DRAFT

Multi-Pollutant TMDL Implementation for the Unincorporated County Area of Ballona Creek

Appendices

County of Los Angeles
Chief Executive Office
Kenneth Hahn Hall of Administration
500 W. Temple Street
Los Angeles, CA 90012

Contents

Appendix A. TMDL Summaries A-1

Appendix B. Monitoring Data and Analysis B-1

B.1. Wet-Weather Monitoring B-5
B.2. Dry-Weather Monitoring B-8
B.3. References B-10

Appendix C. Public Information and Participation Programs C-1

C.1. Stormwater/Urban Runoff Education Program C-1
C.1.1. Goals and Objectives C-1
C.1.2. Description C-1
C.1.3. Target Audience C-1
C.1.4. Message Packaging or Supporting Materials C-1
C.1.5. Languages C-3
C.1.6. Evaluation Method C-3
C.1.7. Program Cost C-3
C.1.8. Division C-3
C.2. Used Oil and Filter Recycling Program C-3
C.2.1. Goals and Objectives C-3
C.2.2. Description C-4
C.2.3. Target Audience C-4
C.2.4. Message Packaging or Supporting Materials C-4
C.2.5. Languages C-4
C.2.6. Evaluation Method C-4
C.2.7. Program Cost C-4
C.2.8. Division C-4
C.3. Environmental Defenders C-4
C.3.1. Goals and Objectives C-4
C.3.2. Description C-5
C.3.3. Target Audience C-5
C.3.4. Message Packaging or Supporting Materials C-5
C.3.5. Languages C-5
C.3.6. Evaluation Method C-5
C.3.7. Program Cost C-5
C.3.8. Division C-5
C.4. Generation Earth C-5
C.4.1. Goals and Objectives C-5
C.4.2. Description C-5
C.4.3. Target Audience C-6
C.4.4. Message Packaging or Supporting Materials C-6
C.4.5. Languages C-6
C.4.6. Evaluation Method C-7
C.4.7. Program Cost C-7
C.4.8. Division C-7
C.5. Plan-It Earth C-7
C.5.1. Goals and Objectives C-7
C.5.2. Description C-7
C.5.3. Target Audience C-7
C.5.4. Message Packaging or Supporting Materials C-7
C.5.5. Languages C-8
C.5.6. Evaluation Method C-8
C.5.7. Program Cost C-8
C.5.8. Division C-8

C.6. Restaurant Training Program C-8
C.6.1. Goals and Objectives C-8
C.6.2. Description C-8
C.6.3. Target Audience C-8
C.6.4. Message Packaging or Supporting Materials C-9
C.6.5. Languages C-9
C.6.6. Evaluation Method C-9
C.6.7. Program Cost C-9
C.6.8. Division C-9
C.7. 888-Clean-LA C-9
C.7.1. Goals and Objectives C-9
C.7.2. Description C-9
C.7.3. Target Audience C-10
C.7.4. Message Packaging or Supporting Materials C-10
C.7.5. Languages C-10
C.7.6. Division C-10

Appendix D. Field Investigations for Distributed BMPs D-1
D.1. Methods D-1
D.1.1. Infiltration Rate D-1
D.1.2. Water Table D-2
D.1.3. Soils Classification D-2
D.2. Results and Discussion D-3
D.2.1. Infiltration Rate D-3
D.2.2. Hydrologic Soil Group Characteristics D-4
D.2.3. Management Category Characteristics D-5
D.2.4. Water Table D-5
D.3. References D-5

Appendix E. Field Investigation for Centralized BMPs E-1
E.1. Field Investigation Methods E-1
E.1.1. Infiltration Rate E-1
E.1.2. Water Table E-2
E.1.3. Soil Quality E-2
E.1.4. Site Slope E-3
E.2. Field Investigation Results and Discussion E-3
E.2.1. Infiltration Rates E-3
E.2.2. Water Table E-4
E.2.3. Soil Quality E-5
E.3. Site Features and Observation E-6
E.3.1. West Los Angeles Community College E-6
E.3.2. Ladera Park E-10
E.4. Summary E-14
E.4.1. West Los Angeles Community College E-14
E.4.2. Ladera Park E-15
E.5. References E-15

Appendix F. BMP Fact Sheets F-1

Appendix G. BMP Model Configuration for the County TMDL Implementation Area G-1
G.1. Watershed Model: LSPC Model Development G-1
G.2. Description of BMPDSS and the BMPDSS Pilot Study G-1
G.3. BMPDSS Configuration for the County TMDL Implementation Area G-2
G.4. Identification of Options for Distributed Structural BMPs G-6
G.4.1. Description of Distributed Structural BMPs Considered G-6

G.4.2. Representation of Distributed Structural BMPs for BMP Modeling....G-7
G.4.3. Distributed BMP Model Representation Upstream of Centralized BMPs....G-11
G.5. Description of Centralized Structural BMPs Considered....G-12
G.5.1. Extended Dry Detention Basin....G-12
G.5.2. Infiltration Basin....G-12
G.6. BMP Cost Functions....G-14
G.6.1. Distributed Structural BMP Cost Functions....G-14
G.6.2. Centralized BMP Cost Functions....G-15
G.6.3. Land Costs....G-17
G.7. Simulation Period....G-17
G.8. Additional Discussion of Structural BMP Optimization Results....G-23
G.8.1. BMPs on Public Land (Points B and C)....G-24
G.8.2. Centralized BMPs on Private Land (Points D, E and F)....G-28
G.9. References....G-29

Appendix H. Summary of Groundwater Basin Characteristics....H-1
H.1. Central Groundwater Basin....H-1
H.2. Hollywood Groundwater Basin....H-1
H.3. West Coast Groundwater Basin....H-1
H.4. Santa Monica Groundwater Basin....H-2
H.5. References....H-3

Appendix I. Pertinent Regulations and Permits....I-1
I.1. Federal Regulations....I-1
I.1.1. Clean Water Act....I-1
I.1.2. Endangered Species Act....I-5
I.1.3. Forest Service Permits....I-5
I.1.4. Migratory Bird Treaty Act....I-5
I.1.5. National Environmental Policy Act....I-5
I.2. State Regulations....I-6
I.2.1. California Air Resources Board Regulations....I-6
I.2.2. California Environmental Quality Act....I-6
I.2.3. Dam Safety Laws....I-7
I.2.4. Lake and Streambed Alteration Program....I-9
I.2.5. Porter-Cologne Water Quality Control Act....I-10
I.2.6. Recycled Water Laws....I-10
I.2.7. State Lands Leasing and Permits Regulation....I-10
I.2.8. Wildlife: State and Related Federal Requirements....I-11
I.3. Local Regulations....I-14
I.3.1. Drought-Tolerant Landscaping Requirements....I-14
I.3.2. Geotechnical Reporting Requirements....I-15
I.3.3. Green Building Requirements....I-17
I.3.4. LID Requirements/LID Manual....I-18
I.3.5. Stormwater Requirements....I-20
I.3.6. Tree Protection Requirements....I-20
I.3.7. Additional County Permits....I-21
I.3.8. Recycled Water Laws....I-21
I.3.9. Regional Planning....I-21
I.3.10. Sanitation Districts of Los Angeles....I-28
I.4. References....I-29

Appendix J. Structural BMP Conceptual Monitoring Plan....J-1
J.1. Pollutants of Concern....J-1
J.2. Monitoring Assumptions....J-1

J.3. Monitoring Approach for Centralized Structural BMPs J-1
J.4. Monitoring Approach for Distributed Structural BMPs J-2
J.5. References J-2

Appendix K. Cost Assumptions and Estimates K-1
K.1. Catch Basin Distributed BMPs: Cost Assumptions and Estimates K-1
K.2. Other Structural BMPs: Cost Assumptions and Estimates K-2
K.2.1. Cost for Distributed BMPs on Public Land K-5
K.2.2. Centralized BMPs on Public Land: Ladera Park BMP Cost Estimate K-9
K.2.3. Centralized BMPs on Public Property: West Los Angeles Community College Cost Estimate K-11
K.2.4. Costs for Centralized Structural BMPs on Private Property K-13
K.3. Nonstructural BMPs: Cost Assumptions and Estimates K-14
K.3.1. General Cost Assumptions for Nonstructural BMPs on Public Property K-14
K.4. References K-18

Appendix L. Detailed TMDL Plan Evaluation L-1
L.1. Detailed Evaluation Criteria L-1
L.2. TMDL Plan Evaluation L-3
L.2.1. Certainty of Meeting TMDL Requirements L-3
L.2.2. Cost L-4
L.2.3. Feasibility L-5
L.2.4. Complementary Integration L-8
L.2.5. Integrated Water Resources Planning L-9
L.2.6. Other Sustainability Benefits L-10
L.2.7. Summary of Evaluation L-12

Appendix M. Assumptions for Development of TMDL Implementation Schedules M-1
M.1. Project Schedules for Nonstructural BMPs M-1
M.2. Project Schedules for Distributed BMPs on Public Land M-2
M.3. Project Schedules for Centralized Structural BMPs M-3
M.4. Project Schedules for Centralized BMPs on Private Property M-4

Tables

Table B-1. Ballona Creek Monitoring Stations B-1
Table B-2. Wet-Weather Monitoring of Heavy Metals (Zinc, Copper, Lead – µg/L) in the Ballona Creek Watershed B-5
Table B-3. Wet-Weather Monitoring of Cadmium and Selenium in the Ballona Creek Watershed (µg/L) B-6
Table B-4. Wet-Weather Monitoring of Fecal Coliform in the Ballona Creek Watershed (MPN/100 mL) B-6
Table B-5. Wet-Weather Monitoring of Nutrients in the Ballona Creek Watershed (mg/L) B-6
Table B-6. Wet-Weather Monitoring of PAHs in the Ballona Creek Watershed (ng/L) B-7
Table B-7. Ballona Creek Watershed Median Wet Weather Concentrations – MS4 Water Quality Assessment B-8
Table B-8. Dry-Weather Monitoring of Heavy Metals (Zinc, Copper, Lead, in µg/L) in the Ballona Creek Watershed B-9
Table B-9. Dry-Weather Monitoring of Cadmium and Selenium in the Ballona Creek Watershed (µg/L) B-9
Table B-10. Dry-Weather Monitoring of Fecal Coliform in the Ballona Creek Watershed (MPN/100mL) B-9
Table B-11. Dry-Weather Monitoring of Nutrients in the Ballona Creek Watershed (mg/L) B-10
Table B-12. Ballona Creek Watershed Median Dry Weather Concentrations – MS4 Water Quality Assessment B-10
Table D-1. Soil Boring Composition D-3
Table D-2. Soil Boring Log D-3
Table D-3. NRCS Hydrologic Soil Group D-4
Table D-4. Measured Infiltration Rates D-4
Table D-5. Infiltration Rate Analysis by HSG D-5

Table E-1. Potential Centralized BMPs E-3
Table E-2. Measured Infiltration Rates E-3
Table E-3. Soil Boring Composition E-4
Table E-4. Soil Boring Log E-4
Table E-5. LACDPW Well Data E-5
Table E-6. Metals Concentrations for Investigated Sites E-6
Table E-7. pH and Nutrient Concentrations for Investigated Sites E-6
Table F-1. Catch Basin Insert Costs F-11
Table F-2. Expected Pollutant Reductions F-11
Table G-1. Modeled HRUs by Unincorporated County Area G-5
Table G-2. Effective Irrigation Coefficients Used in the Model G-5
Table G-3. Distributed BMP Physical Configurations G-11
Table G-4. Distributed BMP Simulation Parameters G-11
Table G-5. Centralized BMP Simulation Parameters G-13
Table G-6. Centralized BMP Physical Configurations G-14
Table G-7. Costs for Vacant Land in Los Angeles G-17
Table G-8. Optimal Maximum Centralized BMPs Size on Public Land Derived from Optimization Scenarios 1 ..... G-26
Table G-9. Pollutant Reductions Achieved by Optimal Maximum Centralized BMPs Size on Public Land Derived from Optimization Scenarios 1 ..... G-26
Table G-10. Land Use Composition of Public-Owned County TMDL Implementation Area G-27
Table G-11. Optimal Distributed BMPs Size on Public Land Derived from Optimization Scenarios 1 (Point C, with Nonstructural BMP, Excluding Area Draining to Public Centralized BMP Sites) G-27
Table G-12. Distributed BMP Physical Configurations G-27
Table G-13. Centralized BMPs on Private Land - Cost and Configurations G-29
Table G-14. Optimal Centralized BMPs of Private Land - Derived from Optimization Scenario 2 (Points D, E, and F) G-29
Table H-1. Summary of Groundwater Storage and Recharge Parameters for Central Basin H-1
Table H-2. Summary of Groundwater Storage and Recharge Parameters for West Coast Basin H-2
Table H-3. Summary of Groundwater Storage and Recharge Parameters for Santa Monica Basin H-2
Table I-1. Green Building Requirements for Projects I-18
Table J-1. Pollutants Recommended for Structural BMP Monitoring J-1
Table K-1. Nonstructural BMPs: Catch Basin Inserts Phase 2 ..... K-2
Table K-2. Nonstructural BMPs: Catch Basin Inserts Phase 3 ..... K-2
Table K-3. Unit Cost Estimates for Other Distributed BMPs on Public Land K-5
Table K-4. Distributed BMPs on Public Land: Bioretention and Linear Bioretention Cost Estimate, Low Infiltration K-6
Table K-5. Distributed BMPs on Public Land: Bioretention and Linear Bioretention Cost Estimate, High Infiltration K-7
Table K-6. Distributed BMPs on Public Land: Porous Pavement Cost Estimate, Low Infiltration K-8
Table K-7. Distributed BMPs on Public Land: Porous Pavement Cost Estimate, High Infiltration K-9
Table K-8. Centralized BMPs on Public Land: Ladera Park BMP Cost Estimate K-11
Table K-9. Centralized BMPs on Public Land: West Los Angeles Community CollegeBMP Cost Estimate K-13
Table K-10. Centralized BMPs on Private Land Estimated Costs K-14
Table K-11. Nonstructural BMPs: TMDL-specific Stormwater Training K-15
Table K-12. Nonstructural BMPs: Enhancement of Commercial and Industrial Facility Inspections K-16
Table K-13. Nonstructural BMPs: Smart Gardening Program Enhancements: Workshops in the Ballona Creek Watershed K-16
Table K-14. Nonstructural BMPs: Smart Gardening Program Enhancements: Workshop Tip Cards on Water Quality K-16
Table K-15. Nonstructural BMPs: Reduction in Irrigation Return Flow + Xeriscaping K-17
Table L-1. Decision Criteria and Rankings L-1
Table L-2. Wet-Weather Metals Cost-Effectiveness Comparison of Phases and Alternatives L-4
Table L-3. Complementary Integration of BMPs L-8
Table L-4. Support of Integrated Water Resources Policy L-9
Table L-5. Other Sustainability Benefits of Alternatives 1 and 2 ..... L-12

