed Remedial Footprint Characteristics

The proposed remedial footprint has the following characteristics:

- Total of 23 Polygons
- Captures 100 percent of triad "likely" and >50 percent of triad "possible" impacted stations
- Total Remedial Surface Area (including under piers) = 764,034 ft^2
- Under-pier Remedial Surface Area = 102,202 ft^2
- Meets SWAC for protection of human health and wildlife
- SWACs are at or near background for 6 out of 9 COCs
- SWACs always less than or equal to 5X background

The estimated post-remedial SWACs are compared to the current or pre-remediation SWACs in Table 35-6.

Table 35-6. Comparison of Pre- and Post-Remedial SWACs

Primary COCs	Pre-Remedy		Post-Remedy	
	SWAC	Station Maximum	SWAC	Station Maximum
Cu (mg/kg)	187	1,500	159	390
Hg (mg/kg)	0.75	4.1	0.67	2.1
HPAH (mg/kg)	3.3	52	2.3	16
PCB (ug/kg)	308	5,500	194	820
TBT (ug/kg)	163	3,300	110	410
SS-MEQ	NA	4.2	NA	0.72

While the above information was used to develop the remedial footprint and anticipated strategy for implantation, the final engineering details necessary to execute the remedial action will require the responsible parties to submit for review and approval a Remedial Act Plan that provides the level of detail necessary to ensure the targeted remedial action will be successful. Many of those details, such as selection of an on-shore dredge material handling site, upland sediment disposal site(s), and alternatives to upland disposal, simply cannot be determined without more extensive engineering assessment and public comment.

35.4 Confirmation of Beneficial Use Protection Using Alternate Cleanup Levels

Post-remedial COC concentrations (based on both the SWAC concentrations and point exposures) were evaluated to determine if the expected improvements in site-wide sediment quality would be protective of beneficial uses. These evaluations are discussed in detail in Section 34. Table 35-7 presents a summary of the results of these evaluations for human health and aquatic-dependant wildlife beneficial uses for copper, mercury, HPAH, total PCBs, and TBT.

Table 35-7. Summary of Aquatic-Dependent Wildlife and Human Health Beneficial Use Protection Analysis

Beneficial Use	Primary COCs	Post-Remedial SWAC	Basis
Human Health and Wildlife	Cu (mg/kg)	159	Protective of human health at 100% recreational consumption (FI) of Site seafood species.
			Protective of human health at 100% subsistence consumption of Site whole sand bass.
			Protective of wildlife at 100% consumption of Site prey items.
	Hg (mg/kg)	0.67	Protective of human health at 100% recreational consumption of Site sand bass fillet and edible lobster.
			Protective of human health at 100% subsistence consumption of Site whole lobster.
			Protective of wildlife at 100% consumption of Site prey items.
	HPAH (mg/kg)	2.3	Protective of wildlife and human health at 100% consumption of Site prey items and seafood.
	TPCB (µg/kg)	194	Protective of human health at 100% recreational consumption of Site edible lobster.
			Protective of human health at 40% recreational consumption of Site sand bass fillet.
			Protective of wildlife at 100% consumption of Site prey items.
	TBT (µg/kg)	110	Protective of wildlife and human health at 100% consumption of Site prey items and seafood.

Aquatic-dependant wildlife is protected at the estimated post-remedial SWACs. Exposure to COCs was estimated by modeling post-remedial prey tissue concentrations and uptake of these prey items for each aquatic-dependant wildlife receptor. The estimated post-remedial SWACs are sufficiently protective to allow for wildlife diet to come entirely from species within the shipyard site (e.g., is protective even when an area use factor of 1 is assumed).

Post-remedial SWACs are protective of human health for consumption of seafood living within the shipyard site. Exposure to COCs was estimated using two surrogate species: sand bass and lobster. For all COCs, except total PCBs, post-remedial SWAC sediment concentrations are protective to allow for 100 percent of seafood consumption from sand bass fillets and the edible portions of lobster caught within the shipyard site for both recreational and subsistence fishers. For some COCs (e.g. copper, mercury, HPAH, and TBT), post-remedial SWAC sediment concentrations are protective to allow for 100 percent consumption of whole lobster or whole sand bass (see table 1).For total PCBs, seafood consumption for recreational fishers would be limited to consumption of the edible portions of the lobster (at 100 percent consumption rate), while sand bass consumption would be limited to fish fillets, and a fractional intake of 40 percent (e.g., only 40 percent of the fishers sand bass fillet diet could come from sand bass caught within the shipyard site).

The analysis of protection of aquatic life beneficial uses was based on protection of the benthic community and considered point exposure to COCs rather than using the SWAC concentrations. Point exposure better represents the exposure environment for benthic organisms as they are relatively non-mobile, and are therefore exposed to the same COC concentrations throughout their life. Table 35-8 presents a summary of the weight of evidence analysis that was used to determine whether post-remedial sediment concentrations would be protective of aquatic life beneficial uses. All areas within the Shipyard Sediment Site that were designated as "likely" impacted based on the sediment quality triad results (Section 17) were included in the remedial footprint, and will be cleaned up to background levels. For those areas of the shipyard site that did not have sufficient biological data to conduct a sediment quality triad analysis in order to determine whether the areas were protective of aquatic life uses, two independent lines of evidence were used based on sediment chemistry. Both lines of evidence indicate that the sediment chemical concentrations within the Shipyard Sediment Site (other than the areas identified using the sediment quality triad data), are below concentration thresholds that are protective of aquatic life beneficial uses.

Table 35-8. Summary of Aquatic Life Beneficial Use Protection Analysis

<table>
<tr><th colspan="3">Beneficial Use</th><th>COC</th><th>Condition</th><th>Basis</th></tr>
<tr><td rowspan="8">Aquatic Life (Benthos)</td><td colspan="2">Triad Stations</td><td>Weight of Evidence Category</td><td>No "Likely" Impacted Stations</td><td>• Cleanup all areas designated as "likely" impacted or above under the weight of evidence analysis in the Section 17.</td></tr>
<tr><td rowspan="7">Non-Triad Stations</td><td>SS-MEQ</td><td>Quotient of 5 COCs</td><td>0.9</td><td>• Protective of benthic communities consistent with "likely" stations (Section 17).</td></tr>
<tr><td rowspan="5">60% LAET</td><td>Cu (mg/kg)</td><td>618</td><td rowspan="5">• Protective of benthic communities consistent with Site-specific Lowest Apparent Effects Threshold (LAET)
• Significant margin of safety</td></tr>
<tr><td>Hg (mg/kg)</td><td>2.4</td></tr>
<tr><td>HPAH (mg/kg)</td><td>15.6</td></tr>
<tr><td>TPCB (µg/kg)</td><td>3,270</td></tr>
<tr><td>TBT (µg/kg)</td><td>1,140</td></tr>
<tr><td>SPI</td><td>NA</td><td>Presence of Stage 3 Community</td><td>• Supporting line of evidence</td></tr>
</table>

35.5 Upland Source Control in Watershed of MS4 Outfall SW-4

Storm water runoff from the shipyards is controlled and monitored in both the BAE Systems and NASSCO NPDES permits. Also, the City of San Diego MS4 outfall located at the foot of Sampson Street discharges at outfall SW4 within the BAE Systems facility. To reduce the risks of ongoing contamination and recontamination post-cleanup from pollutant sources in the watershed that drains to MS4 outfall SW-4, several activities will be completed in the watershed of the SW-4 outfall (shown in Figure 35-5) as part of the remedy. These activities include:

- Investigate the storm drain and surrounding environs to identify sources of pollutants to the storm drain.
- Clean out residual sediments in the storm drain.
- Place structural treatment control Best Management Practices (BMPs), where feasible, in the storm drain system to mitigate entry of pollutants into the storm drain to the maximum extent practicable.
- Maintain BMPs, as necessary, to prevent significant degradation in their performance.

