Draft Staff Report
Substitute Environmental Document

Proposed Amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality for the Protection of Fish and Wildlife

January 28, 2011

STATE WATER RESOURCES CONTROL BOARD
Division of Water Quality

List of Figures

Appendices

Acronyms

2008 Staff Report	Staff Report – Water Quality Control Plan for Enclosed Bays and Estuaries Part 1 Sediment Quality
BAF	Bioaccumulation Factor
BSAF	Biota-Sediment Accumulation Factor
Cal/EPA	California Environmental Protection Agency
CEC	Contaminants of Emerging Concern
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CCR	California Code of Regulation
CSI	Chemical Score Index
CWA	Clean Water Act (federal)
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DFG	California Department of Fish and Game
DTSC	Department of Toxic Substances Control
EIR	Environmental Impact Report
ESA	Endangered Species Act
LOAEL	Lowest Observed Adverse Effect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effect
NPDES	National Pollution Discharge Elimination System
OEEHA	Office of Environmental Health Hazard Assessment
Part 1	Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality
PAHs	Polyaromatic hydrocarbons
PCBs	Polychlorinated Biphenyls
POTW	Publically owned treatment works
Redox	Oxidation reduction
RMP	Regional Monitoring Program
SCCWRP	Southern California Coastal Water Research Project
SED	Substitute Environmental Document
SFEI	San Francisco Estuary Institute
SQG	Sediment Quality Guideline
SQO	Sediment Quality Objectives
TMDL	Total Maximum Daily Load
TRV	Toxicity Reference Value
USACE	United States Army Corps of Engineers
U.S. EPA	United States Environmental Protection Agency
USC	United States Code
USF&WS	United State Fish and Wildlife Service
Wat. Code	California Water Code
WDRs	Waste Discharge Requirements

1 INTRODUCTION

1.1 Purpose

This draft staff report represents the State Water Resources Control Board (State Water Board) formal water quality planning and substitute environmental document (SED) to support amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (Part 1) adopted September 16, 2008, and effective August 25, 2009. Part 1 protects benthic invertebrates from direct exposure to toxic pollutants in sediment and human consumers of resident fish and shellfish from contaminants in fish tissue that were transferred through the food web from sediments into finfish and shellfish. Part 1 and the associated 2008 Staff Report are both incorporated by reference and available at http://www.waterboards.ca.gov/water_issues/programs/bptcp/sediment.html

Because pollutants in sediment can harm other receptors, staff is proposing the following amendments:

- A proposed narrative sediment quality objective that protects wildlife and resident finfish from the effects caused by exposure to pollutants in sediment
- A proposed process for implementing these narrative objectives
- Proposed definitions added to the glossary in support of the narrative objectives described above

Staff is also proposing amendments that address typographical errors and omissions. These amendments consist of:

- Revisions to Part 1, Section II(B), to clarify that all sediment quality objectives and related implementation policies adopted in Part 1 supersede all applicable narrative water quality objectives and related implementation provisions in water quality control plans.
- Corrections to a variable defined in Equation 2 of Part 1.
- Corrections to PAHs, DDD, DDE and DDT values applied to the CSI chemical index score contained in Table 7 of Part 1.
- Corrections to the list of chemicals described in Attachment A of Part 1.

The purpose of this document is to describe the proposed amendments, the rational and basis for the amendments, and the factors considered in the development and analysis of the proposed amendments, in accordance with the California Water Code and California Environmental Quality Act (CEQA). Proposed amendments are presented in Appendix A of this document, and the CEQA checklist is presented in Appendix B. The proposed amendments described herein represent the first formal effort by staff to amend Part 1.

The intent of these proposed amendments is to protect additional receptors not contemplated in Part 1, and provide greater consistency in assessing risk to these receptors and to correct existing errors in Part 1. Adoption of these proposed amendments would create a more comprehensive and effective plan. If these proposed amendments are adopted, the North Coast, San Francisco, Central Coast, Los Angeles, Central Valley, Santa Ana River, and San Diego Regional Water Quality Control Boards (Regional Boards) would

be responsible for implementing the new sediment quality objective (SQO) to ensure that beneficial uses associated with wildlife and resident finfish are protected. Potential actions the Regional Boards would take upon adoption of these amendments vary from:

- No action for sites or discharges that represent little or no risk to resident finfish and wildlife.
- Additional monitoring of sediment and tissue at sites or discharges that represent a potential risk to these receptors.
- Reduction in allowable loads, more stringent effluent limits for discharges that pose a risk either by independent permit action or through the development of a total maximum daily load (TMDL) within a waterbody.
- Remedial action at sites that represent unacceptable risks to these receptors.

All of these actions would and could occur through the State and Regional Water Boards' (Water Boards) implementation of existing narrative water quality objectives that protect beneficial uses designated within enclosed bays and estuaries. The additional proposed SQO for wildlife and resident finfish, and associated policy of implementation, are intended to promote consistency between Regional Boards.

Because the California Fish and Game Code defines "fish" to include mollusks, crustaceans, invertebrates, and amphibians, for the purposes of this report, staff is using the term "finfish" to refer to any species of bony fish or cartilaginous fish (sharks, skates and rays). This definition of "finfish" is consistent with California Department of Fish and Game sport fishing regulations. (14 Cal. Code. Regs, § 1.46.)

1.2 Water Quality Planning Requirements

1.2.1 Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne) provides the basis for the State and Regional Water Boards' processes for adopting water quality control plans. The Regional Water Boards have primary responsibility for formulating and adopting water quality control plans for their respective regions. (Wat. Code, § 13240.) The State Water Board is also authorized, under Water Code section 13170, to adopt water quality control plans in accordance with the provisions of section Water Code section 13240. When the State Water Board adopts a water quality control plan, the state plan supersedes regional water quality control plans for the same waters, to the extent of any conflict. (Wat. Code § 13170.) Fundamentally, a water quality control plan establishes water quality standards for waters within a specified area. The water quality standards consist of the beneficial uses to be protected, water quality objectives, and a program of implementation. (Wat. Code § 13050(j).) Prior to adopting or amending a water quality objective, Water Code section 13241 requires the State or Regional Water Board to assess specific factors to ensure the reasonable protection of beneficial uses. Factors the Water Boards shall consider when establishing water quality objectives include the following:

- Past, present, and probable future beneficial uses of water.
- Environmental characteristics of the hydrographic unit under consideration.
- Water quality conditions that could reasonably be achieved through control of all factors affecting water quality.

- Economic considerations.
- The need for developing housing within the region.
- The need to develop and use recycled water.

Once a water quality objective is established, Water Code section 13242 requires the Water Boards to formulate a program of implementation to achieve each water quality objective. The program of implementation shall include, but not be limited to:

- A description of the nature of actions that is necessary to achieve the objectives, including recommendations for appropriate action by any entity, public or private.
- A time schedule for the actions to be taken.
- A description of surveillance to be undertaken to determine compliance with objectives

Prior to the adoption of a water quality control plan pursuant to Water Code section 13170, the State Water Board must also consider all relevant management agency agreements that are intended to protect a specific beneficial use of water. (Wat. Code, § 13170.1.) The management agency agreements relevant to the proposed amendments to Part 1 are identified in Appendix B. After a water quality control plan is adopted, Water Code section 13240 and Clean Water Act section 303(c)(1) require, respectively, a periodic and a triennial review of water quality standards.

In 1989, the Legislature enacted the Bay Protection and Toxic Cleanup Act, which amended Porter-Cologne to require the State Water Board to develop sediment quality objectives (SQOs) for toxic pollutants in toxic hot spots and for other toxic pollutants of concern, as part of a comprehensive program to protect beneficial uses in enclosed bays and estuaries. (Wat. Code, §§ 13390-13396.9.) The Legislature defined a "sediment quality objective" (SQO) as "that level of a constituent in sediment which is established with an adequate margin of safety, for the reasonable protection of the beneficial uses of water or the prevention of nuisance." (Wat. Code, § 13392.6). The SQOs have to "be based on scientific information, including, but not limited to, chemical monitoring, bioassays, or established modeling procedures" and "provide adequate protection for the most sensitive aquatic organisms." (Wat. Code, § 13393.) The State Water Board is not precluded from adopting SQOs for a pollutant even though additional research may be needed. (Wat. Code, § 13392.6.) In addition, if there is a potential for human exposure to pollutants through the food chain, the State Water Board must base SQOs on a health risk assessment. (Wat. Code, § 13393.) A health risk assessment is an analysis that evaluates and quantifies the potential human exposure to a pollutant that bioaccumulates in edible finfish, shellfish, or wildlife and "includes an analysis of both individual and population-wide health risks associated with anticipated levels of human exposure, including potential synergistic effects of toxic pollutants and impacts on sensitive populations." (Wat. Code, § 13391.5(c).)

1.2.2 California Environmental Quality Act

The Water Boards' planning processes must comply with the California Environmental Quality Act (CEQA). The objectives of CEQA are to: 1) inform the decision makers and public about the potential significant environmental effects of a proposed project; 2) identify ways that environmental damage may be mitigated; 3) prevent significant, avoidable damage to the environment by requiring changes in projects, through the use of alternative or

mitigation measures when feasible; and 4) disclose to the public why an agency approved a project if significant effects are involved. (Cal. Code Regs., tit. 14, § 15002(a).)

Although state agencies are subject to the environmental impact assessment requirements of CEQA (Public Resources Code, §21000 et seq.), CEQA authorizes the Secretary of the Natural Resources Agency to exempt specific state regulatory programs from the requirements to prepare Environmental Impact Reports (EIRs), Negative Declarations, and Initial Studies, if certain conditions are met. (Pub. Resources Code, § 21080.5.) With respect to the State Water Board, the Secretary of the Natural Resources Agency has certified as exempt the Water Quality Control (Basin)/208 Planning Program for the protection, maintenance, and enhancement of water quality in California, including all components of California's water quality management plan as defined in 40 C.F.R sections 130.2(k) and 130.6. (Cal. Code Regs., tit. 14, § 15251(g).) Agencies qualifying for this exemption must comply with CEQA's goals and policies; evaluate environmental impacts; consider cumulative impacts; consult with other agencies with jurisdiction; provide public notice and allow public review; respond to comments on the draft environmental document; adopt CEQA findings; and provide for monitoring of mitigation measures.

The adoption of amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries is a certified regulatory program. Accordingly, the State Water Board has prepared substitute environmental documentation (SED) in lieu of an EIR or negative declaration. State Water Board regulations require that the draft SED prepared for its certified regulatory programs must include:

- A written report prepared for the board, containing a brief description and an environmental analysis of the proposed project;
- An identification of any significant or potentially significant adverse environmental impacts of the proposed project;
- An analysis of reasonable alternatives to the project and mitigation measures to avoid or reduce any significant or potentially significant adverse environmental impacts;
- A completed Environmental Checklist; and
- Other documentation as the State Water Board may include.

(Cal. Code Regs., tit. 23, § 3777.) This Staff Report and its attachments fulfill the requirements of an SED. Responses to public comments and consequent revisions to the information in the draft SED will be subsequently presented in a Final SED for consideration by the State Water Board. After the State Water Board has approved the Final SED and adopted the project, a Notice of Decision will be filed with the Secretary of the Natural Resources Agency.

1.2.3 California Health and Safety Code Scientific Peer Review

In 1997, Section 57004 was added to the California Health and Safety Code (Senate Bill 1320-Sher), which requires external scientific peer review of the scientific basis for any rule proposed by any board, office or department within Cal/EPA. Scientific peer review is a mechanism for ensuring that regulatory decisions and initiatives are based on sound science. Scientific peer review also helps strengthen regulatory activities, establishes credibility with stakeholders, and ensures that public resources are managed effectively. Peer review was not performed on these proposed amendments for the following reasons:

- The proposed narrative SQO protecting wildlife and resident finfish from pollutants in sediment is non-technical in nature and simply describes an expectation to maintain sediment quality that would be protective of specific receptors.
- The proposed process to implement the proposed narrative SQO through ecological risk assessment has undergone peer review by U.S. EPA (U.S. EPA, 1996). Peer review is not needed for source documents that have been previously peer reviewed by a recognized expert or body of experts, which includes the U.S. EPA.
- Proposed definitions to the glossary are consistent with those used by other agencies to avoid confusion.
- Proposed corrections to typographical errors and omissions to Part 1 encompass previously peer-reviewed sections.

1.3 Past Water Board Proceedings Associated with Sediment Quality Objectives

In 2002, the State Water Board initiated its development of SQOs pursuant to Water Code section 13393. During the first phase of development, the State Water Board and science team[1] focused primarily on sediment-dependent aquatic life in marine embayments where existing data sets were available to support the necessary studies. Products from these studies were used to develop an assessment framework to implement a narrative SQO protecting benthic communities from direct exposure. A narrative SQO was also proposed to protect human consumers of finfish from contaminants in fish tissue. Implementation of this narrative relied upon existing policies and guidance from U.S. EPA and Cal/EPA. This phase, referred to informally as Phase I, was completed when the State Water Board approved Resolution 2008-0070 adopting Part 1. Part 1 became effective upon approval by U.S. EPA on August 25, 2009.

Upon adoption of Part 1, staff initiated work to enhance Part 1 in specific areas. The focus of this effort included:

- The collection of sediment grab samples from the Sacramento-San Joaquin Delta to better understand benthic communities and community response across stress gradients in a complex environment.
- Development of benthic indices for the Delta.
- Development of a decision support tool and related implementation policy to better address bioaccumulation and human consumers of finfish and shellfish.

While working on this second phase of SQO development, Staff prepared and circulated a CEQA scoping informational document describing these efforts and held a scoping meeting in Sacramento on May 19, 2010. After review of comments letters received in response to the CEQA Scoping informational document and review of past comment letters received in the development and adoption process associated with Part 1, staff felt that greater benefit could be achieved by refocusing the program resources on receptors not

[1] The Science Team is comprised of scientist from Southern California Coastal Water Research Project and the San Francisco Estuary Institute who have contracted with the State Water Board to perform research and analyses of SQOs.

previously considered in Part 1. Staff is now proposing a narrative objective to better protect resident finfish and wildlife from pollutants in sediment. Though some regions have narrative objectives similar to that being proposed, establishing a state wide narrative objective for resident finfish and wildlife and a policy of implementation will provide greater consistency between Regional Boards. Staff is also proposing to correct errors in Part 1 identified after the plan was approved.

1.4 Document Organization

This remainder of the draft staff report is organized as follows: Section 2 presents a conceptual model for sediment quality that identifies the principal factors affecting fate transport of pollutants in sediment and the receptors potentially at risk. The environmental setting is summarized in Section 3, and the legal and institutional setting associated with water quality regulation and planning are described in Section 4. Section 5 presents a description of the issues evaluated in the course of developing the proposed amendments, while Section 6 describes the analysis of the potential environmental effects associated with the adoption of the proposed amendments in accordance with CEQA. Water Code section 13241 factors are considered in Section 7. A Glossary and References are listed in Sections 8 and 9, respectively. The proposed amendments are included in Appendix A. The CEQA Checklist is included in Appendix B

2 CONCEPTUAL MODEL

Pollutants in sediments can be toxic to organisms living in the sediment, or enter into the food web where they can accumulate in finfish, birds, and mammals at concentrations that may be toxic (U.S. EPA, 1998). This Section describes potential sources of pollutants, fate and transport of processes, and potential receptors at risk from exposure to pollutants that accumulate in bay and estuarine sediments.

2.1 Fate and transport processes

A variety of sources can contribute to sediment contamination in embayments (Figure 2.1). Discharge from rivers, creeks, and drainage channels that carry wet and dry weather runoff from the upland watershed are major nonpoint contaminant sources. Contaminants may also come from point sources such as municipal wastewater and industrial discharges that are located within embayments, as well as spills. Additional nonpoint contaminant sources include atmospheric deposition and groundwater flow. A large portion of the contaminants from most of these sources may be associated with particles, such as suspended particles in the discharge or receiving waterbody. However, each of these discharges influences water and sediment quality on different spatial and temporal scales. This diversity of sources, combined with various physical mixing processes such as currents, tidal exchange, and ship traffic, can produce complex and widespread patterns of sediment contamination.

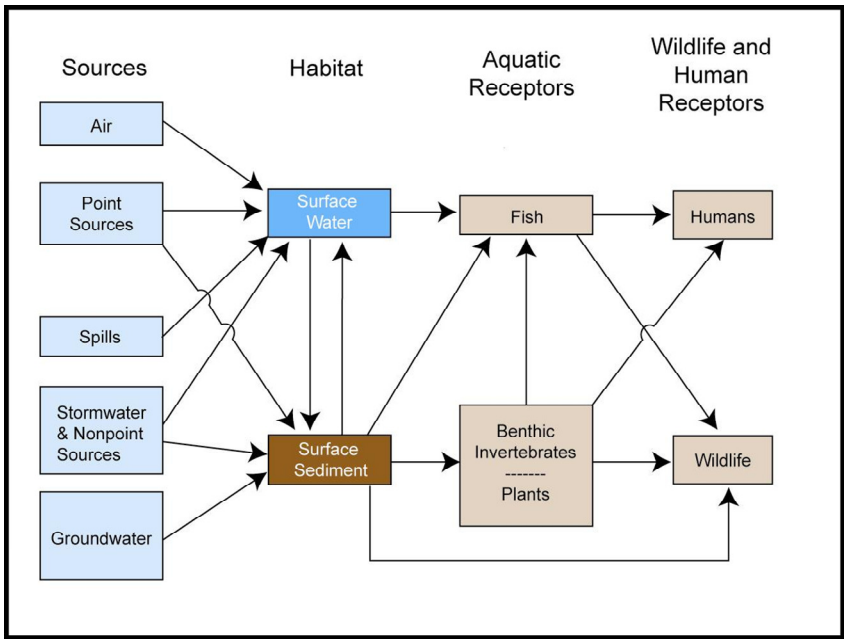

Figure 1. Principal Sources, Fates, and Effects of Sediment Contaminants in Enclosed Bays and Estuaries (Adapted from Bridges et al. 2005)

Several processes affect the fate and distribution of sediment contaminants within enclosed bays and estuaries (Figure 2.1). Upon introduction into the waterbody, dissolved contaminants may bind to suspended particles in the water column or particle-associated contaminants may desorb back into the water column. In brackish embayments in particular, flocculation and aggregation of small-suspended particles into large agglomerates that then settle out of the water column is a primary mechanism for introduction of contaminants to surface sediments. River and/or tidal currents may transport contaminants out of the system. The fraction that remains and eventually settles forms the sediment's surface, a layer (5-20 centimeters (cm)) of high physical, chemical, and biological activity. Most of the benthic infauna resides in this surface layer. Generally deeper sediments exert little influence on organisms unless transported upwards by deep burrowing organisms, transformed into different chemical species under anaerobic conditions, or exposed by physical processes.

