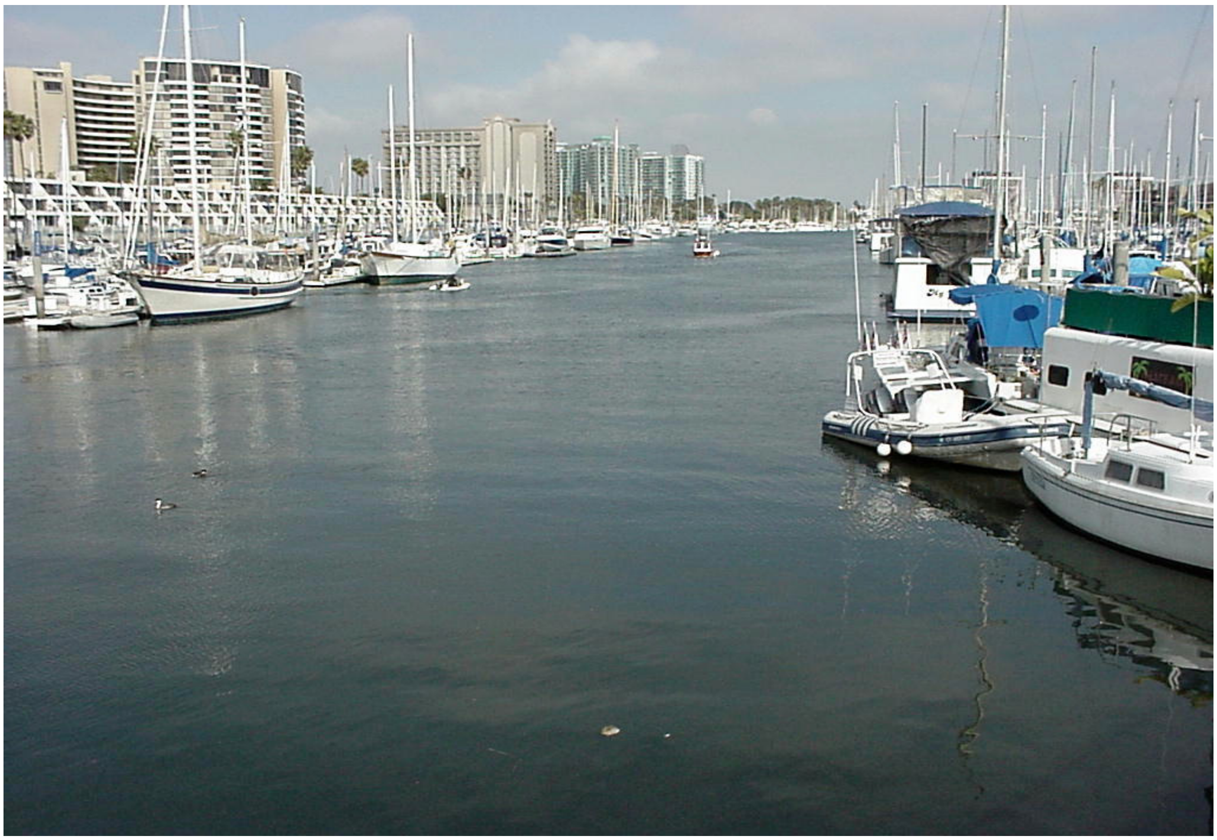
TOTAL MAXIMUM DAILY LOAD FOR TOXIC POLLUTANTS IN MARINA DEL REY HARBOR



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AND

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REGION 9

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TABLE OF CONTENTS

1. INTRODUCTION 1

1.1 REGULATORY BACKGROUND 2
1.2 ENVIRONMENTAL SETTING 4
1.3 ORGANIZATION OF THIS DOCUMENT 8

2. PROBLEM IDENTIFICATION 9

2.1 WATER QUALITY STANDARDS 9
2.1.1 Beneficial Uses 9
2.1.2 Water Quality Objectives (WQOs) 9
2.1.3 Antidegradation 12
2.2 DATA REVIEW 12
2.2.1 Water Column 12
2.2.2 Fish and Shellfish Tissue 13
2.2.3 Sediment 14
2.3 SUMMARY AND FINDINGS CONCERNING TMDLS REQUIRED 19

3 NUMERIC TARGETS 20

3.1 SEDIMENT NUMERIC TARGETS 20
3.2 WATER QUALITY CRITERIA 21
3.3 FISH TISSUE TARGET 21
3.3.1. Deriviation of the Treshold Tissue Residue Level (TTRL) 22

4 SOURCE ASSESSMENT 23

4.1 BACKGROUND ON TOXIC POLLUTANTS 23
4.1.1 Organic Pollutants 23
4.1.2 Metals 24
4.2 POINT SOURCES 24
4.2.1 Stormwater Runofff 25
4.2.2 Summary Point Sources 26
4.3 NONPOINT SOURCES 27
4.3.1. MARINA ACTIVITIES 27
4.3.1.1 Copper Loading from Recreational Boats 27
4.3.2 Atmospheric Deposition 28

5 LINKAGE ANALYSIS, TMDL AND POLLUTANT ALLOCATION 29

5.1 LOADING CAPACITY 29
5.1.1 Critical Conditions 30
5.1.2 Margin of Safety 30
5.2 ALLOCATIONS 30
5.2.1 Load Allocations 31

5.2.2 Waste Load Allocation for Storm Water 31
5.2.3 Waste Load Allocation for other NPDES Permits 33
5.3 SUMMARY OF TMDL 33

6 IMPLEMENTATION 35

6.1 REGULATION BY THE REGIONAL BOARD 35
6.1.1 Stormwater Discharges 36
6.2 POTENTIAL IMPLEMENTATION STRATEGIES 38
6.2.1 Non-Structural Best Management Practices 38
6.2.2 Structural Best Management Practices 38
6.3 IMPLEMENTATION COST ANALYSIS AND CEQA CONSIDERATIONS 38
6.3.1 Implementation Cost Analysis 39
6.3.1.1 Phased Implementation 39
6.3.1.2 Comparison of Costs Estimates with Caltrans Reported Costs 43
6.3.2 Results of a Region-wide Cost Study 44

7 MONITORING 46

7.1 AMBIENT MONITORING 46
7.2 EFFECTIVENESS MONITORING 47
7.3 SPECIAL STUDIES 48

8. FINAL TMDL MILESTONES AND IMPLEMENTATION SCHEDULE 49

8.1 FINAL TMDL MILESTONES 49
8.2 IMPLEMENTATION SCHEDULE 49

9 REFERENCES 52

LIST OF TABLES

Table 1-1: 1998 303(d) list of metal and organic compound impairments 3

Table 1-2. 2002 303(d) List of metal and organic compound impairments 3

Table 1-3. Land Use by Sub-watershed Area for Marina del Rey Watershed 7

Table 2-1. Beneficial Uses of Marina del Rey Harbor (LARWQCB, 1994) 9

Table 2-2. Water quality objectives established in the CTR for metals and organic compounds 11

Table 2-3 Water column data for Basin E in Marina del Rey Harbor 12

Table 2-4. Fish tissue listing data from Toxic Substances Monitoring Program (ppb, wet weight).13

Table 2-5. Fish tissue listing data from Toxic Substances Monitoring Program (ppb, wet weight).14

Location 14

Table 2.6: Summary of Sediment Quality Data for Marina del Rey's back basins (96-03). 16

Table 2-7. Summary of marine sediment quality guidelines used in assessment of TMDL pollutants 18

Table 2-8. Evaluation of sediment data relative to sediment quality guidelines 18

Table 2-9 Sediment Toxicity Data for Marina del Rey's Back Basins – Amphipod Survival Rates19

Table 3-1. Numeric targets for sediment quality in Marina del Rey's back basins 21

Table 3-2: Numeric Targets for total PCBs in the water column 21

Table 4-1. NPDES Permits in the Marina del Rey Watershed 25

Table 4-2. Annual Loading from Stormwater Water Runoff for Metals (lb/year) 26

Table 4-3. Estimate of Atmospheric Deposition of Metals to Surface Water 28

Table 5-1. Average Annual Total Suspended Solids (TSS) Loading to Marina del Rey 29

Table 5-2. Sediment Loading Capacity Expressed as Mass per Year 30

Table 5-3. Mass-based Allocations 31

Table 5-4. Areal extent of watershed and percent area covered under storm water permits 32

Table 5-5. Combined storm water allocation apportioned based on percent of watershed. 32

Table 5-6. Per acre waste load allocation for an individual general construction or industrial storm water permittee (g/day/ac). 33

Table 5-7. Concentration-based waste load allocation for sediment discharged to Marina del Rey Harbor. 33

Table 6-1. Estimated costs for two types of street sweepers. (Source: USEPA, 1999b.) 40

Table 6-2. Annualized sweeper costs, including purchase price and operation and maintenance costs ($/curb mile/year). 40

Table 6-3. Estimated Costs for Infiltration Trenches. 41

Table 6-4. Estimated Costs for Austin and Delaware Sand Filters 42

Table 6-5. Total Estimated costs of structural BMP approach for stormwater discharges. 43

Table 6-6. Estimated costs of structural and non-structural compliance measures for the entire Los Angeles Region. (Source: Devinny et al.) 44

Table 6-7. Comparison of costs for storm water compliance on a per square mile basis. 44

Table 8-1. Implementation Schedule 50

LIST OF FIGURES

Figure 1-1 Marina del Rey Harbor 1

Figure 1-2 Marina del Rey sub-watershed areas 6

LIST OF ACRONYMS

µg/g	Micrograms per Gram
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
BMPs	Best Management Practices
BPTCP	Bay Protection and Toxic Cleanup Program
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
COMM	Commercial and Sport Fishing
CTR	California Toxics Rule
CWA	Clean Water Act
DL	Detection Limit
EMCs	Event Mean Concentrations
ERL	Effects Range-Low
+ERM	Effects Range-Median
EST	Estuarine Habitat
FHWA	Federal Highway Administration
FR	Federal Register
kg	Kilograms
LACDPW	Los Angeles County Department of Public Works
LARWQCB	Los Angeles Regional Water Quality Control Board
LACDBH	Los Angeles County Department OF Beaches and Harbors
MAR	Marine Habitat
MdRH	Marina del Rey Harbor
MGD	Million Gallons per Day
mg/kg	Milligrams per Kilogram
MS4	Municipal Separate Storm Sewer System
MTRL	Maximum Tissue Residue Level
NAV	Navigation
ng/L	Nanograms per Liter
NPDES	National Pollutant Discharge Elimination System
NPTN	National Pesticide Telecommunications Network
O&M	Operation and Maintenance
OEHHA	Office of Environmental Heath Hazard Assessment
PCBs	Polychlorinated biphenyls
PEL	Probable Effects Level
pg/L	Picograms per Liter
ppb	Parts per Billion
ppt	Parts per Thousand
RARE	Rare, Threatened, or Endangered Species
REC1	Water Contact Recreation
REC2	Non-Contact Water Recreation
SHELL	Shellfish Harvesting

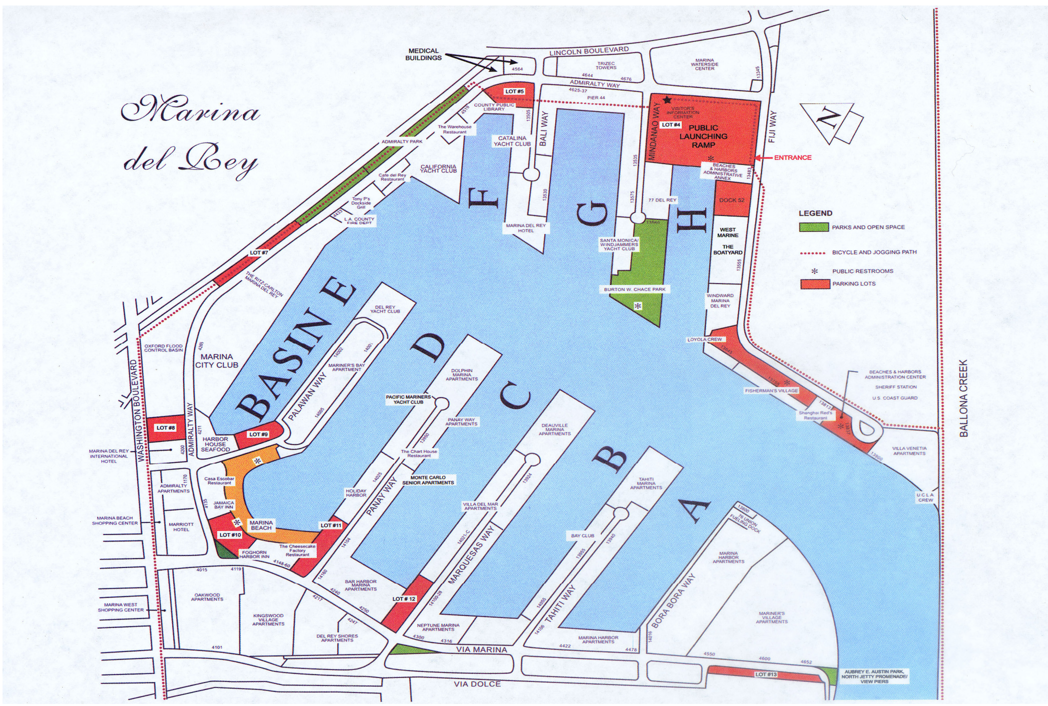
SIYB	Shelter Island Yatch Basin
SQGs	Sediment Quality Guidelines
SQOs	Sediment Quality Objectives
TEL	Threshold Effects Level
TMDL	Total Maximum Daily Load
TSMP	Toxic Substances Monitoring Program
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WDRs	Waste Discharge Requirements
WILD	Wildlife Habitat
WLAs	Waste Load Allocations
WQA	Water Quality Assessment
WQOs	Water Quality Objectives

1. INTRODUCTION

This report presents the required elements of the Total Maximum Daily Load (TMDL) for toxic pollutants in Marina del Rey's Back Basins (Basins D, E and F), and summarizes the technical analyses performed by the California Regional Water Quality Control Board, Los Angeles Region (Regional Board) and the United States Environmental Protection Agency, Region 9 (USEPA) to develop this TMDL.

The back basins of the Marina are listed for a variety of toxic pollutants, including metals, organic compounds and sediment toxicity (Table 1-1). These sections of Marina del Rey Harbor were included on the 1996, 1998 and 2002 California 303(d) list of impaired waterbodies (LARWQCB, 1996, 1998, 2002). The Clean Water Act (CWA) requires a TMDL be developed to restore the impaired waterbodies to their full beneficial uses.

Figure 1: Marina del Rey Harbor



This TMDL complies with 40 CFR 130.2 and 130.7, Section 303(d) of the CWA and USEPA guidance for developing TMDLs in California (USEPA, 2000a). In addition to the summary of the information used in its development, the TMDL includes an implementation plan and cost estimate to achieve the WLAs and attain water quality objectives (WQOs) in Marina del Rey's back basins. The California Water Code (Porter-Cologne Water Quality Control Act) requires that an implementation plan be developed to achieve water quality objectives. This TMDL addresses the impairments in Basins D, E, and F of Marina del Rey Harbor (Figure 1).