Figures

Figure B-1. Ballona Creek Watershed Wet-Weather Monitoring B-2
Figure B-2. Ballona Creek Monitored Subwatersheds—MS4 Water Quality Assessment B-3
Figure B-3. Ballona Creek Dry-Weather Monitoring B-4
Figure D-1. Double Ring Infiltrometer D-1
Figure D-2. Sealing the Rings D-1
Figure D-3. Infiltrometer Test Setup D-2
Figure D-4. Site investigation D-2
Figure D-5. Soil Boring D-2
Figure E-1. Double-Ring Infiltrometer E-1
Figure E-2. Sealing the Rings E-1
Figure E-3. Infiltrometer Test Setup E-2
Figure E-4. Site Investigation E-2
Figure E-5. Soil Boring E-2
Figure E-6. West Los Angeles Community College Drainage Area E-8
Figure E-7. West Los Angeles Community College Available BMP Area E-9
Figure E-8. West Los Angeles Community College Residential Drainage Area E-10
Figure E-9. West Los Angeles Community College Curb Drains E-10
Figure E-10. Ladera Park Watershed E-11
Figure E-11. Ladera Park Available BMP Area E-12
Figure E-12. Ladera Park North Drain E-13
Figure E-13. Ladera Park South Drain E-13
Figure E-14. Ladera Park Commercial Area of the Watershed E-13
Figure E-15. Ladera Park Residential Area of the Watershed E-13
Figure E-16. Ladera Park Amphitheater E-13
Figure E-17. Ladera Park Amphitheater and Tennis Courts E-13
Figure E-18. Ladera Park Sycamore Trees E-14
Figure G-1. Modeled Subbasins and TMDL Implementation Areas G-3
Figure G-2. Conceptual Schematic for Original and Modified Model Configuration G-4
Figure G-3. 85th Percentile 24-Hour Isohyets for the County of Los Angeles G-9
Figure G-4. Distributed BMPs and Flow Pathway for Institutional Areas G-10
Figure G-5. Distributed BMPs and Flow Pathway for Public Transportation Areas G-10
Figure G-6. Example BMP Model Network Representation for Distributed BMPs Upstream of Centralized BMP Facilities G-12
Figure G-7. Selected Stations for Regional Rainfall Volume and Intensity Duration Analysis G-19
Figure G-8. Average Rainfall and Elevation at Selected Stations (10/1/1987–9/30/2006) G-20
Figure G-9. Total Annual Precipitation Volumes vs. 20-Year Annual Average Precipitation at Four Gages in the Los Angeles Region G-20
Figure G-10. Rainfall Volume and Intensity Duration Analysis at Los Angeles International AP gage (045114) G-21
Figure G-11. Rainfall Volume and Intensity Duration Analysis at Los Angeles Downtown Gage (045115) G-21
Figure G-12. Rainfall Volume and Intensity Duration Analysis at Pasadena Gage (046719) G-22
Figure G-13. Rainfall Volume and Intensity Duration Analysis at Mt Wilson No 2 Gage (046006) G-22
Figure G-14. Water Year 2003 Rainfall Duration Summary at Los Angeles International AP (045114) G-23
Figure G-15. Water Year 2003 Rainfall Duration Summary at Pasadena (046719) G-23
Figure G-16. Pollutant Reduction vs. Minimum Cost Relationship Derived from Scenarios 1 and 2 ..... G-24
Figure G-17. Public Land in the County TMDL Implementation Area G-25
Figure G-18. Comparison of Public BMP Cost-Effectiveness G-28
Figure I-1. Jurisdictional Sizing of Dams I-8
Figure I-2. Potential Locations of All Take Prohibited Species under CESA I-13
Figure I-3. Ballona Creek Community Standards Districts I-24
Figure I-4. Ballona Creek Major Zoning Categories I-25
Figure I-5. Ballona Creek Significant Ecological Areas I-26
Figure I-6. Coastal Zone in the Ballona Creek Watershed I-27

Appendix A. TMDL Summaries

To provide a summary of the Ballona Creek TMDLs, the following pages include the Attachments to the Resolutions for Amending LARWQCB's Water Quality Control Plan to incorporate the TMDLs. Amendments are include in the following order:

- TMDL for bacteria in Ballona Creek, Ballona Estuary and Sepulveda Channel
- TMDL for metals in Ballona Creek
- TMDL for trash in Ballona Creek and Wetland
- TMDL for toxics in Ballona Creek Estuary

(This page intentionally left blank.)

Attachment A to Resolution No. 06-011

Amendment to the Water Quality Control Plan – Los Angeles Region to incorporate the TMDL for Bacterial Indicator Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel.

Adopted by the California Regional Water Quality Control Board, Los Angeles Region on June 8, 2006.

Amendments:

Table of Contents
Add:

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries
7-21 Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL

List of Figures, Tables and Inserts
Add:

Chapter 7. Total Maximum Daily Loads (TMDLs)
Tables
7-21 Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL
7-21.1. Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL: Elements
7-21.2a. Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL: Final Allowable Exceedance Days by Reach
7.21.2b. Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL: WLAs and LAs for tributaries to the Impaired Reaches.
7-21.3. Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL: Significant Dates

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries, Section 7-21 (Ballona Creek, Ballona Estuary, and Sepulveda Channel Bacteria TMDL)

This TMDL was adopted by the Regional Water Quality Control Board on June 8, 2006.

This TMDL was approved by:

The State Water Resources Control Board on [Insert Date].
The Office of Administrative Law on [Insert Date].
The U.S. Environmental Protection Agency on [Insert Date].

The following table includes all the elements of this TMDL.

Table 7-21.1. Ballona Creek, Estuary, and Tributaries s Bacteria TMDL: Elements

Element	Key Findings and Regulatory Provisions
Problem Statement	Elevated bacterial indicator densities are causing impairment of the water contact recreation (REC-1) beneficial use designated for Ballona Estuary and Sepulveda Channel, limited water contact recreation (LREC) designated for Ballona Creek Reach 2, and non-contact recreation (REC-2) beneficial uses of Ballona Creek Reach 1. Recreating in waters with elevated bacterial indicator densities has long been associated with adverse human health effects. Specifically, local and national epidemiological studies compel the conclusion that there is a causal relationship between adverse health effects and recreational water quality, as measured by bacterial indicator densities.
Numeric Target *(Interpretation of the numeric water quality objective, used to calculate the waste load allocations)*	The TMDL has a multi-part numeric target based on the bacteriological water quality objectives for marine and fresh water to protect the contact and non-contact recreation uses. These targets are the most appropriate indicators of public health risk in recreational waters. These bacteriological objectives are set forth in Chapter 3 of the Basin Plan.[1] The objectives are based on four bacterial indicators and include both geometric mean limits and single sample limits. The Basin Plan objectives that serve as the numeric targets for this TMDL are: In Marine Waters Designated for Water Contact Recreation (REC-1) <u>1. Geometric Mean Limits</u> a. Total coliform density shall not exceed 1,000/100 ml. b. Fecal coliform density shall not exceed 200/100 ml. c. Enterococcus density shall not exceed 35/100 ml. <u>2. Single Sample Limits</u> a. Total coliform density shall not exceed 10,000/100 ml. b. Fecal coliform density shall not exceed 400/100 ml. c. Enterococcus density shall not exceed 104/100 ml. d. Total coliform density shall not exceed 1,000/100 ml, if the ratio of fecal-to-total coliform exceeds 0.1. In Fresh Waters Designated for Water Contact Recreation (REC-1) 1. Geometric Mean Limits a. *E. coli* density shall not exceed 126/100 ml. b. Fecal coliform density shall not exceed 200/100 ml. 2. Single Sample Limits a. *E. coli* density shall not exceed 235/100 ml. b. Fecal coliform density shall not exceed 400/100 ml.

[1] The bacteriological objectives were revised by a Basin Plan amendment adopted by the Regional Board on October 25, 2001, and subsequently approved by the State Water Resources Control Board, the Office of Administrative Law and finally by U.S. EPA on September 25, 2002.

Element	Key Findings and Regulatory Provisions
	In Fresh Waters Designated for Limited Water Contact Recreation (LREC-1)[2] 1. Geometric Mean Limits a. *E. coli* density shall not exceed 126/100 ml. b. Fecal coliform density shall not exceed 200/100 ml. 2. Single Sample Limits a. *E. coli* density shall not exceed 576/100 ml. In Fresh Waters Designated for Non-Contact Water Recreation (REC-2) 1. Geometric Mean Limits a. Fecal coliform density shall not exceed 2000/100 ml. 2. Single Sample Limits a. Fecal coliform density shall not exceed 4000/100 ml. The targets apply throughout the year. Determination of attainment of the targets will be at in-stream monitoring sites to be specified in the compliance monitoring report. Implementation of the above REC-1 and LREC-1 bacteria objectives and the associated TMDL numeric targets is achieved using a 'reference system/anti-degradation approach' rather than the alternative 'natural sources exclusion approach subject to antidegradation policies' or strict application of the single sample objectives. As required by the CWA and Porter-Cologne Water Quality Control Act, Basin Plans include beneficial uses of waters, water quality objectives to protect those uses, an anti-degradation policy, collectively referred to as water quality standards, and other plans and policies necessary to implement water quality standards. This TMDL and its associated waste load allocations, which shall be incorporated into relevant permits, and load allocations are the vehicles for implementation of the Region's standards. The 'reference system/anti-degradation approach' means that on the basis of historical exceedance levels at existing monitoring locations, including a local reference beach within Santa Monica Bay, a certain number of daily exceedances of the single sample bacteria objectives are permitted. The allowable number of exceedance days is set such that (1) bacteriological water quality at any site is at least as good as at a designated reference site within the watershed and (2) there is no degradation of existing bacteriological water quality. This approach recognizes that there are natural sources of bacteria that may cause or contribute to exceedances of the single sample objectives and that it is not the intent of the Regional Board to require treatment or diversion of natural coastal creeks or to require treatment of natural sources of bacteria from undeveloped areas.

[2] The bacteriological objectives for the LREC-1 use designation were provided in a Basin Plan Amendment adopted by State Board on January 20, 2005, and subsequently approved by the Office of Administrative Law and finally by U.S. EPA on February 17, 2006

Element	Key Findings and Regulatory Provisions
	The geometric mean targets may not be exceeded at any time. The rolling 30-day geometric means will be calculated on each day. If weekly sampling is conducted, the weekly sample result will be assigned to the remaining days of the week in order to calculate the daily rolling 30-day geometric mean. For the single sample targets, each existing monitoring site is assigned an allowable number of exceedance days for three time periods (1) summer dry-weather (April 1 to October 31), (2) winter dry-weather (November 1 to March 31), and (3) wet-weather (defined as days with 0.1 inch of rain or greater and the three days following the rain event.) Implementation of the REC-2 target will be as specified in the Basin Plan. The REC-2 bacteria objectives allow for a 10% exceedance frequency of the single sample limit in samples collected during a 30-day period. This allowance, which is based on an acceptable level of health risk, will be applied in lieu of the allowable exceedance days discussed earlier. As with the other REC-1 and LREC-1 objectives, the geometric mean target for REC-2, which is based on a rolling 30-day period, will be strictly adhered to and may not be exceeded at any time.
Source Analysis	The major contributors of flows and associated bacteria loading to Ballona Creek and Estuary, are dry- and wet-weather urban runoff discharges from the storm water conveyance system. Run-off to Ballona Creek is regulated as a point source under the Los Angeles County MS4 Permit, the Caltrans Storm Water Permit, and the General Construction and Industrial Storm Water Permits. In addition to these regulated point sources, the Ballona Estuary receives input from the Del Rey Lagoon and Ballona Wetlands through connecting tide gates. Preliminary data suggest that the Ballona Wetlands are a sink for bacteria from Ballona Creek and it is therefore not considered a source in this TMDL. Inputs to Ballona Estuary from Del Rey Lagoon, are considered non-point sources of bacterial contamination. This waterbody may be considered for a natural source exclusion if its contributing bacteria loads are determined to be as a result of wildlife in the area, as opposed to anthropogenic inputs. The TMDL will require a source identification study for the lagoon in order to apply the natural source exclusion. Other nonpoint sources in Ballona Creek and Estuary include natural sources from birds, waterfowl and other wildlife. Data do not currently exist to quantify the extent of the impact of wildlife on bacteria water quality in the Estuary.
Loading Capacity	The loading capacity is defined in terms of bacterial indicator densities, which is the most appropriate for addressing public health risk, and is equivalent to the numeric targets, listed above.
Waste Load Allocations *(for point sources)*	The Los Angeles County MS4 and Caltrans storm water permittees and co-permittees are assigned waste load allocations (WLAs) expressed as the number of daily or weekly sample days that may exceed the single sample targets equal to the TMDLs established for the impaired reaches (see Table 7.21.2a), and Waste Load Allocations assigned to waters tributary to impaired reaches (Table 7.21.2b). Waste load allocations are expressed as allowable exceedance days because the bacterial density and frequency of single sample

Element	Key Findings and Regulatory Provisions
	exceedances are the most relevant to public health protection. For each monitoring site, allowable exceedance days are set on an annual basis as well as for three time periods. These three periods are: 1. summer dry-weather (April 1 to October 31) 2. winter dry-weather (November 1 to March 31) 3. wet-weather days (defined as days of 0.1 inch of rain or more plus three days following the rain event). The County of Los Angeles, Caltrans, and the Cities of Los Angeles, Culver City, Beverly Hills, Inglewood, West Hollywood, and Santa Monica are the responsible jurisdictions and responsible agencies[3] for the Ballona Creek Watershed. The responsible jurisdictions and responsible agencies within the watershed are jointly responsible for complying with the waste load allocation in each reach. For the single sample objectives of the impaired REC-1 and LREC-1 reaches, the proposed WLA for summer dry-weather are zero (0) days of allowable exceedances, and those for winter dry-weather and wet-weather are three (3) days and seventeen (17) days of exceedance, respectively. In the instances where more than one single sample objective applies, exceedance of any one of the limits constitutes an exceedance day. The proposed waste load allocation for the rolling 30-day geometric mean for the responsible agencies and jurisdictions is zero (0) days of allowable exceedances. For the single sample objectives of the impaired REC-2 reach, the proposed WLA for all periods is a 10% exceedance frequency of the REC-2 single sample water quality objectives. The proposed waste load allocation for the rolling 30-day geometric mean for the responsible agencies and jurisdictions is zero (0) days of allowable exceedances. In addition to assigning TMDLs for the impaired reaches, Waste Load Allocations and Load Allocations are assigned to the tributaries to these impaired reaches. These WLAs and LAs are to be met at the confluence of each tributary and its downstream reach (see Table 7.21.2b).
Load Allocations *(for nonpoint sources)*	Load allocations are expressed as the number of daily or weekly sample days that may exceed the single sample targets identified under "Numeric Target" at a monitoring site, along with a rolling 30-day geometric mean. Load allocations are expressed as allowable exceedance days because the bacterial density and frequency of single sample exceedances are the most relevant to public health protection. Del Rey Lagoon is considered a nonpoint source and is therefore subject to load allocations. The proposed LA for summer dry-weather are zero (0) days of allowable exceedances, and those for winter dry-weather and wet-weather are three (3) days and seventeen (17) days of exceedance, respectively. In the instances where more than one single sample objective applies, exceedance of any one of the limits constitutes an exceedance day. The proposed load allocation for the rolling 30-day geometric mean for the responsible agencies and

[3] For the purposes of this TMDL, "responsible jurisdictions and responsible agencies" are defined as (1) local agencies that are permittees or co-permittees on a municipal storm water permit, (2) local or state agencies that have jurisdiction over Ballona Creek and Estuary, and (3) the California Department of Transportation pursuant to its storm water permit.

Element	Key Findings and Regulatory Provisions
	jurisdictions is zero (0) days of allowable exceedances (see Table 7.21.2a). The City of Los Angeles is the responsible jurisdiction for the Del Rey lagoon, and is responsible for complying with the assigned load allocations presented in Table 7.21.2b at the tide gate(s) between the Lagoon and the Estuary. If other unidentified nonpoint sources are directly impacting bacteriological water quality and causing an exceedance of the numeric targets, within the Estuary, the permittee(s) under the Municipal Storm Water NPDES Permits are not responsible through these permits. However, the jurisdiction or agency adjacent to the monitoring location may have further obligations to identify such sources.
Implementation	The regulatory mechanisms used to implement the TMDL will include the Los Angeles County Municipal Storm Water NPDES Permit (MS4), the Caltrans Storm Water Permit, general NPDES permits, general industrial storm water permits, general construction storm water permits, and the authority contained in Sections 13263 and 13267 of the Water Code. Each NPDES permit assigned a WLA shall be reopened or amended at re-issuance, in accordance with applicable laws, to incorporate the applicable WLAs as a permit requirement. Each responsible jurisdictions and agency will be required to meet the storm water waste load allocations shared by the LA County MS4 and Caltrans permittees at the designated TMDL effectiveness monitoring points. An iterative implementation approach using a combination of non-structural and structural BMPs may 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 waste load allocation. Load allocations for nonpoint sources will be incorporated into Waste Discharge Requirements and MOUs with the responsible jurisdictional agencies. This TMDL will be implemented in two phases over a ten-year period (see Table 7-21.3). Within six years of the effective date of the TMDL, compliance with the allowable number of summer dry-weather (April 1 to October 31), winter dry-weather exceedance days (November 1 to March 31) and the rolling 30-day geometric mean targets for both periods must be achieved. Within ten years of the effective date of the TMDL, compliance with the allowable number of wet-weather exceedance days and rolling 30-day geometric mean targets must be achieved. In order to clearly justify an extended implementation schedule beyond 10 years and up to 14 years from the effective date of the TMDL, the responsible agencies are required to submit additional quantifiable analyses as described below to demonstrate (1) the proposed plans will meet the final WLAs and (2) the proposed implementation actions will achieve multiple water quality benefits and other public goals. The types of approaches proposed coupled with quantifiable estimates of the integrated water resources benefits of the proposed structural and non-structural BMPs included in the Implementation Plan would provide the obligatory demonstration that an integrated water resources approach is being