Figure 35-5. Map of Watershed that Drains to MS4 Outfall SW-4

35.6 Other Considerations Regarding Resolution No. 92-49

The alternative cleanup levels must also comply with the provisions of Resolution No. 92-49. This resolution requires alternative cleanup levels less stringent than background levels be consistent with maximum benefit to the people of the state, and 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.

35.6.1 Maximum Benefit to the People of the State

Resolution No. 92-49 requires that an alternative cleanup level[4] be consistent with maximum benefit to the people of the State of California. When considering an alternative cleanup level under Resolution No. 92-49, a regional water board must consider: “all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible.” Moreover, a regional water board must consider the total values involved in the light of “current, planned, or future land use, social, and economic impacts to the surrounding community, including property owners other than the discharger.”

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 Bay provides habitat for fish and wildlife, extensive commercial and industrial economic benefits, and recreational opportunities to citizens and visitors. The Bay is a key element for the military security of the United States.

San Diego Bay is of significant economic value to California and the Nation. The Bay is a major tourist and convention destination, international shipping center, plays a key role in the national defense, and has many other recreational, industrial, and commercial uses. Most of these uses rely on a healthy Bay. Shipping, shipbuilding, boat repair, tourism, and other industries are either directly dependent on, or otherwise benefit from, the Bay. Because of its beauty and availability as a recreational resource, San Diego Bay is a major draw for the tourist industry. In 1997, tourism in the greater San Diego area accounted for 14 million overnight visitors and $4.4 billion in income. Much of this activity occurred around San Diego Bay and downtown San Diego where the hotels and San Diego Convention Center are located.

San Diego Bay is designated as a State Estuary under Section 1, Division 18 (commencing with section 28000) of the Public Resources Code. A State Estuary is defined as a California saltwater bay or body of water, receiving freshwater stream 5 flows, which supports human beneficial uses and wildlife and merits high priority action for preservation.

[4] An “alternative” cleanup level is one that allows wastes to remain in waters of the State at levels above “background.”

San Diego Bay is bordered by the cities of San Diego, National City, Chula Vista and Coronado, with an estimated population of approximately 1.65 million persons. San Diego County has a population of over 3 million and is growing at a rate of about 50,000 per year; most of these residents are located in the in the metropolitan western portion of the county.

For all these reasons San Diego Bay water quality issues have always been one of the San Diego Water Board's highest priorities.

The proposed alternative cleanup levels are judged to be consistent with maximum benefit to the people of the State because:

1. remediated areas will approach reference area sediment concentrations for most COCs,
2. all areas identified with "likely" impacts to benthic beneficial use will be remediated,
3. adverse impacts to benthic communities from dredging will be temporary, with stasis expected within approximately three years,
4. the alternative cleanup levels reduce risk to human health and aquatic dependent wildlife,
5. impacts on local communities associated with remedial activities are temporary and will be mitigated where feasible,
6. remedial activities will cause no adverse effects to sport or commercial angling, or to contact or non-contact water recreation beneficial uses because they will take place inside the shipyard security boom, and
7. adverse effects to eelgrass beds from dredging will be mitigated to levels of insignificance following remediation.

Compared to background cleanup levels, 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. The alternative cleanup level also requires less barge and crane movement on San Diego Bay, has a lower risk of re-suspension of contaminated sediments and reduces the amount of landfill capacity required to dispose of the sediment wastes. Despite not having an unreasonable affect on beneficial uses in San Diego Bay, the alternative cleanup level will result in no long-term loss of use of the Shipyard site, thereby furthering continued operation of the shipyards, including vessel construction, maintenance and repair, and the concomitant employment of persons in the San Diego region.

The alternative cleanup level also maximizes benefit to the people of the State by effectuating source control at the dischargers' storm water facilities, and by causing significant contaminant mass removal from San Diego Bay. The City of San Diego will take protective measures to remove potential contaminants and prevent their discharge to the Bay from its storm drains and storm water collection system in the areas upland of the shipyards, including cleaning sediments out of the catch basins and conveyances, repairing the system where it is damaged, installing filters, and implementing other BMPs.

Preliminary contaminant mass removal estimates are set forth in Table 35-9, below. These contaminants will be permanently removed from San Diego Bay.

Table 35-9. Preliminary Contaminant Mass Removal Estimates

COC	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%

The Shipyards provide significant economic benefit to the San Diego community. NASSCO is the only major construction shipyard on the West Coast. BAE Systems and NASSCO provide essential repairs and maintenance on U.S. Navy vessels. The two Shipyards have repaired more than 250 U.S. Navy vessels this decade. The two Shipyards directly employ approximately 5,800 skilled trade persons while providing work for another 1,100 subcontractors and other companies. The Shipyards are the largest minority employers in San Diego, and continue to provide more manufacturing jobs in San Diego than any other company.

The Shipyards in conjunction with the remaining working waterfront have an estimated $3.5 billion impact in the local community surrounding the Shipyards. BAE Systems alone has spent or invested about $500 million in the community over the course of the last two years.

The Shipyards have heavily invested to eliminate environmental discharges to San Diego Bay. NASSCO and BAE Systems have both set a "zero discharge" goal for their facilities.

35.6.2 Water Quality Control Plans

The Water Quality Control Plans that apply to the alternative cleanup levels are the Basin Plan and State Water Quality Control Plan for Enclosed Bays and Estuaries (Bays and Estuaries Plan). The Basin Plan contains a narrative water quality objective for toxicity that states in relevant part:

> "All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board."

The Bays and Estuaries Plan contains narrative sediment quality objectives for the protection of aquatic life and human health. These objectives are as follows:

A. **Aquatic Life – Benthic Community Protection**
Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California.

B. **Human Health**
Pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health.

The alternative cleanup levels comply with the Basin Plan and Bays and Estuaries Plan narrative water quality objectives because, as discussed in the previous section, human health, aquatic-dependent wildlife, and aquatic life beneficial uses will not be unreasonably affected by the post-cleanup sediment chemistry concentrations. Regarding aquatic life objectives, polygons associated with triad stations characterized as "likely impacted" are included in the cleanup footprint. Furthermore, polygons without a triad station, but with sediment chemistry that exceeds 60 percent of the LAET, or the SS-MEQ are included in the cleanup footprint (see Section 35.1). The alternative cleanup levels comply with the human health and aquatic dependent wildlife objectives as shown by the risk assessments for the alternative cleanup levels discussed in Section 35.4.

36 Finding 36: 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 *macoma*. For aquatic wildlife beneficial uses, post-remediation monitoring should include sediment chemistry, toxicity, and benthic community condition assessments to demonstrate the remediation has successfully created conditions to promote re-colonization of a healthy benthic community.

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 be considered successful.

36.1 Pre-Remediation Monitoring

In order to verify the protectiveness of the selected remedy for benthic community beneficial uses, a supplemental Triad study was conducted at the Shipyard Sediment Site in July 2009. Five stations (NA23, NA24, SW06, SW19, and SW30) were selected for inclusion in the study, based on the following criteria:

1. They were not included in the Phase 1 sediment investigation Triad study, conducted in 2001.
2. Station locations were outside of the proposed remedial footprint (see Attachment 2).
3. These stations had relatively high primary COC concentrations compared to other stations outside the remedial footprint.

The sediment chemistry, toxicity, and benthic community data from these five stations were evaluated in a manner consistent with that contained in the Section 17. The purpose of the monitoring was to test the analysis for aquatic life at non-triad stations (Section 34.3.2) to ensure that the SS-MEQ and 60% LAET approaches used to evaluate the likelihood of benthic community impairment at stations where only chemistry data are available is accurate and sufficiently protective. The study depicted that, while 4 of the 5 stations had moderately elevated chemistry (SW19 was low), all had low toxicity. Benthic community disturbance was found to be low at three of the five stations, and moderate at NA23 and NA24. The results in the pre-remediation monitoring are shown in Table 36-1.

