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Interim

Sediment Screening Criteria and Testing Requirements for Wetland Creation and Upland Beneficial Reuse

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STATE OF CALIFORNIA

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Mr. Ray Ramos
Western Division
Naval Facilities Engineering Command
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San Bruno, CA 94066-0720

Subject: **State "Applicable or Relevant and Appropriate Requirements" (ARARs) for Naval Station Treasure Island, Hunters Point Annex, San Francisco, California**

Dear Mr. Ramos:

Enclosed, please find a copy of the document entitled "Interim Sediment Screening Criteria and Testing Requirements for Wetland Creation and Upland Beneficial Reuse" adopted by the San Francisco Regional Water Quality Control Board (Board) on December 16, 1992. The approach and criteria presented in this document, because it was adopted by the Board but has not been approved by the State Water Resources Control Board (SWRCB), therefore, constitute a "To Be Considered" or "TBC" for determining sediment cleanup levels at Hunters Point Annex (HPA). Because these "Screening Criteria" identify sediment contaminant concentrations which are permitted to be emplaced in the environment, they constitute functional equivalents of cleanup criteria. The emplacement "Screening Criteria" for contaminants represent ambient concentrations which may be, in some instances, higher than preanthropogenic "background" concentrations. Nevertheless, these criteria are considered protective of water quality, consistent with the procedures outlined in State Board Resolution 92-49 for determining cleanup criteria, and State Board Resolution 68-16 policy to maintain the high quality of California Waters.

It should be noted that these criteria are considered interim and that criteria will be submitted to the SWRCB in Fall of 1993. It is unlikely that the concentration levels will change substantially, although the format of the criteria document may. Once passed by the SWRCB, these criteria will be "promulgated" and because the standards are of "general applicability and are legally enforceable", they will constitute "relevant and appropriate requirements" for determining sediment cleanup at HPA.

Please direct your questions to me at (510) 286-4222.

Sincerely,

Barbara M. Smith

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Sediment Screening Criteria and Testing Requirements for Wetland Creation and Upland Beneficial Reuse

1.0 Introduction

The San Francisco Bay Area has an annual aquatic dredged sediment disposal requirement of approximately 8 million cubic yards (mcy) of dredged material to maintain deep and shallow draft navigation channels. The Bay Area presently also has a one-time new work requirement of approximately 19 mcy for the Oakland Harbor, Richmond Harbor, John F. Baldwin ship channel and two Navy projects. Annually, more than $5.4 billion of economic activity is directly dependent on the deep and shallow draft navigation channels of the San Francisco Bay region. Disposal in the San Francisco Bay Area takes place mainly at four in-bay disposal sites; the Alcatraz, Carquinez Strait, San Pablo Bay and Suisun Channel disposal sites. Insufficient capacity at the present disposal sites to accommodate maintenance and new work projects in the region has led to the formation of the Long Term Management Strategy (LTMS).

The LTMS is a US Army Corps of Engineers' (COE) national policy initiative. The purpose of the LTMS initiative is to secure timely, technically feasible, cost effective and environmentally acceptable disposal options in an orderly, sequential process. The LTMS development occurs in five phases: Phase I, evaluation of existing options; Phase II, formulation of alternatives; Phase III, analysis of alternatives; Phase IV, implementation; and Phase V, periodic review and update of the selected management strategy.

The San Francisco Bay LTMS was formed in January 1990 as a multi-participant effort to provide a mechanism for consensus building to solve regional disposal issues and concerns. It involves over thirty different participants including government agencies, environmental organizations, development interests, ports and fisherman groups. A management structure was discussed and approved by this group, now identified as the Policy Review Committee, in July 1990. Under this management structure, the LTMS is led by an Executive Committee which includes the COE's South Pacific Division Commander, the US EPA's Regional Administrator, the San Francisco Bay Regional Water Quality Control Board's Chairperson, the San Francisco Bay Conservation and Development Commission's Chairperson, and the Secretary of the California Environmental Protection Agency who serves as the State Coordinator. This group is advised regularly by the Policy Review Committee on all pertinent issues. Work is performed by a Management Committee chaired by the COE's San Francisco District Commander. This committee oversees the LTMS studies, budget, and schedule. The Management Committee is supported by the Work Groups: Ocean, In-Bay, Nonaquatic/reuse, and Implementation.

The LTMS will culminate in 1994 with a long term dredged material disposal plan including detailed conclusions on the impacts of dredging and disposal, a range of recommended environmentally acceptable and economically and technically feasible disposal options, and a methodology for the use of each option.

1.1 Problems Associated with Dredging

The disposal of dredged material affects the Estuary's biological resources and water quality in several ways. Effects include the direct burial of organisms at the disposal site, increases in suspended sediments in the water column, reduced fishing success near the disposal area, and potential mobilization of pollutants previously bound in the bottom sediments. Disposal at the current "dispersive" sites may also result in impacts off-site as currents carry the dredged material to other parts of the Estuary.

Mounding at the main disposal site near Alcatraz Island is limiting the site's capacity. Federal and state resource agencies have commented that closure or further restriction of existing in-Bay disposal sites is warranted. There is no existing ocean site for this material, and federal and state agencies are demanding ocean site investigations that are off of the continental shelf, prior to new ocean site designation.

The beneficial reuse of dredged material to create, restore or enhance wetlands would reduce a portion of the current in-bay disposal requirements and its associated impacts. Currently, there are several dredged material beneficial reuse projects existing or in the design stage. Several projects in the design phase would use dredged sediment to create, restore, or enhance wetlands. There is a high potential for restoration or enhancement opportunities in former wetland areas which have been diked, drained and used for agricultural purposes. However, there are currently no sediment screening criteria or testing requirements for wetlands construction projects using dredged sediment.

1.2 Purpose and Scope

This document provides sediment screening criteria and testing requirements for the beneficial reuse of dredged material such as wetlands creation and upland disposal of dredged material. This document is intended to facilitate creation, enhancement and restoration of wetlands. As such the Regional Board will not apply the screening criteria without consideration of site-specific factors.

This includes dredged sediment screening criteria for determining acceptable concentrations of constituents in dredged sediment for beneficial reuse purposes and dredged sediment testing requirements for applying the sediment screening criteria.

Wetlands creation, restoration, or enhancement is considered aquatic disposal of dredged sediment under the Clean Water Act Section 404 and thus is regulated by the State and Regional Boards under Section 401 of the Clean Water Act. Upland disposal of dredged sediment includes disposal options such as landfill cover material, levee restoration and other related nonaquatic projects. In general, the discharge of dredged sediment in the nonaquatic environment is regulated by California Code of Regulations Title 23, Chapter 15.