Element	Key Findings and Regulatory Provisions
	pursued. This demonstration shall include numeric estimates of the benefits, including but not limited to reductions in other pollutants, groundwater recharged, acres of multi-use projects and water (e.g. urban runoff) beneficially reused. The responsible jurisdictions and the responsible agencies must submit a report to the Executive Officer (see Table 7-21.3) describing how they intend to comply with the dry-weather and wet-weather WLAs. As the primary jurisdiction, the City of Los Angeles is responsible for submitting the implementation plan report described above. In addition, as the responsible agency for Del Rey Lagoon, the City of Los Angeles must submit a report detailing how it intends to comply with the load allocations assigned to this waterbody. Alternatively, the City of Los Angeles may submit data clearly demonstrating that Del Rey Lagoon is not a source, for the Regional Board's consideration.. The Regional Board intends to reconsider this TMDL, within 4 years of its effective date to incorporate modifications to the WLAs based on results of the scheduled reconsideration of the Santa Monica Bay (SMB) beaches TMDLs. The SMB beaches TMDLs are scheduled to be reconsidered in four years to re-evaluate the allowable winter dry-weather and wet-weather exceedance days based on additional data on bacterial indicator densities in the wave wash; to re-evaluate the reference system selected to set allowable exceedance levels; to re-evaluate the reference year used in the calculation of allowable exceedance days, and to re-evaluate the need for revision of the geometric mean implementation provision. The Regional Board also intends to re-asses the WLAs for Benedict Canyon Channel, Sepulveda Channel, and Centinela Creek based on results of the required compliance monitoring, and/or any voluntary beneficial use investigations.
Margin of Safety	By directly applying the numeric water quality standards and implementation procedures as Waste Load Allocations, there is little uncertainty about whether meeting the TMDLs will result in meeting the water quality standards.
Seasonal Variations and Critical Conditions	Seasonal variations are addressed by developing separate waste load allocations for three time periods (summer dry-weather, winter-dry weather, and wet-weather) based on public health concerns and observed natural background levels of exceedance of bacterial indicators. The critical condition for bacteria loading to the Ballona Creek, Ballona Estuary, and Sepulveda Channel is during wet weather when monitoring data indicate greater exceedance probabilities of the single sample bacteria objectives than during dry-weather. The Santa Monica Bay Beaches Bacteria TMDL identified the critical condition within wet weather more specifically, in order to set the allowable number of exceedances of the single sample limit days. The 90^{th} percentile storm year in terms of wet days was used as the reference year. The 90^{th} percentile year was selected for several reasons. First, selecting the 90^{th} percentile year avoids an untenable situation where the reference system is frequently out of compliance. Second, selecting the 90^{th} percentile year allows responsible jurisdictions and responsible agencies to plan for a 'worst-case scenario', as a critical condition is intended to do

Element	Key Findings and Regulatory Provisions
Monitoring	The TMDL effectiveness monitoring program will assess attainment of the allowable exceedances for Ballona Creek, Ballona Estuary, and Sepulveda Channel, and the WLAs for the tributaries. Responsible jurisdictions and responsible agencies shall conduct daily or systematic weekly sampling at a minimum of two locations within Ballona Estuary and Reach 2 of Ballona Creek, at least one location each in Reach 1 of Ballona Creek and Sepulveda Channel, and at the confluence with Centinela Creek and Benedict Canyon Channel, to determine compliance. Similar monitoring at the connecting tide gates of Del Rey Lagoon is also required. Where monitoring locations are located at or close to the boundary of two reaches, data from sampling points will also be used to assess the immediate downstream reach. This will ensure that the downstream reaches, which have more stringent water quality objectives, are adequately protected. If the number of exceedance days is greater than the allowable number of exceedance days in the REC-1 and LREC-1 waters, and/or the frequency of exceedance is greater than 10% in the REC-2 waters, the responsible jurisdictions and/or responsible agencies shall be considered not to be attaining the TMDLs and/or assigned allocations (non-attaining). Responsible jurisdictions or agencies shall not be deemed non-attaining if the investigation described in the paragraph below demonstrates that bacterial sources originating within the jurisdiction of the responsible agency have not caused or contributed to the exceedance. If an in-stream location is non-attaining as determined in the previous paragraph, the Regional Board shall require responsible agencies to initiate an investigation, which at a minimum shall include daily sampling at the existing monitoring location until all single sample events meet bacteria water quality objectives.
Special Studies	Should the jurisdictional agency for Del Rey Lagoon opt for the natural source exclusion, the TMDL requires that a separate bacteria source identification study be conducted to determine its eligibility.. The study should identify all probable sources of bacteria loads, their estimated contributions to the Lagoon, and a determination of the frequency of exceedances of the single sample bacteria objectives caused by the identified natural sources.

Table 7.21.2a: Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL: Final Allowable Exceedance Days by Reach

Time Period	Ballona Estuary, Ballona Creek Reach 2, and Sepulveda Channel *	Ballona Creek Reach 1**
Summer Dry-Weather (April 1 to October 31)	Zero (0) exceedance days based on the applicable Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives	No more than 10% of the Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives
Winter Dry-Weather (November 1-March 31)	Three (3) exceedance days based on the applicable Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives	No more than 10% of the Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives
Wet-Weather (days with ≥0.1 inch of rain + 3 days following the rain event)	17*** exceedance days based on the applicable Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives	No more than 10% of the Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives

* Exceedance days for Ballona Estuary based on REC-1 marine water numeric targets; for Ballona Creek Reach 2 based on LREC-1 freshwater numeric targets; and for Sepulveda Channel, based on fresh water REC-1 numeric targets

**Exceedance frequency for Ballona Creek Reach 1 based on freshwater REC-2 numeric targets

*** In Reach 2, the greater of the allowable exceedance days under the reference system approach or high flow suspension shall apply.

Table 7.21.2b: Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL: WLAs and LAs for tributaries to the Impaired Reaches.

Tributary	Point of Application	Water Quality Objectives	Waste Load Allocation (No. exceedance days)
Ballona Creek Reach 1	At confluence with Reach 2	LREC-1 Freshwater	For single sample objectives: *(0) summer dry weather,* *(3) winter dry weather* *(17*) winter wet weather* For geometric mean objectives: *(0) for all periods*
Benedict Canyon Channel	At confluence with Reach 2	LREC-1 Freshwater	For single sample objectives: *(0) summer dry weather,* *(3) winter dry weather* *(17*) winter wet weather* For geometric mean objectives: *(0) for all periods*
Ballona Creek Reach 2	At confluence with Ballona Estuary	REC-1 Marine water	For single sample objectives: *(0) summer dry weather,* *(3) winter dry weather* *(17) winter wet weather* For geometric mean objectives: *(0) for all periods*
Centinela Creek	At confluence with Ballona Estuary	REC-1 Marine water	For single sample objectives: *(0) summer dry weather,* *(3) winter dry weather* *(17) winter wet weather* For geometric mean objectives: *(0) for all periods*
Del Rey Lagoon	At confluence with Ballona Estuary	REC-1 Marine water	For single sample objectives: *(0) summer dry weather,* *(3)winter dry weather* *(17) winter wet weather* For geometric mean objectives: *(0) for all periods*

*At the confluence with Reach 2, the greater of the allowable exceedance days under the reference system approach or high flow suspension shall apply.

Sepulveda Channel was not assigned a waste load allocation at its confluence with Reach 2 since the TMDL requires the more stringent REC-1 objectives to be met in this waterbody, which should lead to the attainment of the less stringent LREC-1 objectives of the downstream reach.

Table 7.21.3 Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL: Significant Dates

Date	Action
Responsible Jurisdictions for the Waste Load Allocations	
12 months after the effective date of the TMDL	Responsible jurisdictions and responsible agencies must submit, for Regional Board approval, a comprehensive bacteria water quality monitoring plan for the Ballona Creek Watershed. The plan must be approved by the Executive Officer before the monitoring data can be considered during the implementation of the TMDL. The plan must provide for analyses of all applicable bacteria indicators for which the Basin Plan and subsequent amendments have established objectives The plan must also include a minimum of two sampling locations (mid-stream and downstream) in Ballona Estuary, Ballona Creek (Reach 1 and 2), and their tributaries. The draft monitoring report shall be made available for public comment and the Executive Officer shall accept public comments for at least 30 days. Once the coordinated monitoring plan is approved by the Executive Officer, monitoring shall commence within 6 months.
$2^1/_2$ years after the effective date of the TMDL	Responsible jurisdictions and agencies must provide a draft Implementation Plan to the Regional Board outlining how each intends to cooperatively achieve compliance with the dry-weather and wet-weather TMDL Waste Load Allocations. The report shall include implementation methods, an implementation schedule, and proposed milestones. The description of the implementation methods and milestones shall include a technically defensible quantitative linkage to the interim and final waste load allocations (WLAs). The linkage should include target reductions in stormwater runoff and/or fecal indicator bacteria. The plan shall include quantitative estimates of the water quality benefits provided by the proposed structural and non-structural BMPs. Estimates should address reductions in exceedance days, bacteria concentration and loading, and flow in the drain and at each beach compliance monitoring location. As part of the draft plan, responsible agencies must submit results of all special studies and/or Environmental Impact Assessments, designed to determine feasibility of any strategy that requires diversion and/or reduction of Creek flows. If a responsible jurisdiction or agency is requesting a longer schedule for wet-weather compliance based on an integrated approach, the plan must include a clear demonstration that the plan meets the criteria of an IWRA, and a clear demonstration of the need for the proposed schedule. Compliance with the wet-weather allocations shall be as soon as possible but under no circumstances shall it exceed the time frame adopted in the

Date	Action
	TMDL for non-integrated approaches or for an integrated approach. The draft Plan shall be made available for public comment and the Executive Officer shall accept public comments for at least 30 days.
3 months after receipt of Regional Board comments on the draft plan	Responsible jurisdictions and agencies submit a Final Implementation Plan to the Regional Board.
Responsible agencies for Load Allocations	
1 year after the effective date of the TMDL	Responsible agencies must submit, for Regional Board approval, separate comprehensive bacteria water quality monitoring plans for inputs from Del Rey Lagoon and the Ballona Wetlands to the Ballona Estuary. Each plan must be approved by the Executive Officer before the monitoring data can be considered during the implementation of the TMDL. The plan must provide for analyses of all applicable bacteria indicators for which the Basin Plan and subsequent amendments have established objectives The plan must also include a minimum of one sampling location at the connecting tide gate(s). The draft monitoring reports shall be made available for public comment and the Executive Officer shall accept public comments for at least 30 days. Once a coordinated monitoring plan is approved by the Executive Officer, monitoring shall commence within 6 months.
3 years after the effective date of the TMDL.	If the responsible agency for the Del Rey Lagoon intends to pursue a natural source exclusion, it shall submit the results of separate natural source study for the Lagoon to the Executive Officer of the Regional Board. The study shall include a comprehensive assessment of all sources of bacteria loads to the Lagoon and estimates of their individual contributions. In addition, a determination of the number of exceedance days caused by these sources should be made These studies shall be made available for public comment and the Executive Officer shall accept public comments for at least 30 days.
Responsible Agencies for WLAs and LAs* *(*Only if not eligible for natural source exclusion(s)*	
4 years after the effective date of the TMDL:	The Regional Board shall reconsider this TMDL to: (1) Re-assess the allowable winter dry-weather and wet-weather exceedance days based on a re-evaluation of the selected reference watershed and consideration of other reference watersheds that may better represent reaches of Ballona

Date	Action
	Creek and Estuary, (2) Consider whether the allowable winter dry-weather and wet-weather exceedance days should be adjusted annually dependent on the rainfall conditions and an evaluation of natural variability in exceedance levels in the reference system(s), (3) Re-evaluate the reference year used in the calculation of allowable exceedance days, and (4) Re-evaluate whether there is a need for further clarification or revision of the geometric mean implementation provision. (5) Consider natural source exclusions for bacteria loading from Del Rey Lagoon and the Ballona Wetlands based on results of the source identification study. (6) Re-assess WLAs for Benedict Canyon Channel, Sepulveda Channel, and Centinela Creek based on results of the required compliance monitoring, and/or any voluntary beneficial use investigations.
6 years after the effective date of the TMDL:	Achieve compliance with the allowable exceedance days for summer and winter dry-weather as set forth in Table 6-1 and rolling 30-day geometric mean targets.
10 years after effective date of the TMDL or, if an Integrated Water Resources Approach is implemented, up to July 15, 2021.*	Achieve compliance with the allowable exceedance days as set forth in Table 6-1 and rolling 30-day geometric mean targets during wet-weather.

*July 15, 2021 is the final compliance date of the Santa Monica Bay Beaches Bacteria Wet-Weather TMDL.

Attachment A to Resolution No. R05-007

Amendment to the Water Quality Control Plan – Los Angeles Region to incorporate the Ballona Creek Metals TMDL

Adopted by the California Regional Water Quality Control Board, Los Angeles Region on July 7, 2005.

Amendments:

Table of Contents
Add:

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries
7-12 Ballona Creek Metals TMDL

List of Figures, Tables and Inserts
Add:

Chapter 7. Total Maximum Daily Loads (TMDLs)
Tables
7-12 Ballona Creek Metals TMDL
7-12.1. Ballona Creek Metals TMDL: Elements
7-12.2. Ballona Creek Metals TMDL: Implementation Schedule

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries, Section 7-12 (Ballona Creek Metals TMDL)
Add:

This TMDL was adopted by the Regional Water Quality Control Board on July 7, 2005.

This TMDL was approved by:

The State Water Resources Control Board on [Insert Date].
The Office of Administrative Law on [Insert Date].
The U.S. Environmental Protection Agency on [Insert Date].

The following tables include the elements of this TMDL.

Table 7-12.1. Ballona Creek and Ballona Creek Estuary Metals TMDL: Elements

<table>
<tr><th>Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td>Problem Statement</td><td>Ballona Creek is on Clean Water Act Section 303(d) list of impaired waterbodies for dissolved copper, dissolved lead, total selenium, and dissolved zinc and Sepulveda Canyon Channel is 303(d) listed for lead. The metals subject to this TMDL are toxic pollutants, and the existing water quality objectives for the metals reflect national policy that the discharge of toxic pollutants in toxic amounts be prohibited. When one of the metals subject to this TMDL is present at levels exceeding the existing numeric objectives, then the receiving water is toxic. The following designated beneficial uses are impaired by these metals: water contact recreation (REC1); non-contact water recreation (REC2); warm freshwater habitat (WARM); estuarine habitat (EST); marine habitat (MAR); wildlife habitat (WILD); rare and threatened or endangered species (RARE); migration of aquatic organisms (MIGR); reproduction and early development of fish (SPWN); commercial and sport fishing (COMM); and shellfish harvesting (SHELL).

TMDLs are developed for reaches on the 303(d) list and metal allocations are developed for tributaries that drain to impaired reaches. This TMDL address dry- and wet-weather discharges of copper, lead, selenium and zinc in Ballona Creek and Sepulveda Canyon Channel.</td></tr>
<tr><td>Numeric Target
(Interpretation of the narrative and numeric water quality objective, used to calculate the load allocations)</td><td>Numeric water quality targets are based on the numeric water quality standards established for metals by the California Toxics Rule (CTR). The targets are expressed in terms of total recoverable metals. There are separate numeric targets for dry and wet weather because hardness values and flow conditions in Ballona Creek and Sepulveda Canyon Channel vary between dry and wet weather. The dry-weather targets apply to days when the maximum daily flow in Ballona Creek is less than 40 cubic feet per second (cfs). The wet-weather targets apply to days when the maximum daily flow in Ballona Creek is equal to or greater than 40 cfs.

Dry Weather

The dry-weather targets are based on the chronic CTR criteria. The copper, lead and zinc targets are dependent on hardness to adjust for site-specific conditions and require conversion factors to convert between dissolved and total recoverable metals. These targets are based on the 50th percentile hardness value of 300 mg/L and the CTR default conversion factors. The conversion factor for lead is hardness dependent, which is also based on a hardness of 300 mg/L. The dry-weather target for selenium is independent of hardness and expressed as total recoverable metals.

Dry-weather numeric targets (µg total recoverable metals/L)
<table>
<tr><th></th><th>Dissolved</th><th>Conversion Factor</th><th>Total Recoverable</th></tr>
<tr><td>Copper</td><td>23</td><td>0.96</td><td>24</td></tr>
<tr><td>Lead</td><td>8.1</td><td>0.631</td><td>13</td></tr>
<tr><td>Selenium</td><td></td><td></td><td>5</td></tr>
<tr><td>Zinc</td><td>300</td><td>0.986</td><td>304</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td></td><td>
Wet Weather

The wet-weather targets for copper, lead and zinc are based on the acute CTR criteria and the 50th percentile hardness value of 77 mg/L for storm water collected at Sawtelle Boulevard. Conversion factors for copper and zinc are based on a regression of dissolved metal values to total metal values collected at Sawtelle. The CTR default conversion factor based on a hardness value of 77 mg/L is used for lead. The wet-weather target for selenium is independent of hardness and expressed as total recoverable metals.