Sediment contaminants in the surface layer are not static, their concentration, distribution, and chemical form are being continually modified Figure 2. For example, particle bound contaminants can move into the water column by desorption from particles, resuspension, or from the burrowing and feeding activities of many benthic organisms (bioturbation). The form and biological availability of contaminants is influenced by many factors in the sediment. Variations in the size and composition of these sediment particles have an effect on the binding of contaminants to them, with the finer particles generally containing higher contaminant concentrations due to a much greater surface area and greater number of chemical sorption sites. The sediment particles contain variable amounts and types of organic carbon, including natural plant or animal detritus, microbial films, and anthropogenic materials such as ash, soot, wood chips, oils, and tars. The partitioning of many contaminants between sediment particles, water, and biota is strongly influenced by the nature of sediment organic carbon (Figure 2.2). The predominant forms for metals (or speciation) are largely governed by the reduction-oxidation (redox) potential (or E_h) and the co-occurrence of binding constituents such as sulfides, organic material, metal oxides, and

clay minerals. Microbial activities also influence the characteristics of sediment contaminants. The microbial degradation of sediment organic matter can alter the pH and oxygen content of sediments, which may in turn affect the rates of metal desorption/precipitation. Bacterial metabolism or chemical processes can also transform or degrade some contaminants to other forms. In some cases, the transformation product may have greater biological availability or toxicity, such as methyl mercury. In other cases, such as for some pesticides, degradation may alter the contaminant so that it is no longer toxic.

Certain types of trace metals and organic chemicals can accumulate in tissue from exposure to these pollutants in the water column, sediment, and prey tissue. Bioaccumulation* is the result of the uptake and retention of a chemical by an aquatic organism from the surrounding water, food, and sediment (Mackay and Fraser 2000). Contaminants such as polychlorinated biphenyls (PCBs), organochlorine pesticides, and methyl mercury have an affinity for tissue lipids and tend to be biomagnified in organisms. Biomagnification* is the process where chemicals accumulate at higher concentrations as they are transferred up a food web. Some of the biological factors affecting this process are lipid content, food web structure, diet, consumption rate and age. As a result of bioaccumulation and biomagnification, contaminants may accumulate at higher trophic levels at concentrations that cause risks to human consumers and harm biota.

Existing monitoring data for many of these compounds indicate mercury, chlorinated pesticides (chlordane, DDT, dieldrin), and PCBs are the most prevalent in bay and estuarine seafood (i.e. finfish and shellfish) tissue and present the greatest risk to beneficial uses (State Water Board, 2006). Some chemicals such as PBDEs and other contaminants of emerging concern (CECs) may pose risks as well, however only a few targeted studies have been conducted to date (California Ocean Science Trust et al, 2009). As a result, very little is known about the fate, transport, and distribution of these CECs in the coastal waters, as well as sediments, tissue, and potential biological effects associated with long-term exposures.

2.2 Receptors and Exposure

California's bays and estuaries are home to a tremendous diversity of life. As such, there are multiple routes by which these organisms can be exposed to and affected by sediment contaminants. There are two general types of contaminant exposure: direct and indirect. Most of the **direct exposure** results from the contact of organisms with the sediment and sediment ingestion. Organisms at greatest risk from direct exposure are benthic invertebrates in living the sediment. **Indirect exposure** results from the consumption of prey that are contaminated via bioaccumulation and trophic transfer. Organisms at greatest risk from indirect exposure feed at top level. These predators include striped bass, ospreys, terns, sea otters and sea lions. Exposure for some species such as arrow gobies living in close proximity to sediment represents an intermediate exposure type between direct and indirect exposure. In this case, direct exposure occurs in the water column via contaminant flux from sediment into water.

Direct Exposure

Benthic invertebrates live in continual direct contact with sediment/pore water, and many species ingest significant quantities of sediment as a source of nutrition. The relative importance of sediment ingestion vs. sediment contact for contaminant exposure varies depending upon the life history of the species. In addition, there are species-specific differences in contaminant uptake rates and metabolism that affect the amount of contaminant (or dose) accumulated by benthic organisms. As a result, benthic species vary

in their sensitivity to sediment contamination. This in turn produces a gradation of benthic community composition change that corresponds to the magnitude of contaminant exposure.

Indirect Exposure

Indirect contaminant exposure results from the consumption of contaminated prey via bioaccumulation and trophic transfer. In many habitats, benthic organisms represent an important component of the aquatic food web. Pollutants accumulated in the tissue of these organisms are passed on to benthic feeding finfish and birds. Because prey tissue is often a significant route of exposure and often less difficult to sample, contaminant concentrations in tissue are measured to assess risk posed by indirect exposure. The general equation used to assess concentrations in prey tissue is (Oregon DEQ, 2007, U.S. EPA 1998, 2000, 2009)

ATV = (TRV) / (IR/BW)

Where

ATV = acceptable tissue level

TRV = toxicity reference value

IR = daily ingestion rate

BW = body weight

Toxicity reference values (TRVs) are chemical and receptor specific values calculated from toxicological studies that represent either the Lowest Observed Adverse Effects Levels (LOAELs) or No Observed Adverse Effects Levels (NOAELs). TRVs have been developed by U.S. EPA, U.S. EPA Region IX Biological Technical Assistance Group (BTAG) (California Department of Toxic Substances Control (DTSC) Human and Ecological Risk Division 2000) and others to support ecological risk assessments. Acceptable tissue levels can be used with bioaccumulation factors (BAF) or biota-sediment accumulation factors (BSAF) derived from empirical or mechanistic models to calculate sediment values protective of these receptors (Oregon DEQ 2007, U.S. EPA 2009).

The relationships between contaminated sediments and the accumulation of pollutants in finfish and shellfish and higher trophic level predators is influenced by many species-specific and site-specific factors, such as sediment organic content, complexity of the food web, species-specific feeding habits, home range and lipid content; factors that vary with both age and season. Contaminants that accumulate in an organism's tissue represent the net uptake over time and are reflective of the distribution of contaminants throughout the organism's entire foraging area. Sedentary receptors such as benthic invertebrates and gobies exhibit high site fidelity ranging from less then one square meter (m^2) to 100 m^2 respectively. For these receptors, the relationship between organism exposure and contaminants in sediment can be evaluated directly by a combination of indicators including sediment chemistry sediment toxicity and benthic community conditions.

Assessing exposure of mobile receptors to sediment contaminants is more challenging. Resident finfish may forage over 0.5 square kilometers (km^2) to 50 km^2 or more. Over areas this large, quantifying exposure and contribution of contaminants from a specific portion of the forage area becomes difficult due to variations in contaminant distribution and bioavailability, preferential feeding in select habitats within foraging area, and **variability*** in diet, age, and lipid content. Highly mobile receptors such as anadromous finfish and migratory birds and marine mammals have even larger foraging areas. Evaluating contaminant exposure from a site becomes even more difficult for these receptors as significant foraging activity would occur in distant locations.

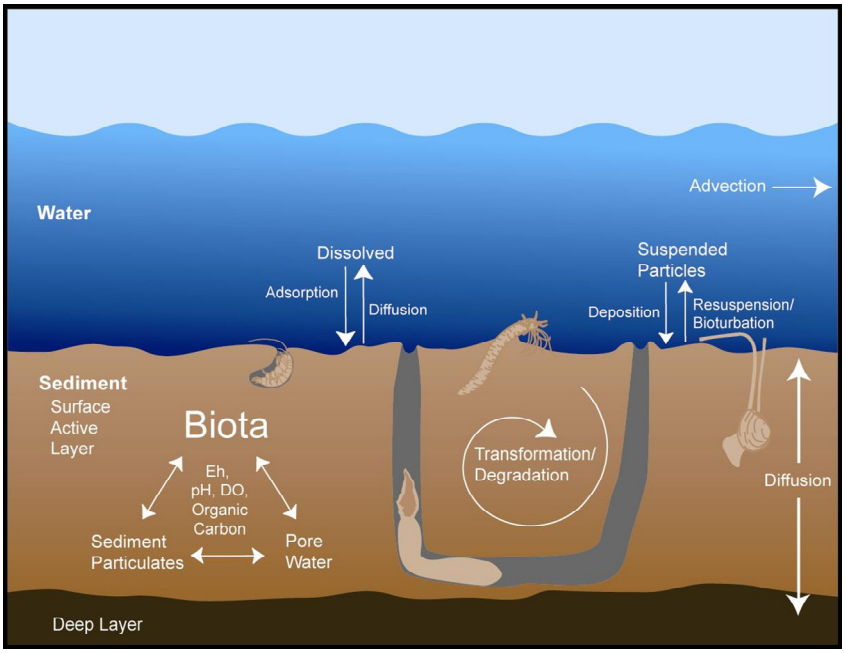

Figure 2. Sediment Processes Affecting the Distribution and Form of Contaminants

3 ENVIRONMENTAL SETTING

This section summarizes the environmental setting and existing conditions within those water bodies the proposed amendments are intended to protect. Because the environmental setting has changed little since the 2008 Staff Report, for brevity, only a summary is provided below, because the 2008 Staff Report is incorporated by reference. The Bay Protection and Toxic Cleanup Act defines "enclosed bays" as:

> [I]ndentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. "Enclosed bays" include all bays where the narrowest distance between the headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. "Enclosed bays" include, but are not limited to, Humboldt Bay, Bodega Harbor, Tomales Bay, Drake's Estero, San Francisco Bay, Morro Bay, Los Angeles-Long Beach Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay. For the purposes of identifying, characterizing, and ranking toxic hot spots pursuant to this chapter, Monterey Bay and Santa Monica Bay shall also be considered to be enclosed bays.

(Wat. Code, § 13391.5, subd. (a). Further, Section 13391.5 (b) defines "estuaries" as:

> [W]aters, including coastal lagoons, located at the mouths of streams which serve as mixing zones for fresh and ocean waters. Coastal lagoons and mouths of streams which are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters shall be considered to extend from a bay or the open ocean to a point upstream where there is no significant mixing of fresh water and sea water. Estuarine waters include, but are not limited to, the Sacramento-San Joaquin Delta, as defined in Section 12220, Suisun Bay, Carquinez Strait downstream to the

Carquinez Bridge, and appropriate areas of the Smith, Mad, Eel, Noyo, Russian, Klamath, San Diego, and Otay Rivers.

Regional Boards that encompass enclosed bays and estuaries are the North Coast, San Francisco, Central Coast, Los Angeles, Central Valley, Santa Ana River, and San Diego Regional Water Quality Control Boards. Each of these regions represents a unique combination of landforms and waterbodies hosting a variety of aquatic and terrestrial communities in and adjacent to enclosed bays and estuaries. Many of these bays and estuaries were also the first heavily industrialized regions in the state, providing safe ports and infrastructure to support logging mining agriculture, petroleum industry, ship building, manufacturing and other industries.

Wastes from these activities have been discharged into bays either directly as point sources, indirectly as runoff, or accidentally through releases and spills. Inputs from rivers and creeks also contribute to the contaminant loading into bays and estuaries. Poor flushing and lower current speeds allow suspended sediments and contaminants to settle out in the bays and estuaries before reaching the open ocean. For these reasons, sediments in enclosed bays and estuaries are, with few exceptions, the most highly polluted sediments in the state. In the 2008 Staff Report, staff evaluated current or baseline conditions after reviewing a variety of factors. As part of this evaluation, staff reviewed sites, segments or waterbodies within enclosed bays and estuaries included on the State Water Board's 2006 Clean Water Act (CWA) Section 303(d) list of impaired water bodies or designated by the State Water Board as a Toxic Hot Spot under Porter-Cologne. At that time, staff identified over sixty sites or segments within enclosed bays and estuaries listed for either degraded sediment quality or increased risks to human consumers of seafood from contaminants in fish tissue.

In addition, another thirty sites in these waters were impaired due to pollutants in the water column (State Water Board, 2008). Because listings are frequently associated a high proportion of development, land use and large populations, the majority of these listings were located in San Francisco Bay, Los Angeles-Long Beach Harbor, and San Diego Bay. Staff limited this analysis to toxic or priority pollutants and did not include other pollutants such as nutrients or bacteria. Pollutants most frequently associated with these listings are organochlorine pesticides such as chlordane, DDT, and dieldrin; polycyclic aromatic hydrocarbons; PCBs; metals such as copper, lead, and zinc; and sediment toxicity in marine bays. Mercury was the basis for many listing in San Francisco Bay and in the Sacramento-San Joaquin Delta. The Sacramento-San Joaquin Delta was also listed for a variety of organochlorine and organophosphate pesticides. Selenium was another contaminant causing impairment in San Francisco Bay. Regional differences were also apparent in the number and distribution of listings associated with mercury (San Francisco Bay and Sacramento San Joaquin Delta) and pesticides (Sacramento San Joaquin Delta).

Since the 2008 Staff report was finalized, no new toxic hotspots were designated under the Bay Protection Program. However, the State Water Board has developed and adopted the 2010 CWA Section 303(d) list of impaired waterbodies (State Water Board, 2010b). The 2010 303(d) list identifies 127 segments within enclosed bays and estuaries as impaired. Of these listings 88 are attributed to degraded sediment quality or tissue. New listings associated with degraded sediment quality or tissue include:

- Moss Landing Harbor Sediment toxicity, Chlorpyrifos, Diazinon and nickel
- Santa Clara River Estuary - toxicity

- Los Angeles Long Beach Inner Harbor chrysene, benzo(a)pyrene, sediment toxicity
- Dominguez Channel - Sediment toxicity
- Sacramento-San Joaquin Delta (north) - chlordane and dieldrin
- Suisun Marsh - mercury
- Dana Point - copper, toxicity and zinc,
- Oceanside Harbor - copper
- Mission Bay Quivera Basin - copper
- Mission Bay/mouth of Rose and Tecote Creeks – copper and lead

4 LEGAL AND INSTITUTIONAL SETTING

This section presents a brief summary of current state and federal laws, programs and practices that govern sediment quality in bays and estuaries. A thorough account is presented in the 2008 Staff Report.

4.1 Clean Water Act

The principal goal of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." (33 U.S.C. § 1251(a).) As described in the 2008 Staff Report, the State Water Board is the state water pollution control agency for all purposes stated in the Clean Water Act, and is therefore authorized to regulate and control discharges into bays and estuaries in California. State and Regional Boards' programs mandated by the Clean Water Act include:

- Development of water quality standards in accordance with CWA Section 303(c).
- Designation of impaired waterbodies and development of total maximum daily loads in accordance with Section CWA 303(d).
- Issuance of Water Quality Certifications described in CWA Section 401.
- Regulation of point source discharges under the National Pollution Discharge Elimination System as described in CWA Section 402.
- Regulating nonpoint sources under CWA as well as Porter-Cologne and the Coastal Zone Reauthorization Act amendments of 1990 (CZARA).

4.2 Porter-Cologne Water Quality Control Act

Porter-Cologne, enacted in 1969, is the primary water quality law in California. Porter-Cologne addresses two primary functions – water quality control planning discussed in Section 1.2, and waste discharge regulation. Porter-Cologne is administered regionally, within a framework of statewide coordination and policy. The state is divided into nine regions, each governed by a Regional Water Board. The State Legislature, in adopting

Porter-Cologne, directed that the state's waters "shall be regulated to attain the highest water quality which is reasonable."

To achieve this mandate, Porter-Cologne establishes a program to regulate waste discharges that could affect water quality through waste discharge requirements (WDRs), conditional waivers, or prohibitions. (See Wat. Code, §§ 13243, 13263, 13269.) Issuance of WDRs, waivers, and prohibitions are the principal tools the Water Boards apply to implement water quality control plans and policies. The term "waste" is broadly defined in Porter-Cologne and includes toxic pollutants, as well as other waste substances. (*Id.* §13050(d).) The term "waters of the state" is similarly broadly defined to include all surface waters, including bays and estuaries and groundwater within state boundaries. (*Id.* §13050(e).)

Porter-Cologne also authorizes the Water Boards to investigate water quality and to require waste dischargers to submit monitoring and technical reports. (*Id.* §13267, 13383.) In addition, Porter-Cologne gives the Water Boards extensive enforcement authority to respond to unauthorized discharges, discharges in violation of applicable requirements, discharges that cause pollution or nuisance, and other matters. The enforcement options include, among others, cleanup and abatement orders, cease and desist orders, and administrative civil liability orders. (*Id.* §13301, 13304, 13323.)

4.3 Water Quality Control Plans, Beneficial Uses and Narrative Objectives

As described in Section 2.1, Porter-Cologne provides the authority for the State and Regional Water Boards to develop water quality control plans within their respective regions. These water quality control plans describe the beneficial uses, water quality objectives and policy of implementation established for that region. The following Water Quality Control Plans are applicable to waters within enclosed bays and estuaries;

- Water Quality Control Plan for the North Coast Region (North Coast Basin Plan)
- San Francisco Bay Basin (Region 2) Water Quality Control Plan (San Francisco Bay Basin Plan)
- Water Quality Control Plan for the Central Coast Region (Central Coast Basin Plan)
- Water Quality Control Plan Los Angeles Region – Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (Los Angeles Basin Plan)
- Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board Central Valley Region - The Sacramento River Basin and San Joaquin River Basin (Central Valley Basin Plan)
- Water Quality Control Plan (Basin Plan) for the Santa Ana River Basin (Santa Ana Basin Plan)
- Water Quality Control Plan for the San Diego Basin (San Diego Basin Plan)
- Water Quality Control Plan for the San Francisco Bay /Sacramento –San Joaquin Delta Bay Estuary (Delta Plan)
- Water Quality Control Plan for Enclosed Bays and Estuaries Part 1 Sediment Quality (Part 1)

4.3.1 Beneficial Uses

The Water Boards have designated for protection a variety of beneficial uses for bay and estuarine waters, including, among others, the preservation and enhancement of finfish, wildlife, and other aquatic resources and habitats; commercial and sport fishing; and shellfish harvesting. Beneficial uses designated by the State and Regional Boards within Water

Quality Control Plans for enclosed bays and estuaries are presented in Table 2.1. Only a subset of these uses directly addresses water quality factors that support finfish and wildlife related uses in marine and estuarine waters. These include the following:

- **Preservation of Biological Habitats of Special Significance (BIOL)** Uses of water that support designated areas or habitats, or enhancement of natural resources requires special protection.
- **Estuarine Habitat (EST)** - Uses of water that support estuarine ecosystems including preservation or enhancement of estuarine habitats, vegetation, finfish, shellfish, or wildlife.
- **Marine Habitat (MAR)** - Uses of water that support marine ecosystems, including, preservation or enhancement of marine habitats, vegetation such as kelp, finfish, shellfish, or wildlife.
- **Migration of Aquatic Organisms (MIGR)** - Uses of water that support habitats necessary for migration by aquatic organisms, such as anadromous finfish.
- **Rare, Threatened, or Endangered Species (RARE)** - Uses of water that support habitats necessary for the survival and successful maintenance of state or federally listed rare, threatened, or endangered species.
- **Spawning, Reproduction, and/or Early Development (SPWN)** - Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
- **Wildlife Habitat (WILD)** - Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, including mammals, birds, reptiles, amphibians, invertebrates, or wildlife water and food sources.