Table 36-1. Supplemental Triad Analysis Results and SS-MEQ/60%LAET Predictions

Station ID	Sediment Chemistry	Toxicity	Benthic Community	Relative Likelihood of Benthic Community Impairment	Likelihood of Impairment Predicted by Non-Triad Data Approach	Accurate SS-MEQ/ 60%LAET Prediction?
SW06	Moderate	Low	Low	Unlikely	Unlikely or Possible	Yes
SW19	Low	Low	Low	Unlikely	Unlikely or Possible	Yes
SW30	Moderate	Low	Low	Unlikely	Unlikely or Possible	Yes
NA23	Moderate	Low	Moderate	Possible	Unlikely or Possible	Yes
NA24	Moderate	Low	Moderate	Possible	Unlikely or Possible	Yes

These findings indicated that no benthic community impacts are resulting from elevated contaminants of primary concern in the sediments at these locations. None of the stations studied were deemed “likely” impaired (although some benthic impacts are likely in some areas due to physical disturbance from shipyard activities, such as ship movements and dry dock operations). At all five stations, the "Non Triad Data" approach successfully predicted the absence of “Likely” benthic community impacts. Based on the preceding evidence, the SS-MEQ and 60 percent LAET approach appears to be accurate for predicting areas of benthic impairment at other locations at the Shipyard Sediment Site.

36.2 Remediation Monitoring

Remediation monitoring is the monitoring phase conducted during remedy implementation and consists of three components: 1) water quality monitoring, 2) sediment monitoring, and 3) disposal monitoring. The objectives of this monitoring are to document that cleanup activities 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. If the monitoring shows that any of these objectives are not being met, then action will be taken to bring the remedy implementation into compliance. Monitoring decision rules which specify when an action should occur and the type of action that should occur are also discussed in this section. The remediation monitoring provisions described below should be included in the waste discharge requirements issued by the San Diego Water Board for dredging activities.

36.2.1 Water Quality

The goal of water quality monitoring during active remediation is to demonstrate that remedy implementation does not result in violations of water quality standards outside the construction area, specifically at a distance of 500 feet from the dredging activity as the point of compliance. Measures of turbidity and dissolved oxygen (DO) will be used to assess compliance with water quality monitoring goals. One of two methods will be employed:

1. Prior to remedy implementation, a model of turbidity and synoptic water quality measures will be developed for ambient conditions. This model will be used to determine if monitored turbidity would likely result in unacceptable water quality. Turbidity measures will be monitored from four samples each on two arcs outside of the construction area: one arc at 250 feet and one arc at 500 feet. Samples will be collected from a depth of 10 feet below the water surface. Monitored turbidity measures will be compared to synoptic "ambient" measurements outside the construction area, including Bay conditions and effects of non-remedial shipyard activities. The samples collected from the 250 foot arc are intended to warn of potential problems with the point of compliance at the 500 foot arc.
2. Real time monitoring of turbidity, salinity, and DO readings will be taken synoptically at locations 250 feet from the dredge zone, 500 feet from the dredge zone, and at ambient locations. The 250 and 500 feet measurements will be compared to real time ambient readings taken by the same type of meters. If turbidity exceeds the ambient concentration by more than the error rate of the monitors' measurement ability, then appropriate corrective action will be taken in the dredge area. As in the prior option the 250 foot arc will warn of potential problems and the 500 foot arc will be the point of compliance.

The frequency of water quality monitoring may be reduced if three days of daily monitoring (performed at the start of dredging activities) shows that no samples exceed water quality targets. In this event, water quality monitoring will be reduced from daily to weekly. Monitoring frequency will return to daily if a significant change in operations occurs. Monitoring frequency can again be reduced to weekly if three days of monitoring show that there are no exceedances.

36.2.2 Sediment Conditions

Sediment monitoring during dredging activities is intended to confirm that remediation has achieved target cleanup levels within the remedial footprint. This confirmation sampling is necessary because sediment resuspension and chemical release are unavoidable during dredging. Resuspended particulate material will be re-deposited and some resuspended contaminants may also dissolve into the water column and be available for uptake by biota. Sediments are resuspended not only from dredge head movement, but also by other mechanisms associated with dredging such as spillage, prop wash, and anchor systems. Chemical release can occur when bed sediments are suspended in the water column and increased turbidity can itself degrade acceptable levels of habitat quality for organisms in the water column. Re-deposition may occur near the dredge area or, depending on the environmental conditions and controls, resuspended sediment may be transported to other locations in the water body. Further, sediment dredging activities are planned such that a sufficient volume of contaminated sediment is removed, however, removing all particles of contaminated sediment is neither practical or feasible.

Sediment monitoring will occur in Phase 1 footprint polygons and will be implemented immediately after the dredging contractor has confirmed that dredge depths within the footprint area have been achieved. Dredge depths are confirmed using multibeam dual frequency Global Positioning Satellite (GPS) equipment. Confirmation sediment sampling will consist of core sediment sample collection in each footprint polygon. Sediment concentrations in the surface sediment (top two centimeters) will be analyzed along with subsurface sediment concentrations in a 0-2 foot interval. COCs that will be monitored and compared to the alternative cleanup level concentrations include: PCBs, copper, PAHs, TBT, and mercury. The alternative cleanup levels consist of the post-remediation SWACs, and can be found in Section 34, Table 34-20.

36.2.3 Disposal

When dredging sediments, assessment of the sediments is necessary to identify the disposal options which include landfills, confined aquatic disposal facilities (CDFs), uplands re-use, or open water disposal. Disposal options for dredged sediments are typically based on an array of tests which are dictated by the disposal facility. The testing of dredged sediments at this site will occur in a two-tiered approach.

Tier 1 evaluation will be based on existing data. Results will be compared to federal and state disposal criteria, as well as disposal facility specific requirements. The sediments in San Diego Bay have been adequately characterized to facilitate preliminary and conditional approval for identifying general disposal options which include landfills and open water disposal.

Tier II testing will occur if specific landfills or in water facilities have been selected for disposal. For uplands disposal, the dredged sediments typically require stockpiling and de-watering prior to disposal. Most uplands landfills require leaching tests for specific chemicals prior to final disposal and these can be performed on the stockpiled sediments after de-watering has occurred. Concentrations of chemicals in the leachate are compared to limit values allowing the dredged material to be characterized as non hazardous or hazardous, allowing disposal of the sediments in the appropriate type of landfill. Moisture content will be necessary as well as potentially other physical property measurements for upland disposal or re-use options. Development and placement of materials in CDFs is often preferred to uplands disposal as it minimizes the amount of distance and associated risks with transporting materials. Requirements of CDFs typically include data to show the sediments do not contain free oil, are not designated as hazardous waste, and do not exceed limits on TPH concentrations. Additionally, the geotechnical properties and leachability of the sediments must be shown to be protective of human health and the environment when allowances are made for mixing and natural attenuation. If a CDF in San Diego Bay is determined to be a viable option, Tier II testing to evaluate geotechnical properties associated with the sediments will be completed prior to the start of the sediment dredging activity.

Details on the disposal sampling will be developed once a disposal facility or option is developed as these options will dictate the extent and type of characterization required.

36.2.4 Contingencies

The descriptions above related to sediment and water quality monitoring presume that the conditions as specified for each of these media will be met. This section describes the contingencies (management actions) that will occur in the event that water quality and sediment monitoring conditions are not met.

With respect to water quality, if turbidity or DO are not compliant at 250 feet, the construction activities will be adjusted to reduce turbidity and raise DO to achieve compliance. If turbidity or DO problems are found at 500 feet from the construction area, then remediation activities will be halted while best management practices (BMPs) and alternate remedial methods (i.e., equipment) are evaluated.