Wet-weather numeric targets (µg total recoverable metals/L)
<table>
<tr><th></th><th>Dissolved</th><th>Conversion Factor</th><th>Total Recoverable</th></tr>
<tr><td>Copper</td><td>11</td><td>0.62</td><td>18</td></tr>
<tr><td>Lead</td><td>49</td><td>0.829</td><td>59</td></tr>
<tr><td>Selenium</td><td></td><td></td><td>5</td></tr>
<tr><td>Zinc</td><td>94</td><td>0.79</td><td>119</td></tr>
</table>
</td></tr>
<tr><td>Source Analysis</td><td>
There are significant difference in the sources of copper, lead, selenium and zinc loadings during dry weather and wet weather. During dry weather, most of the metals loadings are in the dissolved form. Storm drains convey a large percentage of the metals loadings during dry weather because although their flows are typically low, concentrations of metals in urban runoff may be quite high. During dry years, dry-weather loadings account for 25-35% of the annual metals loadings. Additional sources of dry weather flow and metals loading include groundwater discharge and flows from other permitted NPDES discharges within the watershed.

During wet weather, most of the metals loadings in Ballona Creek are in the particulate form and are associated with wet-weather storm water flows. On an annual basis, storm water contributes about 91% of the copper loading and 92% of the lead loading to Ballona Creek. Storm water flow is permitted through the municipal separate storm sewer system (MS4) permit issued to the County of Los Angeles, a separate Caltrans storm water permit, a general construction storm water permit, and a general industrial storm water permit.

Non-point sources are not considered to be a significant source in this TMDL. Direct atmospheric deposition of metals is insignificant relative to the annual dry-weather loading or the total annual loading. Indirect atmospheric deposition reflects the process by which metals deposited on the land surface may be washed off during storm events and delivered to Ballona Creek and its tributaries. The loading of metals associated with indirect atmospheric deposition are accounted for in the estimates of the storm water loading.
</td></tr>
</table>

<table>
<tr><th>Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td>Loading Capacity</td><td>TMDLs are developed for copper, lead, selenium and zinc for Ballona Creek and Sepulveda Canyon Channel.

Dry Weather

Dry-weather loading capacities for Ballona Creek and Sepulveda Canyon Channel are equal to the dry-weather numeric targets multiplied by the critical dry-weather flow for each waterbody. Based on long-term flow records for Ballona Creek at Sawtelle the median dry-weather flow is 14 cfs. The median dry-weather flow for Sepulveda Canyon Channel, based on measurements conducted in 2003, is 6.3 cfs.

<u>Dry-weather loading capacity (grams total recoverable metals/day)</u>
<table><tr><th></th><th>Copper</th><th>Lead</th><th>Selenium</th><th>Zinc</th></tr><tr><td>Ballona Creek</td><td>821</td><td>440</td><td>171</td><td>10,423</td></tr><tr><td>Sepulveda Channel</td><td>371</td><td>199</td><td>77</td><td>4,712</td></tr></table>
Wet Weather

Wet-weather loading capacities are calculated by multiplying the daily storm volume by the wet-weather numeric target for each metal.

<u>Wet-weather loading capacity (total recoverable metals)</u>
<table><tr><th>Metal</th><th>Load Capacity</th></tr><tr><td>Copper</td><td>Daily storm volume x 18 µg/L</td></tr><tr><td>Lead</td><td>Daily storm volume x 59 µg/L</td></tr><tr><td>Selenium</td><td>Daily storm volume x 5 µg/L</td></tr><tr><td>Zinc</td><td>Daily storm volume x 119 µg/L</td></tr></table></td></tr>
<tr><td>Load Allocations (for nonpoint sources)</td><td>Load allocations (LA) are assigned to non-point sources for Ballona Creek and Sepulveda Canyon Channel.

Dry Weather

Dry-weather load allocations for copper, lead and zinc are developed for direct atmospheric deposition. The mass-based load allocations are equal to the ratio of the length of each segment over the total length multiplied by the estimates of direct atmospheric loading for Ballona Creek (3.5 g/day for copper, 2.3 g/day for lead, and 11.7 k/day for zinc).

<u>Dry-weather direct air deposition LAs (total recoverable metals)</u>
<table><tr><th></th><th>Copper (g/day)</th><th>Lead (g/day)</th><th>Zinc (g/day)</th></tr><tr><td>Ballona Creek</td><td>2.0</td><td>1.4</td><td>6.8</td></tr><tr><td>Sepulveda Channel</td><td>0.3</td><td>0.2</td><td>0.9</td></tr></table>
Wet Weather

Wet-weather load allocations for copper, lead, selenium and zinc are developed for direct atmospheric deposition. The mass-based load allocations for direct atmospheric deposition are equal to the percent area of surface water (0.6%) multiplied by the total loading capacity.</td></tr>
</table>

Element	Key Findings and Regulatory Provisions

Wet-weather direct air deposition LAs (total recoverable metals)

	Load Allocation (grams/day)
Copper	1.05E-07 x Daily storm volume (L)
Lead	3.54E-07 x Daily storm volume (L)
Selenium	3.00E-08 x Daily storm volume (L)
Zinc	7.14E-07 x Daily storm volume (L)

Waste Load Allocations *(for point sources)*

Waste load allocations (WLA) are assigned to point sources for Ballona Creek and Sepulveda Canyon Channel. A grouped mass-based waste load allocation is developed for the storm water permittees (Los Angeles County MS4, Caltrans, General Construction and General Industrial) by subtracting the load allocation from the total loading capacity. Concentration-based waste load allocations are developed for other point sources in the watershed.

Dry Weather

Dry-weather waste load allocation for storm water is equal to the dry-weather critical flow multiplied by the dry-weather numeric target minus the load allocation for direct atmospheric deposition.

Dry-weather Storm Water WLAs (grams total recoverable metals/day)

	Copper	Lead	Selenium	Zinc
Ballona Creek	818.9	438.6	171	10,416.2
Sepulveda Channel	370.7	198.8	77	4,711.1

A waste load allocation of zero is assigned to all general construction and industrial storm water permits during dry weather. Therefore, the storm water waste load allocations are apportioned between the MS4 permittees and Caltrans, based on an areal weighting approach.

Dry-weather Storm Water WLAs Apportioned between Storm Water Permits (grams total recoverable metals/day)

	Copper	Lead	Selenium	Zinc
Ballona Creek				
MS4 permittees	807.7	432.6	169	10,273.1
Caltrans	11.2	6.0	2	143.1
Sepulveda Channel				
MS4 Permittees	365.6	196.1	76	4646.4
Caltrans	5.1	2.7	1	64.7

Concentration-based dry-weather waste load allocations are assigned to the minor NPDES permits and general non-storm water NPDES permits that discharge to Ballona Creek or its tributaries. 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.

Dry-weather WLAs for other permits (total recoverable metals)

Copper (µg/L)	Lead (µg/L)	Selenium (µg/L)	Zinc (µg/L)
24	13	5	304

Element	Key Findings and Regulatory Provisions

Wet Weather

Wet-weather waste load allocation for storm water is equal to the total loading capacity minus the load allocation for direct atmospheric deposition. Wet-weather waste load allocations for the grouped storm water permittees apply to all reaches and tributaries.

Wet-weather Storm Water WLAs (total recoverable metals)

	Waste Load Allocation (grams/day)
Copper	1.79E-05 x Daily storm volume (L)
Lead	5.87E-05 x Daily storm volume (L)
Selenium	4.97E-06 x Daily storm volume (L)
Zinc	1.18E-04 x Daily storm volume (L)

The storm water waste load allocations are apportioned between the MS4 permittees, Caltrans, the general construction and the general industrial storm water permits based on an areal weighting approach.

Wet-weather Storm Water WLAs Apportioned Between Storm Water Permits (total recoverable metals)

	Waste Load Allocation (grams/day)
Copper	
MS4 Permittees	1.70E-05 x Daily storm volume (L)
Caltrans	2.37E-07 x Daily storm volume (L)
General Construction	4.94E-07 x Daily storm volume (L)
General Industrial	1.24E-07 x Daily storm volume (L)
Lead	
MS4 Permittees	5.58E-05 x Daily storm volume (L)
Caltrans	7.78E-07 x Daily storm volume (L)
General Construction	1.62E-06 x Daily storm volume (L)
General Industrial	4.06E-07 x Daily storm volume (L)
Selenium	
MS4 Permittees	4.73E-06 x Daily storm volume (L)
Caltrans	6.59E-08 x Daily storm volume (L)
General Construction	1.37E-07 x Daily storm volume (L)
General Industrial	3.44E-08 x Daily storm volume (L)
Zinc	
MS4 Permittees	1.13E-04 x Daily storm volume (L)
Caltrans	1.57E-06 x Daily storm volume (L)
General Construction	3.27E-06 x Daily storm volume (L)
General Industrial	8.19E-07 x Daily storm volume (L)

Each storm water permittee enrolled under the general construction or industrial storm water permits will receive an individual waste load allocation on a per acre basis, based on the acreage of their facility.

<table>
<tr><th>Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td></td><td>
<u>Individual per Acre WLAs for General Construction or Industrial Storm Water Permittees (total recoverable metals)</u>
<table>
<tr><td></td><td><u>Waste Load Allocation (grams/day/acre)</u></td></tr>
<tr><td>Copper</td><td>2.20E-10 x Daily storm volume (L)</td></tr>
<tr><td>Lead</td><td>7.20E-10 x Daily storm volume (L)</td></tr>
<tr><td>Selenium</td><td>6.10E-11 x Daily storm volume (L)</td></tr>
<tr><td>Zinc</td><td>1.45E-09 x Daily storm volume (L)</td></tr>
</table>

Concentration-based wet-weather waste load allocations are assigned to the minor NPDES permits and general non-storm water NPDES permits that discharge to Ballona Creek or its tributaries. 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.

<u>Wet-weather WLAs for other permits (total recoverable metals)</u>
<table>
<tr><td><u>Copper (µg/L)</u></td><td><u>Lead (µg/L)</u></td><td><u>Selenium (µg/L)</u></td><td><u>Zinc (µg/L)</u></td></tr>
<tr><td>18</td><td>59</td><td>5</td><td>119</td></tr>
</table>
</td></tr>
<tr><td>Margin of Safety</td><td>There is an implicit margin of safety through the use of conservative values for the conversion from total recoverable metals to the dissolved fraction during dry and wet weather. In addition, the TMDL includes a margin of safety by evaluating dry-weather and wet-weather conditions separately and assigning allocations based on two disparate critical conditions.</td></tr>
<tr><td>Implementation</td><td>The regulatory mechanisms used to implement the TMDL will include the Los Angeles County Municipal Storm Water NPDES Permit (MS4), the State of California Department of Transportation (Caltrans) Storm Water Permit, minor NPDES permits, general NPDES permits, general industrial storm water NPDES permits, and general construction storm water NPDES permits. Nonpoint sources will be regulated through the authority contained in Sections 13263 and 13269 of the Water Code, in conformance with the State Water Resources Control Board’s Nonpoint Source Implementation and Enforcement Policy (May 2004). Each NPDES permit assigned a WLA shall be reopened or amended at re-issuance, in accordance with applicable laws, to incorporate the applicable WLAs as a permit requirement.

The Regional Board shall reconsider this TMDL in five years after the effective date of the TMDL based on additional data obtained from special studies. Table 7-12.2 presents the implementation schedule for the responsible permittees.

Minor NPDES Permits and General Non-Storm Water NPDES Permits:

Permit writers may translate applicable waste load allocations into effluent limits for the minor and general NPDES permits by applying the effluent limitation procedures in Section 1.4 of the State Water Resources Control Board’s Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of</td></tr>
</table>

Element	Key Findings and Regulatory Provisions
	California (2000) or other applicable engineering practices authorized under federal regulations. Compliance schedules may be established in individual NPDES permits, allowing up to 5 years within a permit cycle to achieve compliance. Compliance schedules may not be established in general NPDES permits. A discharger that can not comply immediately with effluent limitations specified to meet waste load allocations will be required to apply for an individual permit, in order to, demonstrate the need for a compliance schedule. Permittees that hold individual NPDES permits and solely discharge storm water may be allowed (at Regional Board discretion) compliance schedules up to 10 years from the effective date of the TMDL to achieve compliance with final WLAs. **General Industrial Storm Water Permits:** The Regional Board will develop a watershed specific general industrial storm water permit to incorporate waste load allocations. Dry-weather Implementation Non-storm water flows authorized by Order No. 97-03 DWQ, or any successor order, are exempt from the dry-weather waste load allocation equal to zero. Instead, these authorized non-storm water flows shall meet the concentration-based waste load allocations assigned to the other NPDES Permits. The dry-weather waste load allocation equal to zero applies to unauthorized non-storm water flows, which are prohibited by Order No. 97-03 DWQ. It is anticipated that the dry-weather waste load allocations will be implemented by requiring improved best management practices (BMPs) to eliminate the discharge of non-storm water flows. 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. Wet-weather Implementation The general industrial storm water permittees are allowed interim wet-weather concentration-based waste load allocations based on benchmarks contained in EPA's Storm Water Multi-sector General Permit for Industrial Activities. The interim waste load allocations apply to all industry sectors for a period not to exceed ten years from the effective date of the TMDL. **Interim Wet-Weather WLAs for General Industrial Storm Water Permittees (total recoverable metals)** Copper (µg/L) — Lead (µg/L) — Selenium (µg/L) — Zinc (µg/L) 63.6 — 81.6 — 238.5 — 117 In the first five years from the effective date of the TMDL, interim waste load allocations will not be interpreted as enforceable permit conditions. If monitoring demonstrates that interim waste load

Element	Key Findings and Regulatory Provisions
	allocations are being exceeded, the permittee shall evaluate existing and potential BMPs, including structural BMPs, and implement any necessary BMP improvements. It is anticipated that monitoring results and any necessary BMP improvements would occur as part of an annual reporting process. After five years from the effective date of the TMDL, interim waste load allocations shall be translated into enforceable permit conditions. Compliance with permit conditions may be demonstrated through the installation, maintenance, and monitoring of Regional Board-approved BMPs. If this method of compliance is chosen, permit writers must provide adequate justification and documentation to demonstrate that BMPs are expected to result in attainment of interim waste load allocations. The general industrial storm water permits shall achieve final wet-weather waste load allocations no later than 10 years from the effective date of the TMDL, which shall be expressed as NPDES water quality-based effluent limitations. Effluent limitations may be expressed as permit conditions, such as the installation, maintenance, and monitoring of Regional Board-approved BMPs if adequate justification and documentation demonstrate that BMPs are expected to result in attainment of waste load allocations. **General Construction Storm Water Permits:** Waste load allocations will be incorporated into the State Board general permit upon renewal or into a watershed-specific general permit developed by the Regional Board. <u>Dry-weather Implementation</u> Non-storm water flows authorized by the General Permit for Storm Water Discharges Associated with Construction Activity (Water Quality Order No. 99-08 DWQ), or any successor order, are exempt from the dry-weather waste load allocation equal to zero as long as they comply with the provisions of sections C.3 and A.9 of the Order No. 99-08 DWQ, which state that these authorized non-storm discharges shall be (1) infeasible to eliminate (2) comply with BMPs as described in the Storm Water Pollution Prevention Plan prepared by the permittee, and (3) not cause or contribute to a violation of water quality standards, or comparable provisions in any successor order. Unauthorized non-storm water flows are already prohibited by Order No. 99-08 DWQ. <u>Wet-weather Implementation</u> 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 final 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

Element	Key Findings and Regulatory Provisions
	in compliance with final waste load allocations if they implement these Regional Board approved BMPs. All permittees must implement the approved BMPs within nine years of the effective date of the TMDL. If no effectiveness studies are conducted and no BMPs are approved by the Regional Board within eight years of the effective date of the TMDL, each general construction storm water permit holder will be subject to site-specific BMPs and monitoring requirements to demonstrate compliance with final waste load allocations. **MS4 and Caltrans Storm Water Permits:** The County of Los Angeles, City of Los Angeles, Beverly Hills, Culver City, Inglewood, Santa Monica, and West Hollywood 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. The primary jurisdiction for the Ballona Creek watershed is the City of Los Angeles. Applicable CTR limits are being met most of the time during dry weather, with episodic exceedances. Due to the expense of obtaining accurate flow measurements required for calculating loads, concentration-based permit limits may apply during dry weather. These concentration-based limits would be equal to the dry-weather concentration-based waste load allocations assigned to the other NPDES permits. Each municipality and permittee will be required to meet the storm water waste load allocation at the designated TMDL effectiveness monitoring points. A phased implementation approach, using a combination of non-structural and structural BMPs may be used to achieve compliance with the stormwater 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 waste load allocations. The implementation schedule for the MS4 and Caltrans permittees consists of a phased approach, with compliance to be achieved in prescribed percentages of the watershed, with total compliance to be achieved within 15 years.
Seasonal Variations and Critical Conditions	Seasonal variations are addressed by developing separate waste load allocations for dry weather and wet weather. Based on long-term flow records, dry-weather flows in Ballona Creek are estimated to be 14 cubic feet per second (cfs). Since, this flow has been very consistent, 14 cfs is used to define the critical dry-weather flow for Ballona Creek at Sawtelle Boulevard (upstream of Sepulveda Canyon Channel). There are no historic flow records to determine the average long-term flows for Sepulveda Canyon Channel. Therefore, in the absence of historical records the 2003 dry-weather characterization study measurements are assumed reasonable estimates of flow for this

<table>
<tr><th>Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td></td><td>channel. The critical dry-weather flow for Sepulveda Canyon Channel is defined as the average flow of 6.3 cfs.