Section 2 of this document discusses the approach taken in developing the sediment screening criteria. Section 3 discusses the requirements of the California Code of Regulations with respect to discharges of waste to land and the relationship to dredged sediment. Section 4 discusses regional sediment concentrations. The sediment screening criteria are selected in Section 5. Section 6 describes the testing requirements for the wetlands and nonaquatic disposal options.

2.0 Approach

The general approach used in developing sediment screening criteria and testing requirements is based on the document General Decisionmaking Framework for Management of Dredged Materi//al: Example Application to Commencement Bay, Washington, (Lee et al., 1991). This document provides a decisionmaking framework for selecting the appropriate dredged sediment testing requirements based on the disposal options considered and provides a process to evaluate the test results.

Some wetlands creation projects most likely will accept small amounts of dredged material from many different dredging projects. These "multi-user" wetland projects may be accepting the cumulative quantity of a large project.

Lee et al. (1991) sets out the five following different tests that should be conducted to determine the acceptability of disposal of dredged sediment in an upland area. The associated pathway of pollutant mobility, which each test is designed to assess, is also listed.

	Test	Pathway of Contaminant Mobility
1.	Effluent Quality	Effluent Discharge
2.	Surface Runoff Quality	Runoff
3.	Leachate Quality	Leachate Seepage Soluble Diffusion, Seepage Soluble Convection Via Tidal Pumping Capillary Action Mobility Between Layers
4.	Plant Uptake	Bioturbation (Uptake through roots)
5.	Animal Uptake	Bioturbation (Uptake through soil consumption or contact)

Figure 1 depicts the pathways that would occur in a wetland environment. These pathways are a combination of upland and aquatic pathways.

The approach also involved reviewing the pertinent section of the California Code of Regulations to determine a classification scheme for dredged sediment. San

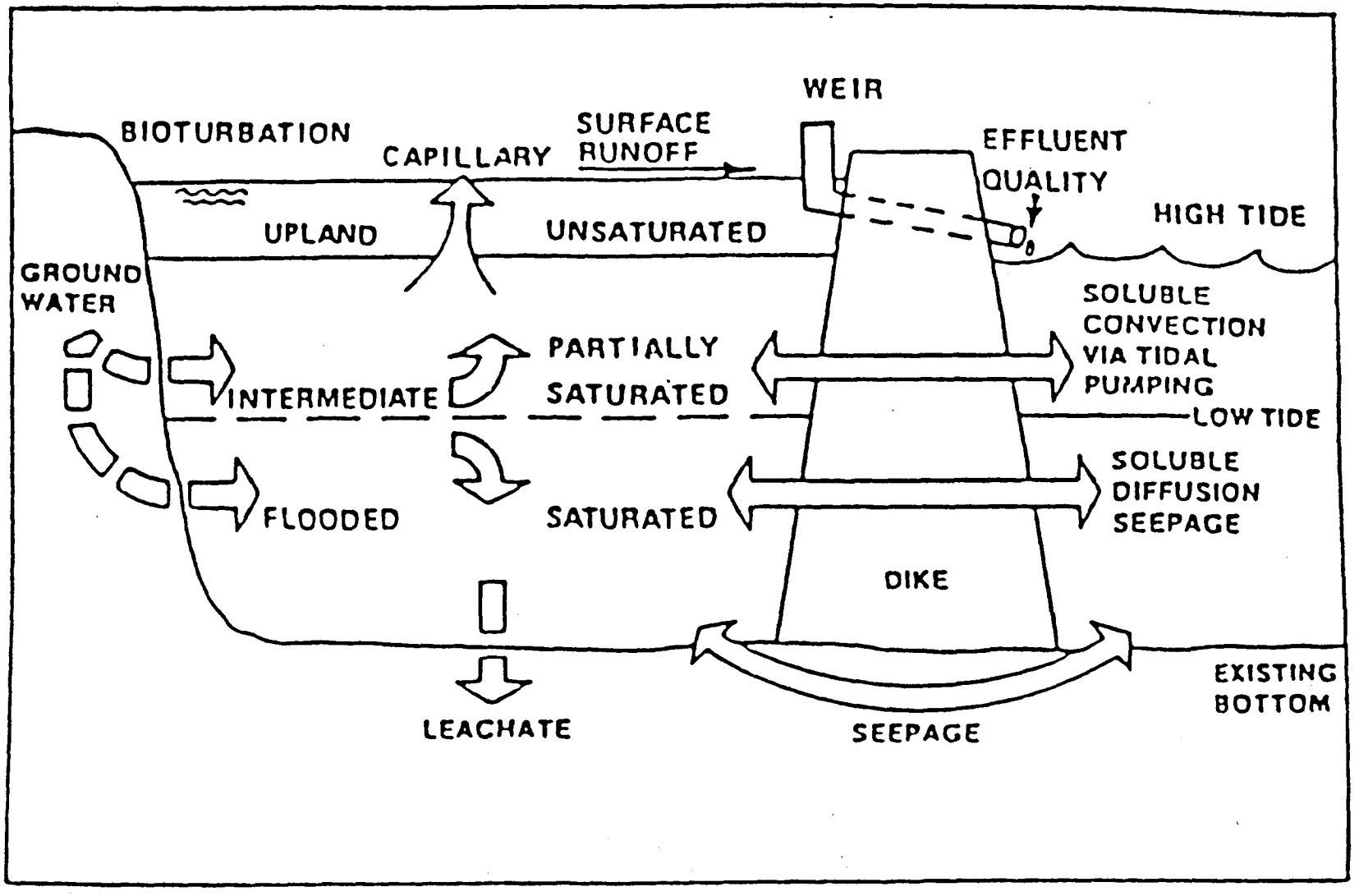


Figure 1 - Restored Wetland Contaminant Mobility Pathways (Lee et al., 1991)

Francisco Bay wetlands sediment background concentrations were then reviewed to establish a range of concentrations levels for comparison to potential sources of dredged sediment. Sediment toxicity literature was then reviewed to determine how regional sediment concentrations compare to sediment toxicity values. Wetlands sediment background concentrations and sediment toxicity values and associated chemical concentrations were then used to establish sediment screening criteria which should eliminate aquatic impacts of dredged sediment disposal through the beneficial reuse of dredged sediment.

Sediment screening criteria are defined in the context of this report as the maximum concentrations of constituents in dredged sediment acceptable for the designated use. Instances where this criteria are exceeded will be reviewed on a case-by-case basis due to the inherent uncertainty in establishing such criteria. As the results of the more detailed project specific testing is published, these data will be compared to the sediment screening criteria and modifications will be made as appropriate.