With respect to determining sediment remediation success, there will be natural variability in the sediment chemistry data collected, which does not represent a true difference from the expected value. Natural variability can be attributed to random error in laboratory instrument outputs, sample collection and handling techniques, grain size distribution variance in sedment samples, or other random non-systematic differences that cannot be measured or specifically accounted for. Furthermore, sediment cannot be dredged at depths of 2 centimeters or less. Therefore, dredging success will be evaluated based on the following decision rules applied to subsurface monitored sediment:

- If concentrations of COCs in subsurface sediments (deeper than the upper 2 cm) are above 120 percent of background concentrations,[5] then additional sediments will be dredged by performing an additional "pass" with the equipment.
- If concentrations of COCs in subsurface sediments are below 120 percent of background concentrations, then dredging is sufficient and will 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 will be evaluated to determine whether sand cover is required.

36.3 Post-Remediation Monitoring

The objective with post-remedy implementation monitoring is to verify that remaining pollutant concentrations in the sediments will not unreasonably affect San Diego Bay beneficial uses. These long-term beneficial uses include shellfish harvesting (SHELL), commercial and sport fishing (COMM), contact water recreation (REC-1), non-contact water recreations (REC-2), estuarine habitat (EST), marine habitat (MAR), wildlife habitat (WILD), and migration of aquatic organisms (MIGR). The sediment monitoring program will be based upon a conceptual model of the site that identifies the physical and chemical factors that control the fate and transport of pollutants and receptors that could be exposed to pollutants in the sediment.

Post-remediation monitoring will be initiated two years after remedy implementation has been completed and will continue for a period of up to 10 years after remediation.

[5] See Table 31-1 for background concentrations of COCs.

36.3.1 Human Health and Aquatic-Dependent Wildlife

Post-remediation monitoring is intended to verify that remediation was effective in reducing and maintaining pollutants in sediments at levels that do not unreasonably impact human health and aquatic-dependent wildlife. To achieve these goals, composite surface sediment samples will be collected from six polygon groups comprising sub-regions of the site. The six groups are described below and shown in Figure 36-1:

Group 1. Northern half of the site inside the remedial footprint

Group 2. Northern half of the site outside the remedial footprint – smaller polygons

Group 3. Northern half of the site outside the remedial footprint – larger polygons

Group 4. Southern half of the site inside the remedial footprint

Group 5. Southern half of the site outside the remedial footprint – smaller polygons

Group 6. Southern half of the site outside the remedial footprint – larger polygons

To prepare the composite samples, the 65 station locations within the six polygon groups will be sampled. The volume of the sample at each station will be proportional to the area of the polygon the station represents. These samples will be collected from the 0-2 cm interval. Two (2) grab samples will be composited in the field at each station. The composite samples will be separated into six (6) pools and composited into six (6) composite samples representing the areas noted above. Three (3) replicates will be taken from each of these six (6) composite samples and analyzed for the COCs. The average concentration of each of the six (6) composites will 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. The site-wide SWAC calculated from the average COC concentrations of the six (6) composite sample results is consistent with the SWAC method discussed in this Technical Report. 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 will be archived for potential future analysis.

Analyses of surface sediment samples will include sediment bulk chemistry of the parameters PCBs, copper, mercury, PAHs, and TBT, and sediment conventional parameters (e.g., grain size, TOC, ammonia). Nine (9) sediment samples will undergo bioaccumulation testing using the 28-day *macoma* test. The samples selected for bioaccumulation testing will be from the same stations that underwent bioaccumulation testing in the Shipyard Report (Exponent, 2003). These stations are SW04, SW08, SW13, SW21, SW28, and NA06, NA11, NA12, and NA20.

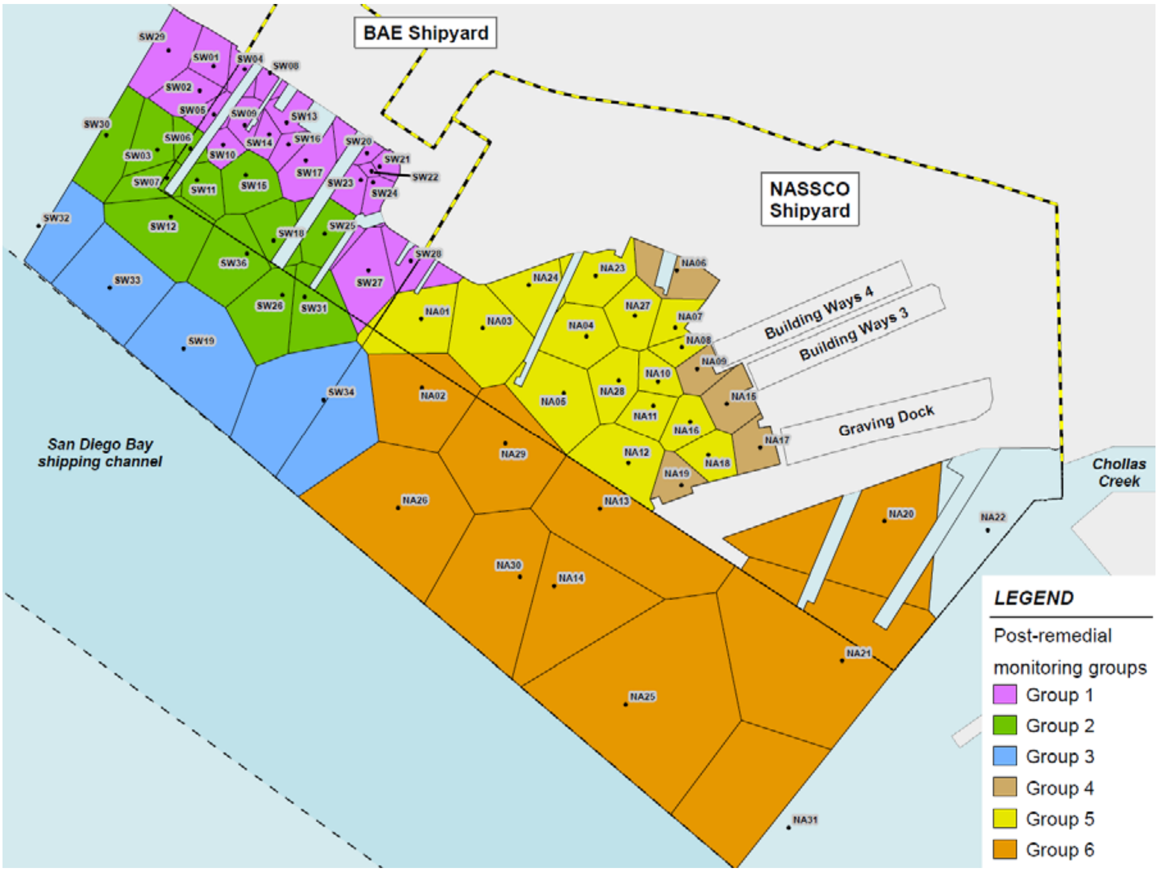


Figure 36-1. Polygon Groups for Composite Sampling

The frequency of sediment sampling and analyses (chemical, physical, and bioaccumulation) will occur at two and five years post-remediation and, depending on the results at year five post-remediation, may also occur at ten years post remediation.

The goals of the sediment chemistry monitoring are to demonstrate that the post-remedial site-wide SWACs are at or below threshold target levels for specific COCs. The goals of bioaccumulation testing are to show decreasing bioaccumulation over time such that at two years post-remediation, the average of stations sampled shows bioaccumulation levels below what was measured in the Shipyard Report (Exponent, 2003) and that this decreasing trend continues at year five post-remediation and, if determined necessary, at year ten post-remediation.

36.3.2 Post-Remediation SWAC Trigger Concentrations

When collecting environmental data, there is natural variability in the data collected, which does not represent a true difference from the expected value. Natural variability can be attributed to random error in laboratory instrument outputs, sample collection and handling techniques, grain size distribution variance in sedment samples, or other random non-systematic differences that cannot be measured or specifically accounted for. Therefore, if the measured SWAC is within a range of the expected SWAC, then it can be stated with statistical significance that the expected SWAC was achieved. This is accounted for with statistically calculated confidence limits that describe the amount that the measured SWAC can vary from the expected SWAC and still be considered to be the same as the expected SWAC due to random error in the sampling or analytical techniques. The 95 percent Upper Confidence Limit (UCL) is typically employed in environmental sampling programs to determine if a measured set of values are significantly different from the expected set of values.