Wet-weather allocations are developed using the load-duration curve concept. The total wet-weather waste load allocation varies by storm, therefore, given this variability in storm water flows, no justification was found for selecting a particular sized storm as the critical condition.</td></tr>
<tr><td>Monitoring</td><td>Effective monitoring will be required to assess the condition of the Ballona Creek and to assess the on-going effectiveness of efforts by dischargers to reduce metals loading to Ballona Creek. Special studies may also be appropriate to provide further information about new data, new or alternative sources, and revised scientific assumptions. Below the Regional Board identifies the various goals of monitoring efforts and studies. The programs, reports, and studies will be developed in response to subsequent orders issued by the Executive Officer.

Ambient monitoring

An ambient monitoring program is necessary to assess water quality throughout Ballona Creek and its tributaries and the progress being made to remove the metals impairments. The MS4 and Caltrans storm water NPDES permittees are jointly responsible for implementing the ambient monitoring program. The responsible agencies shall analyze samples for total recoverable metals and dissolved metals, including cadmium and silver, and hardness once a month at each monitoring location. The reported detection limits shall be lower than the hardness adjusted CTR criteria to determine if water quality objectives are being met. There are three ambient monitoring locations.

Ambient Monitoring Locations
<table><tr><th>Waterbody</th><th>Location</th></tr><tr><td>Ballona Creek</td><td>At Sawtelle Boulevard</td></tr><tr><td>Sepulveda Channel</td><td>Just Above the Confluence with Ballona Creek</td></tr><tr><td>Ballona Creek</td><td>At Inglewood Boulevard</td></tr></table>
TMDL Effectiveness Monitoring

The MS4 and Caltrans storm water NPDES permittees are jointly responsible for assessing the progress in reducing pollutant loads to achieve the TMDL. The MS4 and Caltrans storm water NPDES permittees are required to submit for approval of the Executive Officer a coordinated monitoring plan that will demonstrate the effectiveness of the phased implementation schedule for this TMDL, which requires attainment of the applicable waste load allocations in prescribed percentages of the watershed over a 15-year period. The monitoring locations specified for the ambient monitoring program may be used as the effectiveness monitoring locations.

The MS4 and Caltrans storm water NPDES permittees will be found to be effectively meeting the dry-weather waste load allocations if the in-stream pollutant concentrations or load at the first downstream monitoring location is equal to or less than the corresponding</td></tr>
</table>

Element	Key Findings and Regulatory Provisions
	concentration- or load-based waste load allocation. Alternatively, effectiveness of the TMDL may be assessed at the storm drain outlet based on the concentration-based waste load allocation for the receiving water. For storm drains that discharge to other storm drains, the waste load allocation will be based on the waste load allocation for the ultimate receiving water for that storm drain system. The MS4 and Caltrans storm water NPDES permittees will be found to be effectively meeting the wet-weather waste load allocations if the loading at the most downstream monitoring location is equal to or less then the wet-weather waste load allocation. Compliance with individual general construction and industrial storm water permittees will be based on monitoring of discharges at the property boundary. Compliance may be assessed based on concentration and/or load allocations. The general storm water permits shall contain a model monitoring and reporting program to evaluate BMP effectiveness. A permittee enrolled under the general permits 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 under their jurisdiction because compliance with waste load allocations by these facilities will in many cases translate to reductions in metals loads to the MS4 system. **Special studies** The implementation schedule, Table 7-12.2, allows time for special studies that may serve to refine the estimate of loading capacity, waste load and/or load allocations, and other studies that may serve to optimize implementation efforts. The Regional Board will re-consider the TMDL in the fifth year after the effective date in light of the findings of these studies. Studies may include: • Refinement of hydrologic and water quality model • Additional source assessment • Refinement of potency factors correlation between total suspended solids and metals loadings during dry and wet weather • Correlation between short-term rainfall intensity and metals loadings for use in sizing in-line structural BMPs • Correlation between storm volume and total recoverable metals loading for use in sizing storm water retention facilities • Refined estimates of metals partitioning coefficients, conversion factors, and site-specific toxicity. • Evaluation of potential contribution of aerial deposition and sources of aerial deposition.

Table 7-12.2. Ballona Creek Metals TMDL: Implementation Schedule

Date	Action
Effective date of the TMDL	Regional Board permit writers shall incorporate the waste load allocations 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 or re-issuance.
4 years after effective date of the TMDL	Responsible jurisdictions and agencies shall provide to the Regional Board results of the special studies.
5 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.
MINOR NPDES PERMITS AND GENERAL NON-STORM WATER NPDES PERMITS	
Upon permit issuance or renewal	The non-storm water NPDES permittees shall achieve the waste load allocations, which shall be expressed as NPDES water quality-based effluent limitations specified in accordance with federal regulations and state policy on water quality control. Compliance schedules may allow up to five years in individual NPDES permits to meet permit requirements. Compliance schedules may not be established in general NPDES permits. Permittees that hold individual NPDES permits and solely discharge storm water may be allowed (at Regional Board discretion) compliance schedules up to 10 years from the effective date of the TMDL to achieve compliance with final WLAs.
GENERAL INDUSTRIAL STORM WATER PERMITS	
Upon permit issuance or renewal	The general industrial storm water NPDES permittees shall achieve dry-weather waste load allocations, which shall be expressed as NPDES water quality-based effluent limitations specified in accordance with federal regulations and state policy on water quality control. Effluent limitations may be expressed as permit conditions, such as the installation, maintenance, and monitoring of Regional Board-approved BMPs. Permittees shall begin to install and test BMPs to meet the interim wet-weather WLAs. BMP effectiveness monitoring will be implemented to determine progress in achieving interim wet-weather waste load allocations.
5 years after effective date of the TMDL	The general industrial storm water NPDES permittees shall achieve the interim wet-weather waste load allocations, which shall be expressed as NPDES water quality-based effluent limitations specified in accordance with federal regulations and state policy on water quality control. Effluent limitations may be expressed as permit conditions, such as the installation, maintenance, and monitoring of Regional Board-approved BMPs. Permittees shall begin an iterative BMP process including BMP effectiveness monitoring to achieve compliance

Date	Action
	with final wet-weather WLAs.
10 years after the effective date of the TMDL	The general industrial storm water NPDES permittees shall achieve the final wet-weather waste load allocations, which shall be expressed as NPDES water quality-based effluent limitations specified in accordance with federal regulations and state policy on water quality control. Effluent limitations may be expressed as permit conditions, such as the installation, maintenance, and monitoring of Regional Board-approved BMPs.
GENERAL CONSTRUCTION STORM WATER PERMITS	
Upon permit issuance, renewal, or re-opener	Non-storm water flows not authorized by Order No. 99-08 DWQ, or any successor order, shall achieve dry-weather waste load allocations of zero. Waste load allocations shall be expressed as NPDES water quality-based effluent limitations specified in accordance with federal regulations and state policy on water quality control. Effluent limitations may be expressed as permit conditions, such as the installation, maintenance, and monitoring of Regional Board-approved BMPs.
7 years from the effective date of the TMDL	The construction industry will submit the results of wet-weather 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 wet-weather BMP effectiveness studies and consider approval of BMPs no later than six 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	In response to an order issued by the Executive Officer, 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.
48 months after effective date of TMDL (Draft Report) 54 months after effective date of TMDL (Final Report)	MS4 and Caltrans storm water NPDES permittees shall provide a written report to the Regional Board outlining the drainage areas to be address and how these areas will achieve compliance with the waste load allocations. The report shall include implementation methods, an implementation schedule,

Date	Action
	proposed milestones, and any applicable revisions to the TMDL effectiveness monitoring plan.
6 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 dry-weather waste load allocations and 25% of the total drainage area served by the MS4 system is effectively meeting the wet-weather waste load allocations.
8 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 dry-weather waste load allocations.
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 dry-weather waste load allocations and 50% of the total drainage area served by the MS4 system is effectively meeting the wet-weather waste load allocations.
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 both the dry-weather and wet-weather waste load allocations.

Attachment A to Resolution No. 04-023

Amendments

to the

Water Quality Control Plan – Los Angeles Region

for the

Ballona Creek Trash TMDL

Amendments:

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries Ballona Creek Trash TMDL*

Add a second paragraph documenting the dates when the amendment to the Ballona Creek Trash TMDL was adopted and approved.

"This TMDL was amended by:

The Regional Water Quality Control Board on March 4, 2004.
The State Water Resources Control Board on [Insert Date]
The Office of Administrative Law on [Insert Date]
The U.S. Environmental Protection Agency on [Insert Date]"

Table 7-3.1 Ballona Creek Trash TMDL Elements

Add to Table 7-3.1, Row 6, "Implementation":

"Compliance with the final waste load allocation may be achieved through a full capture system. A full capture system is any device or series of devices that traps all particles retained by a 5 mm mesh screen and has a design treatment capacity of not less than the peak flow rate (Q) resulting from a one-year, one-hour, storm in the subdrainage area. Rational equation is used to compute the peak flow rate: $Q = C \times I \times A$, where Q = design flow rate (cubic feet per second, cfs); C = runoff coefficient (dimensionless); I = design rainfall intensity (inches per hour, as determined per the rainfall isohyetal map in Figure A), and A= subdrainage area (acres). The isohyetal map may be updated annually by the Los Angeles County hydrologist to reflect additional rain data gathered during the previous year. Annual updates published by the Los Angeles County Department of Public Works are prospectively incorporated by reference into this TMDL and accompanying Basin Plan amendment."

Add Figure A, referenced in Table 7-3.1.

Table 7-3.2 Ballona Creek Trash TMDL: Implementation Schedule

Add footnote to Table 7-3.2:

"Notwithstanding the zero trash target and the default waste load allocations shown in Table 7-3.2, a Permittee will be deemed in compliance with the Trash TMDL in areas served by a Full Capture System within the Ballona Creek and Estuary Watershed."

Change existing footnote 1 to footnote 2 and modify language to clarify that the Regional Board will conduct the review and will reconsider the final Waste Load Allocations:

[2] The Regional Board will review and reconsider the final Waste Load Allocations once a reduction of 50% has been achieved and sustained.

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries
Ballona Creek Trash TMDL*

This TMDL was adopted by:

The Regional Water Quality Control Board on September 19, 2001.
The State Water Resources Control Board on February 19, 2002.
The Office of Administrative Law on July 18, 2002.
The U.S. Environmental Protection Agency on August 1, 2002.

This TMDL was amended by:

The Regional Water Quality Control Board on March 4, 2004.
The State Water Resources Control Board on [Insert Date]
The Office of Administrative Law on [Insert Date]
The U.S. Environmental Protection Agency on [Insert Date]"

The following table presents the key elements of this TMDL.

Table 7-3.1 Ballona Creek: Trash TMDL Elements

Element	Derivation of Numbers
Problem Statement	Trash in Ballona Creek is causing impairment of beneficial uses. The following designated beneficial uses are impacted by trash: water contact recreation (REC1); non-contact water recreation (REC2); warm freshwater habitat (WARM); wildlife habitat (WILD), estuarine habitat (EST); marine habitat (MAR); rare and threatened or endangered species (RARE); migration of aquatic organisms (MIGR); spawning, reproduction and early development of fish (SPWN); commercial and sport fishing (COMM); shellfish harvesting (SHELL); wetland habitat (WET); and cold freshwater habitat (COLD).
Numeric Target *(interpretation of the narrative water quality objective, used to calculate the load allocations)*	Zero trash in the river.
Source Analysis	Stormwater discharge is the major source of trash in the river.

Loading Capacity	Zero.
Waste Load, Allocations	Phased reduction for a period of 10 years, from existing baseline load to zero.
Implementation	This TMDL will be implemented through stormwater permits and via the authority vested in the Executive Officer by section13267 of the Porter-Cologne Water Quality Control Act: Water Code section 13000 et seq. Compliance with the final waste load allocation may be achieved through a full capture system. A full capture system is any device or series of devices that traps all particles retained by a 5 mm mesh screen and has a design treatment capacity of not less than the peak flow rate (Q) resulting from a one-year, one-hour, storm in the subdrainage area. Rational equation is used to compute the peak flow rate: $Q = C \times I \times A$, where Q = design flow rate (cubic feet per second, cfs); C = runoff coefficient (dimensionless); I = design rainfall intensity (inches per hour, as determined per the rainfall isohyetal map in Figure A), and A= subdrainage area (acres). The isohyetal map may be updated annually by the Los Angeles County hydrologist to reflect additional rain data gathered during the previous year. Annual updates published by the Los Angeles County Department of Public Works are prospectively incorporated by reference into this TMDL and accompanying Basin Plan amendment.
Margin of Safety	"Zero discharge" is a conservative standard which contains an implicit margin of safety.
Seasonal Variations and Critical Conditions	Discharge of trash from the storm drain occurs primarily during or shortly after a rain event of greater than 0.25 inches.

*The complete administrative record for the TMDL is available for review upon request.

Figure A

1-Year 30-Min Rainfall Intensity (Inches/Hour)

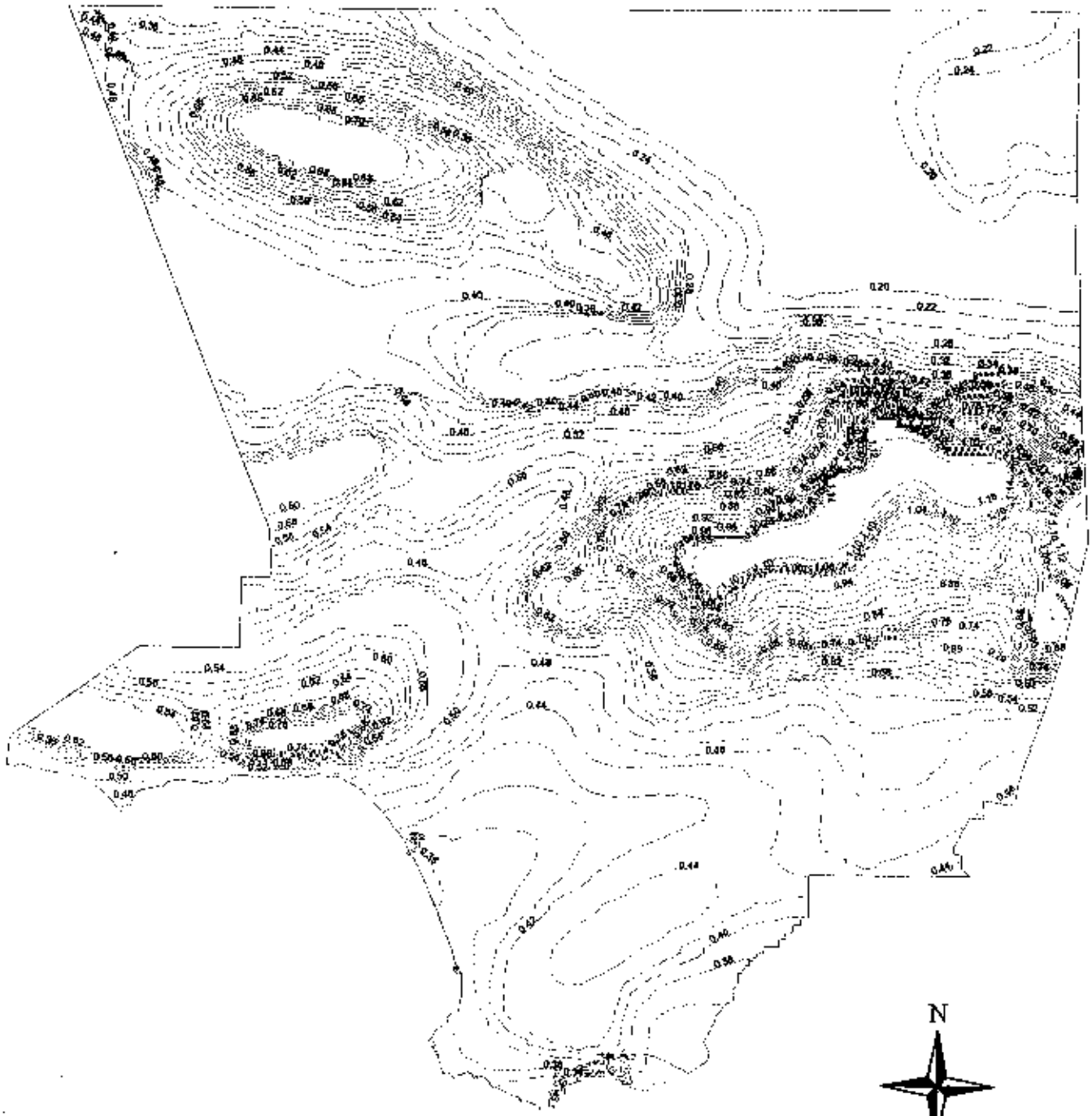


Table 7-3.2 Ballona Creek Trash TMDL: Implementation Schedule.[1]
(Default waste load allocations expressed as cubic feet of uncompressed trash and % reduction.)