3.0 Dredged Material Disposal Options Relationship to Title 23, Chapter 15

Dredged sediment disposal to land restrictions are based on the concentration of certain constituents in the dredged sediment and on site-specific conditions. The disposal of waste material to land is regulated by the California Code of Regulations, Title 23 (Waters), Division 3 (State Water Resources Control Board), Chapter 15 (Discharges of Waste to Land). In Chapter 15, wastes are separated into four different categories; hazardous waste, designated waste, nonhazardous solid waste, and inert waste. Each different category of waste has different disposal requirements. Hazardous waste must be disposed of at a Class I waste management unit, designated waste must be disposed of at a Class I or II waste management unit, nonhazardous solid waste may be disposed of at a Class III landfill, and inert waste does not have to be disposed of at a classified waste management unit.

3.1 Waste Descriptions

Chapter 15 contains descriptions of the four different waste categories which are summarized below.

3.1.1 Hazardous Waste

The description of hazardous waste is referenced to Title 22, Division 4.5, Chapter 11, Article 3. Article 3 contains specific concentrations for certain hazardous waste constituents as shown in Table 1. A waste is hazardous if it has constituents (hazardous waste constituents) in excess of specified concentrations. Hazardous waste constituents have been established for a relatively few constituents. Other constituents must be assessed based on toxicity, reactivity, flammability and corrosivity. Chapter 15 does not contain numerical concentration values for designated waste, nonhazardous solid waste or inert waste but does have narrative criteria to differentiate the type of wastes, as described below.

3.1.2 Designated Waste

Designated waste is nonhazardous waste which consists of or contains pollutants which, under ambient environmental conditions at the waste management unit, could be released at concentrations in excess of applicable water quality objectives, or which could cause degradation of waters of the state.

3.1.3 Nonhazardous Solid Waste

Nonhazardous solid waste is all putrescent(decomposable) and/or non-putrescent. solid, semi-solid and liquid wastes, including garbage and trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned

Table 1
Sediment Concentrations for the United States and the San Francisco Bay Area;
and Surface Water Quality Criteria and Hazardous Waste Concentrations

Constituent	Western United States Mean[1] (Range in parens.)	Contermin-uous United States Mean[1] (Range in parens.)	SF Bay Basins Mean[2] (No. of samples, first parens.; range, second parens.)	NOAA[3] Effects Range-low / Effects Range-median	USACOE Bay Area Marsh Study Mean[4] (Range in parens.)	SFB-RWQCB[5] Marine Water Quality Objectives	Title 22, Section 66261.24 Hazardous Waste Concentra-tion(TTLC, Wet-Weight)
Cadmium	N/A	N/A	0.94 (256) (0.02-17.3)	5.0 / 9.0	0.34 (0.14-0.56)	0.0093	100
Chromium	56 (3-2,000)	54 (1-2000)	108 (140) (9-769)	80.0 / 145.0	181 (110-224)	0.050	500
Copper	27 (2-300)	25 (<1-700)	36 (376) (3-145)	70.0 / 390.0	90.6 (24.2-90.6)	0.0029	2,500
Lead	20 (<10-700)	19 (<10-700)	32 (461) (1-421)	35.0 / 110.0	35.4 (13.7-85.6)	0.0056	1,000
Mercury	0.065 (<0.01-4.6)	0.089 (<0.01-4.6)	0.45 (396) (<0.01-6.60)	0.15 / 1.3	0.33 (0.059-0.515)	0.025×10^{-3}	20
Nickel	19 (<5-700)	19 (<5-700)	N/A	30 / 50	105.4 (32.2-145.2)	0.0083	2,000
Silver	N/A	N/A	0.51 (148) (0.01-2.4)	1.0 / 2.2	N/A	0.0023	500

Constituent	Western United States Mean[1] (Range in parens.)	Conterminuous United States Mean[1] (Range in parens.)	SF Bay Basins Mean[2] (No. of samples, first parens.; range, second parens.)	NOAA[3] Effects Range-low / Effects Range-median	USACOE Bay Area Marsh Study Mean[4] (Range in parens.)	SFB-RWQCB[5] Marine Water Quality Objectives	Title 22, Section 66261.24 Hazardous Waste Concentration(TTLC, Wet-Weight)
Selenium	0.34 (<0.1-94.3)	0.39 (<0.1-4.3)	N/A	N/A	0.32 (<0.14-0.91)	0.071	100
Zinc	65 (10-2,100)	60 (<5-2900)	N/A	120 / 270	143.3 (88.5-166.1)	0.086	5,000
Nonmetals							
Arsenic	7.0 (<0.01-97)	7.2 (<0.01-97)	N/A	33.0 / 85.0	14.8 (5.29-23.7)	0.036	500
PCBs			0.045 (37) (0.006-0.14)	0.050 / 0.40		0.070×10^{-6}	50
Pesticides							
Total DDT			0.009 (75) (0.00025-91)	0.003 / 0.35		0.6×10^{-6}	1.0
DDT				0.001 / 0.007			1.0
DDE				0.002 / 0.015			1.0

Constituent	Western United States Mean[1] (Range in parens.)	Conterminuous United States Mean[1] (Range in parens.)	SF Bay Basins Mean[2] (No. of samples, first parens.; range, second parens.)	NOAA[3] Effects Range-low / Effects Range-median	USACOE Bay Area Marsh Study Mean[4] (Range in parens.)	SFB-RWQCB[5] Marine Water Quality Objectives	Title 22, Section 66261.24 Hazardous Waste Concentration(TTLC, Wet-Weight)
DDD				0.002 / 0.020			1.0
Other Pesticides							
Chlordane				0.0005 /0.006		0.081×10^{-6}	2.5
Dieldrin				0.00002 / 0.008		0.14×10^{-6}	8.0
Endrin				0.00002 / 0.045		0.0023×10^{-3}	0.2
Polynuclear Aromatic Hydrocarbons (PAH)							
Acenaphthene				0.150 / 0.650			
Anthracene				0.085 / 0.960			

Constituent	Western United States Mean[1] (Range in parens.)	Contermin-uous United States Mean[1] (Range in parens.)	SF Bay Basins Mean[2] (No. of samples, first parens.; range, second parens.)	NOAA[3] Effects Range-low / Effects Range-median	USACOE Bay Area Marsh Study Mean[4] (Range in parens.)	SFB-RWQCB[5] Marine Water Quality Objectives	Title 22, Section 66261.24 Hazardous Waste Concentra-tion(TTLC, Wet-Weight)
Benzo(a)-anthracene				0.230 / 1.600			
Benzo(a)-pyrene				0.400 / 2.500			
Benzo(e)-pyrene				NA			
Biphenyl				NA			
Chrysene				0.400 / 2.800			
Dibenz(a,h)-anthracene				0.060 / 0.260			
2,6-dimethyl-naphthy-lene				NA			
Fluoran-thene				0.600 / 3.600			
Fluorene				0.035 / 0.640			
1-methyl-naphtha-lene				NA			