1.1 Regulatory Background

Section 303(d) of the CWA requires that each State "shall identify those waters within its boundaries for which the effluent limitations are not stringent enough to implement any water quality objective applicable to such waters." The CWA also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and establish TMDLs for such waters. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and Section 303(d) of the CWA, as well as in the USEPA guidance (USEPA, 2000a). A TMDL is defined as the "sum of the individual waste load allocations for point sources and load allocations for non-point sources and natural background" (40 CFR 130.2) such that the capacity of the waterbody to assimilate pollutant loads (the loading capacity) is not exceeded. A TMDL is also required to account for seasonal variations and include a margin of safety to address uncertainty in the analysis (USEPA, 2000a).

States must develop water quality management plans to implement the TMDL (40 CFR 130.6). The USEPA has oversight authority for the 303(d) program and is required to review and either approve or disapprove the TMDLs submitted by states. In California, the State Water Resources Control Board (State Board) and the nine Regional Water Quality Control Boards are responsible for preparing lists of impaired waterbodies under the 303(d) program and for preparing TMDLs, both subject to USEPA approval. If USEPA does not approve a TMDL submitted by a state, USEPA is required to establish a TMDL for that waterbody. The Regional Boards also hold regulatory authority for many of the instruments used to implement the TMDLs, such as the National Pollutant Discharge Elimination System (NPDES) permits and state-specified Waste Discharge Requirements (WDRs).

As part of its 1996 and 1998 regional water quality assessments (WQAs), the Regional Board identified over 700 waterbody-pollutant combinations in the Los Angeles Region where TMDLs would be required (LARWQCB, 1996, 1998). These are referred to as "listed" or "303(d) listed" waterbodies or waterbody segments. A 13-year schedule for development of TMDLs in the Los Angeles Region was established in a consent decree that was approved on March 22, 1999 (Heal the Bay Inc., et al. v. Browner, et al. C 98-4825 SBA).

For the purpose of scheduling TMDL development, the consent decree combined the more than 700 waterbody-pollutant combinations into 92 TMDL analytical units. Analytical Unit 54 addresses the impairments in Marina del Rey back basins associated with organic pollutants (chlordane, dieldrin, DDT, PCBs, benthic community effects, fish consumption advisory and sediment toxicity) and Analytical Unit 56 addresses the impairments associated with metals (lead, copper, and zinc). In addition, the Tributyltin impairment is addressed under Analytical Unit 70. Table 1-1 presents the 1998 303(d) list of toxic impairments in the Marina del Rey back basins The consent decree also prescribed schedules for certain TMDLs, and according to this schedule, USEPA must either approve a state TMDL for Analytical Units 55 and 57 or establish its own, by March 22, 2006

Table 1-1: 1998 303(d) list of metal and organic compound impairments

Media	Pollutant		
	Analytical Unit 54	**Analytical Unit 56**	**Analytical Unit 70**
Sediment	DDT Chlordane Sediment toxicity	Lead (Pb) Copper (Cu) Zinc (Zn)	
Fish Tissue	DDT Chlordane PCBs Dieldrin Fish consumption advisory	Lead (Pb) Copper (Cu) Zinc (Zn)	Tributyltin (TBT)
Benthic infauna	Benthic community effects		

Paragraph 8 of the consent decree provides that TMDLs need not be completed for specific waterbody by pollutant combinations if the State or EPA determines that TMDLs are not needed for these combinations, consistent with the requirements of Section 303(d). The consent decree provides that this determination may be made either through a formal decision to remove a combination from the State Section 303(d) list or through a separate determination that the specific TMDLs are not needed. Paragraph 9 of the consent decree describes procedures for giving notice that TMDLs are not needed.

On the 2002 303(d) list, the Regional Board de-listed copper, lead, zinc and tributyltin in fish tissue. The tissue listings for these pollutants were removed because the elevated data levels upon which the 1998 listings were based no longer reflect valid assessment guidelines. DDT in sediment was de-listed since sediment concentrations have dropped below sediment quality guidelines. The benthic community degradation impairment was also de-listed since the benthic infauna was determined to be only moderately degraded. In addition, the Regional Board added a new listing for PCBs in sediment for the Marina del Rey back basins. Current listings are presented in Table 1-2.

Table 1-2. 2002 303(d) List of metal and organic compound impairments

Media	Pollutant
Sediment	Copper (Cu) Lead (Pb) Zinc (Zn) Chlordane PCBs Sediment toxicity
Fish Tissue	DDT Dieldrin Chlordane PCBs Fish consumption advisory

Pursuant to paragraph 8, the Regional Board determined that TMDLs are not required for chlordane, total DDT, and dieldrin in fish tissue. More recent data shows these pollutants to be below screening values. A more detailed discussion on these findings is provided in Section 2.2 Data Review. This constitutes the notice as provided for in paragraph 9 of the consent decree.

On May 6, 2003, the Regional Board held a California Environmental Quality Act (CEQA) scoping meeting to solicit input from the public and interested stakeholders in determining the scope, content and implementation options of the proposed TMDL for toxic pollutants in Marina del Rey's back basins. At the scoping meeting, the CEQA checklist of significant environmental issues and mitigation measures were discussed. This meeting fulfilled the requirements under CEQA (Public Resources Code, Section 21083.9).

This TMDL will address impairment of beneficial uses due to elevated concentrations of chlordane, copper, lead, and zinc in Marina del Rey Harbor sediments, and total PCBs in fish tissue. The sediment toxicity and fish advisory listing will be addressed by the TMDLs waste load allocations (WLAs) and load allocations (LAs) for these toxic pollutants. The TMDLs for nearby Ballona Creek required under Analytical Units # 55 and 57 have been addressed in a separate TMDL.

1.2 Environmental Setting

The MdR watershed is approximately 2.9 square miles located in the Santa Monica Bay, California. It is south of Venice and north of Playa del Rey, and approximately 15 miles southwest of downtown Los Angeles. The watershed includes the City of Los Angeles, Culver City and unincorporated areas of Los Angeles County. The climate is warm and dry most of the year with intermittent wet weather events typically between November and March.

MdR Harbor (MdRH) was developed in the early 1960s on degraded wetlands that formed part of the estuary of Ballona Creek Wetlands. MdRH, which opens into Santa Monica Bay, was constructed by the Army Corps of Engineers and is the largest artificial small-craft harbor in the United States. MdRH harbors more than 6,000 wet berthed slips for privately owned pleasure craft, dry storage of approximately 3,000 boats, and launch facilities, which can accommodate approximately 240 trailered boats. The back basins (Basins D, E and F) house approximately 2,000 slips (Joseph Chesler, Los Angeles County Department of Beaches and Harbors, personal communication).

The Corps of Engineers maintains the harbor entrance channel and main channel for navigation by dredging. Since the late 1980's, the Corps of Engineers has not been able to use open water disposal for sediments dredged from the entrance channel due to the elevated levels of contaminants deposited from adjacent Ballona Creek. Based on Corps of Engineers' hydrodynamic numerical modeling (RMA4 model) results, the contaminant influence from Ballona Creek does not travel to nor affect the back basins (USACE 1999). Therefore, the back basins of the MdRH are assumed to be outside any significant influence from Ballona Creek.

The MdR watershed is highly developed with high-density single family residence (HDSFR), multiple family residence (MFR), and mixed residential comprising the primary land use in the watershed (46.6%) followed by retail, commercial, and general office representing the second largest land use (12.2%). The receiving waters of MdRH constitute 11.6% of the land area and marina facilities cover 9.2% of the land use. Open space and recreation represents 4.8% of the land use in the watershed. Light industrial and vacant/urban vacant each represent 4.7% of the land use. The remaining 6% of land area is covered by educational institutions (3.8%), under construction (1.2%), institutional and military installations (0.6%), transportation (0.3%), and mixed urban (0.2%).

For the purposes of this TMDL, the Regional Board has divided the watershed into five sub-watersheds based on the drainage patterns provided by the Los Angeles County Department of Public Works (LACDPW). Area 1A drains into the back basins (Basins D, E and F) of MdRH and Area 1B drains into the rest of the MdRH area (all other basins). Area 2 drains into Ballona Lagoon and then to the harbor entrance. Area 3 drains into the back basins via storm drains and Area 4 drains into the Oxford Flood Control Basin (OFCB) via storm drains and then into Basin E through a tidal gate. The sub-watersheds of the harbor are shown in Figure 1-2. See Table 1-3 for land use breakdowns by sub-watersheds.

Figure 1-2: Marina del Rey sub-watershed areas

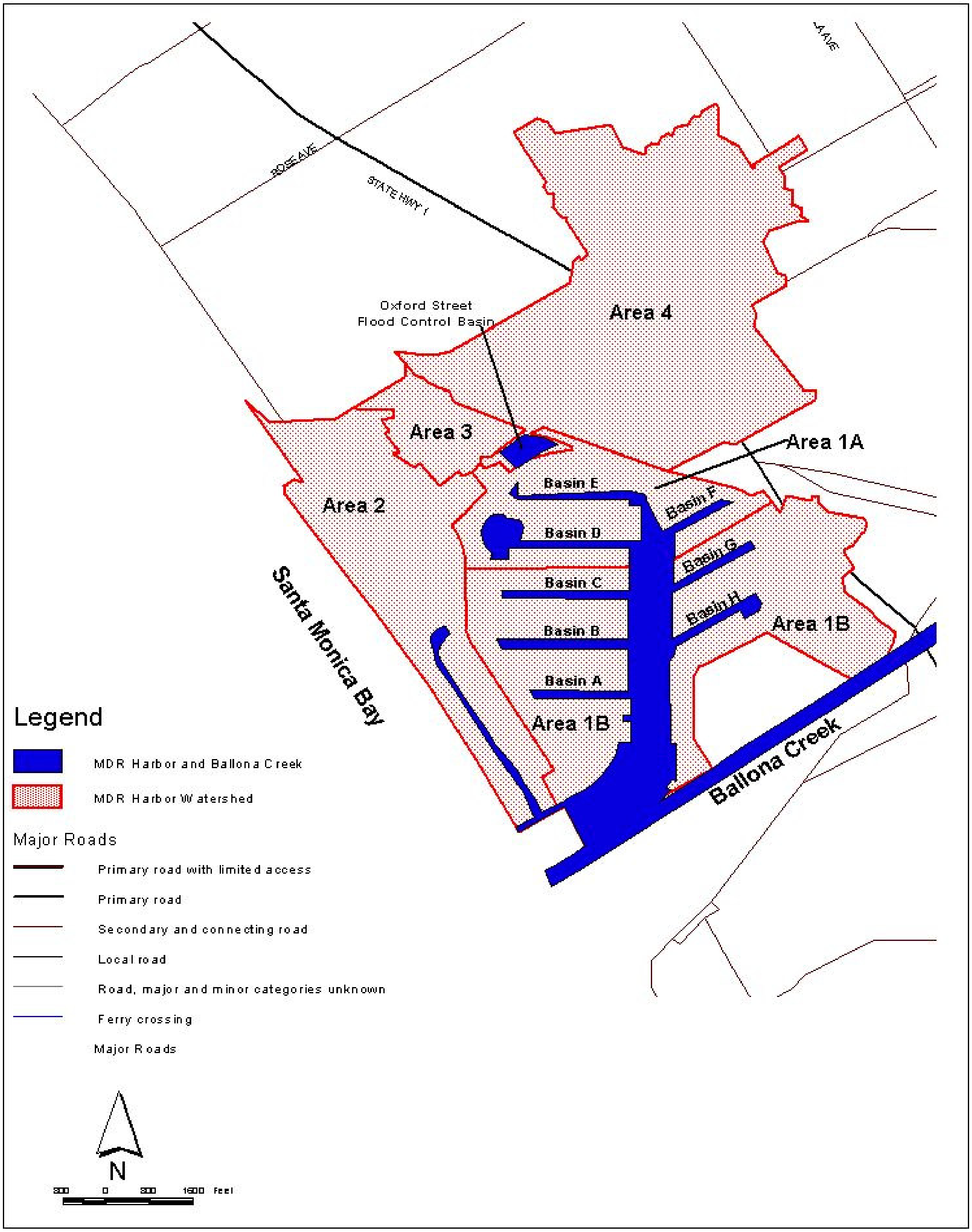


Table 1-3. Land Use by Sub-watershed Area for Marina del Rey Watershed

Land Use Type*	Marina del Rey Watershed (acres)				
	Area 1A	Area 1B	Area 2	Area 3	Area 4
Education			3		67
General Office	2	17			
HDSFR			65	38	304
Institutional	1	9			
Light Industrial				2	86
Marina Facilities	65	106			
MFR	32	128	201	14	50
Military Installations		1			
Mixed Residential			1	13	18
Mixed Urban					3
Open Space/Recreation	19	65	2		3
Other Commercial	16	3	9		2
Receiving Waters	44	151	13		8
Retail/Commercial	32	30	21		94
Transportation	4				2
Under Construction		2	11	4	6
Urban Vacant	2	4			29
Vacant		53			
Total	217	569	326	71	672

* Land use data was provided by the LACDPW on May 20, 2002 by Dr. T.J. Kim

1.3 Organization of this Document

Guidance from USEPA (1991) identifies seven elements of a TMDL. Sections 2 through 7 of this document present these elements, with the analysis and findings of this TMDL for that element. The required elements are as follows:

- **Section 2: Problem Identification.** This section describes the nature of the impairments addressed by this TMDL, and presents data to demonstrate the extent of impairment. Beneficial uses of the impaired water bodies and the relevanr water quality objectives are also presented.
- **Section 3: Numeric Targets.** This section identifies the numeric targets established for the TMDLs and representing attainment of water quality objectives (WQOs) and beneficial uses.
- **Section 4: Source Assessment.** This section identifies the potential point sources and nonpoint sources of organic pollutants and metals to Marina del Rey Harbor
- **Section 5: Linkage Analysis, TMDL and Pollutant Allocations.** This section presents the analysis to evaluate the link between sources of toxic pollutants and the resulting conditions in the impaired waterbody. Each identifiable source is allocated a quantitative load or waste load allocations for the listed pollutants, representing the load that it can discharge while still ensuring that the receiving water meets the WQOs. Allocations are designed to protect the waterbody from conditions that exceed the applicable numeric target.
- **Section 6: Implementation.** This section describes the regulatory tools, plans and other mechanisms available to achieve the WLAs. The TMDL provides cost estimates to implement best management practices (BMPs) required throughout the Marina del Rey watershed to meet water quality objectives in the back basins of the harbor.
- **Section 7: Monitoring.** This TMDL describes the monitoring to ensure that the WQOs are attained. If the monitoring results demonstrate the TMDL has not resulted in attainment of WQOs, then revised allocations will be developed While the TMDL identifies the goals for a monitoring program, the Executive Officer will issue subsequent orders to identify the specific requirements and the specific entities that will development and implement a monitoring program and submit technical reports.