Table 2-1 Beneficial Uses established for Enclosed Bays and Estuaries

Region/Plan		AGR	AQUA	BIOL	COLD	COMM	CUL	EST	FRESH	GWR	IND	MAR	MIGR	MUN	NAV	POW	PROC	RARE	REC-1	REC-2	SAL	SHELL	SPAWN	WARM	WET	WILD
NORTH COAST[1]	Bay		P		E	E	P	E			P	E	E		E		P	P	P	E	E	E	E	P		E
	Est	P	P		E	E	P	E	P		P	E	E	P	E	P	P	P	E	E	E	E	E	P		E
SAN FRANCISCO[2]	Bay					E		E			E	E	E		E			E	E	E		E	E			
	Est	E			E	E		E			E		E	E	E	E	E	E	E	E		E	E	E	E	E
CENTRAL COAST[3]	Bay					E					E	E			E			E	E	E		E				E
	Est			E	E	E		E					E					E	E	E		E	E	E		E
LOS ANGELES[4]	Bay					E						E			E			E	E	E		E				E
	Est					E		E				E	E		E			E	E	E			E		E	E
CENTRAL VALLEY[5]	Bay																									
	Est	E			E						E		E	E	E		E		E	E			E	E		E
SANTA ANA[6]	Bay			N	N	E		N				N			N			N	N	N		N	N			N
	Est			N	N	E		N			N	N						N	N	N		N	N			N
SAN DIEGO[7]	Bay		E	E		E		E			E	E	E		E			E	E	E	E	E	E			E
	Est		E	E		E		E			E	E	E					E	E	E	E	E	E			E
S. F. BAY/SAC-S. J. DELTA ESTUARY[8]	Bay	E			E	E		E		E	E		E	E	E		E	E	E	E		E	E	E		E
	Est	E			E	E		E		E	E		E	E	E		E	E	E	E		E	E	E		E

Abbreviations

AGR - Agricultural Supply
AQUA – Aquaculture
BIOL – Preservation of Biological Habitats
COLD – Coldwater Habitat
COMM – Commercial and Sportfishing
CUL – Native American Culture
EST - Estuarine Habitat
FISH – Subsistence Fishing
FRSH – Freshwater Replenishment
GWR – Groundwater Replenishment
IND – Industrial Service Supply
MAR - Marine Habitat
MIGR - Migration of Aquatic Organisms
MUN – Municipal and Domestic Supply
NAV - Navigation
POW – Hydropower Generation
PROC – Industrial Process Supply
RARE – Preservation of Rare Threatened and/or Endangered Species
REC-1 - Water Contact Recreation
REC-2 - Non-Contact Recreation
SAL – Saline Habitat
SHELL – Shellfish Harvesting
SPWN – Spawning Reproduction and Early Development
WARM - Warm Freshwater Habitat
WET - Wetland Habitat
WILD - Wildlife Habitat
WQE – Water Quality Enhancement
E - Established
P - Potential

Note: Table identifies those beneficial uses that have been established within representative enclosed bays and estuaries in each region. Individual water bodies may differ from those identified in Table XX. Beneficial uses may not necessarily encompass the entire water. Refer to individual water quality control plans for beneficial uses established for specific water bodies.

4.3.2 Water Quality Objectives

Water quality standards for California include narrative and numeric water quality objectives for toxic and other pollutants contained in water quality control plans and federally promulgated criteria for toxic pollutants, which are contained in the National Toxics Rule and the California Toxics Rule. (See 40 C.F.R. §§ 131.36, 131.38.) The California Toxics Rule (CTR) criteria apply to inland surface waters, enclosed bays, and estuaries in the state. The numeric criteria and objectives establish permissible water column concentrations for the affected pollutants. None of the Regional Boards have adopted numeric sediment quality objectives within their Basin Plans.

Narrative objectives contained in water quality control plans address specific issues or concerns that, for a variety of reasons, cannot be addressed with single-indicator-based numeric values. The current narrative objectives and prohibitions potentially applicable to the regulation of sediment quality are listed below by Regional Board. Sections of individual narrative objectives that address water column-specific factors and effluents have been omitted for brevity.

North Coast Region

- Toxicity - *All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. 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 Water Board* (Sec. 3, pg 4).
- Pesticides - *No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no bioaccumulation of pesticide concentrations found in bottom sediments or aquatic life* (Sec 3, pg 5).

San Francisco Bay Region

- Bioaccumulation - *Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered* (Sec. 3, pg 3).
- Sediment - *The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life* (Sec. 3 pg 5).
- Toxicity - *All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species. The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors* (Sec. 3, pg 6)
- Objectives for Specific Chemical Constituents - *Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use* (Sec. 3, pg 7)

Central Coast Region

- Toxicity - *All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which 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, toxicity bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board* (Sec. III, pg 4).
- Pesticides - *No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life* (Sec. III, pg 4).

Los Angeles Region

- Bioaccumulation - *Many pollutants can bioaccumulate in fish and other aquatic organisms at levels which are harmful for both aquatic organisms as well as organisms that prey upon these species (including humans). Toxic pollutants shall not be present at levels that will bioaccumulate in aquatic life to levels which are harmful to aquatic life or human health* (Sec. 3, pg 8).
- Pesticides - *No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life* (Sec. 3, pg 9).
- Toxicity - *Toxicity is the adverse response of organisms to chemical or physical agents. When adverse response is mortality, the result is termed acute toxicity. When the adverse response is not mortality but instead reduced growth in larval organisms or reduced reproduction in adult organisms (or other appropriate measurements), a critical life stage effect (chronic toxicity) has occurred. The use of aquatic bioassays (toxicity tests) is widely accepted as a valid approach to evaluating toxicity of wastes and receiving waters. 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 State or 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 then that for the same waterbody in areas unaffected by the waste discharge or when necessary other control water. There shall be no acute toxicity in ambient waters including mixing zones. There shall be no chronic toxicity in ambient waters outside mixing zones* (Sec. 3, pg 16).

Central Valley Region

- Chemical Constituents - *Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses* (Sec III, pg 3).
- Pesticides - *No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. Discharges shall not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial uses….For the purposes of this objective, the term pesticide shall include: (1) any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, which may infest or be detrimental to vegetation, man, animals,*

or households, or be present in any agricultural or nonagricultural environment whatsoever, or (2) any spray adjuvant (Sec. III, pg 6).

- Toxicity - *All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests of appropriate duration or other methods as specified by the Regional Water Board. The Regional Water Board will also consider all material and relevant information submitted by the discharger and other interested parties and numerical criteria and guidelines for toxic substances developed by the State Water Board, the California Office of Environmental Health Hazard Assessment, the California Department of Health Services, the U.S. Food and Drug Administration, the National Academy of Sciences, the U.S. Environmental Protection Agency, and other appropriate organizations to evaluate compliance with this objective* (Sec. III, pg 8.01).

Santa Ana Region

- Enclosed Bays and Estuaries - *Enclosed bay and estuarine communities and populations, including vertebrate, invertebrate, and plant species, shall not be degraded as a result of the discharge of waste. Degradation is damage to an aquatic community or population with the result that a balanced community no longer exists. A balance community is one that is (1) diverse, (2) has the ability to sustain itself through cyclic seasonal changes, (3) includes necessary food chain species, and (4) is not dominated by pollution-tolerant species, unless that domination is caused by physical habitat limitations. A balanced community also (5) may include historically introduced non-native species, but (6) does not include species present because best available technology has not been implemented, or (7) because site-specific objectives have been adopted, or (8) because of thermal discharges* (Sec. 4, pg 2).
- Toxic Substances - *Toxic substances shall not be discharged at levels that will bioaccumulate in aquatic resources to level which are harmful to human health. The concentrations of toxic substances in the water column, sediments or biota shall not adversely affect beneficial uses* (Sec. 4, pg 6).

San Diego Region

- Water Quality Objectives for Pesticides - *No individual pesticide or combination of pesticides shall be present in the water column, sediments or biota at concentration(s) that adversely affect beneficial uses. Pesticides shall not be present at levels which will bioaccumulate in aquatic organisms to levels which are harmful to human health, wildlife or aquatic organisms* (Sec. 3, pg 26).
- Water Quality Objectives for Toxicity - *All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. 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* (Sec. 3, pg 29).

State Water Board – Division of Water Rights

Water Quality Control Plan for the San Francisco Bay /Sacramento –San Joaquin Delta Bay Estuary

- *Brackish Tidal Marshes of Suisun Bay - Water quality conditions sufficient to support a natural gradient in species composition and wildlife habitat characteristic of a brackish marsh throughout all elevations of the tidal marshes bordering Suisun Bay shall be maintained. Water quality conditions shall be maintained so that none of the following occurs: (a) loss of diversity; (b) conversion of brackish marsh to salt marsh; (c) for animals, decreased population abundance of those species vulnerable to increased mortality and loss of habitat from increased water salinity; or (d) for plants, significant reduction in stature or percent cover from increased water or soil salinity or other water quality parameters* (pg 14).
- *Salmon - Water quality conditions shall be maintained, together with other measures in the watershed, sufficient to achieve a doubling of natural production of Chinook salmon from the average production of 1967-1991, consistent with the provisions of State and Federal Law* (pg 14).

State Water Board – Division of Water Quality
The Water Quality Control Plan for Enclosed Bays and Estuaries Part 1 Sediment Quality contains receptor exposure specific narrative SQOs, neither of which, are intended to be directly protect fish or wildlife though some protection is provided secondarily by the protecting the benthic community, a primary food source for many bay and estuarine fish and birds. These narratives are

- 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* (pg 3).
- 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 (pg 3).*

4.4 Ambient and Receiving Water Monitoring

4.4.1 Regional Monitoring

In order to assess the status of the beneficial uses described in Section 4.3 above, monitoring is required. In California, water and sediment quality monitoring are routinely performed by the Water Boards, U.S. EPA, other state and federal agencies, academic institutions and other public research organizations, the regulated community, environmental advocacy organizations and stakeholders in bays and estuaries. Collaborative regional monitoring programs are probably best suited for assessing the health of many of these beneficial uses for several reasons:

- Monitor large areas that for many resident species represent a significant portion of the entire foraging area or habitat.
- Apply multiple indicators to develop a comprehensive understanding of the health of these beneficial uses.
- Generate high quality data that can be applied with confidence.
- Greater cost effectiveness where multiple organizations are participating in the program. Those with trawl capabilities or bioassay laboratories and other resources or expertise can provide in kind services that other participants may be lacking.

There are several regional monitoring programs that monitor marine and estuarine waters in California. The two largest are the Southern California Bight Regional Monitoring

Survey and the San Francisco Regional Monitoring Program for Trace Substances. A summary of each of these regional programs is provided below.

- **Southern California Bight Regional Monitoring Surveys** are managed by the Southern California Coastal Water Research Project to evaluate the physical, chemical and biological impacts to ocean, bay and estuarine waters from Point Conception to the U.S Mexico Border. These surveys are performed every 4 to 5 years. The most recent effort, "Bight 2008 Survey" included chemical analysis of tissue and sediment, sediment toxicity, analysis of benthic invertebrate and fish community structure, evaluation of gross pathology in trawl caught fish in bays and coastal waters. Collaborators include storm water agencies, sanitation districts, Water Boards U.S. EPA and other agencies.
- **San Francisco Regional Monitoring Program for Trace Substances** (RMP) is managed by the San Francisco Estuary Institute. The RMP collects data to evaluate contaminant exposure within the San Francisco Bay eco system. Specific studies conducted in 2010 aimed at fish and wildlife exposure and effects include monitoring contaminant bioaccumulation in small fish, bird shells, and assessing sensitivity of terns to PBDEs (SFEI, 2009). The RMP is an annual effort, though individual parameters may be monitored more or less frequently. Partners include storm water agencies, sanitation districts, San Francisco Regional Water Board and other agencies as described in Section 4.4.2 below.
- **Water Boards Surface Water Ambient Monitoring Program** (SWAMP) SWAMP's mission is to provide decision makers and the public with the information necessary to evaluate surface water quality throughout California. SWAMP supports the collection of high quality data in all regions for 303(d) listing and 305(b) reporting on impaired waterbodies and waters supporting beneficial uses.
- **NOAA National Status and Trends Mussel Watch Program** is funded by NOAA with additional resources provided by the Water Boards, SCCWRP and SFEI. The Mussel Watch Program is the longest-running contaminant monitoring program in the United States. Contaminant concentrations in mussel tissue are a direct measure of exposure for all similar filter feeders in those habitats where found, as well as an indicator of dietary exposure for biota that feed on these filter feeders.
- **Regional Harbors Monitoring Program** (RHMP) is a collaborative program initiated in response to a request for water quality information for Dana Point Oceanside, Mission and San Diego Bays made pursuant to Water Code section 13255 issued by the San Diego Regional Board. The RHMP is supported by the Port of San Diego, and the Cities of San Diego and Oceanside, and the County of Orange. RHMP's objectives include assessing the quality of water and sediment to sustain healthy biota, and the long-term trends in harbor conditions (Weston, 2008).
- **Central Coast Long-term Environmental Assessment Network** (CCLEAN), is a central coast program funded by the Cities of Santa Cruz and Watsonville, Duke Energy, Monterey Regional Water Pollution Control Agency, Carmel Area Wastewater District, under the direction of the Central Coast Regional Board. CCLEAN's goals are to assist stakeholders in maintaining, restoring, and enhancing nearshore water and sediment quality and associated beneficial uses including rare, threatened, or endangered species, water contact recreation, and wildlife habitat uses in the Central Coast Region. CCLEAN satisfies the NPDES receiving water monitoring and reporting requirements of program participants. Concerns center around elevated concentrations of persistent organic pollutants (e.g., petroleum hydrocarbons, chlorinated pesticides, polychlorinated biphenyls) in fish from the Monterey Submarine Canyon, declines in sea otter populations, diseases

in sea otters related to high concentrations of persistent organic pollutants, bird and mammal deaths due to blooms of toxic phytoplankton, See summary description at http://www.amarine.com/information/cclean/cclean_summary.pdf

4.4.2 NPDES Permit Monitoring

The Water Boards issue National Pollutant Discharge Elimination System (NPDES) permits pursuant to section 402 of the Clean Water Act. Section 402 requires that all point source discharges of pollutants to waters of the United States be regulated under an NPDES permit. NPDES permits contain both technology-based and water quality-based effluent limitations. Water quality-based effluent limitations are developed to implement applicable water quality standards.

NPDES Permits also identify applicable receiving water limitations, including narrative objectives contained in basin plans described in Section 4.3.2. An example of a narrative receiving water limitation is provided in Section V. of the San Francisco Bay Regional Final Order 2010 – 0060, which states, "*the discharge shall not cause the following in Central San Francisco Bay….Toxic or other deleterious substances to be present in concentrations or quantities which will cause deleterious effects on wildlife, waterfowl, or other aquatic biota, or which render any of these unfit for human consumption, either at levels created in the receiving waters or as a result of biological concentration*." (California Regional Water Quality Control Board – San Francisco Region 2010.) As described in the 2008 Staff Report, NPDES permittees in the San Francisco Bay may fulfill receiving water monitoring requirements by contributing and supporting the RMP described in Section 4.4.1 in accordance with Regional Water Board Resolution R2 92-043. Several special studies focus on exposure and effects to fish and wildlife in order to assess compliance with receiving water limits. Similarly, San Francisco Bay municipal storm water agencies are provided similar flexibility under Order No. R2-2009-0074, Municipal Regional Storm water Permit NPDES CAS612008 also requires receiving water monitoring and participation within the RMP to assess receiving water quality (See Section 4.4.1). Specific provisions require monitoring of water column and sediment toxicity, benthic invertebrates (bioassessment) and sediment bound toxic pollutants DDT, PCBs, copper, mercury, selenium to assess effectiveness DDT. The City of Los Angeles Terminal Island treatment plant that discharges into the Los Angeles Long Beach Harbor complex is required, under Order R4-2010-0071 (NPDES CA0053856), to perform a number of special studies related to the protection of finfish and wildlife, including a local demersal finfish survey, local bioaccumulation trends survey, and participation in the Southern California Bight Regional Demersal Finfish and Invertebrate Survey and Regional Predator Risk Survey.

4.5 Assessing and Restoring Beneficial Uses

Under current law, sediment cleanup activities may be undertaken in response to a Clean Water Act section 303(d) listing, an enforcement order issued pursuant to Porter-Cologne, or the Bay Protection and Toxic Cleanup Program. In addition, cleanup of hazardous wastes may be driven by the California Health and Safety Code well as federal Laws such as Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Superfund Amendments and Reauthorization Act (SARA). This section briefly describes programs that are oriented toward assessing and restoring beneficial uses. Section 4.2 – 4.5 of the 2008 Staff Report describes each of these programs in greater detail.

4.5.1 303(d) Listings and TMDLs

303(d) List of Impaired Water Bodies

Clean Water Act section 303(d) requires that the states list waters that do not meet applicable water quality standards with technology-based controls alone. This 303(d) list is developed in accordance with the State Water Boards' Water Quality Control Policy for Developing California's Section 303(d) List (Listing Policy) adopted in 2004. The listing policy identifies the factors and information that shall by used by the State and Regional Boards to list and delist a waterbody. Factors applicable to pollutants that bioaccumulate from sediment into finfish at concentrations that could be toxic to finfish and wildlife include:

- Bioaccumulation of pollutants in muscle or whole body exceeds pollutant specific guideline using the binomial distribution and
    - Applicable to the beneficial use
    - Protective of the beneficial use
    - Linked to the pollutant under consideration
    - Scientifically-based and peer reviewed
    - Well described
    - Identifies a range above which impacts occur and below which no or few impacts are predicted. For non-threshold chemicals, risk levels shall be consistent with comparable water quality objectives or water quality criteria.
- Adverse Biological Response in resident organisms compared to reference conditions and associated elevated sediment chemistry. Adverse biological response may include
    - Reduction in growth
    - Reduction in reproductive capacity,
    - Abnormal development,
    - Histopathological abnormalities
    - Other adverse conditions including finfish or bird kills
    - Degradation of biological populations and communities compared to reference conditions and associated elevated sediment chemistry
- Situation-specific weight of evidence listing factor

For each listing, the Listing Policy directs the Water Boards to identify the pollutant causing degradation of the beneficial uses, a total maximum daily load (TMDL) completion date and whether a total maximum daily load is required or whether existing programs can be applied to restore the beneficial use.