Constituent	Western United States Mean[1] (Range in parens.)	Contermin-uous United States Mean[1] (Range in parens.)	SF Bay Basins Mean[2] (No. of samples, first parens.; range, second parens.)	NOAA[3] Effects Range-low / Effects Range-median	USACOE Bay Area Marsh Study Mean[4] (Range in parens.)	SFB-RWQCB[5] Marine Water Quality Objectives	Title 22, Section 66261.24 Hazardous Waste Concentra-tion(TTLC, Wet-Weight)
2-methyl-naphtha-lene				0.065 / 0.670			
1-methyl-phenan-threne				NA			
Naphtha-lene				0.340 / 2.100			
Perylene				NA			
Phenan-threne				0.225 / 1.380			
Pyrene				0.350 / 2.200			
2,3,5-tri-methyl-naphtha-lene				NA			
Total PAH			4.1 (101) (0.02-80.9)	4.0 / 35.0		0.031×10^{-3}	

All sediment units are mg/kg, dry weight, except the TTLC's, which are wet weight.
Water quality units are mg/l.

Footnotes:

1. Shacklette and Boerngen, (1984)
2. Long et al. (1988)
3. Long et al. (1990)
4. Lee et al. (1992)
5. SFBRWQCB, (1992)

vehicles, discarded home and industrial appliances, manure, vegetable or animal solid and semi-solid wastes and other discarded solid or semi-solid wastes; provided that such wastes are not hazardous or designated wastes.

3.1.4 Inert Waste

Inert waste is waste that does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives, and does not contain significant quantities of decomposable waste.

3.1.5 Treated Sediment

Dredged sediments may be treated prior to disposal in order to meet disposal or reuse contaminant criteria. Dredgers may use a variety of treatment methods, including chemical fixation of inorganic contaminants and biodegradation of petroleum hydrocarbons, provided that the treatment methods employed have been demonstrated to be effective for a particular sediment. Such demonstration studies typically are based on the results of leachate testing and modeling.

3.2 Waste Management Units Requirements

The three different classes of waste management units (landfills) are defined in Chapter 15 based on their ability to isolate wastes from waters of the state. Inert waste does not have to be disposed of at a classified waste management unit. Class III landfills shall be located where soil characteristics, distance from waste to groundwater, and other factors will ensure no impairment of beneficial uses of surface water or of groundwater beneath or adjacent to the landfill. Class II units must be underlain by natural geologic materials which have a permeability of not more than 1×10^{-6} cm/sec and which are of sufficient thickness to prevent vertical movement of fluid from waste management units to waters of the state as long as wastes in such units pose a threat to water quality. Class I units must be underlain by natural geologic materials which have a permeability of not more than 1×10^{-7} cm/sec and which are of sufficient thickness to prevent vertical movement of fluid from waste managements units to waters of the state as long as wastes in such units pose a threat to water quality.

4.0 Regional Sediment Concentrations

Because no numerical standards exist for the definition of designated, nonhazardous or inert waste, sediment data from several different sources throughout the country were compiled as shown in Table 1 to assist in categorizing sediments with respect to Chapter 15 narrative criteria.

4.1 United States Geological Survey

Element Concentrations in Soils and Other Surface Materials of the Conterminous United States, U. S. Geological Survey (USGS) Professional Paper 1270, (Shacklette and Boerngen, 1984) presents concentrations of elements in soil collected at 1,318 sampling sites throughout the country. This report establishes nationwide background soil concentrations. Sediments in this range would generally be classified as inert waste. Western, eastern and the conterminous United States data are presented. The western and eastern portions of the country are separated by an area that runs from western Minnesota through east-central Texas. The paper presents arithmetic and geometric means and ranges for 50 different elements. Concentrations from the USGS report of priority pollutant metals commonly found in dredged sediment are presented in Table 1. Western United States values (e.g. mercury, selenium, and boron) are generally greater than the conterminous United States values.

4.2 National Oceanic and Atmospheric Administration

San Francisco Bay Basin mean sediment concentrations from the report Status and Trends in Concentrations of Contaminants and Measures of Biological Stress in San Francisco Bay, National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NOS OMA 41 are presented in Table 1 (Long et al., 1988). This report compiled sediment data collected by many different authors from San Francisco Bay from the 1970's and 1980's. In this report, San Francisco Bay includes Suisun Bay/Carquinez Strait, San Pablo Bay, Central Bay and South San Francisco Bay. The report refers to areas such as Mare Island Strait, Richmond Harbor Channel, Oakland Inner and Outer Harbor, Islais Creek Waterway, China Basin, and Redwood Creek as "periphery" areas, and data from these areas are not included in the data set presented in Table 1.

Table 1 also contains Effects Range-Low (ER-L) and Effects Range-Median (ER-M) sediment concentrations from the report The Potential for Biological Effects of Sediment-Sorbed Contaminants in the National Status and Trends Program, National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NOS OMA 52, (Long et al., 1990). The Long et al. (1990) report contains a compilation of different sediment toxicity evaluation reports which followed four different approaches: equilibrium-partitioning approach, spiked-sediment bioassay

approach, apparent effects approach, and the co-occurrence analysis of field date approach. The sediment toxicity results of all the different studies were ranked for each individual parameter, and the lower 10 percentile toxicity value in the data was identified as the ER-L and the median toxicity value was identified as the ER-M. The ER-L is the chemical concentration above which adverse biological effects may be expected 10% of the time. The ER-M is the chemical concentration above which adverse biological effects may be expected 50% of the time. Adverse biological effects include mortality or sublethal effects (e.g. reduced growth or reproduction success).

4.3 United States Army Corps of Engineers

The United States Army Corps of Engineers (COE) conducted a study of wetlands in the San Francisco Bay Area that were in nondeveloped areas away from potential source areas in order to compare wetlands creation using dredged material to natural wetland areas. These data are published in the report Evaluation of Wetland Creation with J. F. Baldwin Ship Channel Sediment (Lee et al. 1992). Table 1 contains the averages and ranges of the metals analyses from the natural wetlands.

4.4 Marine Water Quality Objectives

The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) marine water quality objectives are the water quality concentrations that should be attained in a marine water body to protect aquatic resources (SFBRWQCB, 1992). These values are provided in Table 1 for comparison purposes to the sediment concentrations.