2. PROBLEM IDENTIFICATION

The listings for Marina del Rey's back basins are based on concentrations of chlordane, dieldrin, DDT and PCBs in fish tissue and concentrations of copper, lead, zinc, chlordane, and PCBs in sediments. This section provides an overview of water quality criteria and guidelines applicable to Marina del Rey and reviews the fish tissue, and sediment and water quality data compiled for the purpose of this TMDL.

As a result of the data review conducted to prepare this section, the Regional Board concluded that some of the 303(d) listing decisions were no longer valid. Section 2.2 describes the basis for these conclusions. Pursuant to the consent decree, TMDLs are not required to address these listings and are therefore not developed.

2.1 Water Quality Standards

California state water quality standards consist of the following elements: 1) beneficial uses; 2) narrative and/or numeric WQOs; and 3) an anti-degradation policy. In California, the Regional Boards define beneficial uses in the Water Quality Control Plans (Basin Plans). Numeric and narrative objectives are specified in each region's Basin Plan. The objectives are set to be protective of the beneficial uses in each waterbody in the region and/or to protect against degradation. Numeric objectives for toxics can be found in the California Toxics Rule (40 CFR §131.38).

2.1.1 Beneficial Uses

The Basin Plan for the Los Angeles Regional Board (1994) defines 7 existing (E), beneficial uses for Marina del Rey Harbor (Table 2-1).

Table 2-1. Beneficial Uses of Marina del Rey Harbor (LARWQCB, 1994)

Coastal Feature	Hydro Unit #	NAV	REC1	REC2	COMM	MAR	WILD	SHELL
Marina del Rey Harbor	405.13	E	E	E	E	E	E	E

Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
E: Existing beneficial use

There are existing designated uses to protect aquatic life that use the marine, and wildlife habitat (MAR and WILD). There are also beneficial uses associated with human use of the habor including recreational use for water contact (REC1), non-contact water recreation (REC2), navigation (NAV), commercial and sport fishing (COMM), and shellfish harvesting (SHELL).

Discharges of toxic pollutants to the harbor back basins may result in impairments of beneficial uses associated with aquatic life (MAR and WILD), and human use of these resources (COMM, SHELL, and REC-1).

2.1.2 Water Quality Objectives (WQOs)

As stated in the Basin Plan, water quality objectives (WQOs) are intended to protect the public health and welfare and to maintain or enhance water quality in relation to the designated existing and potential beneficial uses of the water. The Basin Plan specifies both narrative and numeric water quality objectives. The following narrative water quality objectives are the most pertinent to this TMDL. These narrative WQOs may be applied to both the water column and the sediments.

> Chemical Constituents: *Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use.*
>
> Bioaccumulation: *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*.
>
> 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*.
>
> 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.*

The Regional Board's narrative toxicity objective reflects and implements national policy set by Congress. The Clean Water Act states that, "it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited." (33 U.S.C. 1251(a)(3).) In 2000, USEPA established numeric water quality objectives for several pollutants addressed in this TMDL in the California Toxics Rule (CTR) (USEPA, 2000b). The CTR establishes numeric aquatic life criteria for 23 priority toxic pollutants and numeric human health criteria for 92 priority toxic pollutants. These criteria are established to protect human health and the environment and are applicable to inland surface waters enclosed bays and estuaries.

For the protection of aquatic life, the CTR establishes short-term (acute) and long-term (chronic) criteria in both freshwater and saltwater. The acute criterion equals the highest concentration of a pollutant to which aquatic life can be exposed, for a short period of time, without deleterious effects. The chronic criterion equals the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects. Freshwater criteria apply to waters in which the salinity is equal to or less than 1 part per thousand (ppt) 95 percent or more of the time. Saltwater criteria apply to waters in which salinity is equal to or greater than 10 ppt 95 percent or more of the time. For waters in which the salinity is between 1 and 10 ppt, the more stringent of the two criteria apply.

In the CTR, freshwater and saltwater criteria for metals are expressed in terms of the dissolved fraction of the metal in the water column. These criteria were calculated based on methods in USEPA's *Summary of Revisions to Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (50 FR 30792, July 29, 1985), developed under Section 304(a) of the CWA. This methodology is used to calculate the total recoverable fraction of metals in the water column and then appropriate conversion factors, included in the CTR are applied, to calculate the dissolved criteria for metals in the water column.

The human health criteria are established to protect the general population from priority toxic pollutants regulated as carcinogens (cancer-causing substances) and are based on the consumption of water and aquatic organisms or aquatic organisms only, assuming a typical consumption of 6.5 grams per day of fish and shellfish and drinking 2.0 liters per day of water. Table 2-2 summarizes the aquatic life, and human health criteria for metals and organic constituents, covered under this TMDL.

Table 2-2. Water quality objectives established in the CTR for metals and organic compounds

Pollutant	Criteria for the Protection of Aquatic Life		Criteria for the Protection of Human Health	
	Saltwater			
	Acute (µg/L)	Chronic (µg/L)	Water & Organisms (µg/L)	Organisms only (µg/L)
Chlordane	0.09	0.004	0.00057	0.00059
Total PCBs[1]	-	0.03	0.00017	0.00017
Copper (dissolved)	4.8	3.1	1300	-
Lead (dissolved)	210	8.1	-	-
Zinc (dissolved)	90	81	-	-

[1]Based on total PCBs, the sum of all congener or isomer or homolog or aroclor analyses.

For PCBs, the Basin Plan states that, "*Pass-through or uncontrollable discharges to waters of the Region, or at locations where the waste can subsequently reach water of the Region, are limited to 70 picograms per liter (pg/L) measured as a 30 day average for protection of human health and 14 nanograms per liter (ng/L) measured as a daily average and 30 ng/L measured as a daily average to protect aquatic life in inland fresh water and estuarine waters, respectively*." The 30-day average aquatic life value for PCBs in the Basin is the same as the 4-day average value in the CTR. However, the human health 30-day average value in the Basin Plan of 70 pg/L is more stringent the CTR value of 170 pg/L, which is also a 30-day average.

There are no numeric standards for fish tissue in the Basin Plan. The human health criteria in the CTR were developed to ensure that bioaccumulative substances do not concentrate in fish tissue at levels that could impact human health.

There are no water quality objectives for sediment in the Basin Plan. The Regional Board applied best professional judgment to define elevated values for metals in sediment during the water quality assessments conducted in 1996, 1998, and 2002. The State Board is in the process of developing sediment quality objectives (SQOs) for enclosed bays and estuaries, and expects to adopt these objectives and an implementation policy by February 28, 2007. The final objectives and implementation policy would be subject to review by the Office of Administrative Law before becoming effective. The Regional Board will review the numeric targets in this TMDL for consistency with the final sediment quality objectives within six months after the effective date.

2.1.3 Antidegradation

State Board Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality Water" in California, known as the "Anti-degradation Policy," protects surface and ground waters from degradation. Any actions that can adversely affect water quality in all surface and ground waters must be consistent with the maximum benefit to the people of the state, must not unreasonably affect present and anticipated beneficial use of such water, and must not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are also subject to the federal Anti-degradation Policy (40 CFR 131.12).

2.2 Data Review

This section summarizes the data for Marina del Rey back basins for the listed toxic pollutants in water, fish and sediments. The summary includes water quality, fish tissue, and sediment quality data from different sources, for the period of 1993 to 2003.

2.2.1 Water Column

Although no water column impairments for Marina del Rey back basins were listed in the current CWA 303(d) list, this was due to a lack of data rather than an indication of no impairment. Some assessment of water quality is useful as sediment and fish tissue concentrations are ultimately impacted by water-borne inputs of contaminants. Conversely, high concentrations of contaminants in sediment have the potential to impact water quality through de-sorption of chemicals into water.

No data were available for assessing water column concentrations of metals and organic pollutants in Marina del Rey harbor at the onset of developing this TMDL. In order to bridge this data gap, the Los Angeles County Public Works (LACDPW) collected water column data for the listed contaminants in the summer of 2002 (June to July). The data collected represents the results of four sampling episodes during this period (see Table 2-3).

Table 2-3 Water column data for Basin E in Marina del Rey Harbor

Pollutant	Detection Limit	CTR chronic Target	6/6//02[1]	6/18/05[1]	7/1/02[1]	7/16/02	Average
Copper* (µg/L)	0.5	3.1	53	58	12.7	16.4	35
Lead* (µg/L)	0.5	8.1	n.d	n.d	n.d	0.52	-
Zinc* (µg/L)	1.0	81	55.2	39.4	96	43	58.4
Chlordane (µg/L)	0.05	0.004	n.d	n.d	n.d	n.d	n.d
DDT (µg/L)	0.1	0.001	n.d	n.d	n.d	n.d	n.d
Dieldrin (µg/L)	0.1	0.0019	n.d	n.d	n.d	n.d	n.d
PCB (µg/L)	0.5	0.03	n.d	n.d	n.d	n.d	n.d

*Values presented are dissolved metal concentrations, n.d: not detected.
[1]Uncertainty exists with respect to the analytical method used in obtaining this data.

Dissolved copper concentrations in Basin E ranged from 12.7 µg/L to 58 µg/L, exceeding both the CTR chronic criterion values of 3.1 µg/L, and the 4.8 µg/L acute criterion for salt water. Lead was not detected in three samples out of four and the only detectable concentration was below the acute and chronic criteria for saltwater. Only one sample exceeded the acute and chronic limits for zinc. Uncertainty exists with regard to the validity of the analytical methods with which results for the metals were obtained - the analytes were not removed from their salt matrix prior to analysis. Therefore, a finding of impairment for copper in the water column cannot be made at present. Further sample collection and analysis, using appropriate methods, will be required to make a final determination.

There is no indication that CTR standards are exceeded for any of the organic pollutants in Marina del Rey. However, this may be as a result of the use of analytical methods with detection limits that are below CTR standards. Further monitoring will be necessary to make a final determination of no impairment.

2.2.2 Fish and Shellfish Tissue

As discussed in section 2.2.1, there is limited data on water column concentrations to address the potential for bioaccumulation in fish. Analysis of fish tissue for chemical contaminants provides a more direct means for assessing impacts.

Maximum tissue residue levels (MTRLs) were developed by State Board by multiplying the human health CTR water quality objectives by the bioconcentration factor for each substance as recommended by USEPA (USEPA, 1991). These objectives represent levels that protect human health from consumption of fish and shellfish. The MTRLs are an assessment tool and do not constitute enforceable regulatory limits. MTRLs have value as alert levels indicating water bodies with potential human health concerns. However, the MTRLs are no longer used by the State to evaluate fish or shellfish tissue data for 303(d) listing purposes. Screening values have been developed by the Office of Environmental Health Hazard Assessment (OEHHA). These screening values relate human health endpoints to contaminant concentrations in fish based on an average consumption rate for fish and shellfish (California EPA OEHHA 1999).

To assess potential impairments associated with contaminant concentrations in fish tissue, we reviewed the 1996 WQA worksheets, which formed the basis for the 1998 303(d) list. Tissue data used in the assessment were data collected as part of the Toxic Substances Monitoring Program (TSMP) in 1993 and 1995 (Table 2-4).

Table 2-4. Fish tissue listing data from Toxic Substances Monitoring Program (ppb, wet weight).

Program	TSMP				SWRCB	OEHHA
Date	1993	1995	1995	1995	Maximum Tissue Residue Level (MTRL)	Screening Value (µg/kg)
Species	White Croaker	Round Stingray	Sargo	Yellow Croaker		
Number of individuals	1	1	1	1		
Chlordane	128		30.7		8.3	30
Dieldrin	5.6		5.3		0.7	2.0
Total DDTs	230		101	60	--	100
Total PCBs	490	255	59		5.3	20

The TSMP data represents the results from a single sample (White Croaker) in 1993, and three samples (Round Stingray, Sargo, and Yellow Croaker) in 1995 that were collected in Marina del Rey Harbor. The TSMP data indicate concentrations of chlordane, dieldrin, DDT, and PCBs that are above the MTRLs or OEHHA screening values.

More recent fish data was obtained for the Marina del Rey back basins during the Southern California Bight Regional Monitoring Project. Fish tissue samples were analyzed for chlordane, total DDTs, and total PCBs. In addition, the Los Angeles County Department of Beaches and Harbors (LACDBH) conducted fish tissue analysis analyses at EPA's request in 2002. Chlordane, total DDTs, and dieldrin in whole fish were analyzed. Data from both sources are presented in Table 2-4.

Table 2-5. Fish tissue listing data from Toxic Substances Monitoring Program (ppb, wet weight).

Source/Date	**Bight 98**				**LACDBH 2002**	**OEHHA**
Location	MdR Basin D/E	MdR Basin H	MdR Main Channel - Entrance	MdR Main Channel - Center	MdR back basins	Screening Value (µg/kg)
Species	California Halibut	California Halibut	California Halibut	California Halibut	White Croaker	
Number of individuals	1	1	1	1	6	
Chlordane	0	0	0	2.4	<1	30
Dieldrin	n.a	n.a	n.a	n.a	<1	2.0
Total DDTs	7.4	8.8	18.6	35.2	74.4	100
Total PCBs	7	10.8	23	50.2	n.a	20

* 6 fish merged into one composite sample

The (Bight 98) data indicates that total DDT and chlordane are below the fish screening values at all locations in the harbor. Total PCB concentration in fish tissue exceeded the fish target in 2 of 4 samples in the harbor. Dieldrin was not measured for the Bight 98 studies. Additional data from the LACDBH 2002 analyses showed chlordane and dieldrin to be undetectable and total DDTs to be below screening values. These more recent data indicate that total PCBs are currently the only fish tissue impairment.

2.2.3 Sediment

Assessment of the extent of sediment impairment was based on data from the following sources:

Bay Protection and Toxic Cleanup Program Data (BPTCP): Sampling was conducted in January 93, February 94, June 96 and February 97 at different locations in the Marina del Rey Harbor. This assessment included three sampling locations in the back harbor (1 in Basin D and 2 in Basin E). The samples were analyzed for sediment chemistry and toxicity.

Los Angeles County Department of Beaches and Harbors (LACDBH 1996 –2004): This annual Marina del Rey Harbor sampling program is conducted by the Los Angeles County Department of Beaches and Harbors. The samples were taken from different locations throughout the harbor, including 4 stations in the back basins (1 in Basin D, 2 in Basin E, and 1 in Basin F). The samples were analyzed for sediment chemistry, benthic community index, water column general chemistry and physical parameters, and bacteria.

Southern California Bight Regional Monitoring Project (Bight 98): provides an integrated assessment of Southern California coastal estuaries. The samples were collected in summer of 1998 and were analyzed for sediment chemistry, toxicity (solid phase, elutriate test and enzyme induced), bioaccumulation in whole fish (juvenile California Halibut) and AVS/SEM for metals. The samples included three stations in the Marina del Rey back basin (Basin D and Basin E).

Data from these sources are presented and evaluated in Table 2-6 through 2-9.

Table 2.6: Summary of Sediment Quality Data for Marina del Rey's back basins (96-03).