Total Maximum Daily Loads

Clean Water Act section 303(d) mandates that the state develop TMDLs for its listed waters. A TMDL, in general, identifies the maximum amount of a pollutant that a waterbody can assimilate while still meeting water quality standards. The TMDL identifies pollutant sources and includes an implementation plan that describes the actions necessary to achieve standards, including a schedule and monitoring and surveillance activities to determine compliance. TMDLs are not regulatory however, the TMDLs establish loads that are implemented through regulatory programs such as NPDES permits. TMDLs either in development or adopted to address degraded sediment and tissue impairments within bays and estuaries include:

- San Francisco Bay Mercury TMDL
- San Francisco Bay PCBs TMDL
- Dominguez Channel, Greater Los Angeles/Long Beach Harbor Toxic Pollutants TMDL

- Marina del Rey Harbor Toxics TMDL
- Ballona Creek Estuary Toxic Pollutants
- Central Valley Organochlorine Pesticide TMDL and Basin Plan Amendment
- Newport Bay/ San Diego Creek Selenium TMDLs
- Organochlorine Compounds and Metals TMDL, Lower Newport Bay - Rhine Channel
- Mouth of Chollas Creek Metals TMDL

TMDLs developed by the San Francisco Bay Water Board illustrate application of the TMDL program to protect finfish and wildlife receptors. The San Francisco Bay Regional Water Board recently adopted two TMDLs to address bay-wide exceedances of the narrative bioaccumulation objective described in Section 4.3.2 caused by excessive levels of methyl-mercury and PCBs in finfish tissue (California Regional Water Quality Control Board San Francisco Bay Region 2006 and 2008 respectively). High mercury levels in sediments are due, in large part, to legacy gold mining operations and have resulted in bay-wide finfish consumption advisories. PCBs, another legacy contaminant found in sediments, were used in many high voltage applications as a dielectric fluid, in paints, caulking and sealants. For both pollutants, the mechanism to restore beneficial uses is through the development of TMDLs where all sources of loading regardless of media are evaluated and controlled to the extent practical. The mercury targets were derived based upon the estimated reduction in mercury mass in tissue that would be needed to be protective of human health and wildlife (California Regional Water Quality Control Board San Francisco Bay Region 2006). In this case the U. S. Fish and Wildlife Service performed an ecological risk assessment on the methyl-mercury tissue criteria to determine if the concentration was protective of rare and endangered species in California. Unlike mercury, the movement of PCBs and other hydrophobic organochlorine compounds up through the food web can be predicted with food web models. Targets developed for PCBs were supported by complimentary empirical and mechanistic models. Though the final target was based on human health risk, harbor seals, birds such as cormorants and terns were protected because the human health derived target was less then the wildlife target (California Regional Water Quality Control Board San Francisco Bay Region 2007).

Other examples include the Santa Ana River Region's effort underway to develop a TMDL and site specific objective (SSO) to protect wildlife risk posed by selenium that has accumulated in finfish tissue and egg shells. Though still in the early stages, to support TMDL and SSO development, the County of Orange working under Order R8 2004-0021, has assembled a technical work group to identify relevant and appropriate endpoints and targets that protect wildlife in the waterbody.

TMDLs when adopted are implemented by the Regional Water Boards through permits. An example of a permit adopted to address a apply TMDL developed waste load allocations is the San Francisco Bay Region Order No. R2-2007-0077 NPDES CA0038849s adopted in December 2007 to implement the Regional Boards mercury TMDL for municipal and industrial discharges into San Francisco Bay.

4.5.2 Point Source Controls

This section describes actions by individual permittees. The Water Boards issue National Pollutant Discharge Elimination System (NPDES) permits pursuant to section 402 of

the Clean Water Act. Section 402 of the Clean Water Act requires that all point source discharges of pollutants to waters of the United States be regulated under a permit. Under the NPDES permit program, discharges are regulated under permits that contain both technology-based and water quality-based effluent limits. Water quality-based effluent limits are developed to implement applicable water quality standards including those contained in basin plans and the California Toxic Rule. If a discharge is found to be causing or contributing to the degradation of beneficial uses, the Water Boards have the authority to reopen modify or terminate the permit. In order to restore the beneficial uses the Water Boards may include more stringent effluent limits for those pollutants causing degradation. Waste load allocations developed for TMDLs are implemented in part through NPDES permits. Once a TMDL is approved, permits are amended to include waste loads allocations as a permit condition. Within enclosed bays and estuaries, existing discharges contributing to the accumulation of pollutants in sediments have been assessed waste load allocation through TMDLs, for a segment or waterbody, rather than through an independent permit modification.

4.5.3 Site Assessment and Cleanup

As described in Section 4.2 Porter-Cologne provides the Water Boards with broad authority and enforcement options such as cleanup and abatement orders, cease and desist orders, and administrative civil liability orders. Sediment cleanup activities may also be undertaken in response to a Clean Water Act §303(d) listing or other state and federal regulations described in Section 4.2 of the 2008 Staff Report. Depending upon the site, contaminated media and types of waste present, either U.S. EPA, Regional Water Board or DTSC may be designated as the lead regulatory agency oversight for the cleanup of hazardous waste sites. The extent of site cleanup actions are based upon the desired goals and end uses established for the site, the evaluation of risks to human health and the environment at the site, and the selection of appropriate management alternatives that will reduce the risks to acceptable levels that are consistent with the desired goals and end uses. In order to evaluate existing risks and potential future risks, conceptual models are prepared that identify receptors potentially at risk and the probable exposure pathways. This conceptual model serves as the basis for formulating the human health and ecological risk assessment. At sites where polluted sediments are the primary concern, receptors commonly evaluated include:

- Benthic communities exposed directly to pollutants in sediment,
- Finfish exposed directly to pollutants in sediment or indirectly through consumption of pollutants in prey tissue or
- Birds, marine mammals and humans also exposed indirectly through consumption of pollutants in prey tissue.

For many receptors, risk is estimated by comparing pollutant concentrations in sediments and prey tissues to calculated risk thresholds developed specifically for those receptors. For other receptors, such as benthic invertebrates, direct measurements such as benthic community composition, sediment toxicity and chemistry may be applied instead. Typically, those most sensitive receptors identified will become the focus of the remedial effort. Water quality objectives may be utilized to assess risk to receptors when the objective is based upon related receptors and similar exposure pathways. However many aquatic life and human health based water quality objectives were not derived to protect these receptors from the exposure pathways that exist at sites where contaminants accumulate in the food web through trophic transfer (U.S EPA 1985). In these cases human and ecological risk

assessments are conducted to assess and characterize the risks posed by these contaminants.

Remedial alternatives and strategies considered by the State Water Board for the forty-eight sites designated toxic hotspots as part of the Bay Protection Program are described in the State Water Boards Amended Final Functional Equivalent Document – Consolidated Hotspots Cleanup Plan (State Water Board, 2004).

4.5.4 Ecological Risk Assessment

U.S. EPA (2008) describes ecological risk assessment (ERA) as "a process to collect, organize, and analyze scientific information in order to evaluate the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors. While many identify ERA with site assessment and cleanup, ERAs are equally applicable to a waterbody or watershed (EPA, 2008). ERA is a flexible iterative process that can be used for any site segment or waterbody either prospectively to assess future conditions or retrospectively to assess risk associated with spills or releases or existing degradation (USEPA 1998). ERA consists of three principal steps:

1. Problem Formulation – The goal of this phase is to ensure that the study design is appropriate for the specific site by identifying key study questions, developing a conceptual model and designing a well-focused study to addresses specific receptors, anticipated exposures, relevant endpoints and site specific factors to address and respond to key study questions.
2. Analysis – The goal of this phase is to assess, analyze and quantify the exposure and to identify potential biological effects associated exposures that may occur at the site.
3. Risk Characterization – This phase integrates the exposure and effects information, accounting for data limitations, (e.g uncertainty and variability) assumptions and site conditions to address the study questions.

Because data gathered during each phase may reveal previously overlooked or omitted sources, receptors or transport processes, these steps may be repeated at any stage as necessary to complete the ERA (USEPA 1998). As with direct exposure studies described in Part 1 and 2008 Staff Report, a detailed conceptual model provides the foundation for site related assessment activities and support management decisions. A conceptual model is tailored for the specific site segment or waterbody and complexity of the problem. In general a conceptual model for finfish and wildlife exposed to contaminants in sediment will contain the following information:

- Site and surrounding land uses and boundaries
- Contaminants known or suspected of being present at site
- Sources
- Surface waters, groundwater and beneficial uses
- Affected media (air, soil, sediment, surface and ground water)
- Fate and transport processes
- Receptors potentially exposed directly or indirectly
- Feeding strategies, food web relationships
- Exposure routes and sensitive life stages

Ecological risk assessments may be relatively simple or extremely complex depending upon the site conditions, number of pollutants, exposure pathways and receptors. In all cases, a variety of expertise is needed to ensure that the results of the ERA are valid and relevant for the species, exposure pathways and pollutants associated with the site segment or waterbody.

ERAs have been performed on a wide variety of sites in California through several programs. Examples include natural resources damages assessments by federal and state resource trustees (NOAA, et al 2010), as part of the Department of Defense Base Realignment and Closure (BRAC) efforts and U.S. EPA Superfund Program Sites (Naval Facilities Engineering Command, 2006), and Department of Toxic Substances Control (DTSC) site assessment and cleanup actions (DTSC, 1996). The Regional Water Boards also use the results of ERAs to support management decisions. Examples of ERAs performed at contaminated sediment sites managed directly by the Regional Water Boards include Anchor QEA's 2006 Feasibility Study and Alternatives Evaluation Rhine Channel Sediment Remediation Newport Bay California and Geomatrix's 2007 Scoping Ecological and Offsite Human Health Risk Assessment Sierra Pacific Industries Arcata Division Sawmill, Arcata California. EPA A large number of documents have been prepared by state and federal agencies to support ecological risk assessment. Several of these documents are listed below.

- U.S. EPA 1993. Wildlife Exposure Factors Handbook Volume I of II. Office of Research and Development EPA/600/R-93/187
- U.S. EPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-006,
- U.S. EPA. 1998. Guidelines for Ecological Risk Assessment. U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, DC, EPA/630/R095/002F.
- U.S. EPA 2003. Generic Ecological Assessment Endpoints (GEAEs) for Ecological Risk Assessment. Risk Assessment Forum EPA/630/P-02/004F
- U.S. EPA. 2007. Framework for Metals Risk Assessment Office of the Science Advisor/Risk Assessment Forum EPA 120/R-07/001 March
- U.S. EPA. 2008. Application of watershed ecological risk assessment methods to watershed management. National Center for Environmental Assessment, Washington, DC; EPA/600/R-06/037F.
- U.S. EPA 2008b Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment. Office of the Science Advisor/Risk Assessment Forum EPA/100/R-08/004 June
- Cal/EPA Department of Toxic Substances Control 1996. Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities – Part A: Overview
- Cal/EPA Department of Toxic Substances Control 1996. Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities – Part B: Scoping Assessment
- U.S. Department of Energy (DOE), Office of Environmental Management, Oak Ridge Operations (ORO) Office Risk Assessment Information System http://rais.ornl.gov/

Additional guidance to support evaluation of site specific bioaccumulation factors and biota sediment bioaccumulation factors where trophic transfer is a potentially significant pathway is presented below:

- U.S. EPA 2009. Technical Support Document Volume 3: Development of Site-Specific Bioaccumulation Factors (Site-Specific TSD) EPA-822-R-09-008. Washington D.C.

Burkhard, L.P. 2006. Estimation Of Biota Sediment Accumulation Factor (BSAF) From Paired Observations Of Chemical Concentrations In Biota And Sediment. U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Duluth, MN:

4.5.5 Ecological Risk Assessment and Cleanup Targets

Although both ecological and human health risk assessments may guide the development of appropriate cleanup targets, the targets must comply with State Water Board Resolution No. 92-49. 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 including 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. Section 4.2.2 of the 2008 Staff Report provides additional information on cleanup and Resolution No. 92-49.

5 ISSUES AND ALTERNATIVES

This section describes the major policy related issues identified and alternatives that have been considered by staff during the development of proposed amendments to Draft Part 1. Staff's recommended alternatives form the basis for the proposed amendments included as Appendix B.

5.1 Analysis of No Project Alternatives

CEQA requires that the State Water Board consider the "No-Project" alternative. Although the assessment of contaminant bioaccumulation into the aquatic food web would continue to occur if the project was not adopted, the narrative applied and the assessment framework would lack consistency between the regions. In addition the errors included within Part 1 would remain in place. Adopting the no project alternative would prevent the State Water Board from correcting existing errors, potentially reducing the accuracy of the assessment and preventing end users from applying the indicators as the State Water Board had intended. As a result, the "no project" alternative would reduce the confidence in, and technical basis for these assessments by ignoring errors contained in Part 1. The "No-Project" would not limit the Regional Board's ability to assess or restore water quality to support the use and propagation of these receptors; however the Regional Boards must continue to apply Part 1 with the existing errors.

Alternative 1: Adopt the no project alternative. As stated above the "No Project" results in no changes to Part 1.

Alternative 2: Do not adopt the "no project" alternative and adopt staff recommendations.

Staff Recommendation: Alternative 2

5.2 Receptors

Part 1 addresses aquatic life, specifically benthic infauna directly exposed to pollutants in sediment and humans exposed to contaminants through consumption of finfish and shellfish caught within bays and estuaries. Other receptors may be at risk either from direct or indirect exposure through trophic transfer and bioaccumulation, or as a result of both. U.S EPA (1997) identified several cases were pollutants in sediment were associated with fin rot, lesions and tumors in finfish living in close proximity to sediment and reproductive effects in piscivorous birds and wildlife. In Puget Sound, Johnson et. al (2002) reported on the relationship between the concentrations of poly aromatic hydrocarbons in sediment and liver lesions and decreased growth and reproduction in *Pleuronectes vetulus* (English Sole).

In California, *Gillichthys mirabilis* (Longjaw mudsucker) a small benthic feeding goby has been studied to evaluate the relationship between biological effects and sediment and water column pollutants. Forrester et al (2003) evaluated populations of *Gillichthys mirabilis* in Alamitos Bay, Ballona Wetland, and Mugu Lagoon and correlated contaminant mixtures with reduced growth and size among the populations. McGourty et al (2009) established a similar relationship between pollutants in sediment and population level effects in San Francisco Bay relative to less disturbed sites in Tomales Bay. Resident finfish are the focus of most of these studies because all exposure occurs in the waterbody of interest over the full life span of the finfish. The duration of exposure to migratory finfish would be significantly less and difficult to characterize.

Studies have also been performed to evaluate risks to wildlife including birds and marine mammals. CH2M Hill (2007) summarized exposure and accumulation of DDTs and PCBs in eggs from bald eagles, brown pelicans, cormorants and peregrine falcons in the Southern California Bight. Trophic transfer from sediment up through the food web is the primary pathway of exposure for these species (CH2M Hill, 2007). Thompson et al (2007) summarized previous studies in the San Francisco Estuary that correlated contaminant concentrations with a variety of effects to finfish and birds. Jarvis et al (2007) reported concentrations of PCBs and DDTs in forage fish exceeding predator risk thresholds in the Southern California Bight. Blasius and Goodmanlowe (2008) evaluated tissue samples in sea lions and seals Southern California Bight and concluded that over half of the sea lions had PCB concentrations above levels that suppress immune system response. While some of these studies are not a direct assessment of conditions in southern California bays and estuaries, these studies do indicate that these contaminants readily bioaccumulate within the marine food web at levels posing risks to marine mammals.

Regulatory Framework: Within each of the affected regions, beneficial uses have been designated for finfish and wildlife uses within each Basin Plan. These beneficial uses are protected by narrative and numeric water quality objectives. Part 1 protects benthic communities and human consumers of fish and shellfish.

Alternative 1: Protect resident finfish from the effects caused by contaminants in sediment.

Alternative 2: Protect wildlife from the effects caused by contaminants in sediment

Alternative 3: Protects both resident finfish and wildlife from the effects caused by contaminants in sediment

Staff Recommendation: Alternative 3

5.3 Type of Sediment Quality Objectives

Objectives can be either narrative or numeric. Included in Part 1 are two narrative objectives that protect benthic communities from direct exposure and human consumers of fish and shellfish from indirect effects through consumption of fish and shellfish. Narrative objectives are used in situations where a single numeric objective is insufficient or incapable of providing the appropriate certainty for assessing and protecting beneficial uses. In Part 1, narrative protecting benthic communities supersedes those narrative contained in the basin plans to the extent that they are applied to protect bay or estuarine benthic communities from toxic pollutants in sediment.

Numeric sediment-based chemical targets have been developed to protect finfish and wildlife for specific TMDL and site cleanup efforts. These are site or segment-specific values that are based upon many factors that vary from site to site including biota and food web, organic carbon content of sediment, grain size, distribution and partitioning of contaminants at the site and other factors. Due to the many factors that affect bioavailability and trophic transfer, developing chemical specific concentrations to protect finfish and wildlife in all enclosed bays and estuaries presents a significant challenge. In order to accomplish this task, the State Water Board would need to collect a significant amount of sediment and prey tissue data for a variety of species and habitats over a long period of time to account for spatial and temporal variability. At this time neither, U.S. EPA nor other states have adopted sediment quality objectives or criteria that specifically protect finfish or wildlife.

U.S. EPA's updated methodology for deriving water quality criteria for the protection of human health addresses bioaccumulation and trophic transfer, and acknowledges many of the limitations and uncertainties associated with bioaccumulation, trophic transfer and criteria development (U.S. EPA 2009). This methodology provides guidance on the development of site-specific bioaccumulation factors to better protect human health. Similarly, Oregon Department of Environmental Quality (2007) recently developed guidance for evaluating risk to humans and wildlife associated with bioaccumulation from sediment into the food web. The Oregon guidance includes sediment screening values, for the preliminary assessment that were calculated as described in Section 2.2). Within this sequential framework, if site sediments exceed the preliminary screening values, site specific factors and data can be collected and applied within the framework to better account for site specific factors.

Regulatory Framework: Part 1 contains narrative SQOs for benthic macroinvertebrates and human health:

Alternative 1: Propose a narrative SQO that protects resident finfish and wildlife from the effects caused by contaminants in sediment.

Alternative 2: Develop a numeric SQO that protects wildlife from the effects caused by contaminants in sediment.

Staff Recommendation: Alternative 1

5.4 Implementation of the Sediment Quality Objectives

5.4.1 Assessment

The methodology used to assess sediment quality relative to the proposed SQO is just as important as the narrative itself. However there are few scientifically defensible options available. Mechanistic sediment quality guidelines (SQGs) based on equilibrium partitioning theory is one potential option. Equilibrium partitioning theory incorporates factors relating to

bioavailability and toxicity and can be used to predict pore water concentrations of contaminants from dissolved concentration of contaminants in the water column for select classes of contaminants. Empirical SQGs derived from the statistical analysis of matched sediment chemistry and biological effects data present another option. Examples of empirical SQGs for the marine environment include the effects range-median (ERM) probable effects level (PEL), apparent effects level (AET) as described in the 2008 Staff Report. An advantage to these approaches is the relative ease of use compared to more complex approaches and minimal need for best professional judgment. However, there are significant limitations in the application of mechanistic and empirical SQGs for these receptors as well. None of these SQGs were developed to protect higher level organisms from effects associated with the accumulation of contaminants through trophic transfer (Wenning et al, 2005).

Another option is to use screening values developed by other states that specifically address bioaccumulation and trophic transfer. The advantage of this approach is that the numeric values are established and the methodology and assumptions used to derive the values are typically described in detail, providing end users the necessary technical understanding and transparency. An example is the Oregon Department of Environmental Quality 2007 document titled "Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment." This option provides a distinct advantage over the previous option in that it directly addresses the risk associated with bioaccumulation of contaminants from sediment through the food web into wildlife. This approach also provides the advantage associated with look up tables for both sediment and tissue concentrations. However the sediment concentrations are based upon relatively conservative assumptions to ensure protection under a variety of conditions across the state. As a result, comparison of site sediment chemistry to these concentrations represents the initial evaluation in the multi-step sequential framework. Later steps utilize more site specific information to better assess bioaccumulation risk ending with prey tissue residue analysis or laboratory bioaccumulation testing. Several additional limitations are associated with this approach as applied directly in California. California bays and estuaries exhibit a broad range of habitats conditions and communities from the Tijuana River Estuary to the mouth of the Smith River. The choice of receptors and toxicity reference value applied, default biota sediment accumulation factors and other default values and assumptions may not be appropriate for or applicable to all enclosed bays and estuaries of California.