4.5 Title 22, Section 66699(a) Hazardous Waste Concentrations

The Title 22, Section 66699(a) Hazardous Waste Concentrations are referred to as the Total Threshold Limit Concentration (TTLC) and are the total concentration of the constituents in the waste such that at concentrations greater than the TTLC the waste is considered hazardous and must be disposed of at a Class I waste management unit. A waste is also defined as hazardous if the concentration of a constituent in its extract is greater than the soluble limit threshold concentration (STLC), as defined in Section 66261.24. A waste is also considered hazardous if it exhibits toxicity to test organisms in a bioassay at a concentration of 500 mg/l.

5.0 Sediment Screening Criteria

Sediment screening criteria have been included for different categories of disposal options including Class I, II and III landfills, and wetlands creation cover and noncover material. In order to facilitate the determination of the waste classification and associated disposal options for dredged material, sediment screening criteria for each disposal option are proposed in Table 2.

These values are sediment screening criteria in that these values will be the initial values that any dredged sediment project proponent will have to compare the quality of its dredged sediment to in order to determine the appropriate disposal option. The project proponent will also compare the results of their biological testing for the wetlands creation cover material option to the appropriate reference results. The results of the chemical and biological testing together will determine the appropriate disposal location.

Four disposal options are presented in Table 2 and each is described below.

5.1 Wetlands Creation Cover

Dredged sediment with chemical concentrations less than the chemical concentrations listed in this column is acceptable for potential use in all wetlands creation projects at any depth within the wetland. Further testing is necessary to determine the suitability as described in Section 6. Dredged material below these concentrations is also acceptable for levee restoration and maintenance, landfill daily cover, and upland building material.

5.2 Wetlands Creation Noncover or Class III Landfill

Dredged material with sediment concentrations within the ranges listed in this column is acceptable for wetlands creation noncover material as long as there is a minimum 3 feet of wetlands creation cover material or native material on the top and sides of the noncover material. For tidal wetland systems, a greater lateral distance may be necessary due to tidal fluctuations. This material or sediment will be referred to as noncover material. This material will be isolated by the cover material from exposure to biological communities (Figure 2).

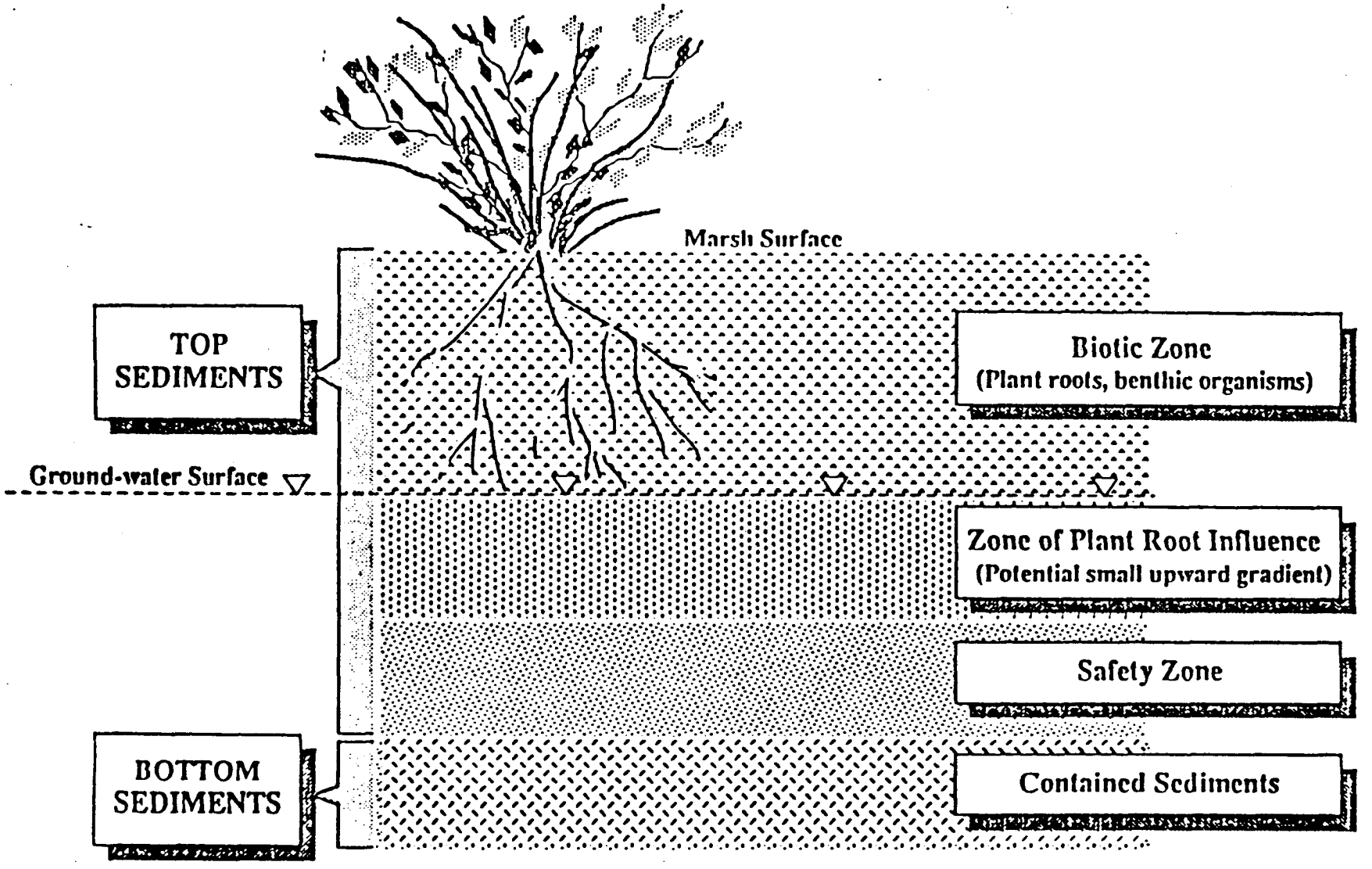
A distinct hydrogeological separation should exist between the first-encountered shallow groundwater aquifer and any local deeper drinking water aquifers. If a distinct hydrogeological separation does not exist, a 1 to 3 foot layer of cover material is required to be placed beneath the noncover material, and the use of the noncover material in these situations will be evaluated on a case-by-case basis.