Date	Location	Pollutants of Concern (metals in mg/Kg and organics in µg/Kg)				
	Basin D	**Cu**	**Pb**	**Zn**	**Chlordane**	**Total PCBs**
Jun-96	BPTCP (#48002)	320	52.2	520	11.15	130.2
Oct-95	LACDBH (#8)	367	81	387	<20	
Oct-96		210	57.2	213	<0.3	<20
Oct-97		300	92	320	<0.4	<20
Oct-98		242	62	238	<0.4	<20
Oct-99		312	91	320	<0.4	<20
Oct-00		307	76	320	<0.4	<20
Oct-01		354	79	293	<2	22.66
Oct-02		330	105	322	<2	<1
Oct-03		351	72	445	<2	<1
	Basin E					
Jan-93	BPTCP (#44014)	550	240	620	22.1	308.9
Feb-94		427	171	636	38.1	391.5
Jun-96		321	149	400	24.9	237.9
Jun-96	BPTCP (#48001)	266	206	496	14.87	165.3
Oct-95	LACDBH (#10)	299	177	455	110	
Oct-96		314	292	440	2	<20
Oct-97		380	210	480	3	<20
Oct-98		172	106	320	<1.4	<20
Oct-99		108	51	157	<0.3	<20
Oct-00		147	88	252	<0.4	<20
Oct-01		122	45	155	<2	50.06
Oct-02		241	89	335	<1	59.7
Oct-03		362	109	648	<2	<1
Oct-95	LACDBH (#11)	373	95	423	<20	
Oct-96		346	114	426	0.5	<20
Oct-97		390	120	390	<0.5	<20
Oct-98		312	113	390	<1.1	<20
Oct-99		450	128	450	<0.4	<20
Oct-00		420	103	390	<0.5	<20
Oct-01		359	106	339	<2	58.82
Oct-02		433	109	451	5.3	93.3
Oct-03		403	96	523	<2	<1
1998	Bight 98 (2443)	146.5	117.5			177.31
1998	Bight 98 (2444)	263	98.6			20.1
	Basin F					
Oct-95	LACDBH (#9)	380	115	419	<20	
Oct-96		346	141	382	0.6	<20
Oct-97		360	140	370	<0.5	<20
Oct-98		320	116	360	<1.2	<20
Oct-99		390	149	410	<0.5	<20
Oct-00		167	105	245	<0.5	<30
Oct-01		333	143	324	<2	137.12
Oct-02		368	187	396	<2.15	101.6
Oct-03		294	95	371	<2	<1

No. of samples	**43**	**43**	**41**	**41**	**39**
Average	**318**	**118**	**386**		
Min.	**108**	**45**	**155**	**<0.3**	**<1**
Max.	**550**	**292**	**648**	**110**	**391.5**

The sediment contaminants were evaluated relative to sediment quality guidelines (SQGs), specifically the values for Effects Range-Low (ERL), Effects Range-Median (ERM) (Long et al., 1995), Threshold Effects Level (TEL), and Probable Effects Level (PEL) (MacDonald, 1994). These SQGs are based on empirical data compiled from numerous field and laboratory studies performed in North America.

The National Oceanic Atmospheric Administration (Long et al., 1995) assembled data from throughout the country that correlated chemical concentrations in sediments with effects. These data included spiked bioassay results and field data of matched biological effects and chemistry. The product of the analysis is the identification of two concentrations for each substance evaluated. The ERL values were set at the 10th percentile of the ranked data and represent the point below which adverse biological effects are not expected to occur. The ERM values were set at the 50th percentile and are interpreted as the point above which adverse effects are expected.

The TEL and PEL values were developed by the State of Florida and were based on a biological effects empirical approach similar to the ERLs/ERMs. The development of the TELs and PELs differ from the development of the ERLs and ERMs in that data showing no effects were incorporated into the analysis. In the Florida weight-of-evidence approach, two databases were assembled: a "no-effects" database and an "effects" database. Taking the geometric mean of the 15th percentile value in the effects database and the 50th percentile value of the no-effects database generated the TEL values. The PEL values were generated by taking the geometric mean of the 50th percentile value in the effects database and the 85th percentile value of the no-effects database. By including the no-effect data in the analysis, a clearer picture of the chemical concentrations associated with the three ranges of concern (no effects, possible effects, and probable effects) can be established.

The ERLs and TELs are presumed to be non-toxic levels with a high degree of confidence of no potential threat. The ERMs and PELs identify pollutant concentrations that are more probably elevated due to toxic levels. In the "*Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) Lis*t," ERMs for copper, zinc, and chlordane, and the PEL value for lead, are identified as the guidelines most predictive of biological effects (SWRCB, 2004). The listing policy also identifies a consensus-based SQG for total PCBs as most predictive of biological effects. Table 2-7.summarizes these guidelines.

Table 2-7. Summary of marine sediment quality guidelines used in assessment of TMDL pollutants

Organics	ERL (µg/kg)	ERM (µg/kg)	TEL (µg/kg)	PEL (µg/kg)	Consensus-based SQG (µg/kg)
Chlordane	0.5	6*	2.26	4.79	
Total PCBs	22.7	180	21.6	189	400*
Metals	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	
Copper	34	270*	18.7	108	
Lead	46.7	218	30.2	112*	
Zinc	150	410*	124	271	

*SQGs most predictive of biological effects (CSWRCB, 2004).

As shown in Table 2-6, several sediment samples had chlordane and total PCBs in concentrations at or below detection limits; and, in some cases, the detection limits were greater than the SQG. In Table 2-8, the detection limits were treated as the actual concentration when evaluating the sediment data.

Table 2-8. Evaluation of sediment data relative to sediment quality guidelines

Pollutant	Number of samples	# >DL	# > ERL	# > ERM	# > TEL	# > PEL	# > Other SQG
Copper	**43**	**43**	**43**	**32**	**43**	**42**	**n.a**
Lead	**43**	**43**	**42**	**2**	**40**	**19**	**n.a**
Zinc	**41**	**41**	**41**	**15**	**41**	**35**	**n.a**
Chlordane	**41**	**11**	**27**	**9**	**11**	**10**	**n.a**
PCBs	**39**	**14**	**13**	**3**	**14**	**3**	**0**

n.a not applicable

Organics in Sediments

Chlordane was detected in 11 out of 41 sediment samples used for this assessment. In 16 of the 41 samples the detection limit was above the SQGs. Based on the assumption that the detection limit is the actual concentration, 9 of 41 samples exceeded the ERM value. This number of exceedances of the ERM value indicates that chlordane remains an impairment in the harbor sediment.

Total PCBs were detected 14 out of 39 sediment samples. Concentrations ranged from <1 to 391.5 µg/kg (calculated as the sum of the congeners). Treating detection limits as true values, 3 out of the 39 samples had concentrations greater than ERM and no samples were greater than the consensus-based SQG value of 400 µg/Kg. While there are no exceedances of the SQG value for total PCBs, the elevated levels of this pollutant in fish tissue would make a determination of no impairment premature.

Metals in Sediments

Copper was detected in all sediment samples from Basins D, E, and F of Marina del Rey Harbor. Sediment concentrations ranged from 108 to 550 mg/kg. All 43 samples were above ERL guidelines, and 32 of 43 exceeded the ERM value. Copper remains at elevated concentrations within Marina del Rey's back basins.

All sediment samples had detectable lead concentrations. Lead in the sediments of Marina del Rey's back basins ranged from 45 to 292 mg/kg. Samples from Basins E and F exhibited higher lead levels than those from Basin D. The PEL guideline was exceeded in 19 of 43 samples, which indicates a continuing impairment in the sediments of the back basin.

Zinc concentrations in the sediment samples ranged from 155 to 648 mg/kg in Marina del Rey's back basins. All 41 samples exceeded the ERL values, and 15 of 41 samples exceeded the ERM guideline, confirming the zinc impairment.

Sediment Toxicity

Sediment toxicity data for the Marina del Rey back basins is presented in Table 2-9. These data were compiled from the Bay Protection and Toxic Cleanup Program (BPTCP) from 1993 to 1997 and the Southern California Bight 1998 Regional Monitoring Program (Bight 98). The reported data shows sediment toxicity in seven of nine samples.

Table 2-9 Sediment Toxicity Data for Marina del Rey's Back Basins – Amphipod Survival Rates

Source	Date	Location	Specie	Survival
BPTCP	1/14/93	Basin E (#44014)	Rhepoxynius	53% (T)
	2/15/94	Basin E (#48001)	Rhepoxynius	32% (T)
	2/15/94	Basin E (#48001)	Rhepoxynius	42% (T)
	2/15/94	Basin E (#48001)	Rhepoxynius	35% (T)
	6/19/96	Basin E (#44014)	Eohaustorius	92% (NT)
	2/5/97	Basin E (#48001)	Eohaustorius	49% (T)
	2/5/97	Basin D (#48002)	Eohaustorius	65% (T)
Bight 98	Summer 1998	Basin E (#2443)	Eohaustorius	66% (T)
	Summer 1998	Basin E (#2444)	Eohaustorius	79% (NT)

T – toxic, NT = non toxic

2.3 Summary and Findings concerning TMDLs Required

There is indication of water column impairment by dissolved copper in Marina del Rey Harbor. However due to the uncertainty involved with the method used for sample analysis, further monitoring is necessary to make a final determination. Sediment concentrations of copper, lead, zinc, and chlordane remain elevated, while total PCBs meet the State's de-listing criteria. However, more recent fish tissue data indicates that total PCB concentrations are above fish tissue targets; while fish tissue levels of chlordane, dieldrin and total DDTs are below the fish tissue targets.

This TMDL will be developed to reduce sediment impairment by copper, lead, zinc, and chlordane. In addition, the fish tissue impairment by total PCBs will be addressed. Based on the above assessment of available data, fish tissue impairment by chlordane, dieldrin and DDTs, do not require a TMDL. Sediment toxicity and the fish consumption advisory impairments will be mitigated through implementing TMDLs for the listed pollutants.

3 NUMERIC TARGETS

Numeric Targets for this TMDL are used to calculate waste load allocations for the impairing metals and organic compounds, and/or to indicate attainment of water quality objectives. Sediment quality guidelines are used to calculate the TMDLs for the copper, lead, zinc, and chlordane impairments in sediments. Water criteria, fish tissue and sediment quality guidelines are selected as numeric targets for the total PCB fish tissue impairment. The sediment target for total PCBs is the primary numeric target, which is used to calculate the TMDL and allocations. Water quality objectives and fish tissue guidelines for total PCBs are secondary targets that will provide additional means of assessing success in attaining water quality standards, including the narrative toxicity objective.

3.1 Sediment Numeric Targets

Numeric targets that are protective of aquatic life beneficial uses are developed for copper, lead, zinc, total PCBs and chlordane in sediments. While the PCB impairment occurs in fish tissue only, a sediment target is necessary as PCBs are directly associated with sediments which are the transport mechanism of these compounds from the Marina del Rey watershed to the harbor. As discussed in Section 2, the Basin Plan provides narrative objectives that can be applied to sediments but does not provide numeric WQOs for sediment quality. To develop the TMDLs, it is necessary to translate the narrative objectives into numeric targets that identify the measurable endpoint or goal of the TMDL and represent attainment of applicable numeric and narrative water quality standards.

Sediment quality guidelines compiled by National Oceanic and Atmospheric Administration (NOAA) are used in evaluating waterbodies within the Los Angeles Region for development of the 303(d) list. The sediment quality guidelines are applicable numeric targets because the impairments and the 303(d) listings are primarily based on sediment quality data. In addition, the pollutants being addressed have a high affinity for particles and the delivery of these pollutants is generally associated with the transport of suspended solids from the watershed or from sediments within the harbor.

The ERLs (Long et al., 1995) guidelines are established as the numeric targets for sediments in Marina del Rey's back basins, as summarized in Table 3-2. The State Board listing policy recommends the use of ERMs, PELs, and other SQGs as a threshold for listing. ERM and PEL values are interpreted as levels above which the adverse biological effects are expected, which makes them applicable in the determination of impairment. The ERL values, on the other hand, represent the levels below which adverse biological effects are not expected to occur, and are more applicable to the prevention of impairment. These SQGs are discussed in greater detail in Section 2.2.3. The goal of the TMDL is to remove impairment and restore beneficial uses; therefore, the ERLs are selected as numeric targets over the ERMs to limit adverse effects to aquatic life. The selection of the ERLs, which are lower than ERMs, provides an implicit margin of safety.

Table 3-1. Numeric targets for sediment quality in Marina del Rey's back basins

Organics	Numeric Target for Sediment
Chlordane	0.5 µg/kg
Total PCBs	22.7 µg/kg
Copper	34 mg/kg
Lead	46.7 mg/kg
Zinc	150 mg/kg

3.2 Water Quality Criteria

The California Toxics Rule (CTR) Criterion for the protection of human health from the consumption of aquatic organisms is selected as the final numeric target for total PCBs in the water column. However, given the inability of current analytical methods to detect concentrations at this low level, an interim numeric target will be applied. The CTR Chronic Criterion for the protection of aquatic life in saltwater is selected as the interim numeric target for the fish tissue impairment by PCBs. This numeric target will remain in effect until advances in technology allow for analysis of PCBs at lower detection limits. The interim and final numeric targets for total PCBs in the water column are provided in Table 3-2. As discussed in Section 3, this secondary target will serve as a means of gauging improvements in water quality, and not as a basis for calculating TMDL allocations.

Table 3-2: Numeric Targets for total PCBs in the water column

	Numeric Targets (µg/L)
Interim	0.00017
Final	0.03

3.3 Fish Tissue Target

The fish tissue target of 5.3 µg/Kg for total PCBs is derived from CTR human health criteria, which are adopted criteria for water designated to protect humans from consumption of contaminated fish or other aquatic organisms. The derived fish tissue target is referred to as the Threshold Tissue Residue Level (TTRL), in this document. Use of a fish tissue target is appropriate to account for uncertainties in the relationship between pollutant loadings and beneficial use effects (EPA, Newport Bay TMDL, 2002) and directly addresses human health impacts from consumption of contaminated fish or other aquatic organisms. While the detection limit for total PCBs in water is currently higher than the CTR criteria for the protection of human health, the TTRL numeric target is detectable with current technology; making compliance monitoring feasible. Thus, the TTRL provides an effective method for accurately quantifying achievement of the water quality objectives.

3.3.1. Deriviation of the Treshold Tissue Residue Level (TTRL)

The TTRL value of 5.3 μg/Kg for total PCBs is derived from the CTR human health criteria for consumption of organisms only (i.e. 0.00017 μg/L). CTR criteria were developed by determining pollutant concentrations in edible fish tissue that would pose a health risk to humans consuming 6.5 grams of fish per day. These fish tissue concentrations were converted to water column concentrations using a bioconcentration factor (BCF), which is the ratio of the chemical concentration in fish to the chemical concentration in water. The TTRL was derived by reverting back to the original fish tissue concentration upon which the human health criteria are based (see equation 3-1). This was the same approach used in the Calleguas Creek OC Pesticides and PCBs TMDL (LARWQCB, 2005a).

$$\text{TTRL} = \text{CTR criterion} \times \text{BCF} \qquad \text{(equation 3-1)}$$

TTRL = Threshold Tissue Residue Level μg/Kg
CTR criterion = 0.00017 μg/L
BCF = Bioconcentration Factor = 31200 L/Kg

4 SOURCE ASSESSMENT

This section identifies the potential sources of metals and organochlorine compounds to Marina del Rey's back basins. The toxic pollutants can enter surface waters from both point and non-point sources. Point sources typically include discharges from a discrete human-engineered point. These types of discharges are regulated through the federal National Pollutant Discharge Elimination System (NPDES) program, which the Regional Boards have been delegated to implement through the issuance of Waste Discharge Requirements (WDRs). In Los Angeles County urban runoff to Marina del Rey is regulated under storm water NPDES permits, which are regulated as a point source discharge. Non-point sources, by definition, include pollutants that reach surface waters from a number of diffuse land uses and activities that are not regulated through NPDES permits. Examples of non-point sources in the Marina del Rey Watershed include atmospheric deposition and boat discharges.