Another option is to utilize an ecological risk assessment framework to implement the resident finfish and wildlife SQO. The advantage of this approach is that it is an iterative flexible framework that can be applied to almost any site segment or waterbody. Though the Water Boards have applied ERA to site assessment and cleanup actions for many years, water quality oriented programs such as TMDL development have also incorporated aspects of the ERA process. In California, state and federal resource trustees agency staff from California Department of Fish and Game Office of Spill Prevention and Response, Cal/EPA Office of Environmental Health Hazard Assessment, Cal/EPA Department of Toxic Substances Control Human and Ecological Risk Assessment Division, U.S. EPA Region 9 Biological Technical Advisory Group, U.S Fish and Wildlife have applied ERAs to address many different concerns. While performing an ERA does require a broad body of expertise and professional judgment, there are a number of state and federal resource trustee agencies with significant guidance available. Many of these documents are presented in Section 4.5.3.

Regulatory Framework: Most Regional Boards have utilized the ERA process within site assessment and cleanup programs. Some Regional Boards incorporate the ERA process into water quality planning TMDL development.

Alternative 1: Do not implement the ERA process in NDPES permits until the State Water Board develops a more prescriptive framework. Utilize the ERA process to determine attainment of the proposed resident finfish and wildlife SQO.

Alternative 2: Utilize existing sediment quality guidelines to measure attainment of the proposed resident finfish and wildlife SQO.

Alternative 3: Utilize bioaccumulation values used as guidance in other states to measure attainment of the proposed resident finfish and wildlife SQO.

Alternative 4: Utilize the ERA process to determine attainment of the proposed resident finfish and wildlife SQO.

Staff Recommendation: Alternative 4.

5.4.2 Application within Water Board Programs

Site assessment and cleanup programs utilize ERAs on a site-by-site basis appropriate for isolated land-based spills and releases confined to small areas. While this site-by-site approach could be applied to NPDES permitees, this may not provide staff with the type of information that can be used to inform and support the decision making process. As described in Section 2, water releases within the water column are typically more diffuse and sediment bound contaminants can be transported long distances by currents generated by tides, winds, and rivers that cause these contaminants to accumulate over broad areas. Fish foraging over these areas will accumulate a contaminant burden that reflects bioaccumulation from sediment into the food web over the entire area which for many species encompasses several square kilometers. To accurately assess the risks associated with this pathway, a broad spatially representative survey would provide a better understanding of the overall ecological risks associated with a waterbody than multiple isolated independent studies conducted at near individual outfalls. Regional data would better suit the needs of the Water Boards as well, in establishing 303(d) listings and prioritizing TMDL development given the limited resources available. This approach is currently used in some waterbodies as described in Section 4.4 where permittees are assessing ecological risks through regional monitoring programs (see the 2008 Staff Report for additional discussion on the benefits of regional monitoring programs).

An ERA can be either simple or complex depending upon the problem or study questions the magnitude of effects and the types of management decisions the ERA would be used to inform. Burton et. al (2002) presents a framework for assessing different aspects of sediment quality including trophic transfer in a weight of the evidence framework, and identifies important issues that should be considered in planning these studies.

A preliminary ERA can be performed based upon existing data, if enough relevant data and information is available to screen sites or waterbodies. In these situations, conservative estimates and assumptions are used to account for uncertainties and data limitations. Implementation of an ERA in water programs would follow the 3-step process outlined in Section 4.5.4 from U.S. EPA (1998). These steps consist of 1) Problem Formulation, 2) Analysis, and 3) Risk Characterization. The goal of problem formation is to develop an effective design based upon the problem or study question. An effective design would focus resources on those receptors and relevant exposure pathways that could result in risk and

account for effects associated with potential confounding factors such as habitat degradation and how these effects can be minimized During problem formulation, all relevant data and information are collected.

Once the problem or study questions are established and agreed upon, a conceptual model is prepared. A conceptual model may be either simple or highly detailed depending upon the problem. Elements identified in the conceptual model include study boundaries, contaminants and sources, media (sediment, ground water, surface water), receptors and potential exposure pathways and factors affecting bioavailability and fate and transport. Once the receptors and likely exposure pathways are identified, potential indicators and endpoints can be identified. Examples of indicators include prey tissue chemistry when trophic transfer is a likely exposure pathway from sediments into piscivorous fish or birds or histopathology, or population measures when direct exposure is a concern. In some cases the indicator may be based upon exposures predicted from food web models such as those described in Section 2.2.

In many cases, comparisons may be made to background or reference conditions or in conjunction with recognized thresholds such as TRVs described in Section 2.2. These issues, as well as others such as reporting limits, analytical methods, and a description of how the information will be used and integrated with other sources to draw conclusions about the site or waterbody relative to the study questions, are all described in the planning process. In conducting a screening level assessment, data limitations and uncertainty can be offset by applying conservative assumptions to estimate those parameters that have not been measured previously. With the problem formulation step completed, field data can be collected or, if existing data is available, the second step “Analysis” can be initiated. The goal of this second step is to assess, analyze and quantify the exposure and effects to identify potential biological effects associated with these exposures that may occur in the site or waterbody. The final step is risk characterization, which integrates and summarizes the data relative to the study questions, and draws conclusions relevant to the magnitude of risks and background conditions as discussed by Burton et. al (2002). Where a project encompasses habitats used by rare, threatened, or endangered species and potentially results in the disturbance, loss of habitat or harm to these receptors, trustee agencies including DFG, USFW&S and NOAA fisheries must be consulted.

Implementation of the ERA process using NPDES permits or Regional Monitoring programs would follow the 3 steps described above in Section 4.5.3, beginning with the planning process and preparation of a workplan describing how the ERA will be conducted. In assessing sediment contamination relative to the proposed SQO, a Regional Board could use the results of a either a preliminary ERA or an ERA based upon data collected and information obtained specifically for the project to assess whether sediment is contributing to fish or wildlife risk. Where human health risks are also of concern, an ERA will complement this effort where similar pathways and exposure routes exist.

Regulatory Framework: Site assessments/site cleanups conducted under the Water Boards authority have relied upon the results of ERA to inform management decisions. Within water quality programs risks to ecological receptors such as finfish and wildlife have been assessed within the major regional monitoring programs supported by NPDES permittees as described in Section 4.4.1. Not all regions encompass multiple municipalities with the resources to support large scale regional monitoring programs such as the North Coast Region and Central Valley Region.

Alternative 1: Do not implement the ERA process in NDPES permits until the Water Board develops a more prescriptive framework. Utilize the ERA process to determine attainment of the proposed resident finfish and wildlife SQO.

Alternative 2: Implement the ERA process within NPDES permits on a permit by permit basis.

Alternative 3: Implement the ERA within NPDES permits through regional monitoring programs where resources are available to support such efforts.

Staff Recommendation: Alternative 3.

6 CEQA PROJECT REVIEW AND ANALYSIS

This section presents the regulatory requirements for assessing environmental impacts under CEQA for certified regulatory programs. The certified regulatory program at issue here are the proposed amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries of California Part 1 Sediment Quality (Part I). These proposed amendments to Part I (Appendix B) are evaluated at a program level of detail under a Certified Regulatory Program. The relevant substitute environmental documentation must include a written report that describes the proposed activity, an analysis of reasonable alternatives, and an identification of mitigation measures to minimize any significant adverse environmental impacts based on information developed before, during, and after the CEQA scoping process that is specified in California Public Resources Code section 21083.9. The CEQA Checklist is included in Appendix B.

6.1 Project Title

Amendment of the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality for the Protection of Fish and Wildlife

6.2 Project Description

The proposed amendments will only apply to surficial sediments within enclosed bays and estuaries of California. The proposed amendments consist of the following:

1. A proposed narrative sediment quality objective to Section IV of Part 1 that protects resident finfish and wildlife from the detrimental effects caused by exposure to pollutants in sediment.
2. A proposed process for implementing these narrative objectives to Section VI of Part 1.
3. Proposed additions to Section VIII - Glossary with additional definitions in support of the proposed narrative objectives
4. Proposed corrections to omissions within Equation 2 from Section V of Part 1.
5. Proposed corrections to PAHs, DDD, DDE and DDT values applied to the CSI chemical index score contained in Table 7 from Section V of Part 1.
6. Proposed corrections to the list of chemicals described in Attachment A of Part 1

If adopted, these amendments would be incorporated into Part 1. Part 1 is enforced by the State Water Board and coastal Regional Water Quality Control Boards consisting of the North Coast, San Francisco Bay, Central Coast, Los Angeles, Central Valley, Santa Ana and San Diego Regions. Those regulated under the proposed draft Part 1 would include an individual or organization that discharges toxic pollutants to enclosed bays and estuaries of California or rivers or streams draining into enclosed bays and estuaries.

6.3 Necessity and Need for Project

The proposed amendments are necessary for the State Water Board to fulfill the Legislative mandate required under Porter-Cologne (Water Code section 13391.5). Each of the proposed amendments 1-6 described above is necessary to protect those beneficial uses at risk from pollutants in sediments within enclosed bays and estuaries of California. Specifically, proposed amendments 1, 2, and 3 provide the Water Boards with a consistent narrative SQO and the means to implement the narrative SQO across broad habitat types and a variety of aquatic ecosystems. Proposed amendments 4, 5 and 6 correct unintentional errors in the original document that could reduce the overall effectiveness of the Water Quality Control Plan. If the Water Board does not correct these errors, end users may not be able to assess sediment quality in relation to the SQO that was designated to protect benthic communities as the State Water Board intended.

6.4 Project Goals

The goals of this project are:

1. Provide protection to those additional receptors at risk from toxic pollutants in sediment that were not contemplated during the development of Part 1.
2. Provide greater consistency in the assessment of risk to resident finfish and wildlife from toxic pollutants in sediments
3. Correct errors within Part 1 that could potentially reduce the effectiveness of the water quality control plan.
4. Fulfill the State Water Board's legislative mandate required under Porter-Cologne (Water Code section 13391.5)

6.5 Lead Agency

The State Water Board is the lead agency for this project.

6.6 Contact

Primary Contact for this project
Chris Beegan Engineering Geologist
State Water Resources Control Board - Division of Water Quality
Office Phone 916 341 5577 Email cbeegan @waterboards.ca.gov

Secondary Contact for this project
Dominic Gregorio, Senior Supervising Environmental Scientist
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6.7 Review and Analysis

The Substitute Environmental Document must identify the reasonably foreseeable methods of compliance associated project including 1) an analysis of any reasonably foreseeable significant adverse environmental impacts associated with those methods of compliance; 2) analysis of reasonably foreseeable alternative methods of compliance that would have less significant adverse environmental impacts; and 3) An analysis of reasonably foreseeable mitigation measures that would minimize any unavoidable significant adverse environmental impacts of the reasonably foreseeable methods of compliance.

6.7.1 Reasonably Foreseeable Methods of Compliance

In terms of reasonable foreseeable methods of compliance, it is not reasonably foreseeable that a project proponent would propose, or that the Regional Water Board would approve, dredging and disposal of sediment from an entire waterbody if sediment in the waterbody fails to meet the proposed SQO. Dredging of this magnitude would be environmentally and economically infeasible. In the existing TMDL program, even legacy pollutants—those that are no longer in regular use or production, such as DDT, PCBs and mercury—are being controlled through means other than waterbody-wide dredging. Nor would staff anticipate a need for new wastewater treatment plants. The Clean Water Act requires all POTWs to meet secondary treatment standards, and many inland dischargers have or are in the process of upgrading to tertiary treatment. In addition, POTWs that discharge to bays and estuaries must comply with stringent CTR toxic pollutant criteria, which are implemented under the State Water Board's SIP, and must meet U.S. EPA's existing pretreatment program requirements. It is, therefore, unlikely that major modifications to existing POTWs or new POTWs would have to be constructed to meet the SQOs.

This analysis takes into account the knowledge and understanding of existing environmental conditions and current Regional Water Board practices and actions to restore beneficial uses. As discussed in Section 4, all coastal Regional Water Board basin plans currently contain narrative water quality objectives for toxicity or toxic substances, pesticides, bioaccumulation, or a combination of these that apply to sediment quality. In addition, existing basin plan prohibitions and numeric objectives and criteria for toxic pollutants, for example, the CTR criteria, affect sediment quality. Sediment cleanup and remediation programs are either underway or planned in many regions because the sediments do not achieve the applicable objectives or other applicable requirements. These regulatory controls and activities would continue in the absence of the proposed amendments, if adopted. The extent to which additional methods of compliance would be required if the proposed amendments are adopted, considering existing practices and the current environmental conditions, is very difficult to determine. This analysis, nevertheless, assumes that adoption of the proposed amendments will create greater awareness and understanding of contaminated sediments and potential risks to finfish and wildlife, which may result in increased monitoring of sediment and fish tissue in some areas.

One potential consequence of increased monitoring would be the designation of impaired sites or segments within a waterbody that are causing unacceptable risks to finfish and wildlife. These cases could result in a slight or negligible increase in other methods of compliance or remediation activities required in comparison to current actions. Even though the proposed amendments do not require specific methods of compliance or corrective action, for this analysis, the State Water Board has considered these possible indirect actions and the reasonably foreseeable methods of compliance that may be required as a result of a finding that site sediments do not meet the proposed narrative objective.

As described previously, one direct consequence of the proposed amendments, if adopted, would be increased monitoring of sediment and forage or prey fish or other tissue collected from trawls, seine, hook and line or by hand. Although neither the proposed amendments nor Part 1 mandate additional methods of compliance or corrective action for failing to meet the proposed narrative SQO, the Water Boards have the authority to issue and revise waste discharge requirements, and issue and implement enforcement actions that require corrective action at these sites. The number of reasonably foreseeable actions that permitees or responsible parties could implement to comply with the proposed amendments is unlimited. Potential alternatives can be categorized by controls that are applicable to the

quality of water associated with existing discharges and remedial actions that are applied to reduce the risk associated with the pollutants already in the sediment (State Water Board, 2008). Some of these controls and remedial alternatives are described below:

Non-Structural Controls

- Public Education—Education to promote pollution awareness on the proper use and proper disposal of products containing toxic pollutants, pollution prevention and minimization, and environmental stewardship
- Training—Training programs can be used to support effective use of BMPs
- Water Conservation—Water conservation reduces dry weather runoff that may carry sediment and pollutants directly into enclosed bays and estuaries or rivers draining into these waterbodies.
- Street cleaning (includes sweeping)—Frequent or more effective street sweeping or washing can reduce both sediment and pollutant runoff.

Structural Controls

- Detention Basins/Retention Ponds—These ponds and basins can reduce the volume of suspended sediment and pollutants in storm water by allowing suspended solids to settle out and reduce hydraulic load on the conveyance system.
- Storm water Diversions—Storm water diversions have been constructed to divert dry season flows to wastewater treatment plants.
- Vegetated Swales/Buffer Strips—Well maintained buffer strips constructed along roadsides and in medians can reduce the volume of sediment carried to storm drains.
- Removal and Disposal of Polluted Soils—Soil containing toxic pollutant residuals may be removed from sewer lines and excavated out of storm water channels or conveyances or treatment controls such as dention basins or public rights-of-way.
- Treatment process optimization—Measures wastewater treatment plants can implement to modify or adjust the operating efficiency of the existing wastewater treatment process.
- Pretreatment Program Assessment—Wastewater treatment plants can evaluate the effectiveness of the pretreatment programs and require upstream sources to reduce pollutant loading into the plant influent.
- Treatment Plant Upgrades. Treatment plants may be upgraded to reduce pollutant concentrations in effluent.
- Outfall Modifications—Treatment plants may relocate or redesign an outfall to reduce the potential impacts associated with the discharge of effluent. Redesign may include construction of a multi-port diffuser to increase dilution or relocation of the discharge into a location close to the ocean.

Remedial Actions are applied to restore the beneficial uses by reducing the risk of exposure to pollutants in sediment. The types of remedial action, potential environmental

impacts and mitigation and relative costs are described in the Consolidated Toxic Hotspots Cleanup Plan Amended Final Functional Equivalent Document (State Water Board, 2004). Potential actions include:

- Capping/Sequestering of Polluted Sediments - If the polluted sediments are not limiting navigation and risk minimization is the objective, a well-engineered cap can reduce the mass of pollutants available for uptake or exposure.
- Removal Action - Polluted sediments may be dredged from the waterbody for offsite disposal or remediation.
- In-situ Remediation Polluted sediment may be remediated in place.
- Monitored Natural Attenuation – Considered when significant and natural recovery processes are reducing the contaminant bioavailability, source control has been effective, there is little potential for erosion/remobilization, exposure to important receptors is limited during the recovery period and resources exist for continued monitoring of the progress and effectiveness.

6.7.2 Potential Adverse Environmental impacts

Monitoring is unlikely to cause reasonably foreseeable adverse environmental impacts. Sediment and tissue collection for monitoring purposes may be performed from either a boat or at the shore using grab samplers to collect sediment, and seines or trawls to collect prey fish. Where possible, the State and Regional Boards will rely on recent data if the quality, type and location are appropriate and/or encourage collaborative monitoring to reduce duplicative efforts such as those programs described in Section 4.4.1. To ensure that the state's biological resources are protected, collection of biota such as forage fish for chemical analysis requires a Scientific Collecting Permit from the California Department of Fish and Game (DFG). In the application, the permitee is required to identify the species quantity and location of sampling. If the application is approved, the permitee must notify the applicable DFG Region office in advance of the sampling. In some cases, notification of other state and federal agencies is required when sampling or collecting occurs within specially protected areas such as parks and reserves. These events are not expected to have a significant impact on the environment because they would occur infrequently and cause minor disturbance to the sediment and biota. Although neither the proposed amendments nor Part 1 mandate additional controls or corrective action for failing to meet the narrative SQO, the Water Boards have the authority to issue and revise waste discharge requirements, and issue and implement enforcement actions to require remediation of these sites that fail to meet the proposed objective. In those cases where controls or corrective actions are necessary to restore the beneficial uses, these actions could cause potential adverse environmental effects without mitigation. For example:

Potential impacts from actions on land, such as construction of treatment plant upgrades, implementation of BMPs or excavation of retention basins or swales include:

- Degradation of water quality by altering or increasing the flow of runoff and erosion
- Degradation of sensitive terrestrial, riparian or wetland habitat as a result of construction
- Degradation of air quality by operation of construction equipment, loaders, and trucks powered by internal combustion engines

Potential impacts from actions on water such as remedial actions that disturb sediment, removal actions capping or sequestering, and in situ remediation include:

- Degradation of water quality by disturbing sediment
  - Increased turbidity
  - Remobilized contaminants
- Degradation of benthic community
- Degradation of essential fish habitat or disruption of migration, spawning or foraging of rare threatened or endangered species or marine mammals
- Degradation of sensitive terrestrial, riparian or wetland habitat as a result of construction
- Potential exposure to hazardous waste during removal and transport by truck or barge
- Degradation of air quality by operation of dredger, tugs, barges and support boats, and loaders and haul trucks powered by internal combustion engines

Several of these actions fall under the State and Regional Boards' authority and individual projects would be regulated to protect against adverse impacts to the environment under both Porter-Cologne and the CWA. Where potential significant impacts are beyond the Water Boards' authority to regulate, compliance with applicable laws, and local and State regulations will reduce the potential for significant adverse impacts to the environment from individual projects as described below. Important factors to consider when contemplating these effects are the goals of the proposed amendments described in Section 6.4. The first goal is to protect fish and wildlife from effects associated with contaminants in sediment.