Table 2
Disposal Option
Sediment Screening Criteria

Constituent	Class I [1]	Class II or III	Wetlands Creation Noncover	Wetlands Creation Cover, Levee Restoration, Landfill Daily Cover
Metals				
Cadmium	>200	DETERMINED	9 - 5	<5
Chromium	>1000	BY SITE	300 - 220	<220
Copper	>5,000	SPECIFIC	390 - 90	<90
Lead	>2,000	CONDITIONS	110 - 50	<50
Mercury	>40		1.3 - 0.35	<0.35
Nickel	>4,000		200 - 140	<140
Silver	>1,000		2.2 - 1.0	<1.0
Selenium	>200		1.4 - 0.7	<0.7
Zinc	>10,000		270 - 160	<160
Nonmetals				
Arsenic	>1,000		85 - 33	<33
PCBs	>100		0.4 - 0.05	<0.05
Pesticides				
Total DDT	>2.0		0.1 - 0.003	<0.003
Total PAH	N/A		35 - 4	<4

All units are mg/kg.

Footnotes 1. Title 22, Division 4, Chapter 30, Article 11, Section 66699(a); lists concentrations in wet weight; this table lists dry weight value assuming dredged material at 50% solids.



June 12, 1991

CONCEPTUAL PROFILE OF RESTORED WETLANDS SHOWING RELATIONSHIP TO CONTAINED SEDIMENTS

Figure 2 (From Levine-Fricke, 1991)

5.3 Class II or III Landfill

Dredged material with sediment concentrations within the ranges listed in this column should be evaluated for disposal at a Class II or III landfill. Requirements of the individual landfill would have to be followed. It is not the intent of this document to dictate to landfills what concentrations of material should be accepted.

5.4 Class I Landfill

Dredged material with sediment concentrations above the levels listed in this column must be disposed of at Class I landfill. Requirements of the individual landfill would have to be followed. It is not the intent of this document to dictate to landfills what concentrations of material should be accepted.

5.5 Sediment Screening Criteria Rationale

The Long et al. (1990) ER-L and ER-M values were compared to dredged material values typically found in the Bay Area (Long et al., 1988; and other dredging projects) and to sediment samples from around the Bay Area (Lee et al., 1992; Long et al., 1990; Shacklette and Boerngen, 1984). The wetlands creation cover material screening criteria were selected based on the greater of the ER-L or the upper range of the natural wetlands concentrations from Lee et al. (1992), but if the upper range metal value from Lee et al. (1992) was greater than the 20th percentile value from Long et al. (1990), then the 20th percentile value was selected. Chromium, nickel and selenium are exceptions with further discussion in the sections below.

The ER-L, or 10th percentile value from Long et al. (1990), is the chemical concentration above which adverse biological effects may be expected 10% of the time. Up to the 20th percentile value was considered appropriate for the screening criteria based on the values detected in natural wetlands throughout the Bay Area.

The ER-M value was considered the upper value for acceptance of wetlands creation noncover material for all constituents. The ER-M is the chemical concentration above which adverse biological effects may be expected 50% of the time. This value was considered protective for noncover material since there will be three feet of wetlands creation cover material over top of the noncover material. Three feet of cover material should provide adequate distance to insulate benthic organisms and plant roots from he noncover material. Chromium and nickel are the only two constituents whose level was set above the ER-M for the wetlands creation noncover material sediment screening criteria due to the high natural background concentrations of chromium and nickel in the Bay Area. The total DDT value was set below the ER-M.

The following sections provide the specific rationale for the chromium, nickel, selenium, and DDT sediment screening criteria.

5.5.1 Chromium

The following data are available for chromium, all units are mg/kg, dry weight:

ER-L (Long et al. 1990)	80	
ER-M (Long et al. 1990)	145	
SF Bay Basins Mean (Long et al. 1988)		108
Western United States Mean (Shacklette and Boerngen 1984)	56	
Bodega Bay two year average (Long et al. 1990)	349.7	
Tomales Bay two year average (Long et al. 1990)	218	
Dumbarton Bridge two year average (Long et al. 1990)	170	
San Mateo Bridge two year average (Long et al. 1990)	167.5	
San Pablo Bay two year average (Long et al. 1990)		185
Upper range, natural wetland (Lee et al. 1992)		224

The above information indicates the background concentration of chromium in Bay Area sediments is naturally higher than the western United States mean. The Shacklette and Boerngen, (1984) nationwide distribution map for chromium shows that chromium sediment concentrations in northern California are higher than the western United States mean. In particular, Bodega Bay and Tomales Bay, are 6.2 and 3.9 times greater than the western United States mean for chromium. The data from San Francisco Bay showed no consistent pattern of toxicity for the values cited above and thus were excluded from the calculation of the ER-L and ER-M. Preliminary Apparent Effects Threshold values based solely on San Francisco Bay data established levels of 280 mg/kg and 370 mg/kg for chromium for the bivalve larvae and amphipod bioassay respectively (SWRCB 1990). Based on the above information a value of 220 mg/kg is selected as the sediment screening criteria for wetlands cover material and 300 mg/kg for wetlands noncover material. 220 mg/kg and 300 mg/kg are approximately the 78th and 87th percentile values, respectively, for chromium from Long et al. (1990).

5.5.2 Nickel

The following data are available for nickel, all units are mg/kg, dry weight:

ER-L (Long et al. 1990)	30	
ER-M (Long et al. 1990)	50	
SF Bay Basins Mean (Long et al. (1988)		No Data
Western United States Mean (Shacklette and Boerngen 1984)	19	
Bodega Bay two year average (Long et al. 1990)	54.8	
Tomales Bay two year average (Long et al. 1990)	166.7	

Dumbarton Bridge two year average (Long et al. 1990)	90.8
San Mateo Bridge two year average (Long et al. 1990)	112.5
San Pablo Bay two year average (Long et al. 1990)	87.8
Upper range, natural wetland (Lee et al. (1992)	145.2

The above information indicates the background concentration of nickel in Bay Area sediments is naturally higher than the western United States mean. The Shacklette and Boerngen, (1984) nationwide distribution map for nickel shows that nickel sediment concentrations in northern California are higher than the western United States mean. In particular, Bodega Bay and Tomales Bay, two nondeveloped areas, are 2.9 and 8.8 times greater than the western United States mean for nickel. Again, no San Francisco Bay data was used in the calculation of the ER-L and ER-M. Preliminary Apparent Effects Threshold values based solely on San Francisco Bay data established a level of greater than 170 mg/kg for nickel for the bivalve larvae and amphipod bioassay respectively (SWRCB 1990). Based on the above information a value of 140 mg/kg is selected as the sediment screening criteria for wetlands cover material and 200 mg/kg for wetlands noncover material. 140 mg/kg and 200 mg/kg are approximately the 95th and 96th percentile values, respectively, for nickel from Long et al. (1990).