4.1 Background on Toxic Pollutants

The following sections provide background information on the toxic pollutants addressed in this TMDL, including their properties and uses.

4.1.1 Organic Pollutants

Chlordane was used as a pesticide to control insects on agricultural crops, residential lawns and gardens, and in buildings, particularly for termite control. In 1988, all chlordane uses, except for fire ant control, were voluntarily cancelled in the United States (NPTN, [undated]). Chlordane can still be legally manufactured in the United States for sale or use by foreign countries. Although it is no longer used in the US, chlordane persists in the environment, adhering strongly to soil particles. It is assumed that the only source of chlordane in the watershed is storm water runoff carrying historically deposited chlordane most likely attached to eroded sediment particles.

Polychlorinated biphenyls (PCBs) are mixtures of up to 209 individual chlorinated compounds (known as congeners). They were used in a wide variety of applications, including dielectric fluids in transformers and capacitors, heat transfer fluids, and lubricants. In 1976, the manufacture of PCBs was prohibited because of evidence they build up in the environment and can cause harmful health effects. Although it is now illegal to manufacture, distribute, or use PCBs, these synthetic oils were used for many years as insulating fluids in electrical transformers and in other products such as cutting oils. Products made before 1977, which may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils. Historically, PCBs have been introduced into the environment through discharges from point sources and through spills and accidental releases. Although point source contributions are now controlled, non-point sources may still exist, for example, refuse sites and abandoned facilities may still contribute PCBs to the environment. Once in a waterbody, PCBs become associated with solid particles and typically enter sediments (USEPA, 2002).

4.1.2 Metals

Potential anthropogenic sources of copper include corrosion of brass and copper pipe be acidic waters, copper brake pads, the use of copper compounds as aquatic algaecides, sewage treatment plant effluents, runoff and groundwater contamination for agricultural uses of copper as fungicides and pesticides, and effluents from industrial sources. Major industrial sources include mining, smelting and refining industries, copper wire mills, coal burning industries and iron and steel producing industries (MacDonald, 1994). Boats are another source of copper in the in Marina del Rey harbor. Copper is leached constantly from the anti-fouling paints used on boats to effectively reduce fouling organisms. Underwater hull cleaning also contributes copper to the harbor.

The single largest use of lead is in the production of lead-zinc batteries. Lead and its compounds are used in electroplating, metallurgy, construction materials, coating and dyes, electronic equipment, plastics, veterinary medicines, fuels and radiation shielding. Lead is also used for ammunition, corrosive-liquid containers, paints, glassware, fabricating storage tank linings, transporting radioactive materials, solder, piping, cable sheathing, and roofing (MacDonald, 1994). Prior, to the phasing out of leaded gasoline, lead additives in gasoline was a significant source of lead in the environment. Since the phasing out of leaded gasoline, there has been a gradual decline of lead concentrations in the environment.

Zinc is primarily used as a coating on iron and steel to protect against corrosion, in alloys for die-casting, in brass, in dry batteries, in roofing and exterior fittings for buildings, and in some printing processes. The principal sources of zinc in the environment include smelting and refining activities, wood combustion, waste incineration, iron and steel production, and tire wear (MacDonald, 1994). A tire contains about half a pound of zinc, which is needed to cure the rubber (America Zinc Association). In Marina del Rey harbor, the use of sacrificial zinc anodes to prevent corrosion on boats, is a potential source of zinc.

4.2 Point Sources

A point source, according to 40 CFR 122.3, is defined as "any discernable, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged." The NPDES Program, under CWA sections 318, 402, and 405, requires permits for the discharge of pollutants from point sources.

The NPDES permits in the Marina del Rey Watershed include the MS4 and Caltrans Storm Water Permits, general construction storm water permits, general industrial storm water permits, and general NPDES permits (Table 4-1).

Table 4-1. NPDES Permits in the Marina del Rey Watershed

Type of NPDES Permit	Number of Permits
Municipal Storm Water	1
California Department of Transportation Storm Water	1
General Construction Storm Water Tradewind Apartments Marina Point III Apartments Marina Waterside	3
General Industrial Storm Water Fed Ex Windward Yatch & Repair Seamark Boatyard	3
Total	**8**

4.2.1 Stormwater Runofff

Storm water runoff in the Marina del Rey watershed is regulated through a number of permits. The first is the municipal separate storm sewer system (MS4) permit issued to the County of Los Angeles and its co-permittees. The second is a separate statewide storm water permit specifically for the California Department of Transportation (Caltrans). The third is the statewide Construction Activities Storm Water General Permit and the fourth is the statewide Industrial Activities Storm Water General Permit. The permitting process defines these discharges as point sources because the storm water discharges from the end of a storm water conveyance system. Since the industrial and construction storm water discharges are enrolled under NPDES permits, these discharges are treated as point sources in this TMDL.

The Oxford Street Flood Control Basin (OSFCB) and the Washington Street (Palawan Way) drain are two major stormwater conduits with direct drainage into the back basin E. OSFCB is a sump for street drainage, from the community north and east of the marina, draining into Basin E through a tide gate. The Washington Street conduit drains an area north west of the Marina. The runoff carries relatively high contaminant concentration into sheltered, low energy areas such as Basin E and F. The OSFCB serves as a settling basin and detention basin for the major stormwater inflows to the back harbor. Many studies suggested that the OSFCB may be a significant contributor of contaminants in the back basins based on the high contamination levels in the drainage basin and the correlation between back harbor and OSFCB concentrations during storm events (Soule et al. studies 1977, 1984, Los Angeles County Department of Beaches and Harbors 1996-2004).

A GIS based Pollutant Loading Model (PLOAD) was used to calculate stormwater pollutant loads for total and dissolved copper, lead and zinc for Marina del Rey's sub-watersheds (Table 4-2). The detailed calculations are included in Appendix A The loadings for metals were calculated based on the stormwater event mean concentrations (EMCs) analyzed by the Los Angeles County Department Public Works (LADPW) from 1994 to 2000 for eight land use types. EMCs values for organochlorine pesticides and PCBs were not available due to non-detectable levels in stormwater.

Table 4-2. Annual Loading from Stormwater Water Runoff for Metals (lb/year)

Sub-watershed	Total Suspended Solids	Total Copper	Dissolved Copper	Total Lead	Dissolved Lead	Total Zinc	Dissolved Zinc
Average Rain Year							
Area 1A	21,933	9.9	4.4	3.3	0.0	71	47.9
Area 3	7,788	1.4	0.8	0.8	0	13	7.6
Area 4	111,742	23	12.4	9.8	0	218	153.7
TOTAL	**141,463**	**34.3**	**17.6**	**13.9**	**0**	**302**	**209**
Dry Rain Year							
Area 1A	10,231	4.6	2.0	1.5	0.0	33.2	22.4
Area 3	3,633.	0.7	0.4	0.4	0	5.8	3.6
Area 4	52,127	10.7	5.8	4.6	0	101.8	71.7
TOTAL	**65,992**	**16**	**11.5**	**9.2**	**0**	**199**	**136**
Wet Rain Year							
Area 1A	38,153	17.3	7.6	5.8	0.0	124.0	83.4
Area 3	13,547	2.4	1.4	1.3	0	21.7	13.3
Area 4	194,378	39.9	21.5	17	0	379.6	267.4
TOTAL	**246,078**	**59.6**	**30.5**	**24.1**	**0**	**525**	**364**

4.2.2 Summary Point Sources

Urban storm water has been recognized as a substantial source of metals (Characklis and Wiesner 1997, Davis et al. 2001, Buffleben et al. 2002) and organic pollutants (Suffet and Stenstrom, 1997). This is reflected in routine storm water monitoring performed by LACDPW under the MS4 permit (LACDPW, 2002). Studies have also shown that dry-weather pollutant loadings are not insignificant (McPherson et al., 2002).

The Oxford Street Flood Control Basin (OSFCB) and the Washington Street (Palawan way) drain are two major stormwater conduits with direct drainage into the back basin E. In the Marina del Rey Watershed storm water discharges are regulated under the MS4 permit, the Caltrans permit, the general industrial storm water permit and the general construction storm water permit. There are also two non-storm water general permits with low potential to contribute significant loadings to the system.

The most prevalent metals in urban storm water (i.e., copper, lead and zinc) are consistently associated with the suspended solids (Sansalone and Buchberger 1997, Davis et al. 2001). These metals are typically associated with fine particles in storm water runoff (Characklis and Wiesner 1997, Liebens 2001), and have the potential to accumulate in estuarine sediments posing a risk of toxicity (Williamson and Morrisey, 2000). The organic contaminants in storm water are also associated with suspended solids and the particulate fraction.

A major contributor of associated metals, and organic compounds to Marina del Rey Harbor is assumed to be wet-weather runoff discharged from the storm water conveyance system. While the loadings of metals are attributable to ongoing activities in the watershed, the loadings of chlordane and PCBs, reflect historic uses. Although the uses of these compounds are banned, these legacy pollutants continue to be detected in sediments at elevated levels.

4.3 Nonpoint Sources

Marina activities and atmospheric deposition are the major non-point sources of contaminants in the Marina del Rey watershed.

4.3.1. Marina Activities

Elevated metal concentrations occur in the middle and back basins of Marina del Rey Harbor. The numerous boats that utilize the Marina are a likely contributor to the metals impairment in this area. Boats have metal components and engines that constantly corrode from salt water and air. Anti-fouling paints contain heavy metals such as copper that are designed to constantly ablate or leach out (passive leaching) to effectively reduce fouling organisms. Lead and zinc concentrations were also found in high amounts in the back harbor sediments. These metals might have originated from the historical industrial land uses of the Marina or have been derived from boating activity, including copper and lead in the boat paints, and zinc in the anodes of boat engines.

4.3.1.1 Copper Loading from Recreational Boats

Copper inputs from recreational boats to Marina del Rey back basins were estimated based on information obtained from the Dissolved Copper TMDL for Shelter Island Yacht Basin (SIYB), which was developed by the San Diego Regional Water Quality Control Board (SDRWQCB, 2005). The San Diego TMDL, adopted on March 9, 2005 , provides dissolved copper loading equations for both passive leaching from wetted hull surfaces, and from underwater hull cleaning (i.e. wiping down the wetted surface to remove marine growth). Local conditions (number of moored boats) were applied for Marina del Rey. Parameters such as mean boat length and wetted surface area were assumed to be the same as in the SIYB. Passive leaching and hull cleaning were estimated to contribute approximately 3,693-lb/year and 47.6 lbs lb/year of dissolved copper, respectively to the Marina del Rey back harbor. Details of these calculations are provided in the Appendix B.

Copper in the water column can accumulate in sediment through adsorption or by partitioning in pore water. In this way, sediment acts as a “sink” for copper in the water column, and concentration levels can build up and persist over time. The rate of contamination of sediment is dependent on a variety of factors including sediment type and quality, organic matter content and the degree of contamination in the water column and associated sediment (SIYB TMDL, 2005). The poor flushing in the harbor’s back basins increases the likelihood of dissolved copper partitioning to the sediment. However, there is insufficient information available to quantify copper loading to the sediment from boat discharges. This TMDL will require a study designed to estimate copper partitioning between the water column and sediment.

4.3.2 Atmospheric Deposition

Direct deposition of airborne particles to the water surface may be responsible for contributing copper, lead and zinc to the Marina del Rey back basins. Indirect deposition from air to land and subsequent wash into the back basins is accounted for in the stormwater runoff estimates. Indirect and direct deposition of metals to surface water was estimated from dry deposition fluxes in the Los Angeles coastal region presented in Sabin et al., (2004). Table 4-3 shows that the direct air deposition is a relatively small source for the metals impairment.

Table 4-3. Estimate of Atmospheric Deposition of Metals to Surface Water

Metals	Direct Deposition (kg/yr)	Indirect Deposition (kg/yr)
Copper	0.14	29
Lead	0.09	22
Zinc	0.46	144

5 LINKAGE ANALYSIS, TMDL AND POLLUTANT ALLOCATION

The linkage analysis is used to identify the assimilative capacity of the receiving water for the pollutant of concern by linking the source loading information to the water quality target. The TMDL is then divided among existing pollutant sources through the calculation of load and waste load allocations. This section discusses the linkage analysis used for Marina del Rey's back basins and identifies the resulting pollutant allocations.

The goals of the Marina del Rey Toxics TMDL is to reduce pollutant loads of copper, lead, zinc, chlordane, and PCBs from the Marina del Rey watershed to the sediments back basins of its harbor. The TMDL is also intended to reduce elevated levels PCBs in fish tissue.

The impairing contaminants in sediment are associated with fine-grained particles that are delivered to the sediments through suspended solids in stormwater. It is expected that reductions in loadings of these pollutants will lead to reductions in sediment concentrations over time. The existing contaminants in surface sediments will be removed over time as sediments are scoured during storms or removed in dredging operations. For the legacy pollutants (chlordane and PCBs), some loss will also occur through the slow decay and breakdown of these organic compounds. Concentrations in surface sediments will be reduced through mixing with cleaner sediments. Attenuation of pollutant concentration levels in sediment is expected to translate to reductions in fish tissue contaminant levels. Also see Section 3.1 herein.

5.1 Loading Capacity

The loading capacity of the sediments was estimated from the annual average total suspended solids (TSS) loading to the back basins of Marina del Rey Harbor, as estimated from the PLOAD model (Table 5-1). While the TSS load may not represent the total sediment loading to the harbor, it represents the finer material with which pollutants are more readily associated.

Table 5-1. Average Annual Total Suspended Solids (TSS) Loading to Marina del Rey

Subwatershed	TSS (lbs/year)	TSS (kg/year)
Area 1A	21933	9,948
Area 3	7,788	3,533
Area 4	111,742	50,685
Total	**141,463**	**64166**

Assuming fine sediments carried by stormwater to be the main source of contaminated sediments to the back basins, pollutant specific loading capacity was calculated by multiplying the average annual total suspended solids load 64,166 kg/yr discharged to the harbor by the numeric sediment targets (Table 3-2). The resultant numbers are presented in Table 5-2. The TMDL for sediment is set equal to the loading capacity.