6.7.3 Mitigation Measures

As used in this analysis and as defined by CEQA (Article 20, Section 15370), mitigation can be divided into four types:

1. Avoiding the impact altogether by not taking a certain action or part of an action.
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
3. Rectifying or eliminating the impact over time by preservation and maintenance operations during the life of the action.
4. Compensating for the impact by replacing or providing substitute resources or environments.

While the adoption of the proposed amendments do not mandate any actions that would lead to significant, permanent, or are expected to significantly increase the number of sites requiring corrective action or controls placed upon existing discharges, in those cases where these actions are necessary to restore beneficial uses, potentially significant impacts could occur. These significant impacts can be reduced to less than significant with mitigation measures, many of which are mandatory conditions of local, state, and federal regulations and permits. The Water Boards issue permits that regulate existing discharges and dredge and fill actions. These include:

- NPDES permits under Clean Water Act Section 402 to regulate discharges in to surface waters from publicly-owned treatment works and industrial facilities and storm water discharges including runoff associated with construction resulting in a land disturbance of one acre or more.
- Water Quality Certifications issued under CWA Section 401 for federally licensed dredge and fill projects. CWA Section 401 allows States to grant or deny water quality certification for any dredge or fill activity into waters of the United States. Certification must be consistent with the requirements of the Clean Water Act,

CEQA, the California Endangered Species Act (CESA), and the State Water Board's mandate to protect beneficial uses of waters of the State. State and Regional Water Boards use CWA 401 water quality certifications to protect federally designated wetlands.

- Water Boards also issue waste discharge requirements for non-federally licensed dredge and fill actions. Porter-Cologne establishes a program to regulate waste discharges that could affect water quality through waste discharge requirements, conditional waivers, or prohibitions. (See Wat. Code, §§ 13243, 13263, 13269.) Waste discharge requirements for non-federally licensed dredge and fill projects contain similar prohibitions and requirements as described above for water quality certifications.

Water quality certifications and waste discharge requirements may include mitigation measures. The effectiveness of mitigation measures vary depending upon site conditions, the receptors at risk and the remedial alternatives being applied. A detailed description and analysis of mitigation measures for specific remedial alternatives is presented in the State Water Resources Control Board Bay Protection and Toxic Cleanup Program's Amended Final Functional Equivalent Document Consolidated Toxic Hot Spots Cleanup Plan (2004). Some of these mitigation measures include:

- Incorporate into design, the site depositional and erosional characteristics, current velocities, bathymetry, depth and width to contain spread of materials, etc;
- Use dredging equipment or operations that minimize resuspension and remobilization of contaminants in sediment;
- Use silt curtains to reduce dispersal beyond dredge/excavation site and floating booms to contain debris;
- Use coffer dams in small channels or large settling tanks to reduce excessive turbidity;
- Monitor dredging and disposal activities to assess project is being implemented as authorized and whether disposal of dredged/capping material stays within disposal area or is transported out of the disposal area; and
- Avoid dredging operations during periods when species are spawning, migrating or nesting in project area.

Other agencies with jurisdiction in relevant areas include:

- U.S. Environmental Protection Agency (U.S. EPA) implements hazardous waste cleanup under CERCLA and RCRA and water quality programs under CWA.

- U.S. Army Corps of Engineers (U.S. ACE) permits federally licensed dredge and fill activities under CWA Section 404.

- U.S. Fish and Wildlife Service (USFWS) Resource Trustee to implement the federal Endangered Species Act by protecting and restoring federally listed threatened or endangered species and preventing losses from habitat loss and degradation, contaminants or unauthorized take.

- NOAA National Marine Fisheries Service (NOAA Fisheries) Resource Trustee implements the federal Endangered Species Act and Marine Mammals Act by protecting and restoring threatened and endangered marine and anadromous fish, marine mammals and turtles. NOAA fisheries establishes essential fish habitat to maintain and restore fisheries.

- U.S. Coast Guard – Enforces environmental laws and regulations in federal waters and certifies vessels and pilots, maintains navigation aids and responds to emergencies at sea.
- Occupational Health and Safety Administration (OSHA) and Cal OSHA.
- California Department of Fish and Game (CDFG) – Resource Trustee responsible for implementing the California Endangered Species Act and protecting the state biological resources. Provides emergency response in state waters to spills and releases.
- California Department of Toxic Substances Control (DTSC) Resources Trustee is responsible for implementing the states hazardous waste cleanup and disposal laws.
- California Coastal Commission implements the California Coastal Act and the federal Coastal Zone Management Act to ensure that land uses and resources are protected requires mitigation on projects that could potentially affect marine resources in coastal zone.
- State Lands Commission is responsible for managing states lands including submerged lands and leases.
- San Francisco Bay Conservation and Development Commission is responsible for planning and protecting marine resources in San Francisco Bay.
- California Air Resources Board develops air quality standards for mobile sources statewide.
- Air Quality Management Districts implements the CARB standards and develops district standards for other sources can require mitigation to reduce emissions of toxics and greenhouse gasses.
- Local agencies with ordinances regulating land use, noise pollution, water quality traffic.

Each of these agencies implements laws and regulations that can reduce project-specific effects to less than significant. Where mitigation measures may be required, examples are described below under checklist issues. A comprehensive list of mitigation measures would be difficult to assemble given all the potential environmental factors, site-specific conditions and potential project-related actions that could occur. Mitigation measures will be tailored for individual projects in the project level CEQA analysis.

6.8 Project Alternatives

In Section 5, staff considered alternatives relevant to the Water Board's goals and needs. These alternatives considered the type of objectives, choice of appropriate receptors, approaches used to assess the sediment quality, and applications in Water Board programs. None of the issues evaluated or the alternatives identified would lessen or alter the environmental effects of the proposed amendments as described in Section 6.7.2. Alternatives that could result in the need for the collection of additional monitoring data are expected to result in less than significant impacts to the environment as described above. Under the no project alternative, it is likely that Regional Boards would, in time, identify sites or waterbodies where sediment quality has degraded wildlife and finfish-related beneficial uses through the implementation of existing narrative objectives described in Section 4.3.2.

None of these alternatives explored would change the direct effects, nor would these alternatives reduce the environmental effects associated with indirect impacts. Although the proposed amendments do not mandate corrective action or controls, where a site or segment within a waterbody fails to meet the proposed narrative SQO, the Water Boards have the authority to issue and revise waste discharge requirements, and issue and implement enforcement actions to require remediation of these sites. The alternatives evaluated in the development of the proposed amendments would not alter that authority.

6.9 Checklist Issues and Impacts

The proposed amendments do not mandate any actions or projects that would lead to significant, permanent, or negative impacts on the environment. However, this analysis also considers the reasonably foreseeable potential adverse environmental impacts stemming from the reasonably foreseeable methods of compliance with Part I, including additional controls or remediation, or the development of TMDLs. Staff anticipates that all reasonably foreseeable potential environmental impacts will be reduced to less-than-significant by complying with the Water Boards' plans, policies, and permit conditions, appropriate mitigation measures, and any other applicable laws of other agencies with jurisdiction in relevant areas as described in Section 6.7.3.

6.9.1 Aesthetics

Failure to meet the objectives could potentially result in construction activities for additional treatment works, BMPs, and use of land or vessel-based heavy equipment for all projects involving dredging or construction activities. Thus, reasonably foreseeable short-term impacts could occur during construction-related activities. No long-term impacts are anticipated that would result in substantial physical changes to the environment, including light or glare that would affect aesthetics. Construction activities could be limited to spring, fall, and winter weekdays to avoid disrupting recreational, pleasure boating or site-seeing activities associated with the summer tourist season. Appropriate mitigation measures for individual projects would depend upon the type of project activity, and duration. Mitigation of potential impacts to aesthetics will be considered under CEQA for each specific project.

6.9.2 Agricultural and Forest Resources

The proposed amendments will not result in the conversion of farmland to non-agricultural uses nor are the proposed amendments expected to conflict with existing zoning for agricultural use or a Williamson Act contract. Section VII.7.E of Part 1 provides the Regional Boards with discretion to determine how the SQOs will be implemented within the irrigated lands program. The proposed amendments do not alter the Regional Boards discretionary authority within the irrigated lands program.

6.9.3 Air Quality

Reasonably foreseeable methods of compliance could include construction activities for treatment works, BMPs, and/or removal actions using land or vessel-based heavy equipment for all projects involving dredging or construction activities. Emissions from equipment, vehicles, and vessels have the potential for temporary adverse effects to air quality. The primary pollutants of concern in these emissions are NOx or nitrogen oxides. NOx are precursors to ozone formation, and many of the major embayments and the Sacramento San Joaquin Delta are located in areas designated as nonattainment areas for ozone. Other emissions of concern could be carbon monoxide and PM_{10} (particulate matter < 10 microns). In order to evaluate the air quality impact of emissions due to dredging, disposal, and

capping equipment, or other actions, the project proponent must identify the specific type of equipment that will be used in the remediation action. Emissions from the equipment must be quantified and evaluated in the context of local or regional significance thresholds established by the appropriate Air Quality Management Districts were the project is located. Emissions that exceed the thresholds must be mitigated. Potential air quality impacts can be mitigated by using more modern and efficient equipment that produces lower emissions, operating equipment under a permit, use of electric dredging equipment, and planning the project for the time of year or day when emissions would be least likely to cause an exceedance of air quality standards. Other mitigation measures could include optimizing the mode of transportation, favoring disposal sites closer to dredge sites, and minimizing the number of trips necessary to transport dredged material to the disposal site or rehandling facility, covering loads with plastic sheeting and wetting dry materials to minimize dust. If volatile compounds are present in excavated materials, additional controls may be required by the local Air Quality Management District. Mitigation of air quality impacts will be considered under CEQA for each specific project relative to the thresholds established by the appropriate Air Quality Management District. These potentially significant impacts can be reduced to less than significant with mitigation measures.

6.9.4 Biological Resources

Although a goal of the proposed amendments is to improve sediment quality to better protect finfish and wildlife-related beneficial uses, the reasonably foreseeable methods of compliance could include construction activities for treatment works, BMPs, and/or removal actions using land or vessel-based heavy equipment for all projects involving dredging or construction activities. Actions that physically disturb the sediment, including dredging and capping, have the potential to adversely affect biological resources through: short-term habitat destruction and displacement of sensitive species, possibly during critical periods such as nesting, or disturbance of sensitive spawning and migrating fish species; unintentional “take” of endangered species; loss or burial of benthic communities; and degradation of water quality from increased turbidity and remobilization of contaminants into the water column and noise. Many of these effects can be mitigated by proper planning such as avoiding activities during critical windows associated with migration, nesting and spawning seasons. Displaced habitats should be replaced nearby with equal or greater area and density, and restoration of nearby areas. Remedial actions that bury or remove benthic communities by capping or dredging would be expected to improve habitat conditions by the removal of toxic pollutants in sediments. Over-dredging can be performed to ensure that appropriate cleanup levels are achieved to improve benthic habitat. All actions that could potentially disturb state or federally listed species or negatively impact waterbodies identified as essential fish habitat must consult with the appropriate trustee agencies identified in Section 6.7.3. Pre-project and post-project biological surveys can be used to assess adequacy mitigation measures were applied. Through permitting under CWA Section 401 or issuance of WDRs, ESA consultations, compliance with local, state and federal resource and land use laws, and appropriate mitigations measures, potentially significant impacts to biological resources can be reduced to less than significant with mitigation. Turbidity and water quality impacts are discussed in Section 6.9.9. Noise is discussed in Section 6.9.12. Potentially significant impacts to biological resources will be considered in each project related CEQA review.

6.9.5 Cultural Resources

Staff is not aware of any cultural resources present beneath subtidal sediments in bays and estuaries that could potentially be impacted through the adoption of the proposed

amendments. However, our lack of awareness does not preclude the possibility of previously unmapped cultural resources in near-shore subtidal locations that could be impacted by activities in response to exceedance of the narrative SQOs. As a result, any future actions that could impact cultural resources would be subject to CEQA on an individual case-by-case basis, and evaluated at that time.

6.9.6 Geology and Soils

Significant impacts to geology and soils would occur if a project exposed people or structures to potential, substantial adverse effects related to rupture of a known earthquake fault, other seismic events, or landslides. Significant impacts would also occur if a project caused substantial erosion or was located in areas with unsuitable soils or landslide-prone conditions. Adoption of the proposed amendments would not increase risks associated with surface rupture or ground shaking or ground failure resulting from seismic motion. Reasonably foreseeable methods of compliance could include the need for construction or excavation activities on land or water. Dredging activities have the potential to destabilize channel slopes and undermine pilings. Excavation and grading on land can create slope instability and affect foundations. Standard engineering practices that account the geologic conditions and properties of soil and sediment onsite, and practices such as installation of sheet pile walls at the toe of the shore slope would reduce or avoid this impact. Following standard engineering practices and by complying with local state and federal laws and appropriate mitigations measures, potentially significant impacts from slope instability or landslides can be reduced to less than significant with mitigation. Mitigation measures will depend upon the geologic features, physical properties of the earth materials and the types of buildings or infrastructure in the immediate vicinity of the site. These factors and appropriate mitigation would be determined for each individual action during the project CEQA review.

6.9.7 Greenhouse Gas Emissions

Adoption of the proposed sediment quality objectives will not directly contribute to greenhouse gas (GHG) emissions, however reasonably foreseeable methods of compliance could include implementation of additional treatment works, clean-up, and remediation equipment that could generate emissions potentially contributing to GHG levels. Emissions from such operations are unknown but are unlikely to be significant when considered in the context of the state emissions inventory. In any event, due to the lack of data on potential emissions and their relative significance on global climate change, the potential cumulative impacts are far too speculative to analyze. At the programmatic level, it is not possible to estimate the number of monitoring and remediation efforts that could be initiated, the equipment or vehicles that might be required, or the locations throughout the state where such actions might be undertaken. Efforts to assess the level of benefits or adverse impacts of such projects would be speculative at this time. Individual projects will be subject to the appropriate level of environmental review at the time they are proposed, and mitigation would be identified as warranted prior to approval.

6.9.8 Hazards and Hazardous Materials

This category refers to chemicals that have been discharged to the environment that may adversely impact the environment or human health and safety. Soil and groundwater impacted by such chemicals are also included. Significant impacts would occur if a project led to increased hazards to the public or environment from transport, handling, or emissions of such materials. Also included are projects located near airports and listed hazardous materials sites.

Reasonably foreseeable methods of compliance could include construction activities for treatment works, BMPs, and/or removal actions using land or vessel-based heavy equipment. For these situations, potential impacts related to hazardous materials can be mitigated to less than significant levels with appropriate mitigation measures. In any action involving toxic pollutants, there is a potential for release of pollutants due to an accident or upset condition. The potential for such releases can be greatly reduced by proper planning. Measures to prevent releases of toxic pollutants include such things as pollution prevention technology (e.g., automatic sensors and shut-off valves, pressure and vacuum relief valves, secondary containment, air pollution control devices, double walled tanks and piping), access restrictions, fire controls, emergency power supplies, contingency planning for potential spills and releases, pollution prevention training and other types of mitigation appropriate to the cleanup plan. Trucking hazardous wastes through residential areas has the potential to result in the possibility of fire or explosion; exclusion of hazardous waste from certain neighborhoods; inability to get bridge-crossing permits in a timely manner may limit the feasibility of remedial measures. Identifying routes that avoid densely populated areas, selecting alternative means of transportation, developing traffic plans and notifying emergency services, can mitigate these hazards. Fuels, lubricating oils, and other petroleum products will be used during cleanup activity. Well-established techniques for controlling spills, leaks, and drips will be incorporated into work plans to ensure that petroleum products and any other chemicals used during the cleanup activity are controlled. Develop procedures and requirements for loading and unloading polluted sediments to eliminate potential for spillage. Project workers and supervisors are required to comply with applicable Occupational of Health and Safety Administration (OSHA) training requirements for site clean-up personnel. In addition, site-specific health and safety plans would be prepared in accordance with California Code of Regulations, title 8, section 5192 and 29 C.F.R. section 1910.120, which govern site clean-up. These potential impacts can be reduced to less than significant with mitigation measures. These measures would be identified on a case-by-case basis during the project specific CEQA review.

6.9.9 Hydrology and Water Quality

Significant impacts to hydrology and water quality would occur if a project substantially alters existing drainage patterns, alters the course of a river or stream, violates water quality standards, or creates or contributes to runoff that would exceed the capacity of local storm water drainage systems. Significant impacts would also occur if a project placed housing or other structures within the 100-year flood plain, or exposed people or structures to significant risks from flooding, seiche, or tsunamis. Reasonably foreseeable methods of compliance could include construction activities for treatment works, BMPs, and/or removal actions using land or vessel-based heavy equipment. For these situations, drainage patterns, increased runoff, or violations of water quality standards could occur. These potentially significant impacts can be reduced to less than significant through appropriate mitigation measures. Runoff from construction of BMPs, treatment works, excavation activities, or disposal of dredged materials on land can be reduced by working during the dry season or by implementing BMPs to reduce erosion. In addition to the Water Boards' storm water permitting requirements, many local governments also have erosion control ordinances and grading ordinances. Storm water diversions intended to improve water and sediment quality are not expected to degrade receiving water quality; rather, these actions would improve water and sediment quality by means of additional treatment.

Dredging equipment can cause turbulence in the waterbody, and thus, the dredging process can cause short-term adverse impacts to water quality from turbidity or from stirring up pollutants in the sediment. These impacts can be regulated through WDRs and can be

reduced by requiring use of dredging equipment or operations that minimize the discharge of chemical pollutants during dredging (e.g., use of clam shell dredger, etc.), use of settling tanks to reduce excessive turbidity in the discharge, use of silt curtains to reduce dispersal of the turbidity plume beyond the dredge site, coffer dams in small channels, and accurate positioning of disposal equipment during dredging. Changes in bottom contours brought by dredging or capping would probably have minimal effects on water circulation if properly managed. Relatively small areas are under consideration for modification at most of the sites. At larger sites, removal and placement will attempt to retain regional bottom depth and contour, except where bathymetry is planned for environmental improvement. Where site and exposure conditions are complex, hydrodynamic, fate, transport, and bioaccumulation models can used to estimate potential short and long term impacts stemming from remedial actions such as removal, capping, and monitored natural attenuation under a variety of conditions. These tools could also assist in identifying appropriate mitigation measures. The Water Boards have extensive authority to reduce and control impacts associated with storm water runoff and impacts caused by dredging. Through permitting under CWA Section 401, WDRs, compliance with local, state and federal resource and land use laws and coupled with appropriate mitigations measures required by the Water Boards, potentially significant impacts to biological resources can be reduced to less than significant with mitigation. Potentially significant impacts to biological resources will be evaluated on a case-by-case basis in the project specific CEQA review and the appropriate site-specific mitigation measures identified at that time.