5.5.3 Selenium

The western United States mean selenium sediment concentration from Shacklette and Boerngen, (1984) is 0.34 mg/kg. The Long et al. (1988) and Long et al. (1990) reports did not include selenium. Selenium concentrations in Bay Area dredged material is typically in the 0.2 mg/kg to 1.5 mg/kg range. The upper range for natural wetlands found in Lee et al. (1992) was 0.91 mg/kg. Absent of any further information, a value of two times the western United States mean, or 0.7 mg/kg, is selected as the sediment screening criteria for wetlands cover material and a value of four times the western United States mean, or 1.4 mg/kg, is selected as the sediment screening criteria for wetlands noncover material.

5.5.4 Total DDT

The ER-M for Total DDT is 0.35 mg/kg. However the ER-M for DDT, DDE, and DDD are 0.007 mg/kg, 0.015 mg/kg, and 0.02 mg/kg, respectively. Given the relative difference between the ER-Ms of the total and individual DDTs, a conservative screening criteria of 0.1 mg/kg for total DDT including all of the isomers was selected for wetlands noncover material. The ER-L of 0.003 mg/kg was selected for the wetlands cover material screening criteria. See the toxicology article enclosed.)

6.0 Disposal Option Testing Requirements

Each different disposal option has dredged material testing requirements specific to the final disposal location. Certain testing requirements are common to all disposal options. For wetlands creation and upland disposal, all dredging projects are required to complete the testing requirements contained in Public Notice 92-7, Interim Testing Procedures for Evaluating Dredged Material Disposal in San Francisco Bay (USACOE/ USEPA/ SFBRWQCB/BCDC 1992), except for the biological testing. Based on the results of this testing the dredged material analyses, the project may be preliminarily proposed for the appropriate disposal option based on the sediment screening criteria in Table 2.

The following additional testing requirements are specific to the individual disposal options. The results of the additional testing shall be compared to the individual test reference results in order to determine if it is acceptable to use the dredged material for the specific use. Figures 3 and 4 contain flow chart diagrams depicting the sediment concentrations and testing requirements for each disposal option.

6.1 Wetlands Creation Cover

Dredging projects proposed for wetlands creation cover material shall also complete a 10 day solid phase bioassay test (ASTM 1990). Reference sediment will be sediment from an existing wetland in the vicinity of the proposed wetland. In addition a modified leach test using surface waters from the area to be created should also be conducted. The leach test required will be a modified Waste Extraction Test (WET) Procedure described in Title 22, Div. 4, Ch. 30, Art. II, Sect. II, Sect. 66700. Dredged material proposed for levee restoration, landfill daily cover, or upland building material do not have to conduct a 10 day solid phase bioassay.

6.2 Wetlands Creation Noncover

Dredging projects proposed for wetlands creation noncover material shall also complete a leach test on the dredged material. The extraction solution should be surface water from the area where the wetlands will be created. The net extractable concentration should be less than the net extractable concentration from a leach test completed on soil from an adjacent wetland in the area of the proposed wetland and shall not exceed background concentrations in local groundwater. Additionally, the leachate will be evaluated against applicable water quality criteria values for constituents of concern. This leach test will compare the