Year	Baseline Monitoring/ Implementation	Waste Load Allocation	Compliance Point
1 10/1/01– 9/30/02	Baseline Monitoring	No allocation specified. Trash will be reduced by levels collected during the baseline monitoring program.	Achieved through timely compliance with baseline monitoring program.
2 10/1/02-- 9/30/03	Baseline Monitoring	No allocation specified. Trash will be reduced by levels collected during the baseline monitoring program.	Achieved through timely compliance with baseline monitoring program.
3 10/1/03-- 9/30/04	Baseline Monitoring (optional)/ Implementation: Year 1	90% (9,985 for the Municipal permittees, 1,472 for Caltrans)	No compliance point (target of 90%)
4 10/1/04-- 9/30/05	Baseline Monitoring (optional)/ Implementation: Year 2	80% (8,875 for the Municipal permittees; 1,308 for Caltrans)	No compliance point (target of 80%)
5 10/1/05-- 9/30/06	Implementation: Year 3	70% (7,776 for the Municipal permittees; 1,146 for Caltrans)	Compliance is 80% of the baseline load calculated as a rolling 3-year annual average (8,875 for the Municipal permittees; 1,308 for Caltrans).
6 10/1/06-- 9/30/07	Implementation: Year 4	60% (6,656 for the Municipal permittees; 981 for Caltrans)	70% of the baseline load the baseline load calculated as a rolling 3-year annual average (7,776 for the Municipal permittees; 1,146 for Caltrans).
7 10/1/07-- 9/30/08	Implementation: Year 5[2]	50% (5,547 for the Municipal permittees; 818 for Caltrans)	60% of the baseline load calculated as a rolling 3-year annual average (6,656 for the Municipal permittees; 981 for Caltrans)
8 9/1/08-- 30/09	Implementation: Year 6	40% (4,438 for the Municipal permittees; 654 for Caltrans)	50% of the baseline load calculated as a rolling 3-year annual average (5,547 for the Municipal permittees; 818 for Caltrans).
9 10/1/09-- 9/30/10	Implementation: Year 7	30% (3,328 for the Municipal permittees; 491 for Caltrans)	40% of the baseline load calculated as a rolling 3-year annual average (4,438 for the Municipal permittees; 654 for Caltrans).
10 10/1/10-- 9/30/11	Implementation: Year 8	20% (2,218 for the Municipal permittees; 327 for Caltrans).	30% of the baseline load calculated as a rolling 3-year annual average (3,328 for the Municipal permittees; 491 for Caltrans).
11 10/1/11– 9/30/12	Implementation: Year 9	10% (1,110 for the Municipal permittees; 164 for Caltrans).	20% of the baseline load calculated as a rolling 3-year annual average (2,220 for the Municipal permittees; 327 for Caltrans).
12 10/1/12-- 9/30/13	Implementation: Year 10	0 or 0 % of the baseline load.	10% of the baseline load calculated as a rolling 3-year annual average (1,110 for the Municipal permittees; 164 for Caltrans.
13 10/1/13-- 9/30/14	Implementation: Year 11	0 or 0 % of the baseline load.	3.3 % of the baseline load calculated as a rolling 3-year annual average (366 for the Municipal permittees, 54 for Caltrans).
14 10/1/14–. 9/30/15	Implementation: Year 12	0 or 0 % of the baseline.	0 or 0 % of the baseline load.

[1] "Notwithstanding the zero trash target and the default waste load allocations shown in Table 7-3.2, a Permittee will be deemed in compliance with the Trash TMDL in areas served by a Full Capture System within the Ballona Creek and Estuary Watershed."

[2] The Regional Board will review and reconsider the final Waste Load Allocations once a reduction of 50% has been achieved and sustained.

Table7-3.3. Ballona Creek Trash TMDL: Significant Dates.

30 days after receipt of the Executive Officer's request as authorized by Section 13267 of the Water Code annual average.	Submit baseline monitoring plan(s).
120 days after receipt of the Executive Officer's request as authorized by Section 13267 of the Water Code.	List of facilities that are outside of the permittee's jurisdiction but drain to a portion of the permittee's storm drain system, which discharges to Ballona Creek.
Within the first 2 years after approval of this basin plan amendment; to be extended to 4 years at the option of the permittees	Collection of baseline data.
72 hours after each rain event	Clean out of and measurement of trash retained.
Every 3 months during dry weather	Clean out of and measurement of trash retained.

Attachment A to Resolution No. R05-008

Amendment to the Water Quality Control Plan – Los Angeles Region to incorporate the Ballona Creek Estuary Toxic Pollutants TMDL

Adopted by the California Regional Water Quality Control Board, Los Angeles Region on July 7, 2005.

Amendments:

Table of Contents
Add:

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries
7-14 Ballona Creek Estuary Toxic Pollutants TMDL

List of Tables, Figures and Inserts
Add:

Chapter 7. Total Maximum Daily Loads (TMDLs)
Tables
7-14 Ballona Creek Estuary Toxic Pollutants TMDL
7-14.1 Ballona Creek Estuary Toxic Pollutants TMDL: Elements
7-14.2 Ballona Creek Estuary Toxic Pollutants TMDL: Implementation Schedule

Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries, Section 7-14 (Ballona Creek Estuary Toxic Pollutants TMDL)

This TMDL was adopted by the Regional Water Quality Control Board on July 7, 2005.

This TMDL was approved by:

The State Water Resources Control Board on October 20, 2005.
The Office of Administrative Law on December 9, 2005.
The U.S. Environmental Protection Agency on December 22, 2005.

The following tables include the elements of this TMDL.

Attachment A to Resolution No. R05-008

Table 7-14.1. Ballona Creek Estuary Toxic Pollutants TMDL: Elements

<table>
<tr><th>Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td>Problem Statement</td><td>Ballona Creek and Ballona Creek Estuary (Estuary) is on the Clean Water Act Section 303(d) list of impaired waterbodies for cadmium, copper, lead, silver, zinc, chlordane, DDT, PCBs and PAHs in sediments. The following designated beneficial uses are impaired by these toxic pollutants: water contact recreation (REC1); non-contact water recreation (REC2); estuarine habitat (EST); marine habitat (MAR); wildlife habitat (WILD); rare and threatened or endangered species (RARE); migration of aquatic organisms (MIGR); reproduction and early development of fish (SPWN); commercial and sport fishing (COMM); and shellfish harvesting (SHELL).</td></tr>
<tr><td>Numeric Target
(Interpretation of the narrative and numeric water quality objective, used to calculate the allocations)</td><td>Numeric water quality targets are based on the sediment quality guidelines compiled by the National Oceanic and Atmospheric Administration, which are used in evaluating waterbodies within the Los Angeles Region for development of the 303(d) list. The Effects Range-Low (ERLs) guidelines are established as the numeric targets for sediments in Ballona Creek Estuary.

Metal Numeric Targets (mg/kg)
<table><tr><th>Cadmium</th><th>Copper</th><th>Lead</th><th>Silver</th><th>Zinc</th></tr><tr><td>1.2</td><td>34</td><td>46.7</td><td>1.0</td><td>150</td></tr></table>
Organic Numeric Targets (µg/kg)
<table><tr><th>Chlordane</th><th>DDTs</th><th>Total PCBs</th><th>Total PAHs</th></tr><tr><td>0.5</td><td>1.58</td><td>22.7</td><td>4,022</td></tr></table></td></tr>
<tr><td>Source Analysis</td><td>Urban storm water has been recognized as a substantial source of metals. Numerous researchers have documented that the most prevalent metals in urban storm water (i.e., copper, lead, zinc, and to a lesser degree cadmium) are consistently associated with suspended solids. Because metals are typically associated with fine particles in storm water runoff, they have the potential to accumulate in estuarine sediments where they may pose a risk of toxicity. McPherson et al.[1] estimated that 83% of the cadmium and 86% of the lead were associated with the particle phase in Ballona Creek. Similar to metals, the majority of organic constituents in storm water are associated with particulates, measured concentrations of PAHs, phthalates, and organochlorine compounds in Sepulveda Channel, Centinela Creek, and Ballona Creek found that the majority of these compounds occurred in association with suspended solids. There is toxicity associated with suspended solids in urban runoff discharged from Ballona Creek, as well as with the receiving water sediments. This toxicity is likely attributed to metals and PAHs associated with the suspended sediments.</td></tr>
</table>

[1] McPherson, T.N., S.J. Burian, H.J. Turin, M.K. Stenstrom and I.H. Suffet. 2002. Comparison of Pollutant Loads in Dry and Wet Weather Runoff in a Southern California Urban Watershed. *Water Science and Technology* 45:255-261.

<table>
<tr><th>Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td></td><td>Nonpoint sources are not considered a significant source of toxic pollutants in this TMDL. Nonpoint sources are urban runoff from the Ballona Wetland, since this area discharges directly to the Estuary through a tide gate, and direct atmospheric deposition. The Ballona Wetlands cover approximately 460 acres or 0.6% of the watershed, therefore, loading from this source is considered insignificant. Direct atmospheric deposition of metals and PAHs is considered insignificant because the portion of the Ballona Creek watershed covered by water is small, approximately 480 acres or 0.6% of the watershed. Indirect atmospheric deposition reflects the process by which metals deposited on the land surface may be washed off during storm events and delivered to Ballona Creek and its tributaries. The loading of metals associated with indirect atmospheric deposition are accounted for in the storm water runoff.</td></tr>
<tr><td>Loading Capacity</td><td>TMDLs are developed for cadmium, copper, lead, silver, zinc, chlordane, DDT, PCBs and PAHs within the sediments of the Ballona Creek Estuary.

The loading capacity for Ballona Creek Estuary is calculated by multiplying the numeric targets by the average annual deposition of fine sediment, defined as silts (grain size 0.0625 millimeters) and smaller, within the Estuary by the bulk density of the sediment. The average annual fine sediment deposited is 5,004 cubic meters per year (m^3/yr) and the bulk density is 1.42 metric tons per cubic meter (mt/m^3). The TMDL is set equal to the loading capacity.

<u>Metals Loading Capacity (kilograms/year)</u>
<table><tr><th>Cadmium</th><th>Copper</th><th>Lead</th><th>Silver</th><th>Zinc</th></tr><tr><td>8.5</td><td>241.6</td><td>332</td><td>7.1</td><td>1,066</td></tr></table>
<u>Organics Loading Capacity (grams/year)</u>
<table><tr><th>Chlordane</th><th>DDTs</th><th>Total PCBs</th><th>Total PAHs</th></tr><tr><td>3.55</td><td>11.2</td><td>161</td><td>28,580</td></tr></table></td></tr>
<tr><td>Load Allocations (for nonpoint sources)</td><td>Load allocations (LA) are assigned to nonpoint sources for Ballona Creek Estuary. Load allocations are developed for open space and direct atmospheric deposition.

The mass-based load allocation for open space is equal to the percentage of the watershed covered by the Ballona Wetlands (0.6%) multiplied by the total loading capacity.

<u>Metals Load Allocations for Open Space (kg/yr)</u>
<table><tr><th>Cadmium</th><th>Copper</th><th>Lead</th><th>Silver</th><th>Zinc</th></tr><tr><td>0.05</td><td>1.4</td><td>2</td><td>0.04</td><td>6</td></tr></table>
<u>Organics Load Allocations for Open Space (g/yr)</u>
<table><tr><th>Chlordane</th><th>DDTs</th><th>Total PCBs</th><th>Total PAHs</th></tr><tr><td>0.02</td><td>0.1</td><td>1</td><td>160</td></tr></table></td></tr>
</table>

<table>
<tr><th>Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td></td><td>The mass-based load allocation for direct atmospheric deposition is equal to the percentage of the watershed covered by water (0.6%) multiplied by the total loading capacity.

<u>Metals Load Allocations for Direct Atmospheric Deposition (kg/yr)</u>
<table>
<tr><th>Cadmium</th><th>Copper</th><th>Lead</th><th>Silver</th><th>Zinc</th></tr>
<tr><td>0.05</td><td>1.4</td><td>2</td><td>0.04</td><td>6</td></tr>
</table>

<u>Organics Load Allocations for Direct Atmospheric Deposition (g/yr)</u>
<table>
<tr><th>Chlordane</th><th>DDTs</th><th>Total PCBs</th><th>Total PAHs</th></tr>
<tr><td>0.02</td><td>0.1</td><td>1</td><td>170</td></tr>
</table>
</td></tr>
<tr><td>Waste Load Allocations (for point sources)</td><td>Waste load allocations (WLA) are assigned to point sources for the Ballona Creek watershed. A grouped mass-based waste load allocation is developed for the storm water permittees (Los Angeles County MS4, Caltrans, General Construction and General Industrial) by subtracting the load allocations from the total loading capacity. Concentration-based waste load allocations are developed for other point sources in the watershed.

<u>Metals Waste Load Allocations for Storm Water (kg/yr)</u>
<table>
<tr><th>Cadmium</th><th>Copper</th><th>Lead</th><th>Silver</th><th>Zinc</th></tr>
<tr><td>8.4</td><td>238.8</td><td>328</td><td>7.02</td><td>1,054</td></tr>
</table>

<u>Organics Waste Load Allocations for Storm Water (g/yr)</u>
<table>
<tr><th>Chlordane</th><th>DDTs</th><th>Total PCBs</th><th>Total PAHs</th></tr>
<tr><td>3.51</td><td>11</td><td>159</td><td>28,250</td></tr>
</table>

The storm water waste load allocations are apportioned between the MS4 permittees, Caltrans, the general construction and the general industrial storm water permits based on an areal weighting approach.