6.9.10 Land Use and Planning

Significant impacts to land use and planning would occur if a project physically divided a community, conflicted with a land use plan, policy or regulation, or caused conflict with a habitat conservation plan. General plans and zoning delineate those areas that will be developed, and the type and density of development to be allowed. Adopting of the proposed amendments is not expected to result in conflict with any applicable and use plan policy or regulation.

6.9.11 Mineral Resources

Significant impacts to mineral resources would occur if a project resulted in the loss of a mineral resource of value locally, regionally, or statewide. There is no evidence that the adoption of the proposed amendments would result in the loss of a known mineral resource or availability of the mineral resources. Our lack of awareness, however, does not preclude the possibility of mineral resources that could be impacted by construction activities in response to these proposed amendments. Any such construction would be subject to CEQA on an individual case-by-case basis, and potential impacts to mineral resources would be evaluated at that time.

6.9.12 Noise

Significant impacts from noise would occur if a project exposed people to noise or groundborne vibration in excess of established standards in a local general plan or noise ordinance or resulted in a substantial permanent increase to ambient noise levels. Significant impacts can also occur if a project causes substantial temporary or periodic increases in noise or if a project is located in the vicinity of an airport and would expose people residing or working in the project area to excessive noise levels.

Reasonably foreseeable methods of compliance could include construction activities for treatment works, BMPs, and/or removal actions using land or vessel-based heavy equipment

that could potentially result in short-term noise pollution related to construction activities and use of land or vessel-based heavy equipment for all projects involving dredging or construction activities. Mitigation would consist of compliance with local noise ordinances (typical standards include blackouts prohibiting use of heavy equipment on Sundays, early morning hours and evenings all week, and on holidays), use of noise dampening material or barriers around equipment, locating equipment as far as practical from noise-sensitive areas including sensitive habitats and residences and selecting haul routes that avoids sensitive habitats and minimizes impacts within residential areas. Compliance with local noise ordinances and mitigation measures would reduce potential significant effects associated with these reasonable methods of compliance to less than significant with mitigation. Appropriate mitigation measures would be identified on a case-by-case basis during the project specific CEQA review.

6.9.13 Population and Housing

Significant impacts to population and housing would occur if a project substantially encouraged population growth, displacing substantial numbers of people from existing housing and thereby necessitating construction of replacement housing elsewhere. Adoption of the proposed amendments is not expected to result in the need for more housing or displace residents in existing communities. See discussion of growth-inducing impacts in Section 6 and Section 13241 factors in Section 7.

6.9.14 Public Services

Implementation of the proposed amendments is not expected to directly impact public services. This does not, however, preclude the possibility that public services could be impacted by construction activities in response to the proposed amendments. Any such construction activity would be subject to CEQA on an individual case-by-case basis, and potential impacts to public services would be evaluated at that time.

6.9.15 Recreation

Adoption of the proposed amendments is not expected to directly impact recreational uses. This does not, however, preclude the possibility of recreational uses that could be impacted by construction activities or remedial actions in response to the proposed amendments. Any such impacts would be short term and subject to CEQA on an individual case-by-case basis, and potential impacts to recreational resources would be evaluated at that time.

6.9.16 Transportation and Traffic

Significant impacts to transportation and traffic would occur if a project caused a substantial increase in traffic in relation to existing traffic load/capacity of the existing street system, exceeded established level of service standards, resulted in change in air traffic patterns, lead to increases in road-related hazards, resulted in inadequate emergency access or parking. Reasonably foreseeable methods of compliance could include construction activities for treatment works, BMPs, and/or removal actions using land or vessel-based heavy equipment that could potentially result in short-term increase in traffic from construction activities and use of land or vessel-based heavy equipment for all projects involving dredging or haul trucks. Preparation of traffic control plan that identifies routes that avoid schools and residential areas. Ensure that traffic controls are maintained through out the project. Avoid loading and handling materials in densely populated areas, cover all loads and ensure that trucks comply local state and federal requirements and weight limits over

bridges. Vessels and barges that could disrupt boat and shipping traffic would require approval from port authorities, Harbor Master and U.S. Coast Guard in additional to Coast Guard certifications for pilots and commercial vessels. However these impacts would be mitigated under CEQA specifically for each project. Implementation of the proposed amendments is not expected to directly impact transportation uses or circulation patterns. This does not, however, preclude the possibility of transportation uses or circulation patterns being impacted by construction activities in response to the proposed amendments. Any such construction would be subject to CEQA on an individual case-by-case basis, and potential impacts to transportation/circulation would be evaluated at that time.

6.9.17 Utilities and Service Systems

Significant impacts to utilities and service systems would occur if a project exceeded wastewater treatment standards, required construction of new water or wastewater treatment facilities or new or expanded storm water drainage facilities, or a project's water needs exceeded existing resources or entitlements. Significant impacts would also occur if a project was not served by a landfill with sufficient capacity or the project failed to comply with federal, state, or local regulations for solid waste. Failure to meet the proposed objective could potentially result in the need for additional controls and treatment to reduce the discharge of pollutants into waterbodies. As stated previously, it is unlikely that treatment plants that comply with the CWA, the Water Code, the toxic pollutant criteria in the NTR and CTR, the implementation provisions in the SIP, and Basin Plans will cause exceedances of the proposed SQO. Discharge reductions can be accomplished through (1) treatment process optimization (measures facilities can implement to modify or adjust the operating efficiency of the existing wastewater treatment process – such measures usually involve engineering analysis of the existing treatment process to identify adjustments to enhance pollutant removal or reduce chemical additional); (2) waste minimization/pollution prevention costs (conducting a facility waste minimization or pollution prevention study); (3) pretreatment (conducting study of sources and reducing inflow from indirect discharges); or (4) new or additional treatment systems. For storm water, implementation of BMPs can also be applied to reduce pollutants, rather than treatment of storm water to remove pollutants. Because of the nature of storm water discharges, the Water Boards have not typically established numeric effluent limitations for toxic pollutants in storm water permits. The limitations contained in storm water permits are typically narrative and include the requirement to implement the appropriate control practices and/or BMPs. BMPs can range from good housekeeping to structural controls.

In some cases, the cleanup of sites may generate significant amounts of waste materials that could be disposed in an appropriately designated solid waste disposal site. This could create increased demand for landfill capacity. In order to assess the potential effect to landfills, the areal extent and volume of sediment should be characterized. Once this is done, project impact to landfill capacity can be evaluated. If estimates exceed capacities, plans for alternative sites or other alternative means of disposal to remove impact (e.g., land based confined disposal facilities, capping confined aquatic disposal, wetland restoration, levee reuse). These potentially significant environmental effects can be reduced to less than significant with mitigation measures. These measures would be identified during the project specific CEQS review.

6.9.18 Growth-Inducing Impacts

The proposed amendments, if adopted, would have no effect on parameters that are typically evaluated in addressing potential growth inducement, such as generation of

employment opportunities, provision of housing supply, generation of the sale of goods and services, removal of growth obstacles, expansion of infrastructure, or extension of utilities.

6.9.19 Cumulative and Long-Term Impacts

No cumulative adverse environmental impacts are expected to result from the adoption of the proposed amendments at the program level. At the project level, the lead agency will have to analyze whether a compliance project could have environmentally cumulative effects. This analysis will depend on whether other related or unrelated projects are occurring in the same general time and space as the compliance project. Whether or not any potential significant adverse cumulative impacts could occur at the project level will depend on site-specific information related to the location, timing, and nature of the compliance action.

7 WATER CODE SECTION 13241 AND ANTIDEGRADATION

The State Water Board must analyze the factors described in section 13241 of the Water Code when establishing water quality objectives. Chapter 5.6 requires that the State Water Board to adopt SQOs "pursuant to the procedures established by [Division 7] for adopting or amending water quality control plans." (Wat. Code, § 13393, subd. (b).) In addition, the State Water Board must ensure that its actions are consistent with Resolution No. 68-16, the state's antidegradation policy.

7.1 Past, Present, and Probable Future Beneficial

Adoption of the proposed amendments will better protect sediment quality for all of the beneficial uses that focus on these specific receptors and the associated exposure pathways. The proposed SQO will compliment and support the Water Boards' existing water quality control plans and policies, and provide greater consistency across the regions.

7.2 Environmental Characteristics of the Hydrographic Unit

The proposed SQO and framework to implement the SQO account for the characteristics within each hydrographic unit. The proposed framework is intended to address waterbody specific characteristics including differences in the bioavailability of contaminants based upon the physical, chemical and microbiological processes and exposure pathways, bioaccumulation and trophic transfer associated with the predator-prey relationships of interest, and the contribution of contaminants over the forage area. Existing language in Part 1 provides direction on how the proposed SQO shall be implemented within the regions. However, the Regional Water Board retains the authority and flexibility to apply the SQO in the appropriate regulatory program. Part 1 does not describe how a particular site should be corrected or remediated. Selection of corrective action can be addressed only after many site-specific factors are considered such as:

- The hydrodynamics and flow regime in the area of concern.
- The specific pollutant that is causing the degradation or impairment.
- The receptors at risk due to the presence of the pollutants at the levels observed within the area of concern.
- The aerial extent.
- Presence of existing sources or legacy releases.

- Types of controls in place and feasibility of additional controls.

This language remains unchanged.

7.3 Water Quality Conditions that Could Reasonably Be Achieved

This section describes the water quality conditions that could reasonably be achieved through the coordinated control of all the factors which affect water quality in the area. As described in Section 2, wastes have been discharged into bays and estuaries either directly as point sources, indirectly as runoff, or accidentally through releases and spills for many years. In addition, many contaminants readily attach to the sediments and are carried down rivers and creeks contributing to the contaminant loading. Once these sediments reach the bays and estuaries, poor flushing and low current speeds allow the sediments and contaminants to settle before reaching the open ocean. The State and Regional Water Boards are required to ensure that all discharges, regardless of type, comply with all water quality control plans and policies. If the proposed amendments are adopted into a permit as a receiving water limitation, the discharge must meet the limit or, if the limit is not being met due to the discharge of toxic pollutants, determine the causative pollutant. If a discharge is contributing to the accumulation of the pollutant causing the degradation, the discharger would be required under existing authority to control the pollutant to the extent practical through BMPs or additional treatment. The same approach would occur if multiple discharges contribute to the pollutant's accumulation. For additional control measures, see Control Measures under Section 6.7.1 and Appendix C, Economic Considerations.

7.4 Economic Considerations.

In establishing water quality objectives, the State Water Board considers economic factors, among others. Specifically, these economic factors include whether the objectives and alternatives under consideration are currently being attained, the methods available to achieve compliance, and the costs of those methods. The State Water Board is considering these same factors in proposing the SQO amendments. The draft Economic Analysis prepared for these proposed amendments is included as Appendix C.

There are currently 127 segments of bays and estuaries on the state's 2010 303(d) list for toxic pollutants, including 88 listings for sediment quality, and 48 sites identified as known toxic hot spots under the State Water Board's BPTCP. In addition, the State Water Board (2008) identified an additional 8 bays that may be impaired based on the direct effects benthic community SQO. The extent to which those impairments result in direct or indirect toxicity to wildlife and finfish represents the level of existing nonattainment of the proposed wildlife and resident finfish SQO.

The proposed amendments could result in greater efforts to assess sediment quality in relation to fish and wildlife beneficial uses, which in turn could result in identification of new impairments or changes to existing impairments. There are already extensive monitoring and assessment activities supporting the baseline regulatory framework. Absent the proposed amendments, these activities will continue, and additional efforts will be undertaken (e.g., as Regional Boards assess compliance with existing objectives for sediment toxicity, and address sites currently impaired for sediment toxicity). Similarly, in instances in which sediments exceed baseline objectives for sediment toxicity, assessment of the causes and sources (e.g., ERAs, TIEs) will be needed to identify methods of compliance with the objectives. Thus, the incremental level of assessment is uncertain.

Nevertheless, the State Water Board estimated costs of monitoring efforts to assess indirect effects to wildlife and finfish beyond the monitoring necessary to assess water quality criteria and the SQOs for direct effects. These efforts could involve collecting finfish and documenting the presence of deformities, irregularities in size, or population effects, and collection and analysis of wildlife tissue or bird eggs, and range from $7,400 to $11,700 per sampling event. Based on between 5 and 30 samples per bay or estuary, depending on area the State Water Board estimated total statewide monitoring costs of $5.5 million to $8.8 million, assuming that monitoring would be needed at all bays and estuaries in California.

For bays and estuaries not currently on the 303(d) list for sediment toxicity that would exceed the SQO under the proposed amendments, the next step would be a sequential approach to manage the sediment appropriately, including developing and implementing a work plan to confirm and characterize pollutant-related impacts, identify pollutants, and identify sources and management actions (including adopting a TMDL, if appropriate). The cost of the sequential approach described in the Part 1 will vary depending on a number of factors, including the extent of baseline efforts and studies underway to address other impairment issues, and the number of potential stressors to the area. The State Water Board (2001) estimates that development of complex TMDLs (including an implementation plan) could cost over $1 million. In addition, SWRCB (2003a) indicates that TMDL development and mercury reduction strategy cost for the San Francisco Bay could range from $10 million to $20 million. These estimates provide some indication of costs that can be associated with sequential approaches to managing designated use impairments.

For waters that Regional Water Boards identify as being impaired based on the wildlife and finfish SQO under the proposed amendments, remediation actions and/or source controls will be needed to bring them into compliance. Many bays and estuaries are already listed for sediment impairments or are exceeding the benthic community or human health SQOs and, therefore, would require controls under baseline conditions. When the baseline controls are identical to the ones that would be implemented for the wildlife and finfish SQO, there is no incremental cost or cost savings associated with the amendments. When the baseline controls differ, there is potential for either incremental costs or cost-savings associated with the amendments.

For an increased level of control cost associated with compliance with the wildlife and finfish SQO, the concentration of toxic pollutants in discharges would have to meet levels that are more stringent than what is needed to achieve compliance with existing objectives (e.g., since they could have to control based on the benthic community and human health SQOs, narrative sediment objectives, or the CTR). Incremental costs for controls may also result from the identification of additional chemical stressors that are not included in the CTR or Basin Plans. For example, in Ballona Creek, the Regional Water Board identified pyrethoid pesticides as the cause of sediment toxicity, and not metals and other toxic pollutants for which CTR criteria and sediment TMDL targets that already existed (City of Los Angeles WPD, 2010). Since many practices that may be employed under existing TMDLs are applicable for controlling the mobilization of pollutants in general, this situation is also difficult to estimate. For example, the TMDL for pesticides and PCBs in the Calleguas Creek watershed indicates that the BMPs needed to achieve the nutrient and toxicity TMDLs for the watershed would likely reduce pesticides and PCBs to necessary levels as well (LARWQCB, 2005d).

Thus, without being able to identify the particular pollutants causing toxicity to wildlife and finfish, and the development of discharge concentrations needed to achieve the objectives, the needed controls to achieve those concentrations are difficult to estimate.

7.5 Need for Developing Housing within the Region

The adoption of the proposed amendments to Part 1 is not expected to increase the need for housing in the areas surrounding enclosed bays and estuaries of California. The proposed amendments apply only to the protection of subtidal sediments in surface waters.

7.6 Need to Develop and Use Recycled Water

The adoption of the proposed amendments to Part 1are not expected to increase the need to develop and use recycled water.

7.7 Antidegradation

In 1986, the State Water Board adopted Resolution No. 68-16, entitled "Statement of Policy with Respect to Maintaining High Quality of Waters in California." The policy expresses the State Water Board's intent that the quality of existing high quality waters be maintained to the maximum extent possible. Lowering of water quality is allowed only if the lowering is consistent with the maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial uses of waters, and will not result in water quality less than that prescribed in applicable policies. Resolution No. 68-16 has been interpreted to incorporate the provisions of the federal antidegradation policy as well, where the federal policy applies.

The federal policy, in 40 C.F.R. §131.12, establishes three tiers of water quality protection and, like Resolution No. 68-16, allows a lowering of water quality for high quality waters only if certain conditions are met. The state and federal antidegradation policies must be considered for a variety of actions, including water quality standards actions.

The State Water Board does not anticipate any lowering of water quality as a result of the adoption of proposed amendments to Part I. By adopting these amendments the state will have a sediment quality objective that protects resident finfish and wildlife within all enclosed bays and estuaries of California and a consistent framework that would be applicable to any finfish or wildlife receptor and exposure pathway that may occur within enclosed bays and estuaries of California. Currently, Regional Water Boards implement a variety of narrative objectives to address sediment quality with little consistency across the regions. The proposed amendments provide protection to those receptors not contemplated during the development and adoption of Part 1 and provides consistent framework for implementing the proposed SQO that supports the Water Boards mandate to protect and restore water quality. As a result, the proposed SQOs are likely to be more protective, vis-à-vis sediment quality, than current standards.

8 GLOSSARY

Basin Plans – Water Quality Control Plans adopted by each Regional Board for specific basins. Basin Plans referenced in this staff report are the Water Quality Control Plan for the North Coast Basin Central Coast Region, Water Quality Control Plan for the Central Coastal Basin, Water Quality Control Plan for the Sacramento and San Joaquin River Basins, Water Quality Control Plan Santa Ana River Basin, Water Quality Control Plan for the Los Angeles Region, and Water Quality Control Plan for the San Diego Basin.

Beneficial Uses: As defined in the California Water Code, 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.

Benthic: Living on or in the bottom of the ocean, bays, and estuaries, or in the streambed.

Bioaccumulation: A process in which an organism's tissue concentration of a contaminant exceeds that in its surrounding environment as a result of chemical uptake through all routes of chemical exposure; dietary and dermal absorption and transport across the respiratory surface. Bioaccumulation results from a combination of both **bioconcentration*** and biomagnification (Mackay and Fraser 2000).

Bioaccumulation factor (BAF) – The ratio of a chemical compound's concentration in tissue to a compound's concentration in water or sediment.

Bioavailability: The fraction of a chemical pollutant or contaminant that can be absorbed by an organism through gills or other membranes, potentially causing an adverse physiological or toxicological response. Bioavailability is dependent on the chemical form of the pollutant in the media, the physical and biogeochemical processes within the media, the route and duration of exposure, and the organism's age, metabolism, size and sensitivity.

Bioconcentration: net uptake by an organism of a chemical, as a result of exposure the chemical in water (including sediment-associated porewater). Bioconcentration predominantly occurs via the respiratory surface (Mackay and Fraser 2000).

Bioconcentration Factor (BCF): The ration of the contaminant concentrations in biota to that in the water column. BCF represents water only exposure and uptake.

Biomagnification: Process by which higher chemical concentrations are attained in organisms at higher trophic levels (at higher levels in the food web). At its simplest, biomagnification indicates an increase in chemical concentration in an organism to a level higher than the organism's diet (Mackay and Fraser 2000).