Table 5-2. Sediment Loading Capacity Expressed as Mass per Year

Metals	Numeric Target ERL (mg/kg)	TMDL (kg/year)
Copper	34	2.18
Lead	46.7	3.0
Zinc	150	9.6
Organics	**ERL (µg/kg)**	**TMDL(g/year)**
Chlordane	0.5	0.03
PCBs	22.7	1.46

5.1.1 Critical Conditions

The amount of total suspended solids in stormwater run-off is a function of the storms, which are highly variable between years. The TMDL is based on a TSS load derived from long-term average rainfall over a 52-year period from 1948 to 2000. This time period contains a wide range of storm storms in the Marina del Rey watershed. Use of the average condition for the TMDL is appropriate because issues of sediment effects on benthic communities and potential for bioaccumulation to higher trophic levels occurs over long time periods.

5.1.2 Margin of Safety

TMDLs must include a margin of safety to account for any uncertainty concerning the relationships between sources, and water and sediment quality. An implicit margin of safety is applied through the use of more protective SQG values. The ERLs were selected over the higher ERMs as the numeric targets.

5.2 Allocations

Contaminated sediment generated in the watershed is transported to Marina del Rey's back basins through the storm water conveyance system. These are regulated directly in the NPDES process through storm water permits or indirectly through the issuance of NPDES permits for discharges to the storm water system. A mass-based load allocation was developed for direct atmospheric deposition. A grouped mass-based waste load allocation was developed for storm water permittees (Los Angeles County MS4, Caltrans, General Industrial and General Construction) by subtracting the mass-based load allocations from the total loading capacity according to the following equation:

TMDL = Direct Atmospheric Deposition + Combined Storm Water Sources (5-1)

Concentration-based sediment waste load allocations are developed for other point sources in the watershed. These other point sources have intermittent flows and should discharge little to no sediment. These sources will have a minor impact on sediment loading if they are limited by concentration to the applicable ERL-based waste load allocations.

5.2.1 Load Allocations

A mass-based load allocation is developed for direct atmospheric deposition. An estimate of direct atmospheric deposition was developed based on the percent area of surface water, within the watershed area of the back basins, which is approximately 52 acres or 5.4% of the total watershed area. The load allocation for atmospheric deposition is calculated by multiplying this percentage by the total loading capacity, according to the following equation:

Direct Atmospheric Deposition = 0.054 x TMDL (5-2)

The loadings associated with indirect atmospheric deposition are included in the stormwater waste load allocations.

There will be no load allocations assigned to boat discharges at this time, as contribution from water column concentrations to sediment loading cannot be quantified. Upon completion of a study designed to obtain such information, the TMDL will be revised as necessary.

5.2.2 Waste Load Allocation for Storm Water

A mass-based waste load allocation, for the impairing pollutants in sediment, is developed for the storm water permittees according to the following equation:

Combined Storm Water Sources = TMDL - Direct Atmospheric Deposition (5-3)

Since, the direct atmospheric deposition is calculated as a percentage of the total loading capacity equation 5-3 becomes:

Combined Storm Water Sources = TMDL – 0. 054 TMDL (5-4)

Combined Storm Water Sources = 0.946 x TMDL (5-5)

For accounting purposes, it is assumed that Caltrans and the general stormwater permittees discharge entirely to the MS4 system. This assumption has been supported though review of the permits. The resulting allocations are presented in Table 5-3.

Table 5-3. Mass-based Allocations

Metals	**Direct Air (kg/yr)**	**Stormwater (kg/yr)**
Copper	0.12	2.06
Lead	0.16	2.83
Zinc	0.52	9.11
Organics	**Direct Air (g/yr)**	**Stormwater (g/yr)**
Chlordane	0.002	0.03
PCBs	0.079	1.38

USEPA requires that waste load allocations be developed for NPDES-regulated storm water discharges. Allocations for NPDES-regulated storm water discharges from multiple point sources may be expressed as a single categorical waste load allocation when data and information are insufficient to assign each source or outfall individual allocations. The combined storm water waste load allocation is divided among the four storm water permittees (MS4, Caltrans, general industrial and general construction) based on an estimate of the percentage of land area covered under each permit (Table 5-4).

Table 5-4. Areal extent of watershed and percent area covered under storm water permits

Category	**Area in acres**	**Percent area**
MS4 Permit	880	91.9
Caltrans Storm Water Permit	9.58	1
General Construction Storm Water Permit	14.5	1.5
General Industrial Storm Water Permit	2	0.2
Water (LA for direct atmospheric deposition)	52	5.4
Total	**958**	**100**

Based on these areas, the waste load allocations for each storm water permittee are presented in Table 5-5. In the storm water permits, permit writers may translate the numeric waste load allocations to BMPs, based on BMP performance data. It is anticipated that reductions will be achieved either through pollutant control measures or sediment control measures.

Table 5-5. Combined storm water allocation apportioned based on percent of watershed.

Metals	**General Construction permittees (kg/yr)**	**General Industrial permittees (kg/yr)**	**Caltrans (kg/yr)**	**MS4 Permittees (kg/yr)**
Copper	0.033	0.004	0.022	2.01
Lead	0.045	0.006	0.030	2.75
Zinc	0.144	0.018	0.096	8.85
Organics	**General Construction permittees (g/yr)**	**General Industrial permittees (g/yr)**	**Caltrans (g/yr)**	**MS4 Permittees (g/yr)**
Chlordane	0.0005	0.0001	0.0003	0.03
PCBs	0.0219	0.0029	0.015	1.34

Each storm water permittee enrolled under the general construction or industrial storm water permits will receive individual waste load allocations on a per acre basis, based on the acreage of their facility as presented in Table 5-6.

Table 5-6. Per acre waste load allocation for an individual general construction or industrial storm water permittee (g/day/ac).

Metals	Individual General Construction or Individual General Industrial Permittee (g/yr/ac)
Copper	2.3
Lead	3.1
Zinc	10
Organics	**(mg/yr/ac)**
Chlordane	0.03
PCBs	1.5

5.2.3 Waste Load Allocation for other NPDES Permits

Concentration-based sediment waste load allocations have been developed for the minor NPDES permits and general non-storm water NPDES permits that discharge to Marina del Rey Harbor to ensure that these do not contribute significant loadings to the system. The concentration-based waste load allocations are equal to the sediment numeric targets. All minor NPDES permittees and general non-storm water NPDES permittees shall not discharge sediments with concentrations greater than the ERLs as listed in Table 5-7. Monitoring requirements will be placed on these discharges as appropriate in their respective NPDES permits. Any future minor NPDES permits or enrollees under a general non-storm water NPDES permit will also be subject to the concentration-based waste load allocations.

Table 5-7. Concentration-based waste load allocation for sediment discharged to Marina del Rey Harbor.

Metals	Waste Load Allocation for Sediment
Copper	34 mg/kg
Lead	46.7 mg/kg
Zinc	150 mg/kg
Organics	**Waste Load Allocation for Sediment**
Chlordane	0.5 µg/kg
Total PCBs	22.7 µg/kg

5.3 Summary of TMDL

The TMDL is based on pollutant loadings to the sediments of Marina del Rey's back basins. The sediment loading capacity is based on an estimate of the annual pollutant loads that can be delivered to the sediments and still meet the sediment targets. A margin of safety is provided through the use of ERLs. A grouped waste load allocation for sediment has been developed for the storm water permittees (MS4, Caltrans, general industrial and construction storm water permittees). Load allocations have been developed for direct atmospheric deposition. Concentration-based waste load allocations apply to all other non-storm water NPDES permittees. It is anticipated that implementation will be based on BMPs which address pollution prevention and/or sediment reduction. Compliance with the TMDL will be determined through the sediment and water quality monitoring program.

6 IMPLEMENTATION

Because of the high value of the Marina del Rey for commercial and recreational uses and its important biological function as a shallow coastal water habitat, it should be targeted for an intensive, marina specific, contaminant management effort designed to reduce the amount of pollution in urban runoff, and other discharges to the harbor The County of Los Angeles, City of Los Angeles, and Culver City are jointly responsible for meeting the mass-based waste load allocations for the MS4 permittees. Caltrans is responsible for meeting their mass-based waste load allocations, however, they may choose to work with the MS4 permittees. Since, MdRH is located in an unincorporated area of the County of Los Angeles, the County of Los Angeles is the primary jurisdiction. Additional studies and monitoring should assist municipalities in focusing their implementation efforts on key land uses, critical sources and/or storm periods.

The City of Los Angeles, County of Los Angeles, Culver City, and Caltrans may jointly decide how to achieve the necessary reductions in organics and metals loading by employing one or more of the implementation strategies discussed below or any other viable strategy. The Porter Cologne Water Quality Control Act prohibits the Regional Board from prescribing the method of achieving compliance with water quality standards, and likewise TMDLs. Below staff have identified some potential implementation strategies; however, there is no requirement to follow the particular strategies proposed herein as long as the allowable organics and metals loading are not exceeded.

6.1 Regulation by the Regional Board

The Porter-Cologne Water Quality Control Act provides that "All discharges of waste into the waters of the State are privileges, not rights."[1] Furthermore, all discharges are subject to regulation under the Porter-Cologne Act including both point and non-point source discharges.[2] In obligating the State Board and Regional Boards to address all discharges of waste that can affect water quality, the legislature provided the State Board and Regional Boards with authority in the form of administrative tools (waste discharge requirements (WDRs), waivers of WDRs, and Basin Plan waste discharge prohibitions) to address ongoing and proposed waste discharges. Hence, all current and proposed discharges must be regulated under WDRs, waivers of WDRs, or a prohibition, or some combination of these administrative tools. Since the USEPA delegated responsibility to the State and Regional Boards for implementation of the National Pollutant Discharge Elimination System (NPDES) program, WDRs for discharges to surface waters also serve as NPDES permits.

[1] See CWC section 13263(g).

[2] See CWC sections 13260 and 13376.

6.1.1 Stormwater Discharges

As required by the federal Clean Water Act, discharges of pollutants to Marina del Rey Harbor from municipal storm water conveyances are prohibited, unless the discharges are in compliance with a NPDES permit. In December 2001, the Los Angeles County Municipal NPDES Storm Water Permit was re-issued jointly to Los Angeles County and 84 cities as co-permittees. The regulatory mechanisms used to implement the TMDL will include the Los Angeles County MS4 storm water permit, the Caltrans storm water permit, general industrial storm water permits, general construction storm water permits, minor NPDES permits, and general NPDES permits. Each NPDES permit assigned a WLA shall be reopened or amended at re-issuance, in accordance with applicable laws, to address implementation and monitoring of this TMDL and to be consistent with the waste load allocations of this TMDL.

The concentration-based waste load allocations for the minor NPDES permits and general non-storm water NPDES permits will be implemented through NPDES permit conditions. Permit writers for the non-storm water permits may translate applicable waste load allocations into effluent limits for the minor and general NPDES permits by applying applicable engineering practices. The minor and general non-storm water NPDES permittees are allowed up to seven years from the effective date of the TMDL to achieve the waste load allocations.

The mass-based waste load allocations for the general construction and industrial storm water permittees (Table 5-6) will be incorporated into watershed specific general permits. Concentration-based permit limits may be set to achieve the mass-based waste load allocations. These concentration-based limits would be equal to the concentration-based waste load allocations assigned to the other NPDES permits (Table 5-7). It is expected that permit writers will translate the waste load allocations into BMPs, based on BMP performance data. However, the permit writers must provide adequate justification and documentation to demonstrate that specified BMPs are expected to result in attainment of the numeric waste load allocations.

Within seven years of the effective date of the TMDL, the construction industry will submit the results of BMP effectiveness studies to determine BMPs that will achieve compliance with the waste load allocations assigned to construction storm water permittees. Regional Board staff will bring the recommended BMPs before the Regional Board for consideration within eight years of the effective date of the TMDL. General construction storm water permittees will be considered in compliance with waste load allocations if they implement these Regional Board approved BMPs. All general construction permittees must implement the approved BMPs within seven years of the effective date of the TMDL. If no effectiveness studies are conducted and no BMPs are approved by the Regional Board within six years of the effective date of the TMDL, each general construction and industrial storm water permit holder will be subject to site-specific BMPs and monitoring requirements to demonstrate compliance with waste load allocations.

The general industrial storm water permit shall contain a model monitoring and reporting program to evaluate BMP effectiveness. A permittee enrolled under the general industrial stormwater permit shall have the choice of conducting individual monitoring based on the model program or participating in a group monitoring effort. A group monitoring effort will not only assess individual compliance, but will also assess the effectiveness of chosen BMPs to reduce pollutant loading on an industry-wide or permit category basis. MS4 permittees are encouraged to take the lead in group monitoring efforts for industrial facilities within their jurisdiction because compliance with waste load allocations by these facilities will translate to reductions in contaminate loads to the MS4 system.

The MS4 and Caltrans permittees shall be allowed a phased implementation schedule to achieve the waste load allocations. A phased implementation approach, using a combination of non-structural and structural BMPs could be used to achieve compliance with the waste load allocations. The administrative record and the fact sheets for the MS4 and Caltrans storm water permits must provide reasonable assurance that the BMPs selected will be sufficient to implement the WLAs in the TMDL.

We expect that reductions to be achieved by each BMP will be documented and that sufficient monitoring will be put in place to verify that the desired reductions are achieved. The permits should also provide a mechanism to make adjustments to the required BMPs as necessary to ensure their adequate performance. If non-structural BMPs alone adequately implement the waste load allocations then additional controls are not necessary. Alternatively, if the non-structural BMPs selected prove to be inadequate then structural BMPs or additional controls may be required.

Each municipality and permittee will be required to meet the WLAs at the designated assessment locations as defined in the TMDL effectiveness monitoring plan, not necessarily an allocation for their jurisdiction or for specific land uses. Therefore, the focus should be on developed areas where the contribution of metals, historic pesticides, and PCBs are highest and areas where activities occur that contribute significant loading of these toxic pollutants (e.g., high-density residential, industrial areas, boating, and highways). Flexibility will be allowed in determining how to reduce these toxic pollutants as long as the WLAs are achieved.

To achieve the necessary reductions to meet the allowable waste load allocations, permittees will need to balance short-term capital investments directed to addressing this and other TMDLs in the Marina del Rey watershed with long-term planning activities for storm water management in the region as a whole. It should be emphasized that the potential implementation strategies discussed below may contribute to the implementation of other TMDLs for Marina del Rey. Likewise, implementation of other TMDLs in the Marina del Rey Watershed may contribute to the implementation of this TMDL.

6.2 Potential Implementation Strategies

The implementation strategy selected will need to control the loading of contaminated sediments to Marina del Rey Harbor during wet weather, since, metals, historic pesticides, and PCBs are predominately bound to sediment, which are transported with storm runoff. Municipalities may employ a variety of implementation strategies to meet the required waste load allocations such as non-structural and structural best management practices (BMPs). The implementation strategies discussed below incorporate implementation approaches presented in the Ballona Creek Metals and Toxics TMDLs, which focus on source control and sediment control (LARWQCB, 2005b). Specific projects, which may have a significant impact, would be subject to a separate environmental review. The lead agency for subsequent projects would be obligated to mitigate any impacts they identify, for example by mitigating potential flooding impacts by designing the BMPs with adequate margins of safety.