Figure 3

Dredged Material Disposal Option Decision Flow Chart

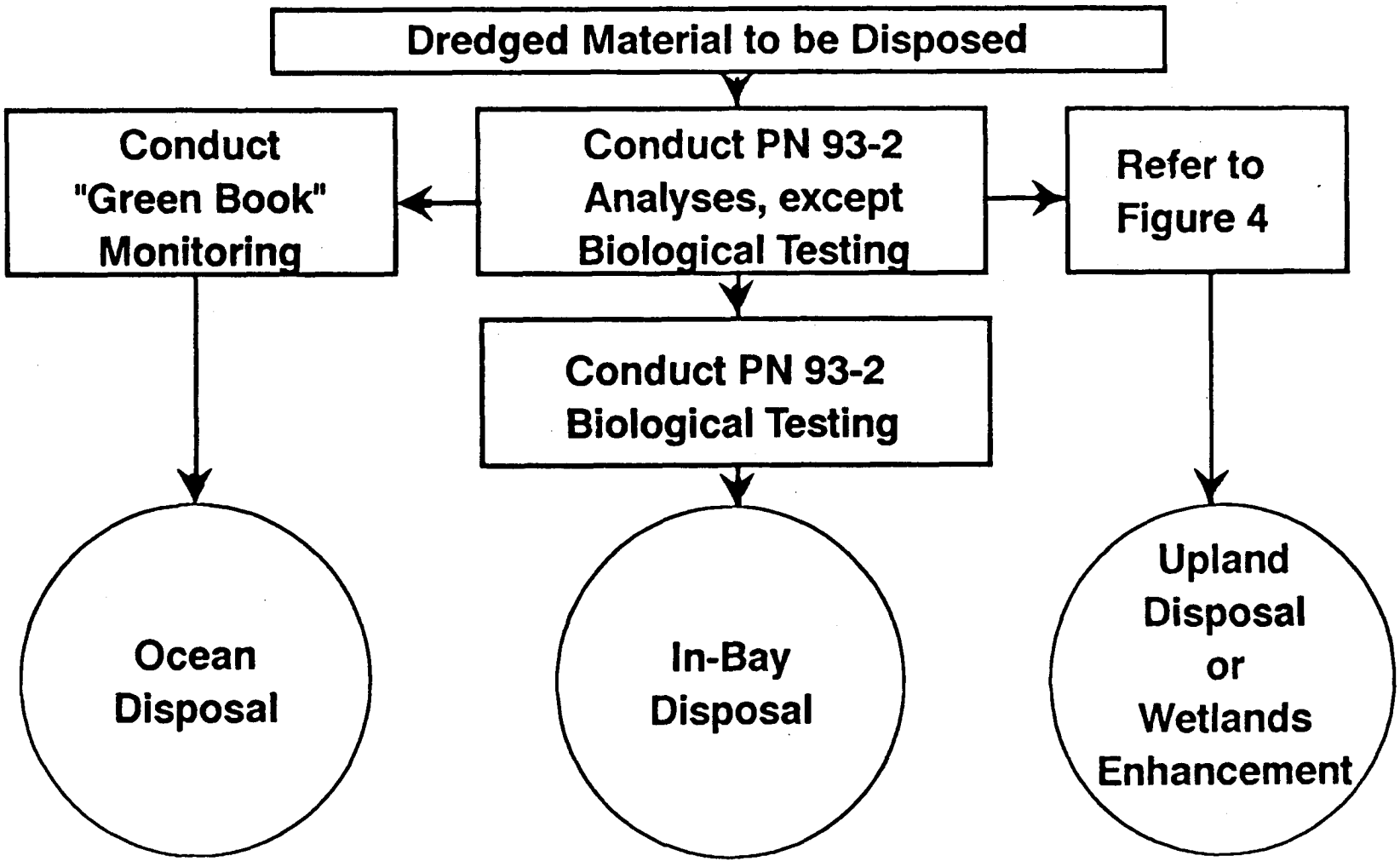
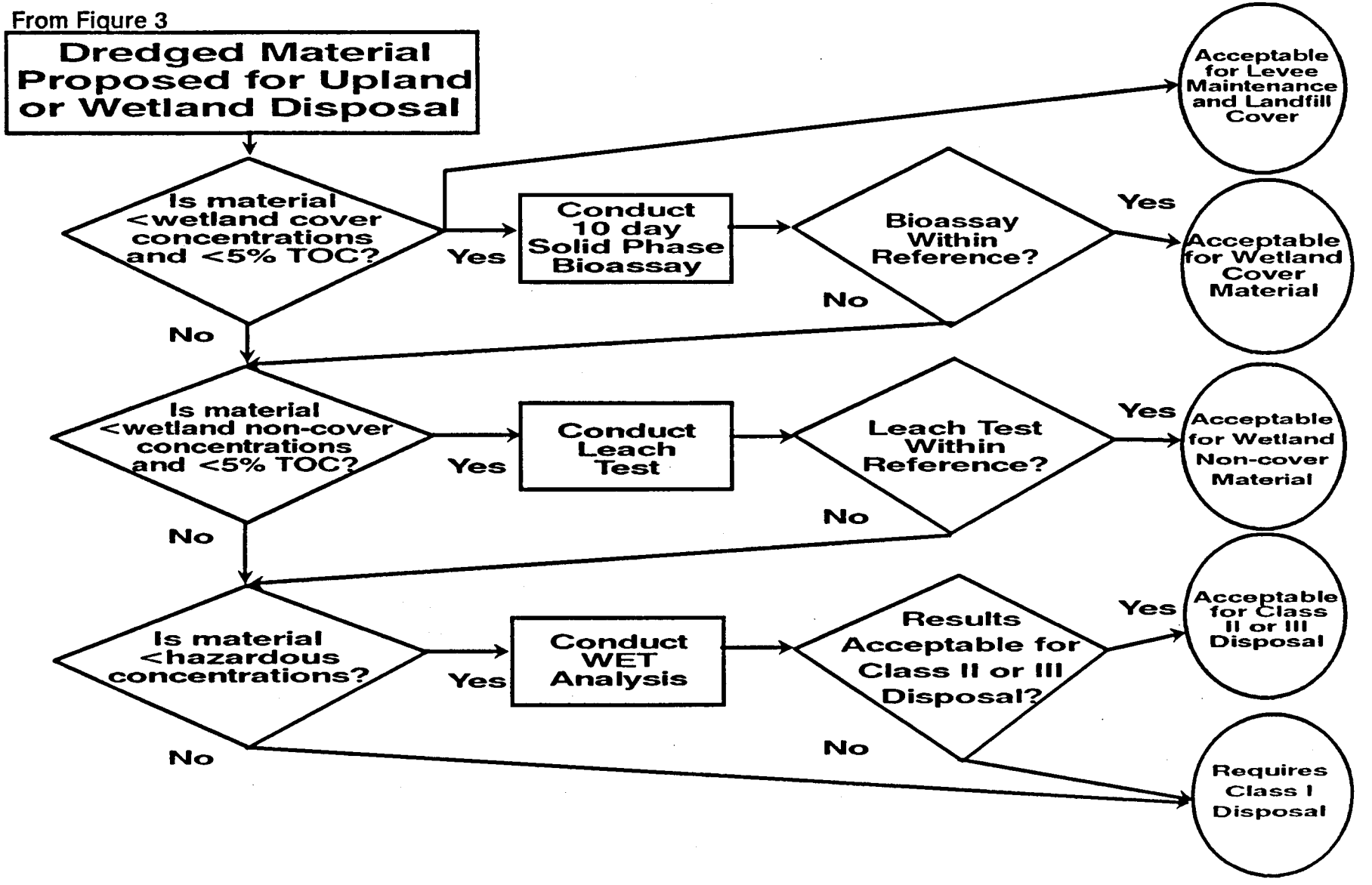


Figure 4
Uplands or Wetlands Disposal Options Decision Flow Chart



amount of soluble pollutants that would naturally leach out of upland sediments, that may at some time in the future become source areas for natural wetlands creation, versus that which will leach out of the dredged material. The leach test employed should include procedures for leachate extraction under reduced as well as oxidized conditions.

6.3 Class III Landfill

Dredged material proposed for disposal at a Class III landfill will ultimately have to meet the testing requirements and sediment screening criteria of the individual landfill. One testing procedure that the SFBRWQCB staff has accepted (SFBRWQCB, 1991) is the CVRWQCB staff "Designated Level Methodology" (Marshak, 1989) to determine if a material is acceptable for disposal at a Class III landfill. This methodology involves running the Waste Extraction Test on a material and multiplying the extractable concentration from the material by an attenuation factor, then comparing this result to the appropriate water quality objective. The attenuation factor accounts for the depth of sediment between groundwater and the landfill. This procedure is site specific and material specific hence criteria are determined on as needed basis by the landfill operator with concurrence by the Regional Board.

6.4 Class II Landfill

Dredged material proposed for disposal at a Class II landfill will ultimately have to meet the testing requirements and sediment screening criteria of the individual landfill. In general if a material fails to be accepted at a Class III landfill and is below the concentrations of a hazardous waste, it is acceptable to be disposed of at a Class II landfill.

6.5 Class I Landfill

Dredged material proposed for disposal at a Class I landfill will ultimately have to meet the testing requirements and sediment screening criteria of the individual landfill. In general if a material contains concentrations greater than those listed in Title 22, Section 66699(a), then the material is hazardous and must be disposed of at a Class I facility.

6.6 Definition of Dredged Material as Inert Waste With Respect to Chapter 15

Dredged material will be considered inert waste if the following criteria are met:

1. It has contaminant concentrations less than those listed for wetlands creation cover material and it passes the 10 day solid-phase bioassay test;

   or

2. It is within the concentrations for the wetlands noncover material and it passes the leach test.

If dredged material meets the above criteria it is considered to be inert waste under ambient conditions because it does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives, and does not contain significant quantities of decomposable waste.

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