Biota Sediment Accumulation Factor (BSAF): The ratio of contaminant concentrations in biota to that in sediment. For organic pollutants, the BSAF is presented on a lipid and organic carbon normalized basis (Burkhard et al. 2003).

Body Burden: Amount of contaminant that has accumulated in a human or organism

Contamination: An impairment of the quality of the waters of the State by **waste*** to a degree that creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" includes any equivalent effect resulting from the disposal of waste whether or not waters of the State are affected (CWC section 13050(k)).

California Toxics Rule (CTR): Numerical water quality criteria established by U.S. EPA for priority toxic pollutants for California's inland surface waters, enclosed bays, and estuaries.

Contaminants of Emerging Concern: Pollutants that are not typically evaluated in water quality protection programs because the analytical methods were until recently largely unavailable and the biological effects could not be observed in routine short-term bioassays. CECs include polybrominated diphenyl ethers (PBDEs);perfluorinated organic acids; certain

pharmaceuticals and personal care products (PPCPs), including drugs such as antidepressants, over-the-counter medications such as ibuprofen, bactericides (e.g., triclosan), veterinary medicines such as antimicrobials, antibiotics, anti-fungals, growth promoters and hormones; endocrine-disrupting chemicals (EDCs), capable of modulating normal hormonal functions and steroidal synthesis in aquatic organisms; (U.S. EPA)

Degradation of sediment quality: Sediment toxicity and changes in benthic community attributes as a result of exposure to toxic pollutants in bedded surficial sediments. Unacceptable risk to human health and wildlife as a result of bioaccumulation from pollutants in bedded surficial sediments* that are transported up the aquatic food chain.

Demersal: Organisms that prefer to spend the majority of their time on or near the bottom of a waterbody.

Ecotoxicity. The study of toxic effects on nonhuman organisms, populations, or communities.

Enclosed Bays: Indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. “Enclosed bays” include all bays where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. “Enclosed Bays” include, but are not limited to: Humboldt Bay, Bodega Harbor, Tomales Bay, Drake’s Estero, San Francisco Bay, Morro Bay, Los Angeles-Long Beach Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay

Estuaries: Waters, including coastal lagoons, located at the mouths of streams which serve as mixing zones for fresh and **ocean waters***. Coastal lagoons and mouths of streams which are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters shall be considered to extend from a bay or the open ocean to a point upstream where there is no significant mixing of fresh water and sea water. Estuarine waters include, but are not limited to, the Sacramento-San Joaquin Delta, as defined in [Water Code] Section 12220, Suisun Bay, Carquinez Strait downstream to the Carquinez Bridge, and appropriate areas of the Smith, Mad, Eel, Noyo, Russian, Klamath, San Diego, and Otay Rivers.

Euhaline: Waters ranging in salinity from 25–32 practical salinity units (psu).

Finfish: Any species of bony fish or cartilaginous fish (sharks, skates and rays). Finfish do not include amphibians, invertebrates, plants or algae. Fish and Game Code. Reference: Sections 200 and 202

Indirect effects: Adverse effects to humans and wildlife as a result of consuming prey items exposed to polluted sediments.

Infauna: Organisms that live within sediment or substrate.

Inland Surface Waters: All surface waters of the State that do not include the ocean, enclosed bays, or estuaries.

Load Allocation (LA): The portion of a receiving water's total maximum daily load that is allocated to one of its nonpoint sources of **pollution*** or to natural background sources.

Mesohaline: waters ranging in salinity from 5 to 18 practical salinity units (psu).

National Toxics Rule: Numerical water quality criteria established by U.S. EPA for priority toxic pollutants for 12 states and two Territories who failed to comply with the section 303(c)(2)(B) of the Clean Water Act.

Nonpoint Sources: Sources are diffused and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet. The commonly used categories for nonpoint sources are agriculture, forestry, mining, land disposal, and salt intrusion.

Ocean Waters: Territorial marine waters of the State as defined by California law to the extent these waters are outside of enclosed bays, estuaries, and coastal lagoons. Discharges to ocean waters are regulated in accordance with the State Water Board's California Ocean Plan.

Part 1: Water Quality Control Plan for Enclosed Bays and Estuaries Part 1 Sediment Quality, effective August 25, 2009.

Part 1 Staff Report: Final Staff Report - Water Quality Control Plan for Enclosed Bays and Estuaries Part 1 Sediment Quality.

Pelagic: Organisms living in the water column.

Pollutant: Defined in section 502(6) of the Clean Water Act as "dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water."

Pollution: defined in section 502(19) of the Clean Water Act as the "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water." Pollution is also defined in CWC section 13050(1) as an alternation of the quality of the waters of the State by waste to a degree that unreasonably affects either the waters for beneficial uses or the facilities that serve these beneficial uses.

Polyhaline: Waters ranging in salinity from 18–25 practical salinity units.

Seafood: Aquatic animals consumed by humans; i.e., human prey. Seafood may include finfish and shellfish.

Site: an area of management concern to be evaluated for the indirect effects SQO. Based on management needs, "site" could be an entire waterbody, or a portion of a waterbody to be evaluated.

Surficial sediments: Those sediments representing recent depositional materials and containing the majority of the benthic invertebrate community.

Uncertainty: Uncertainty refers to the difference between a true value, condition or property and the measured or quantified value, condition or property. (U.S. EPA IRIS - http://www.epa.gov/iris/help_gloss.htm).

Variability: Variability refers to true differences in the parameter measured within a population or strata. Variability could represent a biological response to contaminant exposure. These differences may be the result of different body weights, exposure duration and genetic differences (U.S. EPA IRIS - http://www.epa.gov/iris/help_gloss.htm).

9 REFERENCES

Anchor Environmental, CA L.P. 2006. Feasibility Study and Alternatives Evaluation Rhine Channel Sediment Remediation Newport Bay California. January (http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/docs/rhine/rhine_channel_feasibility_study_main_file.pdf)

Burton Jr, G.A., P.M. Chapman and E.P. Smith. 2002. Weight of evidence approaches for assessing ecosystem impairment. Human and Ecological Risk Assessment 8:1657-73.

Cal/EPA Department of Toxic Substances Control. 1996. Guidance for Ecological Risk Assessments at Hazardous Waste Sites and Permitted Facilities – Part A: Overview http://www.dtsc.ca.gov/AssessingRisk/upload/overview.pdf

Cal/EPA Department of Toxic Substances Control. 1996. Guidance for Ecological Risk Assessments at Hazardous Waste Sites and Permitted Facilities – Part B: Scoping Assessment
http://www.dtsc.ca.gov/AssessingRisk/upload/overview.pdf

California Regional Water Quality Control Board – Central Valley Region 2006. The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board Central Valley Region Fourth Edition. The Sacramento River Basin and the San Joaquin River Basin. Revised February.

California Regional Water Quality Control Board - Central Coast Region Water Quality Control Plan for the Central Coastal Basin
http://www.swrcb.ca.gov/rwqcb3/BasinPlan/Index.htm

California Regional Water Quality Control Board – North Coast Region. Water Quality Control Plan for the North Coast Basin
http://www.swrcb.ca.gov/rwqcb3/BasinPlan/Index.htm

California Regional Water Quality Control Board - Central Valley Region. 2007. *Water Quality Control Plan for the Sacramento and San Joaquin River Basins*
http://www.waterboards.ca.gov/centralvalley/available_documents/index.html#anchor616381

California Regional Water Quality Control Board Los Angeles Region. *1994.* Water Quality Control Plan Los Angeles Region
http://www.waterboards.ca.gov/losangeles/html/meetings/tmdl/Basin_plan/basin_plan_doc.html

California Regional Water Quality Control Board Santa Ana Region. *1994.* Water Quality Control Plan Santa Ana River Basin.
http://www.waterboards.ca.gov/santaana/html/basin_plan.html

California Regional Water Quality Control Board Santa Ana Region. *1994.* Water Quality Control Plan Santa Ana River Basin.
http://www.waterboards.ca.gov/santaana/html/basin_plan.html

California Regional Water Quality Control Board San Francisco Region. 1992. Resolution No. 92-043 Implementation of the Regional Monitoring Plan within the San Francisco Bay Region.

California Regional Water Quality Control Board San Francisco Region. *1994.* Water Quality Control Plan San Francisco Bay Region.
http://www.waterboards.ca.gov/santaana/html/basin_plan.html

California Regional Water Quality Control Board San Francisco Region. 2010. Order No. R2-2010-0060 NPDES No. CA0037702 Water Quality Control Plan San Francisco Bay Region.

California Regional Water Quality Control Board - Santa Ana Region. 2008. Notice of California Environmental Quality Act (CEQA) Scoping Meeting - In the Matter of Proposed Amendments to the Water Quality Control Plan (Basin Plan) for the Santa Ana River Basin to Establish Total Maximum Daily Loads (TMDLs) and Site-Specific Objectives (SSOs) for Selenium in the San Diego Creek/Newport Bay Watershed, and to Revise the Basin Plan Narrative Water Quality Objectives for Toxic Substances.
http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/docs/newport/ceqa_scoping_mtg_notice_se_11202008.pdf

California Regional Water Quality Control Board San Diego Region. *2006.* Water Quality Control Plan for the San Diego Basin
http://www.waterboards.ca.gov/sandiego/programs/basinplan.html

California Regional Water Quality Control Board - San Francisco Bay Region
2006. Mercury in San Francisco Bay Proposed Basin Plan Amendment and Staff Report for Revised Total Maximum Daily Load (TMDL) and Proposed Mercury Water Quality Objectives. August 1
http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/sfbaymercury/sr080906.pdf

California Regional Water Quality Control Board - San Francisco Bay Region
2008. Total Maximum Daily Load for PCBs in San Francisco Bay Final Staff Report for Proposed Basin Plan Amendment. February 13
http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/sfbaypcbs/Staff_Report.pdf

California Regional Water Quality Control Board - San Francisco Bay Region
2007 Waste Discharge Requirements for Municipal and Industrial Wastewater Discharges of Mercury to San Francisco Bay.
http://www.waterboards.ca.gov/sanfranciscobay/board_decisions/adopted_orders/2007_old/R2-2007-0077.pdf

CH2M Hill, 2007. Final Palos Verdes Shelf Superfund Site Remedial Investigation Report Prepared for U.S. EPA Region 9
http://www.epa.gov/region9/superfund/pvshelf/pdf/pvs-remediation-inv.pdf

Crane, J.L., D.D. MacDonald, C.G. Ingersoll, D.E. Smorong, R.A. Lindskoog, C.G. Severn, T.A. Berger, and L.J. Field. 2000. Development of a framework for evaluating numerical sediment quality targets and sediment contamination in the St. Louis River Area of Concern. U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, IL. EPA-905-R-00-008 (http://www.pca.state.mn.us/water/sediments/sqt-slraoc.pdf).

Geomatrix, 2007. Scoping Ecological and Offsite Human Health Risk Assessment Sierra Pacific Industries Arcata Division Sawmill, Arcata California. Prepared for Sierra Pacific Industries.
http://www.waterboards.ca.gov/northcoast/publications_and_forms/available_documents/sierra_pacific/080409/GMX07_SPI_Ecoand_Off-site_HHRA-Revised.pdf

Johnson LL, Collier TK, Stein JE. 2002. An analysis in support of sediment quality thresholds for polycyclic aromatic hydrocarbons (PAHs) to protect estuarine fish Aquatic Conservation: Marine and Freshwater Ecosystems. 12: 517–538

MacDonald DD, C.G. Ingersoll. 2002. A guidance manual to support the assessment of contaminated sediments in freshwater ecosystems. Volume III: Interpretation of the results of sediment quality investigations, (PDF) EPA-905-B02-001-C, U.S. EPA Great
Lakes National Program Office, Chicago, IL
(http://www.cerc.usgs.gov/pubs/sedtox/VolumeIII.pdf).

McGourty, Catherine R, James A. Hobbs, William A. Bennett, Peter G. Green, Hyun-Min Hwang, Naoaki Ikemiyagi, Levi Lewis, Jason M. Cope. Likely Population-Level Effects of Contaminants on a Resident Estuarine Fish Species: Comparing Gillichthys mirabilis Population Static Measurements and Vital Rates in San Francisco and Tomales Bays Estuaries and Coasts (2009) 32:1111–1120

National Oceanic and Atmospheric Administration, United States Fish and Wildlife Service, California Department of Fish and Game 2010. CastroCove/Chevron Refinery Final Damage Assessment and Restoration Plan/Environmental Assessment

Naval Facilities Engineering Command 2006. Final Record of Decision Site 17 Seaplane Lagoon Alameda Point, Alameda, California. October EPA/ROD/R2007090001466

Oregon Department of Environmental Quality (ODEQ) 2007. Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment. (http://www.deq.state.or.us/lq/pubs/docs/cu/GuidanceAssessingBioaccumulative.pdf)

San Francisco Estuary Institute. 2009. Regional Monitoring Program 2010 Detailed Workplan FINAL December 22.
http://www.sfei.org/sites/default/files/2010%20RMP%20Detailed%20workplan%20FINAL12022009.pdf

State Water Resources Control Board 2000. Functional Equivalent Document Amendment of the Water Quality Control Plan for Ocean Waters of California (California Ocean Plan) September 2000.
http://www.swrcb.ca.gov/water_issues/programs/ocean/docs/oplans/2000dffed.pdf

State Water Resources Control Board. 2004a. Amended Final Functional Equivalent Document Consolidated Toxic Hot Spots Cleanup Plan. (http://www.waterboards.ca.gov/bptcp/index.html).

State Water Resources Control Board. 2004b. Final Functional Equivalent Document for Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List http://www.waterboards.ca.gov/tmdl/docs/ffed_093004.pdf

State Water Resources Control Board. 2004c. Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List. (http://www.waterboards.ca.gov/tmdl/docs/ffed_303d_listingpolicy093004.pdf)

State Water Resources Control Board, 2006. Clean Water Act Section 303(d) List of Water Quality Limited Segments http://www.swrcb.ca.gov/water_issues/programs/tmdl/303d_lists2006_epa.shtml

State Water Resources Control Board. 2008. Final Staff Report – Water Quality Control Plan for Enclosed Bays and Estuaries Part 1 Sediment Quality, September 2008. http://www.waterboards.ca.gov/water_issues/programs/bptcp/sediment.shtml

State Water Resources Control Board. 2009. Water Quality Control Plan for Enclosed Bays and Estuaries Part 1 Sediment Quality. Effective August 25, 2009 http://www.waterboards.ca.gov/water_issues/programs/bptcp/sediment.shtml

State Water Resources Control Board. 2010. Staff CEQA Scoping Informational Document – Phase II Sediment Quality Objectives for Enclosed Bays and Estuaries of California http://www.waterboards.ca.gov/water_issues/programs/bptcp/docs/sediment/sqo_scopedoc042110.pdf

State Water Resources Control Board (SWRCB). 2010b. 2010 Clean Water Act Section 303(D) List of Water Quality Limited Segments. Online at http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml

Thompson, Bruce, Terry Adelsbach, Cynthia Brown, Jennifer Hunt, James Kuwabara, Jennifer Neale, Harry Olendorf, Steve Scharzbach, Robert Spies and Karen Taberski. 2007. Biological Effects of Anthropogenic Contaminants in the San Francisco Estuary. Environmental Research Vol. 105 156-174

U.S. EPA 1993. Wildlife Exposure Factors Handbook Volume I of II. Office of Research and Development EPA/600/R-93/187 http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=2799#Download

U.S. EPA. 1996. Peer Review Workshop Report on Draft Proposed Guidelines for Ecolgical Risk Assessment. Office of Research and Development Risk Assessment Forum. EPA /630/R-96/002

U.S. EPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-006,

U.S. EPA. 1997. The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, Volume 1: National Sediment Quality Survey. Office of Science and Technology. EPA 823-R-97-006. September

U.S. EPA. 1998. Guidelines for Ecological Risk Assessment. U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, DC, EPA/630/R095/002F.

U.S EPA 1998 EPA's Contaminated Sediment Management Strategy Office of Water EPA-823-R-98-001 April 1998.

U. S. EPA. 2000. Bioaccumulation testing and interpretation for the purpose of sediment quality assessment status and needs. EPA-823-R-00-001, U.S. Environmental Protection Agency, Washington, D.C. http://www.epa.gov/waterscience/cs/biotesting/

U.S. EPA. 2004 *The Incidence and Severity of Sediment Contamination in Surface Waters ofthe United States, National Sediment Quality Survey Second Edition* Office of Science and Technology Standards and Health Protection Division EPA-823-R-04-007.
http://www.epa.gov/waterscience/cs/

U.S. EPA. 2004. Contaminated Sediments Science Priorities. Contaminated Sediments Science Priorities Workgroup, a workgroup under U.S. EPA's Science Policy Council (http://www.epa.gov/osa/spc/pdfs/cssp-final.pdf)

U.S. EPA 2003. Generic Ecological Assessment Endpoints (GEAEs) for Ecological Risk Assessment. Risk Assessment Forum EPA/630/P-02/004F
http://www.epa.gov/raf/publications/pdfs/GENERIC_ENDPOINTS_2004.PDF

U.S. EPA. 2007. Framework for Metals Risk Assessment. Office of the Science Advisor/Risk Assessment Forum EPA 120/R-07/001 March
http://www.epa.gov/raf/metalsframework/pdfs/metals-risk-assessment-final.pdf

U.S. EPA. 2008a. Application of watershed ecological risk assessment methods to watershed management. National Center for Environmental Assessment, Washington, DC; EPA/600/R-06/037F.

U.S. EPA 2008b Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment. Office of the Science Advisor/Risk Assessment Forum EPA/100/R-08/004 June
http://www.epa.gov/raf/teffframework/pdfs/tefs-draft-052808.pdf

U.S. EPA 2009. Technical Support Document Volume 3: Development of Site-Specific Bioaccumulation Factors (Site-Specific TSD) EPA-822-R-09-008. Washington D.C.
http://www.epa.gov/waterscience/criteria/humanhealth/method/tsdvol3.pdf

Wenning, R.J, Adams, W.J, Batley, G.E., Berry, W.J., Birge,W.J., Bridges, T.S., Burton, G.A.,Chapman, P.M., Douglas, W.S. Engler, R.M., Ingersoll, C.G., Moore, D.W. Stahl, R.G. and J.Q. Word. 2005. Executive Summary. Pp 11-38 in Wenning RJ, Batley GE, Ingersoll CG, Moore DW, eds. 2005. Use of sediment quality guidelines (SQGs) and related tools for the assessment of contaminated sediments. Pensacola (FL): Society of Environmental Toxicology and Chemistry

Weston Solutions, 2008. Regional Harbor Monitoring Program 2008 Final Report. Prepared for Port of San Diego, City of San Diego, City of Oceanside and County of Orange, May http://www.portofsandiego.org/public-documents/cat_view/157-environment/438-copper-reduction-program/442-monitoring-and-data-assessment.html?limit=40&limitstart=0&order=name&dir=DESC

APPENDIX A
PROPOSED AMENDMENTS TO PART 1

APPENDIX B
DRAFT CEQA CHECKLIST

APPENDIX C
DRAFT ECONOMIC ANALYSIS