<u>Metals Storm Water WLAs Apportioned between Permits (kg/yr)</u>
<table>
<tr><th></th><th>Cadmium</th><th>Copper</th><th>Lead</th><th>Silver</th><th>Zinc</th></tr>
<tr><td>MS4 Permittees</td><td>8.0</td><td>227.3</td><td>312.3</td><td>6.69</td><td>1003</td></tr>
<tr><td>Caltrans</td><td>0.11</td><td>3.2</td><td>4.4</td><td>0.09</td><td>14</td></tr>
<tr><td>General Construction</td><td>0.23</td><td>6.6</td><td>9.1</td><td>0.20</td><td>29</td></tr>
<tr><td>General Industrial</td><td>0.06</td><td>1.7</td><td>2.3</td><td>0.05</td><td>7</td></tr>
</table>

<u>Organics Storm Water WLAs Apportioned between Permits (g/yr)</u>
<table>
<tr><th></th><th>Chlordane</th><th>DDTs</th><th>Total PCBs</th><th>Total PAHs</th></tr>
<tr><td>MS4 Permittees</td><td>3.34</td><td>10.56</td><td>152</td><td>26,900</td></tr>
<tr><td>Caltrans</td><td>0.05</td><td>0.15</td><td>2</td><td>400</td></tr>
<tr><td>General Construction</td><td>0.10</td><td>0.31</td><td>4</td><td>800</td></tr>
<tr><td>General Industrial</td><td>0.02</td><td>0.08</td><td>1</td><td>200</td></tr>
</table>

Each storm water permittee enrolled under the general construction or industrial storm water permits will receive an individual waste load allocation on a per acre basis, based on the acreage of their facility.</td></tr>
</table>

<table>
<tr><th>Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td></td><td>
Metals per Acre WLAs for Individual General Construction or Industrial Storm Water Permittees (g/yr/ac)
<table>
<tr><th>Cadmium</th><th>Copper</th><th>Lead</th><th>Silver</th><th>Zinc</th></tr>
<tr><td>0.1</td><td>3</td><td>4</td><td>0.1</td><td>13</td></tr>
</table>
Organics per Acre WLAs for Individual General Construction or Industrial Storm Water Permittees (mg/yr/ac)
<table>
<tr><th>Chlordane</th><th>DDTs</th><th>Total PCBs</th><th>Total PAHs</th></tr>
<tr><td>0.04</td><td>0.14</td><td>2</td><td>350</td></tr>
</table>
Concentration-based waste load allocations are assigned to the minor NPDES permits and general non-storm water NPDES permits that discharge to Ballona Creek or its tributaries. 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.
Metals Concentration-based Waste Load Allocations (mg/kg)
<table>
<tr><th>Cadmium</th><th>Copper</th><th>Lead</th><th>Silver</th><th>Zinc</th></tr>
<tr><td>1.2</td><td>34</td><td>46.7</td><td>1.0</td><td>150</td></tr>
</table>
Organic Concentration-based Waste Load Allocations (µg/kg)
<table>
<tr><th>Chlordane</th><th>DDTs</th><th>Total PCBs</th><th>Total PAHs</th></tr>
<tr><td>0.5</td><td>1.58</td><td>22.7</td><td>4,022</td></tr>
</table>
</td></tr>
<tr><td>Margin of Safety</td><td>An implicit margin of safety is applied through the use of the more protective sediment quality guideline values. The ERLs were selected over the higher ERMs as the numeric targets.</td></tr>
<tr><td>Implementation</td><td>The regulatory mechanisms used to implement the TMDL will include the Los Angeles County Municipal Storm Water NPDES Permit (MS4), the State of California Department of Transportation (Caltrans) Storm Water Permit, minor NPDES permits, general NPDES permits, general industrial storm water NPDES permits, general construction storm water NPDES permits. Nonpoint sources will be regulated through the authority contained in sections 13263 and 13269 of the Water Code, in conformance with the State Water Resources Control Board's Nonpoint Source Implementation and Enforcement Policy (May 2004). Each NPDES permit assigned a WLA shall be reopened or amended at re-issuance, in accordance with applicable laws, to incorporate the applicable WLAs as a permit requirement.

The Regional Board shall reconsider this TMDL in six years after the effective date of the TMDL based on additional data obtained from special studies. Table 7-14.2 presents the implementation schedule for the responsible permittees.</td></tr>
</table>

Element	Key Findings and Regulatory Provisions
	Minor NPDES Permits and General Non-Storm Water NPDES Permits: The concentration-based waste load allocations for the minor NPDES permits and general non-storm water NPDES permits will be implemented through NPDES permit limits. Permit writers may translate applicable waste load allocations into effluent limits for the minor and general NPDES permits by applying applicable engineering practices authorized under federal regulations. 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. **General Industrial Storm Water Permit:** The Regional Board will develop a watershed specific general industrial storm water permit to incorporate waste load allocations. 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. 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. The general industrial storm water permittees are allowed up to seven years from the effective date of the TMDL to achieve the waste load allocations. **General Construction Storm Water Permit:** Waste load allocations will be incorporated into the State Board general permit upon renewal or into a watershed specific general construction storm water permit developed by the Regional Board. 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 nine years of the effective date of the TMDL. If no effectiveness studies are conducted and no BMPs are approved by the Regional Board within eight years of the effective date of the TMDL, each general construction storm water permit holder will be subject to site-specific BMPs and monitoring requirements to demonstrate compliance with waste load allocations.

Element	Key Findings and Regulatory Provisions
	MS4 and Caltrans Storm Water Permits: The County of Los Angeles, City of Los Angeles, Beverly Hills, Culver City, Inglewood, Santa Monica, and West Hollywood 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. The primary jurisdiction for the Ballona Creek watershed is the City of Los Angeles. Each municipality and permittee will be required to meet the waste load allocations at the designated TMDL effectiveness monitoring points. A phased implementation approach, using a combination of non-structural and structural BMPs may 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 numeric waste load allocations. 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 adjust the required BMPs as necessary to ensure their adequate performance. The implementation schedule for the MS4 and Caltrans permittees consists of a phased approach, with compliance to be achieved in prescribed percentages of the watershed, with total compliance to be achieved within 15 years.
Seasonal Variations and Critical Conditions	There is a high degree of inter- and intra-annual variability in sediments deposited at the mouth of Ballona Creek. This is a function of the storms, which are highly variable between years. Studies by the Army Corps of Engineers have shown that sediment delivery to Ballona Creek is related to the size of the storm (USACE, 2003). The TMDL is based on a long-term average deposition patterns over a 10-year period from 1991 to 2001. This time period contains a wide range of storm conditions and flows in the Ballona Creek 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.
Monitoring	Effective monitoring will be required to assess the condition of Ballona Creek and Estuary and to assess the on-going effectiveness of efforts by dischargers to reduce toxic pollutants loading to the Ballona Creek Estuary. Special studies may also be appropriate to provide further information about new data, new or alternative sources, and revised scientific assumptions. Below the Regional Board identifies the various goals of monitoring efforts and studies. The programs, reports, and studies will be developed in response to subsequent orders issued by the Executive Officer.

Element	Key Findings and Regulatory Provisions
	Ambient Monitoring An ambient monitoring program is necessary to assess water quality throughout Ballona Creek and its tributaries and to assess the progress being made to remove the toxic pollutant impairments in Ballona Creek Estuary sediments. Data on background water quality for organics and sediments will help refine the numeric targets and waste load allocations and assist in the effective placement of BMPs. In addition, fish and mussel tissue data is required in Ballona Creek Estuary to confirm the fish tissue listings. Water quality samples shall be collected from Ballona Creek and Estuary monthly and analyzed for cadmium, copper, lead, silver, zinc, chlordane, dieldrin, DDT, total PCBs and total PAHs 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. Storm water monitoring conducted as part of the MS4 storm water monitoring program should continue to provide assessment of water quality during wet-weather conditions and loading estimates from the watershed to the Estuary. If analysis of chlordane, dieldrin, DDT, total PCBs or total PAHs are not currently part of the sampling programs these organics should be added. In addition, special emphasis should be placed on achieving lower detection limits for DDTs, PCBs and PAHs. The MS4 and Caltrans storm water permittees are jointly responsible for conducting bioaccumulation testing of fish and mussel tissue within the Estuary. The permittees are required to submit for approval of the Executive Officer a monitoring plan that will provide the data needed to confirm the 303(d) listing or delisting, as applicable. Representative sediment sampling locations shall be randomly selected within the Estuary and analyzed for cadmium, copper, lead, silver, zinc, chlordane, dieldrin, DDT, total PCBs and total PAHs at detection limits that are lower than the ERLs. Sediment samples shall also be analyzed for total organic carbon, grain size and sediment toxicity testing. Initial sediment monitoring should be done 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

Element	Key Findings and Regulatory Provisions
	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. **TMDL Effectiveness Monitoring** The water quality samples collected during wet weather as part of the MS4 storm water monitoring program shall be analyzed for total dissolved solids, settable solids and total suspended solids if not already part of the existing sampling program. Sampling shall be designed to collect sufficient volumes of settable and suspended solids to allow for analysis of cadmium, copper, lead, silver, zinc, chlordane, dieldrin, total DDT, total PCBs, total PAHs, and total organic carbon in the bulk sediment. Semi-annually, representative sediment sampling locations shall be randomly selected within the Estuary and analyzed for cadmium, copper, lead, silver, zinc, chlordane, dieldrin, DDT, total PCBs, and total PAHs at detection limits that are lower than the ERLs. The sediment samples shall also be analyzed for total organic carbon, grain size and sediment toxicity. 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. 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 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).

Element	Key Findings and Regulatory Provisions
	Bioaccumulation monitoring of fish and mussel tissue within the Estuary shall be conducted. 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. **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: • Evaluation and use of low detection level techniques to evaluate 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. • Developing and implementing a monitoring program to collection the data necessary to apply a multiple lines of evidence approach. • Evaluation and use of sediment TIEs to evaluate causes of any recurring sediment toxicity. • Evaluate partitioning coefficients between water column and sediment to assess the contribution of water column discharges to sediment concentrations in the Estuary. • Studies to refine relationship between pollutants and suspended solids aimed at better understanding of the delivery of pollutants to the watershed. • Studies to understand transport of sediments to the estuary, including the relationship between storm flows, sediment loadings to the estuary, and sediment deposition patterns within the estuary. • Studies to evaluate effectiveness of BMPs to address pollutants and/or sediments.

Table 7-14.2. Ballona Creek Estuary Toxic Pollutants TMDL: 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.
MINOR NPDES PERMITS AND GENERAL NON-STORM WATER NPDES PERMITS	
7 years after effective date of the TMDL	The non-storm water NPDES permits shall achieve the concentration-based waste load allocations for sediment per provisions allowed for in NPDES permits.
GENERAL INDUSTRIAL STORM WATER PERMIT	
7 years after effective date of the TMDL	The general industrial storm water permits 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 PERMIT	
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 six 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.

Attachment A to Resolution No. R05-008

Date	Action
MS4 AND CALTRANS STORM WATER PERMITS	
12 months after the effective date of the TMDL	In response to an order issued by the Executive Officer, 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 within 6 months.
5 years after effective date of TMDL (Draft Report) 5 ½ years after effective date of TMDL (Final Report)	The MS4 and Caltrans storm water NPDES permittees shall provide a written report to the Regional Board outlining how they will achieve the waste load allocations for sediment to Ballona Creek Estuary. The report shall include implementation methods, an implementation schedule, proposed milestones, and any applicable revisions to the TMDL effectiveness monitoring plan.
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.

Appendix B. Monitoring Data and Analysis

A variety of monitoring has been conducted in the Ballona Creek watershed. The majority of data has been collected by LACDPW and SCCWRP. Data summarized for this report include recent data (since 1997) collected at mass loading stations by LACDPW and SCCWRP as well as data collected as part of the Ballona Creek MS4 water quality assessment (Weston 2008). Station information is provided in Table B-1. The monitoring station locations (including all monitored sites) are indicated on the maps that follow (Figure B-1, Figure B-2, and Figure B-3). The maps present both wet- (and unspecified) and dry-monitoring locations.

Table B-1. Ballona Creek Monitoring Stations

Source	Station ID Number	Start	End	Station Description
Ballona Creek water quality assessment (LACDPW)	BC-1	7/20/2006	12/9/2007	Ballona Creek @ Inglewood Blvd
	BC-2	7/20/2006	12/9/2007	Centinela Channel
	BC-3	7/20/2006	12/9/2007	Sepulveda Channel
	BC-4	7/20/2006	12/9/2007	Ballona Creek MES
	BC-5	7/20/2006	12/9/2007	Benedict Canyon Channel
	BC-6	7/20/2006	12/9/2007	Project 84 @ Ballona Creek
	BC-7	7/20/2006	12/9/2007	DDI 11
	BC-8	7/20/2006	12/9/2007	Fairfax Channel: Project 54
	BC-9	7/20/2006	12/9/2007	Cochran
LACDPW	S01	1/1/1997	4/2/2007	Ballona Creek – ME station
	TS07	10/17/2004	4/25/2006	Centinela Creek at Centinela Blvd
	TS08	10/17/2004	4/25/2006	Sepulveda Channel at Culver Blvd
	TS09	10/17/2004	4/25/2006	Culver City Storm Drain at Sepulveda Blvd
	TS10	10/17/2004	4/25/2006	D.D.I. 11 at La Cienega Blvd
	TS11	10/17/2004	4/25/2006	Ballona Creek at Farifax Ave
	TS12	10/17/2004	4/25/2006	Project 181-57 at Cochran Ave
SCCWRP	ME05	2/19/2001	2/22/2004	ME Ballona Creek at Sawtelle