SWAC trigger concentrations will be used to evaluate whether SWAC cleanup levels have been met, or 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 SWAC after remediation is below the trigger concentration then remediation will be considered successful. Exceedance of the trigger concentration will result in further evaluation of the site-specific conditions to determine if the remedy was successful. For these post-remedial comparisons, it is critical to account for the natural variability of the predicted post-remedial SWAC.

The trigger levels for each primary COC was set at the upper 95 percent confidence limit (UCL) on the estimated post-remediation SWAC. The post-remediation SWAC is based on measured concentrations in non-remediated areas and background concentrations in the areas to be remediated. Calculation of the UCL requires an estimate of the variability in concentrations following remedial activities. The UCL trigger concentrations assumed that remediated areas have the same variability as non-remediated areas. This variability was estimated based on the area-weighted variability of the measured concentrations in the non-remediated areas. Specifics regarding the area-weighted variability estimate and the resulting UCL calculation can be found in Bevington and Robinson (1992).

The trigger concentrations for the primary COCs are listed in Table 36-2, below.

Table 36-2. Trigger Concentrations for Primary COCs

Primary COCs	Trigger Concentrations
Copper	185 mg/kg
Mercury	0.78 mg/kg
HPAHs	3.0 mg/kg
Total PCB congeners	253 μg/kg
TBT	156 μg/kg

36.3.3 Benthic Community Conditions

The purpose of assessing benthic community conditions as part of post-remedy monitoring is to demonstrate the remediation will successfully create conditions that would be expected to promote re-colonization of a healthy benthic community. This objective will be evaluated by collecting surface sediment samples (0-2 cm interval) from selected stations within the remedial footprint where pre-remedial triad analyses showed likely effects on benthic receptors. Chemistry and toxicity tests will be performed on these samples to determine if they are likely to have effects on benthic receptors.

Surface sediment samples will be collected at five stations within the footprint area: NA19, SW04, SW13, SW22, and SW23. The frequency of sediment sampling and analyses (chemical, physical, and bioassay testing) will occur at two and five years post-remediation and, depending on the results at year five post-remediation, may also occur at ten years post remediation. Sediments will be analyzed for PCBs, copper, mercury, PAHs, TBT, and sediment conventional parameters (e.g., grain size, TOC, ammonia).

Additionally, sediments will be evaluated using an amphipod bioassay (*Eohaustorius estuarius*, *Leptocheirus plumulosus*, and *Rhepoxynius abronius* test species are accepted) and bivalve larvae (*Mytilus galloprovincialis*) sublethal (embyro development) sediment toxicity methods in accordance with protocols recommended by the San Diego Water Board. Sediment bioassay test results are categorized based on narrative and statistical requirements for each of the categories identified below:

- Nontoxic—Response not substantially different from that expected in sediments that are uncontaminated and have optimum characteristics for the test species (e.g., control sediments).
- Low toxicity—A response that is of relatively low magnitude; the response may not be greater than test variability.
- Moderate toxicity—High confidence that a statistically significant toxic effect is present.
- High toxicity—High confidence that a toxic effect is present and the magnitude of response includes the strongest effects observed for the test.

The goal of bioassay testing is to show that toxicity is not significantly different from reference sediment testing performed as part of the Shipyard Report (Exponent, 2003).

Results from the chemical analyses and bioassays will be evaluated in accordance with the the flow diagrams in Figures 36-2 and 36-3 to determine if further evaluation or action is necessary based on benthic effects indicators.

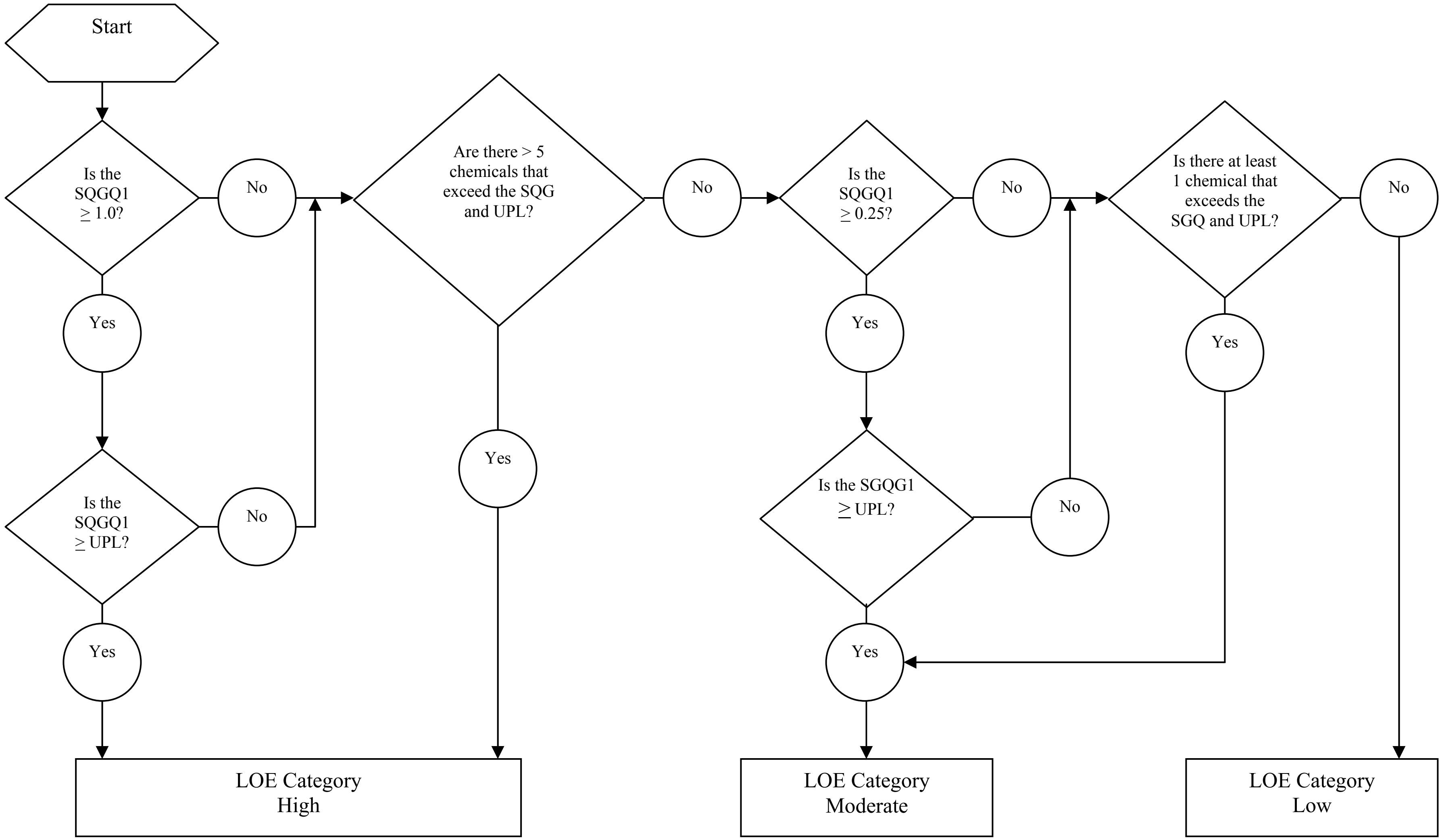


Figure 36-2. Flow Diagram for the Sediment Chemistry Ranking Criteria (Low, Moderate, and High)