6.2.1 Non-Structural Best Management Practices

The non-structural BMPs are based on the premise that specific land uses or critical sources can be targeted to achieve the TMDL waste load allocations. Non-structural BMPs provide several advantages over structural BMPs. Non-structural BMPs can typically be implemented in a relatively short period of time. The capital investment required to implement non-structural BMPs is generally less than for structural BMPs. However, the labor costs associated with non-structural BMPs may be higher, therefore, in the long-term the non-structural BMPs may be more costly. Examples of non-structural controls include better sediment control at construction sites and improved street cleaning by upgrading to vacuum type sweepers.

6.2.2 Structural Best Management Practices

Structural BMPs may include placement of storm water treatment devices specifically designed to reduce sediment loading such as infiltration trenches or filters at critical points in the storm water conveyance system. During storm events, when flow rates are high these types of filters may require surge control, such as underground storage vaults or detention basins to avoid bypassing of the treatment unit.

6.3 Implementation Cost Analysis and CEQA considerations

This section takes into account a reasonable range of economic factors in estimating potential costs associated with this TMDL. This analysis, together with the other sections of this staff report, CEQA checklist, response to comments Basin Plan amendment and supporting documents, were completed in fulfillment of the applicable provisions of the California Environmental Quality Act (Public Resources Code Section 21159.) [3]

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[3] Because this TMDL implements existing water quality objectives it does not "establish" water quality objectives and no further analysis of the factors identified in Water Code section 13241 is required. However, the staff notes that its CEQA analysis provides the necessary information to properly "consider" the factors specified in Water Code section 13241. As a result, the section 13241 analysis would at best be redundant.

6.3.1 Implementation Cost Analysis

This cost analysis focuses on achieving the grouped waste load allocation by the MS4 and Caltrans storm water permittees in the urbanized portion of the watershed[4]. The BMPs and potential compliance approaches analyzed here could apply to the general industrial and construction storm water permittees as well. An evaluation of the costs of implementing this TMDL amounts to evaluating the costs of preventing contaminated sediments from entering storm drains and/or reaching the Marina del Rey Harbor. Most permittees would likely implement a combination of the structural and non-structural BMPs to achieve their waste load allocations. This analysis considers a potential strategy combining structural and non-structural BMPs through a phased implementation approach and estimates the costs for this strategy. It will also be important to document any possible reductions in sediment loading that may concurrently be achieved via BMPs implemented under the Bacteria TMDL.

6.3.1.1 Phased Implementation

Under a phased implementation approach, it is assumed that compliance with the grouped waste load allocation could be achieved in 30% of the urbanized portion of the watershed through various iterations of non-structural BMPs. Compliance with the remaining 70% of the urbanized portion of the watershed could be achieved through structural BMPs.

The first step of the potential phased approach would include the implementation of non-structural BMPs by permittees, such as increasing the frequency and efficiency of street sweeping. In their National Menu of Best Management Practices for Stormwater – Phase II, USEPA reports that conventional mechanical street sweepers can reduce non-point source pollution by 5 to 30% (USEPA, 1999a). The removal efficiencies of sediment for conventional sweepers are dependent on the size of particles. Conventional sweepers, including mechanical broom sweepers and vacuum-assisted wet sweepers, have removal efficiencies of approximately 15 to 50% for particles less than 500 micrometers and up to approximately 65% for larger particles (Walker and Wong, 1999). USEPA reports that vacuum-assisted dry street sweeping can remove significantly more pollution, including fine sediment and metals, before the pollutants are mobilized by rainwater. USEPA reports a 50 to 88% overall reduction in annual sediment loading for residential areas by vacuum-assisted dry street sweepers. Sutherland and Jelen (1997) showed a total removal efficiency of 70% for fine particles and up to 96% for larger particles by vacuum – assisted dry sweepers (also known as small-micron surface sweepers). Upgrading to vacuum-assisted dry sweeping would translate to a significant reduction of sediments. In their 1999 Preliminary Data Summary of Urban Stormwater Best Management Practices, USEPA estimated cost data for both standard mechanical and vacuum-assisted dry sweepers as shown in Table 6-1.

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[4] This TMDL only addresses 1.5 square miles of the 2.9 square mile Marina del Rey watershed. Water comprises 0.08 square miles of the area. It is not expected that the MS4 and Caltrans permittees will need to address areas of open water to meet the waste load allocations. Therefore, areas of water are not considered in the calculation of the cost analysis. The remaining 1.42 square miles is considered the portion of the watershed that may require BMPs and therefore, used in the cost analysis for the purposes of this TMDL.

Table 6-1. Estimated costs for two types of street sweepers. (Source: USEPA, 1999b.)

Sweeper Type	Life (Years)	Purchase Price ($)	Annual O&M Cost ($/curb mile)
Mechanical	5	75,000	30
Vacuum-assisted	8	150,000	15

Table 6-1 illustrates that while the purchase price of vacuum-assisted dry sweepers is higher, the operation and maintenance costs are lower than for standard sweepers. Based on this information, USEPA determined the total annualized cost of operating street sweepers per curb mile, for a variety of frequencies (Table 6-2). In their estimates, USEPA assumed that one sweeper serves 8,160 curb miles during a year and assumed an annual interest rate of 8 percent (USEPA, 1999b). According to Table 6-2, permittees would save money in the long-term by switching to vacuum-assisted dry sweepers.

Table 6-2. Annualized sweeper costs, including purchase price and operation and maintenance costs ($/curb mile/year).

Sweeper Type	Sweeping Frequency					
	Weekly	Bi-weekly	Monthly	Quarterly	Twice per year	Annually
Mechanical	1,680	840	388	129	65	32
Vacuum-Assisted	946	473	218	73	36	18

Under a phased implementation approach, the permittees could monitor effectiveness using flow-weighted composite sampling of runoff throughout representative storms to determine the effectiveness of this first step of implementing non-structural BMPs. If monitoring showed ineffectiveness, permittees could adapt their approach by increasing frequency of street sweeping or incorporating other non-structural BMPs.

If the WLAs can not be achieved through non-structural BMPs, permittees could incorporate structural BMPs. Two potential structural BMPs were analyzed in this cost analysis:

1. Infiltration trenches
2. Sand filters

These approaches are specifically designed to treat urban runoff and to accommodate high-density areas. They were chosen for this analysis because in addition to addressing sediment loadings to the creek, they have the additional positive impact of addressing the effects of development and increased impervious surfaces in the watershed. Both approaches can be designed to capture and treat 0.5 to 1 inch of runoff. When flow exceeds the design capacity of each device, untreated runoff is allowed to bypass the device and enter the storm drain.

Both infiltration trenches and sand filters must be used in conjunction with some type of pretreatment device such as a biofiltration strip or gross solids removal system to remove sediment and trash in order to increase their efficiency and service life. This analysis provides an estimate of the costs associated with installing sand filters or infiltration trenches.

In addition, both infiltration trenches and sand filters are efficient in removing bacteria and could be used to achieve the WLAs in the adopted bacteria TMDL for Marina del Rey Harbor. USEPA reports that sand filters have a 76% removal rate and infiltration trenches have a 90% removal rate for fecal coliform (USEPA, 1999c).

As stated previously, it is assumed that 70% of the urbanized portion of the watershed would need to be treated by structural BMPs. In this cost analysis, it was assumed that infiltration trenches would treat 35% of the watershed and sand filters would treat the other 35%. Costs were estimated using data provided by USEPA (USEPA, 1999a and 1999c) and the Federal Highway Administration (FHWA, 2003). USEPA cost data were reported in 1997 dollars. FHWA costs were reported in 1996 dollars for infiltration trenches and 1994 dollars for sand filters. Where costs were reported as ranges, the highest reported cost was assumed. These costs were then compared to costs determined by Caltrans in their BMP Retrofit Pilot Program (Caltrans, 2004). Caltrans costs were reported in 1999 dollars. To estimate land acquisition cots for individual projects in this cost analysis would be purely speculative.

<u>Infiltration trenches</u>. Infiltration trenches store and slowly filter runoff through the bottom of rock-filled trenches and then through the soil. Infiltration trenches can be designed to treat any amount of runoff, but are ideal for treating small urban drainage areas less than five to ten acres. Soils and topography are limiting factors in design and siting, as soils must have high percolation rates and groundwater must be of adequate depth. Potential impacts to groundwater by infiltration trenches could be avoided by proper design and siting. Infiltration trenches are reported to achieve 75 to 90% suspended solids removal and 75 to 90% metals removal by USEPA and FHWA. In their BMP Retrofit Pilot Program, Caltrans assumed that constituent removal was 100 percent for storm events less than the design storm, because all runoff would be infiltrated.

Table 6-3 presents estimated costs for infiltration trenches designed to treat 0.5 inches of runoff over a five-acre drainage area with a runoff coefficient equal to one. Staff determined that 130 devices, designed to treat five acres each, would be required to treat 35% of the land area of the watershed.

Table 6-3. Estimated Costs for Infiltration Trenches.

	Construction Costs ($ million)	Maintenance Costs ($ million/year)
Based on USEPA estimate (1997 dollars)	2.88	0.58
Based on FHWA estimate (1996 dollars)	2.75	Not reported

<u>Sand Filters</u>. Sand filters work by a combination of sedimentation and filtration. Runoff is temporarily stored in a pretreatment chamber or sedimentation basin, and then flows by gravity or is pumped into a sand filter chamber. The filtered runoff is then discharged to a storm drain or natural channel. The costs of two types of sand filters were analyzed: 1) the Delaware sand filter, which is installed underground and suited to treat drainage areas

of approximately one acre and 2) the Austin sand filter, which is installed at-grade and suited to larger drainage areas up to 50 acres. The underground sand filter is especially well adapted for applications with limited land area and is independent of soil conditions and depth to groundwater. However, both types of sand filters must consider the imperviousness of the drainage areas in their design.

USEPA estimated a 70% removal of total suspended solids and 45% removal of lead and zinc for both types of sand filters. FHWA reported high sediment, zinc and lead removal, but low copper removal for Austin sand filters and high sediment and moderate to high metals removal for Delaware sand filters. Caltrans reported a 50% reduction in total copper, a 7% reduction in dissolved copper, an 87% reduction in total lead, a 40% reduction in dissolved lead, an 80% reduction in total zinc and a 61% reduction in dissolved zinc by the Austin sand filters they tested. Caltrans reported a 66% reduction in total copper, a 40% reduction in dissolved copper, an 85% reduction in total lead, a 31% reduction in dissolved lead, a 92% reduction in total zinc and a 94% reduction in dissolved zinc by the Delaware sand filter they tested.

USEPA and FHWA reported costs per acre for 0.5 inches of runoff. Total costs were calculated by multiplying the per-acre cost by the total acreage of the urbanized portion of the watershed not addressed through an integrated resources plan or non-structural BMPs. Estimated costs are presented in Table 6-4. There are significant economies of scale for Austin filters. USEPA reported that costs per acre decrease with increasing drainage area. FHWA reported two separate costs based on drainage area served. Economies of scale are not a factor for Delaware filters, as they are limited to drainage areas of about one acre.

Table 6-4. Estimated Costs for Austin and Delaware Sand Filters

	Austin Sand Filter Construction Costs ($ million)	Austin Sand Filter Maintenance Costs ($ million/year)	Delaware Sand Filter Construction Costs ($ million)	Delaware Sand Filter Maintenance Costs ($ million/year)
Based on USEPA estimate (1997 dollars)	2.93	0.15	1.74	0.09
Based on FHWA estimate* (1994 dollars)	0.54	Not reported	2.22	Not reported

*FHWA cost estimate for Austin filter was calculated assuming a drainage area greater than five acres. The costs would be $4.6 million for Austin filters designed for a drainage area of less than two acres.

Based on the adaptive management approach, and some assumptions about the efficiencies of each stage of the approach, the cost analysis arrived at the total costs for achieving the WLAs in the Toxic Pollutants TMDL as shown in Table 6-5. The total costs do not include the cost savings associated with switching to vacuum-assisted street sweepers. As stated previously, the costs associated with this adaptive management approach could be applied towards the cost of achieving the WLAs in the Metals TMDLs and the adopted Bacteria TMDL.

Table 6-5. Total Estimated costs of structural BMP approach for stormwater discharges.

	Total Construction ($ million)	Total Maintenance ($ million/year)
Based on USEPA estimate(1997 dollars)	7.6	0.8
Based on FHWA estimate(1994/1996 dollars)	5.5	Not reported

6.3.1.2 Comparison of Costs Estimates with Caltrans Reported Costs

Estimated costs for structural BMPs were compared to costs reported by Caltrans in their BMP Retrofit Pilot Program (Caltrans, 2004). Caltrans sited five Austin sand filters and one Delaware sand filter as part of their study. The five Austin sand filters served an average area of 2 acres and the Delaware sand filter served an area of 0.7 acres. Caltrans sited two infiltration trench/biofiltration strip combinations as part of their study. Each trench and biofiltration strip used in combination served an area of 1.7 acres. Based on these drainage areas, the average adjusted cost of the Austin sand filters in the Caltrans study was $156,600 per acre, the adjusted cost of the Delaware filter was $310,455 per acre and the average adjusted cost of the infiltration trench/biofiltration strips was $84,495 per acre. These costs are approximately an order of magnitude greater than the costs determined using estimates provided by USEPA and FHWA. It should be noted that costs calculated using EPA and FHWA estimates were based on infiltration trench and sand filter designs that would treat 0.5 inches of runoff, while the Caltrans study costs were based on an infiltration trench design that would treat 1 inch of runoff and sand filter designs that would treat 0.56 to 1 inches of runoff. This could explain some of the differences in costs.

The differences in costs can also be explained by a third party review of the Caltrans study, conducted by Holmes & Narver, Inc. and Glenrose Engineering (Caltrans, 2001). Holmes & Narver, Inc. and Glenrose Engineering (Caltrans, 2001). The review compared adjusted Caltrans costs with costs of implementing BMPs by other state transportation agencies and public entities. The adjusted costs exclude costs associated with the unique pilot program and ancillary costs such as improvements to access roads, landscaping or erosion control, and non-BMP related facilities. For the comparison, all costs were adjusted for differences in regional economies. The third party review determined that the median costs reported by Caltrans were higher than the median costs reported by the other agencies for almost every BMP considered, including sand filters and infiltration BMPs. The review attributed the higher Caltrans costs to the small scale and accelerated nature of the pilot program. The third party review then gave recommendations for construction cost reductions based on input from other state agencies. These included simplifying design and material components, combining retrofit work with ongoing construction projects, changing methods used to select and work with construction contractors, allowing for a longer planing horizon, constructing a larger number of BMPs at once, and implementing BMPs over a larger drainage area.

6.3.2 Results of a Region-wide Cost Study

In their report entitled "Alternative Approaches to Storm Water Quality Control, Prepared for the Los Angeles Regional Water Quality Board," Devinny et al. estimated the total costs for compliance with Regional Board storm water quality regulations as ranging from $2.8 billion, using entirely non-structural systems, to between $5.7 billion and $7.4 billion, using regional treatment or infiltration systems. The report stated that final costs would likely fall somewhere within this range. Table 6-6 presents the report's estimated costs for the various types of structural and non-structural systems that could be used to achieve compliance with municipal storm water requirements throughout the Region.