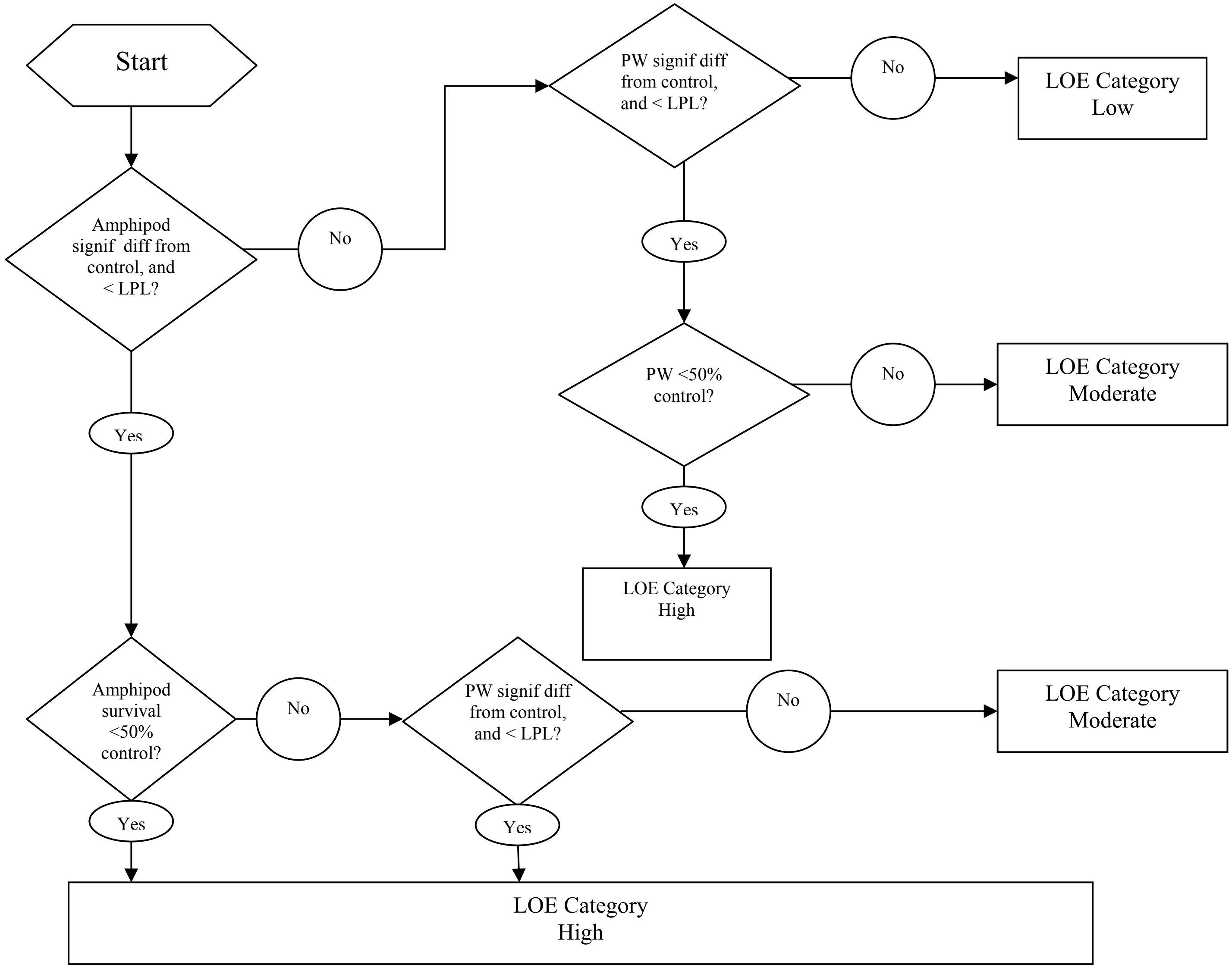


Figure 36-3. Flow Diagram for the Toxicity Ranking Criteria (Low, Moderate, and High)

36.3.4 Benthic Community Development

The purpose of assessing benthic community development as part of post-remedy monitoring is to determine how the benthic community develops within the footprint following remediation. Note that dredging temporarily destroys the benthic community. The intent of these benthic community measurements is to track the degree to which the benthic community re-colonizes the area and will not be used to evaluate the success of the remedy. Benthic community analyses will consist of full taxonomic analyses at five randomly selected sample locations from within the remedial footprint. The random samples will be stratified to assure two to three samples are collected from each of the two shipyard areas, and that sample locations for chemistry, toxicity, and bioaccumulation are avoided as they could potentially be disturbed by sampling activities. Further, to also avoid potential benthic community disturbances from sediment sampling, benthic community development will be assessed on years three and four post-remediation, alternate from sediment sampling years.

The goal of monitoring benthic community development is to observe the nature and extent (e.g., species composition, abundance, and diversity) of re-colonization over time after remediation. All benthic invertebrates in the screened sample shall be identified to the lowest possible taxon and counted. This information will be used to measure the benthic community re-colonization and will be used to assist with remedial decision making elsewhere in San Diego Bay.

37 Finding 37: Remedial Action Implementation Schedule

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 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 is consistent with the provisions in Resolution No. 92-49 for schedules for cleanup and abatement.

37.1 Resolution No. 92-49 Requirements

Resolution No. 92-49 requires the San Diego Water Board to determine schedules for cleanup and abatement taking into consideration:

a. The degree of threat or impact of the discharge on water quality and beneficial uses;

b. The obligation to achieve timely compliance with cleanup and abatement goals and objectives that implement the applicable Water Quality Control Policies adopted by the Water Boards;

c. The financial and technical resources available to the discharger; and

d. Minimizing the likelihood of imposing a burden on the people of the state with the expense of cleanup and abatement, where feasible.

Under Water Code section 13360, the Regional Board may not specify the design, location, type of construction, or particular manner" of compliance with cleanup and abatement orders and dischargers can comply in any lawful manner. This restriction serves as a shield against unwarranted interference with the ingenuity of the party subject to the cleanup and abatement order who can elect between available strategies to comply with cleanup objectives and other standards stipulates in a cleanup and abatement order.

The Responsible Parties have provided a remedial action implementation schedule and a description of specific remedial actions they intend to undertake to comply with the CAO. The proposed remedial actions have a substantial likelihood to achieve compliance with the requirements of the 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.

The remedial action implementation schedule proposed by the Responsible Parties is consistent with the provisions in Resolution No. 92-49 for schedules for cleanup and abatement. The cleanup and abatement actions and milestone dates stipulated in the directives of the CAO, therefore, are based on this remedial action implementation schedule. The schedule, and the remedial actions proposed by the dischargers are discussed in further detail below.

37.2 Remedial Action Implementation Schedule

The remedial action implementation schedule will begin with the adoption of CAO No. R9-2009-0002 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 5 years to complete. The schedule is constrained by the limited dredging window of September 15 through April 1 to protect the endangered California Least Tern. Because of the limited dredging window, three annual dredging episodes will be needed to complete the proposed dredging activities.

Following is a list of the major tasks to be carried out during the remedial action implementation time frame:

a. Establish framework for funding with a funding mechanism based on an allocation share ratio agreed upon by the Responsible Parties.
b. Bid and select the remedial action project management firm.
c. Design and submit the remedial action plan (RAP).
d. Prepare environmental document, most likely an Environmental Impact Report (EIR).
e. Secure all needed permits from permitting agencies. These permits are likely to include a Clean Water Act Section 401 Water Quality Certification, a Coastal Development Permit, a Rivers and Harbors Act Section 10 Permit, and a Clean Water Act Section 404 Permit.
f. Establish sediment management areas.
g. Implement the selected remedial actions.
h. Conduct final confirmation monitoring.
i. Terminate permits and submit final reports.

A timeline showing when these tasks are expected to occur is shown in Figure 37-1. The timeline assumes that the CAO will be adopted by the San Diego Water Board in the first quarter of 2010. This timeline may need to be adjusted depending on when the CAO is actually adopted.

37.3 Remedial Actions

The remedial actions that can be used in the different areas of the Shipyard Sediment Site are constrained by both operations at the site, such as vessel and dry dock operations, and physical conditions such as near-shore obstructions and piers. For this reason a variety of remedial techniques are necessary to achieve remedial action objectives. The selected techniques include removing the sediments from the aquatic environment by dredging, capping[6] contaminated sediments with clean material, source control, and relying on natural processes while monitoring the sediments to ensure that contaminant levels are not increasing. These techniques differ in complexity and cost; dredging is the most complex and expensive, and monitoring without active remediation is the least difficult and least expensive.

[6] Capping refers broadly to the placement of a layer of uncontaminated material over material with elevated concentrations to contain contaminated sediment.

Vessel and dry-dock operation areas are likely to be prioritized for dredging first because their limited open berth space time requires these areas to be dredged quickly. Near-shore areas present challenges for dredging because of the limited room in these areas for the dredge and barge, and the difficulty maneuvering the dredge and barge in these areas. Land-based excavation/dredging may be an option in these areas. Under-pier areas will be dredged where possible. Where dredging is impossible under the piers, sand capping will be used to cover and contain contaminated sediment. Unconstrained open areas are the easiest to dredge. These areas will be scheduled for dredging around the more difficult areas such as piers, berths, and dry docks.

Structures such as pile bulkheads, rock reveted slopes, piers, and pilings will need to be protected during dredging operations. Protection and/or support will be installed iteratively during remedial activities.

Sand capping will be used to manage residual contamination at depth that may be exposed by dredging. Clean sand will be applied in these areas to a depth that will ensure that the bioactive zone does not extend into residually contaminated areas.

Source control measures will be implemented to ensure that recontamination of the site from storm drain discharges does not occur. These measures include identifying storm drains that are sources of sediment discharge to the Shipyard Sediment Site, cleaning sediment from those storm drains, repairing them if damaged, installing filter best management practices within storm drains, and verifying that the storm drains remain clean and in good repair through closed circuit television inspections.

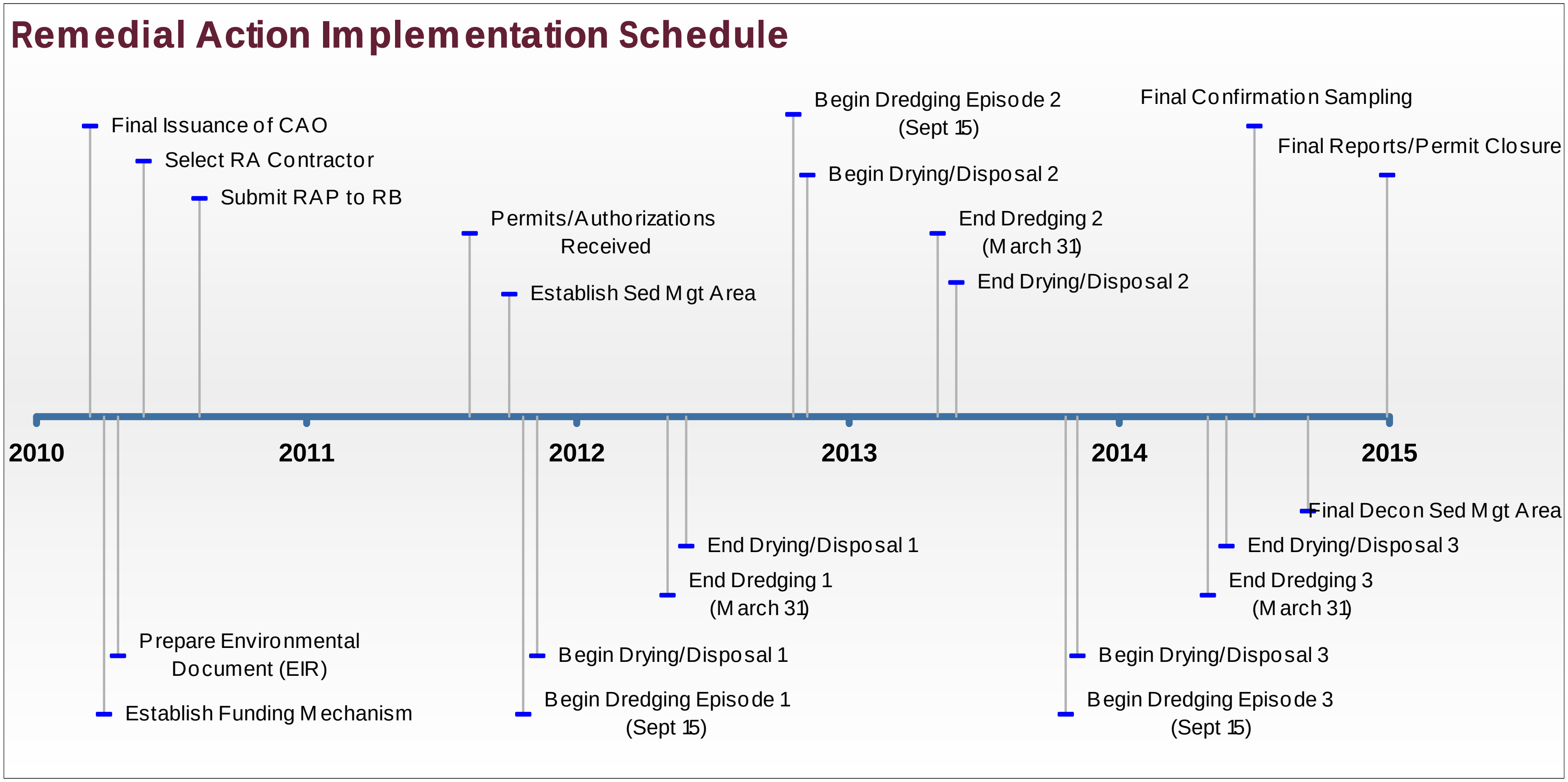


Figure 37-1. Remedial Action Implementation Schedule

38 Finding 38: 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.

38.1 Porter-Cologne Water Quality Control Act Jurisdiction

The Porter-Cologne Water Quality Control Act (Division 7 of the Water Code, commencing with section 13000) is replete with provisions intended to protect beneficial uses from impacts from contaminated sediment. Porter-Cologne jurisdiction extends beyond water column effects to require the reasonable protection of beneficial uses from discharges of waste to waters of the state. Legislative history of the Porter-Cologne Act states in commentary on the definition of "pollution" that "it is the unreasonable effect upon beneficial uses of water, caused by waste, that constitutes pollution."[7] This history expresses the intent that if a person discharges waste into waters of the state and beneficial uses of the water are thereby harmed - then pollution exists even if water column concentrations are not effected by wastes that have settled in sediment.

38.1.1 Water Code Section 13267

Water Code section 13267 provides that the San Diego Water Board can require any person who has discharged, discharges, proposes to discharge or is suspected of discharging waste to investigate, monitor, and report information. The only restriction is that the burden of preparing the reports bears a reasonable relationship to the need for and the benefits to be obtained from the reports.

[7] Final Report of the Study Panel to the California State Water Resources Control Board, 1969, p. 30.

38.1.2 Water Code Section 13304

Water Code section 13304 contains the cleanup and abatement authority of the San Diego Water Board. Section 13304(a) provides that any person who has discharged or discharges waste[8] into waters of the state in violation of any waste discharge requirement[9] or other order or prohibition issued by a Regional Water Board or the State Water Board or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution[10] or nuisance[11] may be required to clean up the discharge and abate the effects thereof. This Section authorizes Regional Water Boards to require complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge).

38.2 Applicable Federal Regulations

U.S. EPA promulgated a final rule prescribing water quality criteria for toxic pollutants in inland surface waters, enclosed bays, and estuaries in California in 2000 (The California Toxics Rule or "CTR."[12] CTR criteria constitute applicable water quality objectives in California. In addition to the CTR, certain criteria for toxic pollutants in the National Toxics Rule (NTR) [40 CFR 131.36] constitute applicable water quality objectives in California as well.

[8] "Waste" is very broadly defined in Water Code section 13050(d) and includes sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, processing operation, including waste placed within containers of whatever nature prior to, and for purposes of, disposal.