Table 6-6. Estimated costs of structural and non-structural compliance measures for the entire Los Angeles Region. (Source: Devinny et al.)

Compliance Approach	Estimated Costs
Enforcement of litter ordinances	$9 million/year
Public Education	$5 million/year
Increased storm drain cleaning	$27 million/year
Installation of catch basin screens, enforcing litter laws, improving street cleaning	$600 million
Low –flow diversion	$28 million
Improved street cleaning	$7.5 million/year
On-site BMPs for individual facilities	$240 million
Structural BMPs – 1st estimation method	$5.7 billion
Structural BMPs – 2nd estimation method	$4.0 billion

The Devinny et al. study calculates costs for the entire Los Angeles Region, which is 3,100 square miles, while the Marina del Rey watershed is 2.9 square miles. When compared on a per square mile basis, the costs estimated in section 6.5.1 are within the range calculated by Devinny et al. (Table 6-7).

Table 6-7. Comparison of costs for storm water compliance on a per square mile basis.

	Construction Costs ($ million/square mile)
Based on U.S. EPA estimate	2.62
Based on FHWA estimate	1.91
Maximum cost calculated by Devinny et al.	1.84 –2.39

The Devinny et al. study also estimated benefits associated with storm water compliance. It was determined that the Region-wide benefits of a non-structural compliance program would equal approximately $5.6 billion while the benefits of non-structural and regional measures would equal approximately $18 billion. Region-wide estimated benefits included:

- Flood control savings due to increased pervious surfaces of about $400 million,
- Property value increase due to additional green space of about $5 billion,
- Additional groundwater supplies due to increased infiltration worth about $7.2 billion,
- Willingness to pay to avoid storm water pollution worth about $2.5 billion,

- Cleaner streets worth about $950 million,
- Improved beach tourism worth about $100 million
- Improved nutrient recycling and atmospheric maintenance in coastal zones worth about $2 billion,
- Savings from reduction of sedimentation in Regional harbors equal to about $330 million, and
- Unquantifiable health benefits of reducing exposure to fine particles from streets.

7 MONITORING

There are three objectives of monitoring associated with the TMDL. The first is to collect additional water, and fish tissue quality data to evaluate the extent of impairment in these media. The second is to assess the effectiveness of the TMDL and ultimately achieving the waste load allocations. The third is to conduct special studies to address the uncertainties in the TMDL and to assist in the design and sizing of BMPs. To achieve these objectives, a monitoring program will need to be developed for the TMDL that consists of three components: (1) ambient monitoring, (2) effectiveness monitoring and (3) special studies.

The monitoring program and any required technical reports will be established pursuant to a subsequent order issued by the Executive Officer. As a planning document, the TMDL identifies the type of information necessary to refine and update it, and to assess its effectiveness. The Executive Officer will comply with any necessary legal requirements in developing the monitoring program, requiring technical reports, and establishing special studies.

7.1 Ambient Monitoring

An ambient monitoring program is necessary to assess water quality throughout Marina del Rey Harbor and to assess fish tissue quality in the harbor's back basins. Data on background water quality for metals and organics will help refine the numeric targets and waste load allocations and assist in the effective placement of BMPs. In addition, fish tissue data is required in Marina del Rey's back basins to confirm continued impairment.

Water quality samples shall be collected monthly and analyzed for chlordane and total PCBs at detection limits that are at or below the minimum levels until the TMDL is reconsidered in the sixth year. The minimum levels are those published by the State Water Resources Control Board in Appendix 4 of the Policy for the Implementation of Toxic Standards for Inland Surface Water, Enclosed Bays, and Estuaries of California, March 2, 2000. Special emphasis should be placed on achieving detection limits that will allow evaluation relative to the CTR standards. If these can not be achieved with conventional techniques, then a special study should be proposed to evaluate concentrations of organics.

Water quality samples shall also be collected monthly and analyzed for total and dissolved copper, lead, and zinc until the TMDL is reconsidered in the sixth year. For metals water column analysis, methods that allow for (1) the removal of salt matrix to reduce interference and avoid inaccurate results prior to the analysis; and (2) the use of trace metal clean sampling techniques, should be applied. Examples of such methods include EPA Method 1669 for sample collection and handling, and EPA Method 1640 for sample preparation and analysis.

Storm water monitoring shall be conducted for total and dissolved metals (copper, lead, and zinc) and organics (chlordane and total PCBs) to provide assessment of water quality during wet-weather conditions and loading estimates from the watershed to the harbor. Special emphasis should be placed on achieving lower detection limits for organochlorine compounds.

The MS4 and Caltrans storm water permittees are jointly responsible for conducting bioaccumulation testing of fish within the harbor. The permittees are required to submit, for approval of the Executive Officer, a monitoring plan that will provide the data needed to confirm or challenge continued impairment of the 303(d) listed pollutants.

Representative sediment sampling shall be conducted quarterly within the harbor for copper, lead, zinc, chlordane, and total PCBs at detection limits that are lower than the ERLs. Sediment samples shall also be analyzed for total organic carbon, grain size and sediment toxicity. The monthly sediment monitoring efforts conducted by the Los Angeles County Department of Beaches and Harbors, throughout Marina del Rey Harbor will be deemed sufficient to satisfy ambient sediment monitoring requirements - if analysis is conducted at these lower detection limits.

Initial sediment toxicity monitoring should be conducted quarterly in the first year of the TMDL to define the baseline and semi-annually, thereafter, to evaluate effectiveness of the BMPs until the TMDL is reconsidered in the sixth year. The sediment toxicity testing shall include testing of multiple species, a minimum of three, for lethal and non-lethal endpoints. Toxicity testing may include: the 28-day and 10-day amphipod mortality test; the sea urchin fertilization testing of sediment pore water; and the bivalve embryo testing of the sediment/water interface. The chronic 28-day and shorter-term 10-day amphipod tests may be conducted in the initial year of quarterly testing and the results compared. If there is no significant difference in the tests, then the less expensive 10-day test can be used throughout the rest of the monitoring, with some periodic 28-day testing.

7.2 Effectiveness Monitoring

The water quality samples collected during wet weather, shall be analyzed for total dissolved solids, settable solids and total suspended solids if not already part of the sampling program. Sampling shall be designed to collect sufficient volumes of settable and suspended solids to allow for analysis of copper, lead, zinc, chlordane, total PCBs, and total organic carbon in the sediment.

Monthly representative sediment sampling shall be conducted at existing monitoring locations throughout the harbor, and analyzed for copper, lead, zinc, chlordane, and total PCBs at detection limits that are lower than the ERLs. The, sediment samples shall also be analyzed for total organic carbon and grain size. Sediment testing shall be conducted semi-annually, and shall include testing of multiple species (a minimum of three) for lethal and non-lethal endpoints. Toxicity testing may include: the 28-day and 10-day amphipod mortality test; the sea urchin fertilization testing of sediment pore water; and the bivalve embryo testing of the sediment/water interface.

Toxicity shall be indicated by an amphipod survival rate of 70% or less in a single test. Accelerated monitoring shall be conducted to confirm toxicity at stations identified as toxic. Accelerated monitoring shall consist of six additional tests, approximately every two weeks, over a 12-week period. If the results of any two of the six accelerated tests are less than 90% survival, then the MS4 and Caltrans permittees shall conduct a Toxicity Identification Evaluation (TIE). The TIE shall include reasonable steps to identify the sources of toxicity and steps to reduce the toxicity The Phase I TIE shall include the following treatments and corresponding blanks: baseline toxicity; particle removal by centrifugation; solid phase extraction of the centrifuged sample using C8, C18, or another approved media; complexation of metals using ethylenediaminetetraacetic acid (EDTA) addition to the raw sample; neutralization of oxidants/metals using sodium thiosulfate addition to the raw sample; and inhibition of organo-phosphate (OP) pesticide activation using piperonyl butoxide addition to the raw sample (crustacean toxicity tests only).

Bioaccumulation monitoring of fish and mussel tissue within the harbor shall be conducted annually. The permittees are required to submit for approval of the Executive Officer a monitoring plan that will provide the data needed to assess the effectiveness of the TMDL The general industrial storm water permit shall contain a model monitoring and reporting program to evaluate BMP effectiveness. A permittee enrolled under the general industrial permit shall have the choice of conducting individual monitoring based on the model program or participating in a group monitoring effort. MS4 permittees are encouraged to take the lead in group monitoring efforts for industrial facilities within their jurisdiction because compliance with waste load allocations by these facilities will in many cases translate to reductions in contaminate loads to the MS4 system.

7.3 Special Studies

Special studies are recommended to refine source assessments, to provide better estimates of loading capacity, and to optimize implementation efforts. The Regional Board will re-consider the TMDL in the sixth year after the effective date in light of the findings of these studies. Special studies may include:

- Evaluate partitioning coefficients between water column and sediment to assess the contribution of water column discharges to sediment concentrations in the harbor
- Evaluate the use of low detection level techniques to determine water quality concentrations for those contaminants where standard detection limits cannot be used to assess compliance for CTR standards or are not sufficient for estimating source loadings from tributaries and storm water
- Develop and implement a monitoring program to collect the data necessary to apply a multiple lines of evidence approach;
- Refine the relationship between pollutants and suspended solids aimed at better understanding of the delivery of pollutants to the watershed, and
- Evaluate the effectiveness of BMPs to address pollutants and/or sediments.

8. Final TMDL Milestones and Implementation Schedule

The TMDL milestones and implementation schedule are summarized in Table 8-1. The schedule allows time for dischargers to perform special studies and to develop implementation plans before any waste load reductions are required.

8.1 Final TMDL Milestones

The Regional Board intends to reconsider this TMDL six years after the effective date of the TMDL to re-evaluate the waste load allocations and the implementation schedule based on the additional data obtained from the special studies. The Regional Board will consider extending the implementation schedule from 10 years up to 15 years if an IRP approach is pursued. Until the TMDL is revised, the waste load allocations will remain as presented in Section 5. Revising the TMDL will not create a conflict, since the total contaminated sediment reductions are not required until 10-15 years after the effective date.

8.2 Implementation Schedule

The implementation schedule for all NPDES permittees is summarized in Table 8-1. The municipalities and Caltrans are encourage to work together to meet the waste load allocations. For the MS4 and Caltrans storm water permittees the proposed implementation schedule consists of a phased approach, with compliance to be achieved in incremental percentages of the watershed, with total compliance achieved within 10 years. This schedule is based on a combination of structural and non-structural strategies designed specifically to reduce toxic pollutant loading to Marina del Rey Harbor. However, should the responsible jurisdictions and agencies pursue an integrated water resources approach that includes beneficial re-use of storm water, the Regional Board will consider extending the allowable time to 15 years, in recognition of the additional planning and time needed for this approach (see Table 8.1).

Table 8-1. Implementation Schedule

Date	Action
Effective date of the TMDL	Regional Board permit writers shall incorporate the waste load allocations for sediment into the NPDES permits. Waste load allocations will be implemented through NPDES permit limits in accordance with the implementation schedule contained herein, at the time of permit issuance, renewal or re-opener.
Within 6 months after the effective date of the State Board adopted sediment quality objectives and implementation policy	The Regional Board will re-assess the numeric targets and waste load allocations for consistency with the State Board adopted sediment quality objectives.
5 years after effective date of the TMDL	Responsible jurisdictions and agencies shall provide to the Regional Board result of any special studies.
6 years after effective date of the TMDL	The Regional Board shall reconsider this TMDL to re-evaluate the waste load allocations and the implementation schedule.
NON-STORM WATER NPDES PERMITS (INCLUDING MINOR AND GENERAL PERMITS)	
7 years after effective date of the TMDL	The non-storm water NPDES permittees shall achieve the concentration-based waste load allocations for sediment per provisions allowed for in NPDES permits.
GENERAL INDUSTRIAL STORM WATER PERMITS	
7 years after effective date of the TMDL	The general industrial storm water permittees shall achieve the mass-based waste load allocations for sediment per provisions allowed for in NPDES permits. Permits shall allow an iterative BMP process including BMP effectiveness monitoring to achieve compliance with permit requirements.
GENERAL CONSTRUCTION STORM WATER PERMITS	
7 years from the effective date of the TMDL	The construction industry will submit the results of the BMP effectiveness studies to the Regional Board for consideration. In the event that no effectiveness studies are conducted and no BMPs are approved, permittees shall be subject to site-specific BMPs and monitoring to demonstrate BMP effectiveness.
8 years from the effective date of the TMDL	The Regional Board will consider results of the BMP effectiveness studies and consider approval of BMPs no later than eight years from the effective date of the TMDL.
9 years from the effective date of the TMDL	All general construction storm water permittees shall implement Regional Board-approved BMPs.
MS4 AND CALTRANS STORM WATER PERMITS	
12 months after the effective date of the TMDL	The MS4 and Caltrans storm water NPDES permittees must submit a coordinated monitoring plan, to be approved by the Executive Officer, which includes both ambient monitoring and TMDL effectiveness monitoring. Once the coordinated monitoring plan is approved by the Executive Officer, ambient monitoring shall commence.
5 years after effective date of TMDL	The MS4 and Caltrans storm water NPDES permittees shall

Date	Action
(Draft Report) 5 ½ years after effective date of TMDL (Final Report)	provide a written report to the Regional Board outlining how they will achieve the waste load allocations for sediment to Marina del Rey Harbor. The report shall include implementation methods, an implementation schedule, proposed milestones, and any applicable revisions to the TMDL effectiveness monitoring plan.
Schedule for MS4 and Caltrans Permittees if Pursuing a TMDL Specific Implementation Plan	
8 years after effective date of the TMDL	The MS4 and Caltrans storm water NPDES permittees shall demonstrate that 50% of the total drainage area served by the MS4 system is effectively meeting the waste load allocations for sediment.
10 years after effective date of the TMDL	The MS4 and Caltrans storm water NPDES permittees shall demonstrate that 100% of the total drainage area served by the MS4 system is effectively meeting the waste load allocations for sediment.
Schedule for MS4 and Caltrans Permittees if Pursuing an Integrated Resources Approach, per Regional Board Approval	
7 years after effective date of the TMDL	The MS4 and Caltrans storm water NPDES permittees shall demonstrate that 25% of the total drainage area served by the MS4 system is effectively meeting the waste load allocations for sediment.
9 years after effective date of the TMDL	The MS4 and Caltrans storm water NPDES permittees shall demonstrate that 50% of the total drainage area served by the MS4 system is effectively meeting the waste load allocations for sediment.
11 years after effective date of the TMDL	The MS4 and Caltrans storm water NPDES permittees shall demonstrate that 75% of the total drainage area served by the MS4 system is effectively meeting the waste load allocations for sediment.
15 years after effective date of the TMDL	The MS4 and Caltrans storm water NPDES permittees shall demonstrate that 100% of the total drainage area served by the MS4 system is effectively meeting the waste load allocations for sediment.

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