[9] The term waste discharge requirements include those, which implement the National Pollutant Discharge Elimination System.

[10] Pollution" is defined in Water Code section 13050 (1) as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects either of the following: (A) the waters for beneficial uses, (B) Facilities which serve these beneficial uses." Pollution" may include "contamination.."

[11] Nuisance is defined in Water Code section 13050(m) "…. anything which: (1) is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, and (2) affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal, and (3) occurs during or as a result of the treatment or disposal of wastes."

[12] The California Toxics Rule (CTR) was finalized by the U.S. EPA in the Federal Register (65 Fed. Register 31682-31719), adding Section 131.38 to Title 40 of the Code of Federal Regulations on May 18, 2000. The full text of the CTR is available at the following web address: http://www.epa.gov/OST/standards/ctrindex.html.

38.3 Water Quality Control Plan for the San Diego Basin (Basin Plan)

The San Diego Water Board's Water Quality Control Plan for the San Diego Basin (Basin Plan) designates 12 beneficial uses[13] for San Diego Bay[14] that may be adversely affected by contaminated sediment. These beneficial uses fall into four broad categories as shown below:

AQUATIC LIFE BENEFICAL USES	AQUATIC - DEPENDENT WILDLIFE BENEFICAL USES	HUMAN HEALTH BENEFICIAL USE	NAVIGATION AND SHIPPING BENEFICICAL USES
Estuarine Habitat (EST)	Wildlife Habitat (WILD)	Contact Water Recreation (REC1)	Navigation (NAV)
Marine Habitat (MAR)	Preservation of Biological Habitats of Special Significance (BIOL)	Non Contact Water Recreation (REC2)	
Migration of Aquatic Organisms (MIGR)	Rare, Threatened or Endangered Species (RARE)	Shellfish Harvesting (SHELL)	
Preservation of Biological Habitats of Special Significance (BIOL)		Commercial and Sport Fishing (COMM)	

The Basin Plan also contains a narrative water quality objective[15] for toxicity[16] applicable to San Diego Bay as follows:

[13] See Water Code section 13050(f). "Beneficial uses" of the waters of the state that may be protected against quality degradation include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.

[14] Basin Plan, Table 2-3, Beneficial Uses of Coastal Waters at page 2-47. Specific definitions of the beneficial uses are provided in the Basin Plan at pages 2-3 and 2-4.

[15] "Water quality objectives" are defined in Water Code section 13050(h) as "the limits or levels water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area."

[16] Basin Plan, Chapter 3. Water Quality Objectives, Page 3-15.

"All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board.

'The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with requirements specified in US EPA, State Water Resources Control Board or other protocol authorized by the Regional Board. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour acute bioassay.

'In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged."

38.4 Resolution No. 92-49

State Water Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code section 13304* describes the policies and procedures that apply to the cleanup and abatement of all types of discharges subject to Water Code section 13304. These include discharges, or threatened discharges, to surface and groundwater. The Resolution requires dischargers to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality or the best water quality that is reasonable if background levels of water quality cannot be restored, considering economic and other factors. In approving any alternative cleanup levels less stringent than background, Regional Water Boards must apply section 2550.4 of Title 23 of the California Code of Regulations.[17] Section 2550.4 provides that a Regional Water Board can only approve cleanup levels less stringent than background if the Regional Water Board finds that it is technologically or economically infeasible to achieve background. 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[18] result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards.

[17] Resolution No. 92-49, Section III.G.

[18] *Id.*

Resolution No. 92-49 is applicable to establishing cleanup levels at the Shipyard Sediment Site. The State Water Board's Office of Chief Counsel (hereinafter Office of Chief Counsel) fully supports this position. A Regional Water Board must apply Resolution No. 92-49 when setting cleanup levels for contaminated sediment if such sediment threatens beneficial uses of the waters of the state, and the contamination or pollution is the result of a discharge of waste. Contaminated sediment must be cleaned up to background sediment quality unless it would be technologically or economically infeasible to do so (Wilson, 2002).

38.5 Resolution No. 68-16

Resolution No. 92-49 specifies that cleanup and abatement actions must conform to State Water Board Resolution No. 68-16, *Statement of Policy with Respect to Maintaining High Quality of Waters in California*. Resolution No. 68-16 is a state policy that establishes the requirement that discharges to waters of the state shall be regulated to achieve the highest water quality with maximum benefit to the people of the state. Resolution No. 68-16 also establishes the intent where the waters of the state are of higher quality than required by state policies, including Water Quality Control Plans, such higher "shall be maintained to the maximum extent possible" consistent with the maximum benefit to the people of the state.

38.6 Policy for Implementation of Toxics Standards

The State Water Board *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California* (State Implementaion Policy, or "SIP") provides that mixing zones shall not result in "objectionable bottom deposits." This term is defined as "an accumulation of materials … on or near the bottom of a water body which creates conditions that adversely impact aquatic life, human health, beneficial uses, or aesthetics. These conditions include, but are not limited to, the accumulation of pollutants in the sediment (SIP at Appendix 4).

38.7 Environmental Justice

Environmental justice is defined in California law[19] as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies." The California Environmental Protection Agency (Cal EPA), and it's Boards, Departments, and Offices, which include the State and Regional Water Boards, are charged[20] with conducting its programs, policies, and activities in a manner that ensures the fair treatment of people of all races, cultures, and income levels, including minority populations and low-income populations of the state.

[19] Government Code section 65040.12(e).

[20] Public Resources Code sections 71110 – 71113.

Cal EPA's stated mission, as described in its 2004 Intra-Agency Environmental Justice Strategy, is to accord the highest respect and value to every individual and community, by developing and conducting our public health and environmental protection programs, policies, and activities in a manner that promotes equity and affords fair treatment, accessibility, and protection for all Californians, regardless of race, age, culture, income, or geographic location. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

39 Finding 39: CEQA Review

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, 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.

40 Finding 40: 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 and has provided them with an opportunity to submit written comments and recommendations.

40.1 Public Notice

Prior to the issuance of a final cleanup and abatement order in this matter, the San Diego Water Board will first provide an opportunity for all Parties and interested persons[21] to review technical information in the files of the San Diego Water Board and comment on issues pertaining to the proposed cleanup and abatement order and to respond to evidence, documents, and comments submitted by other Parties and interested persons. All technical evidence and documentation that Parties and interested persons would like the San Diego Water Board to consider must be submitted to the San Diego Water Board in writing during this period. The San Diego Water Board will hold public hearings on this matter once all written submittals have been made. The purpose of the public hearings is for the San Diego Water Board to receive final comments from Parties and interested persons and to ask questions regarding written submittals.

The San Diego Water Board's consideration of testimony and written submittals by Parties and interested persons may result in revisions to the current version of tentative Cleanup and Abatement Order No. R9-2010-0002 during the course of the proceedings. Thus the finalized version of the tentative Cleanup and Abatement Order that is ultimately considered for adoption by the San Diego Water Board at the conclusion of the proceedings may differ markedly from the initial tentative version of the Cleanup and Abatement Order issued on April 29, 2005.

The San Diego Water Board held pre-hearing conferences on September 26, 2005 and December 6, 2005, and issued a First Amended Order of Proceedings dated January 30, 2006, to establish procedures to ensure an orderly, efficient, and impartial administrative process for the development of an appropriate Cleanup and Abatement Order and to provide a fair opportunity for all Parties and interested persons to fully participate in the proceedings.

[21] "Parties" to the proceeding include the persons to whom the tentative cleanup and abatement order is directed, and any other person whom the Regional Board determines should be designated as a party. "Person" includes an individual, partnership, corporation, governmental subdivision or units of a governmental subdivision, or public or private organization or entity of any character.

41 Finding 41: Public Hearing

The San Diego Water Board has considered all comments pertaining to this Cleanup and Abatement Order 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 and Abatement Order.

41.1 Public Hearing

See discussion in Section 40 of this Technical Report on the public participation process.

42 References

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