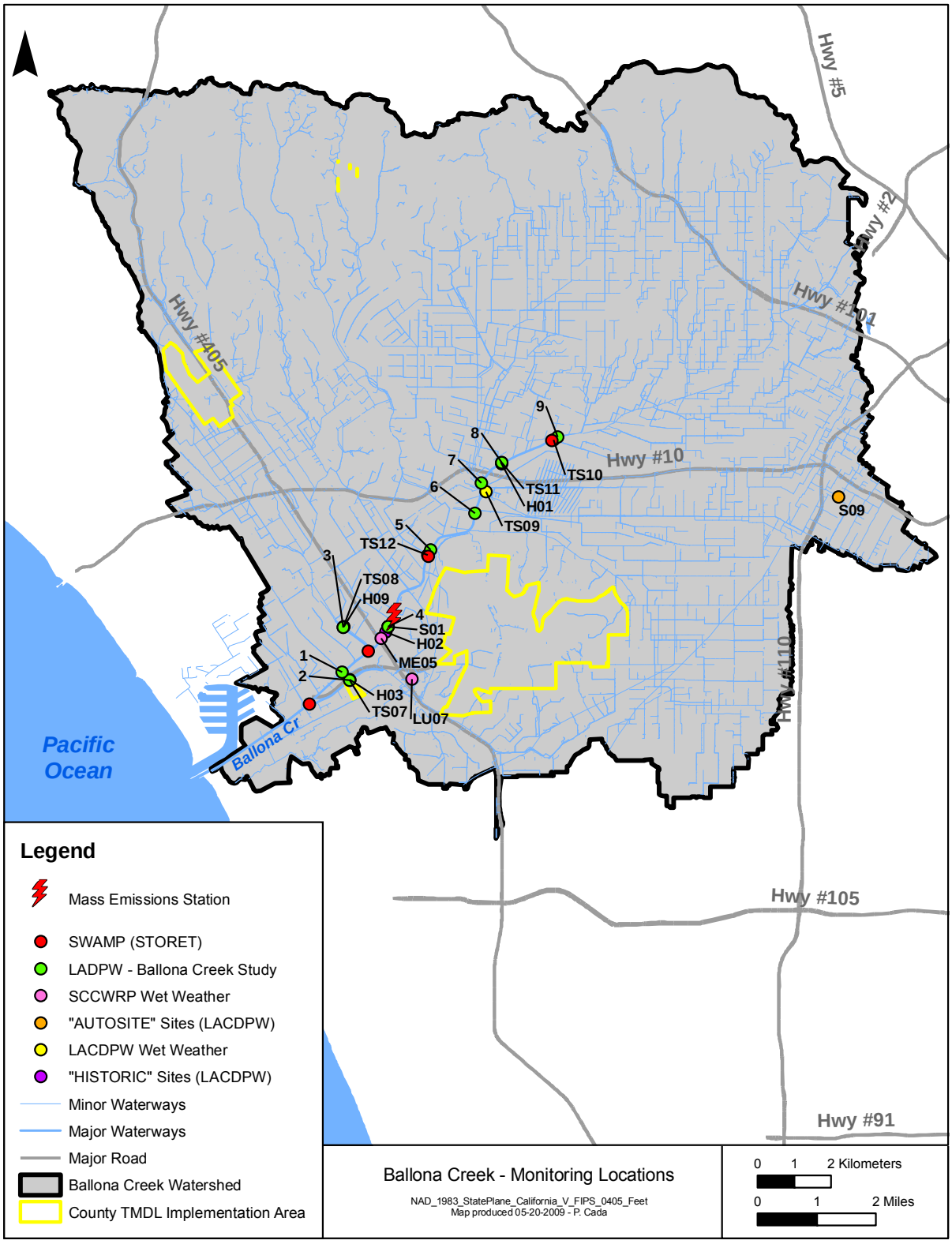


Figure B-1. Ballona Creek Watershed Wet-Weather Monitoring

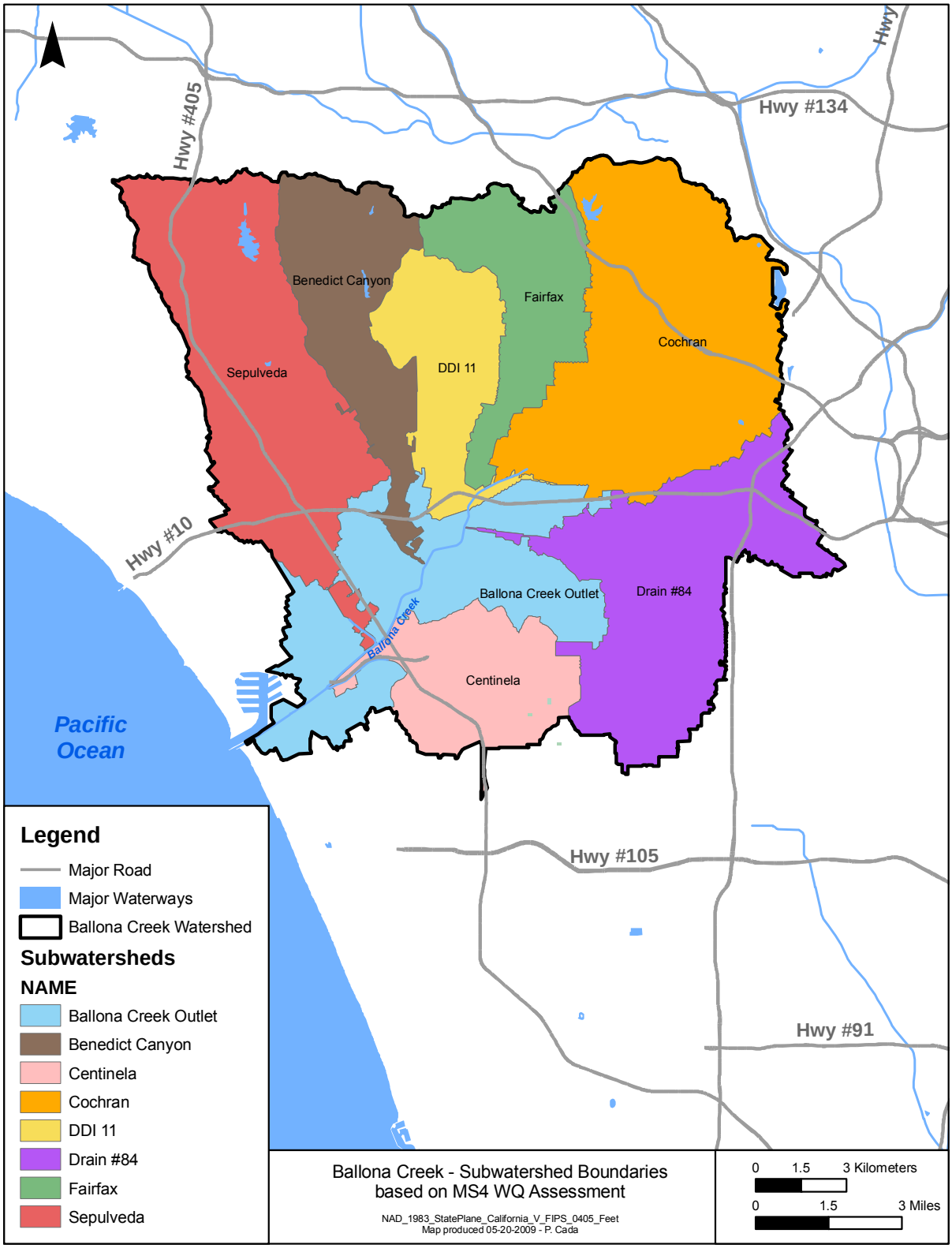


Figure B-2. Ballona Creek Monitored Subwatersheds—MS4 Water Quality Assessment

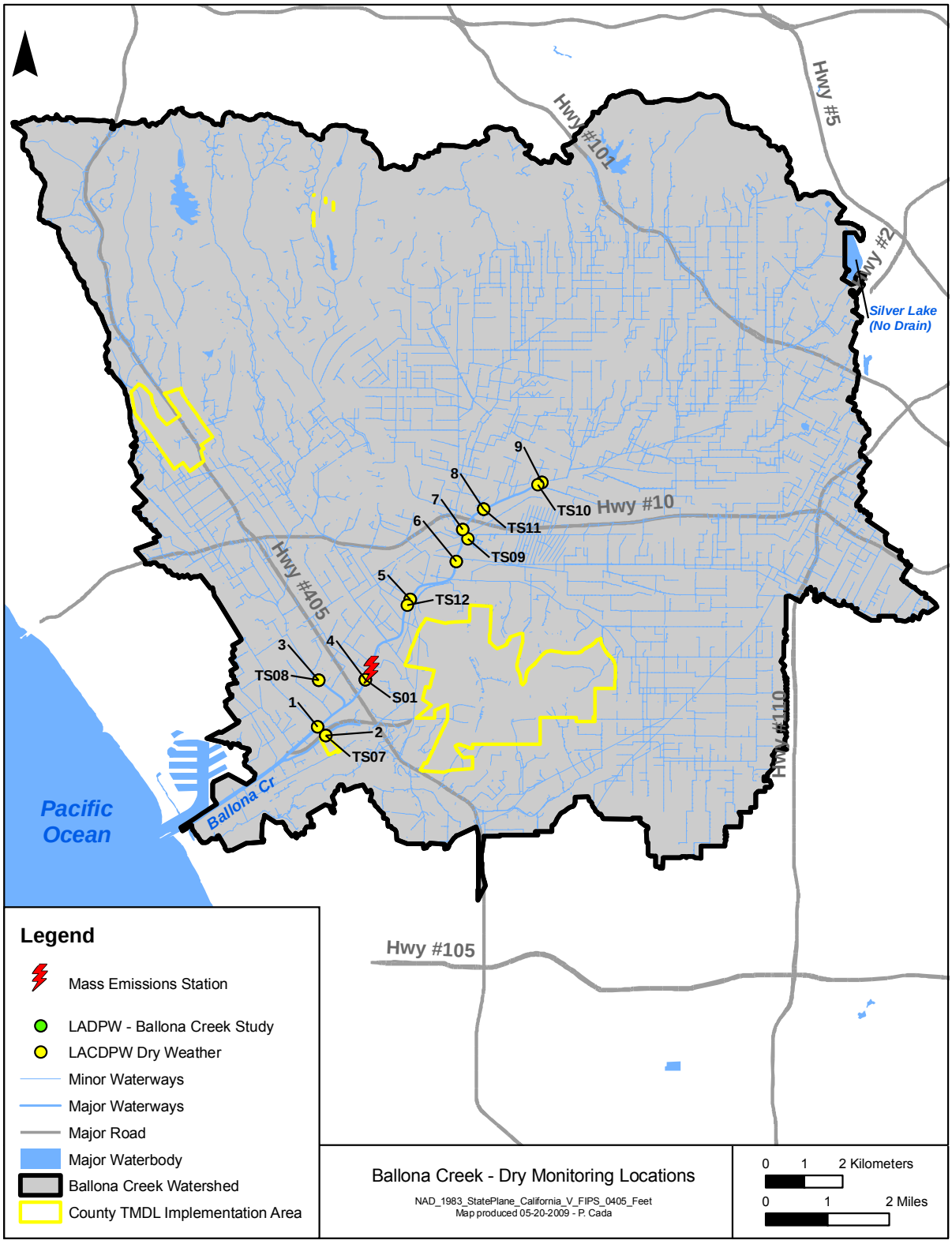


Figure B-3. Ballona Creek Dry-Weather Monitoring

B.1. Wet-Weather Monitoring

Flow-weighted mean concentrations were calculated for selected LACDPW and SCCWRP monitoring sites in the Ballona Creek watershed (Table B-2 through Table B-6). Median wet-weather concentrations are presented for data from the MS4 water quality assessment (Table B-7). The most relevant stations for understanding the effect of the unincorporated County TMDL Implementation Areas are TS08 and BC3 on the Sepulveda Channel (includes West Los Angeles) and TS07 and BC2 on Centinela Creek (includes Ladera Heights/Viewpark-Windsor Hills). The mass emission stations (S01, ME05, BC4) on Ballona Creek are useful for comparison.

Metals concentrations (LACDPW and SCCWRP) for zinc and copper tend to be higher at the tributary stations (TS08, TS07) compared to data at the mass emissions stations based on average values. Median concentrations from the MS4 water quality assessment suggest that they are about the same, but they take into account much less data. Average lead concentrations in Centinela Creek were nearly double that of the mass emission station but less than results from two stations. While cadmium was generally nondetect in the MS4 study, it has been measured consistently in the more regular sampling.

Fecal coliform is typically lower at the subject tributary stations compared to mass emission site, but all values are high and variable. Average nutrient concentrations fall within relatively tight ranges among all stations. Average TP is usually between 0.3 and 0.6 mg/L. TN was high with average values for regular LACDPW data greater than 5 mg/L.

Few detectable levels of the legacy pollutant DDT have been observed at mass emissions stations in the Los Angeles Region (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were measured). Ackerman and Schiff (2003) report EMCs for DDT for only agricultural land use (others were not detected). PCBs and chlordane are also referred to as legacy pollutants, and similar to DDT, watershed sources of the pollutants could exist but are difficult to pinpoint. However, no detectable levels of PCBs and chlordane have been observed at County mass emissions stations. Detectable levels of chlordane were measured at one of the MS4 water quality assessment sites (BC-1).

PAHs are more common than legacy pollutants described above; however, they are nondetect in regular LACDPW sampling. Flouranthene, phenanthrene, and pyrene are the most commonly detected according to results at ME05. The range of total PAHs in the MS4 water quality assessment is 108 to 694 nanograms per liter (ng/L). Research by Stein et al. (2006) found that the dominant source of origin is pyrogenic (combustion of organic matter) in the Los Angeles region that is deposited through atmospheric deposition. The mean EMC for PAHs in this research is 2,300 ng/L.

Table B-2. Wet-Weather Monitoring of Heavy Metals (Zinc, Copper, Lead – µg/L) in the Ballona Creek Watershed

Station	Total Zinc					Total Copper					Total Lead				
	Count	Min	Max	Avg.	Med	Count	Min	Max	Avg.	Med	Count	Min	Max	Avg.	Med
S01	30	27.8	784	173	76	35	6.89	169	36	17	35	0	871	38.6	2.4
TS07	10	18.4	1,890	442	245	10	16.9	379	111	61	10	1.3	198	50.7	36.1
TS08	10	30.8	1,340	353	107	10	18.8	324	92	34	10	2.1	116	31.2	13.8
TS09	10	16.7	648	196	187	10	15.6	137	63	70	10	1.2	47.3	24.1	25.5
TS10	10	94.3	1,980	643	424	10	19.8	288	117	78	10	2.6	230	84.2	42.3
TS11	10	32.4	876	281	266	10	11.4	177	68	61	10	1.6	73.6	32.7	37.9
TS12	10	29	3,760	1,031	512	10	10.3	699	205	73	10	1.9	449	128.9	40.4
ME05	7	123	790	311	237	7	17.4	124.7	50	40	0	Not Sampled			

Table B-3. Wet-Weather Monitoring of Cadmium and Selenium in the Ballona Creek Watershed (µg/L)

Station	Total Cadmium					Total Selenium				
	Count	Min	Max	Avg	Med	Count	Min	Max	Avg	Med
S01	15	0.46	3.79	1	1	8	1.1	6.81	3.30	2.67
TS07	7	0.29	3.53	1.60	0.94	4	1.0	1.4	1.19	1.17
TS08	6	0.43	2.84	1.53	1.65	5	1.1	3.11	2.09	2.40
TS09	7	0.48	2.81	1.53	1.58	5	1.2	3.55	2.01	1.81
TS10	7	0.36	4.32	1.99	1.69	4	1.3	1.73	1.47	1.44
TS11	7	0.29	1.16	0.82	0.91	5	1.0	2.12	1.53	1.30
TS12	6	0.45	9	3.77	2.35	7	1.1	6.46	2.87	1.96
ME05	0	Not sampled				0	Not sampled			

Table B-4. Wet-Weather Monitoring of Fecal Coliform in the Ballona Creek Watershed (MPN/100 mL)

Station	Fecal Coliform					
	Count	Min	Max	Avg	Median	GeoMean
S01	32	500	16,000,000	839,672	110,000	108,406
TS07	10	17,000	500,000	175,400	90,000	89,500
TS08	10	2,400	500,000	130,740	92,000	48,331
TS09	11	16,000	500,000	119,727	30,000	56,216
TS10	10	160,000	2,800,000	666,000	290,000	407,043
TS11	10	17,000	5,000,000	664,700	235,000	186,414
TS12	10	24,000	16,000,000	2,076,400	300,000	480,947
ME05	5	7,463	38,448	22,041	17,731	18,805

Table B-5. Wet-Weather Monitoring of Nutrients in the Ballona Creek Watershed (mg/L)

Station	TP					TN				
	Count	Min	Max	Avg	Med	Count	Min	Max	Avg	Med
S01	34	0.08	1.5	0.46	0.32	8	2.56	16.72	5.84	4.30
TS07	10	0.22	0.84	0.49	0.47	5	2.53	15.43	7.40	3.99
TS08	10	0.19	0.8	0.47	0.45	5	2.34	12.83	5.89	4.62
TS09	10	0.26	0.77	0.45	0.43	5	2.88	13.41	8.51	8.72
TS10	10	0.27	0.87	0.60	0.64	5	3.22	8.69	5.78	5.22
TS11	10	0.21	0.54	0.37	0.38	5	3.72	21.51	8.76	5.41
TS12	10	0.30	1.06	0.62	0.58	5	3.17	10.46	7.00	8.46
ME05	1	0.3	0.3	0.3	0.26	2	3.3	4	4	3.51

Table B-6. Wet-Weather Monitoring of PAHs in the Ballona Creek Watershed (ng/L)

Parameter	ME05					
	4/7/01	11/24/01	5/2/03	10/31/03	2/2/04	2/21/04
1-Methylnaphthalene	ND	76.9	ND	44.5	19.4	17.4
2,3,5-Trimethylnaphthalene	ND	ND	ND	42.8	ND	ND
2,6-Dimethylnaphthalene	ND	113.7	ND	46.2	ND	20.9
2-Methylnaphthalene	ND	154.2	ND	82.4	74.3	35.4
Acenaphthene	ND	14.8	ND	15.2	ND	ND
Anthracene	18.6	36.0	ND	49.2	ND	25.4
Benz(a)anthracene	63.3	192.6	ND	292.0	ND	60.7
Benzo(a)pyrene	43.5	107.8	ND	266.6	ND	45.1
Benzo(b)fluoranthene	68.1	294.2	ND	474.2	ND	96.1
Benzo(e)pyrene	63.8	151.1	ND	367.7	ND	65.8
Benzo(g,h,i)perylene	45.2	104.5	ND	411.3	ND	68.8
Benzo(k)fluoranthene	23.8	75.0	ND	351.6	ND	75.6
Biphenyl	ND	57.7	ND	15.5	ND	18.0
Chrysene	114.4	231.3	ND	557.5	277.2	137.7
Dibenz(a,h)anthracene	ND	ND	ND	55.6	ND	ND
Fluoranthene	169.1	401.7	227.6	952.8	374.7	206.0
Naphthalene	ND	78.6	ND	96.5	ND	23.8
PAH Total	67.0	814.7	151.1	985.0	6,137.0	4,929.5
Perylene	ND	61.4	ND	111.6	ND	ND
Phenanthrene	93.6	281.6	124.6	497.6	202.3	102.8
Pyrene	176.3	399.3	238.0	830.1	334.0	211.4

ND = nondetect

Table B-7. Ballona Creek Watershed Median Wet Weather Concentrations – MS4 Water Quality Assessment

Station	TN (mg/L)	TSS (mg/L)	Cadmium (ug/L)	Copper (ug/L)	Lead (ug/L)	Selenium (ug/L)	Zinc (ug/L)	Chlordane (ng/L)	PAHs (ng/L)	Fecal Coliform (MPN/100mL)
BC-1; Ballona Creek	2.0	14.5	0.20	19.90	7.28	1.00	64.70	100.3	427.50	11,000
BC-2; Centinela Creek	2.0	18.0	ND	20.90	7.69	0.40	115.60	ND	429.0	7,000
BC-3; Sepulveda Channel	2.9	11.0	ND	19.70	3.34	0.90	84.70	ND	164.0	8,000
BC -4; Ballona Creek LACDPW MES	3.0	15.0	0.20	21.20	8.42	0.80	115.90	ND	441.10	17,000
BC-5; Benedict Canyon Channel	3.0	16.70	0.20	20.80	1.46	2.30	61.20	ND	207.60	7,000
BC-6; Drain #84	3.0	25.0	0.2	24.80	12.31	0.40	143.70	ND	693.90	30,000
BC-7; DDI 11	2.10	3.30	ND	23.70	3.65	2.70	131.10	ND	104.70	11,000
BC-8; Fairfax Channel	3.0	12.0	ND	20.80	5.79	0.60	103.7	ND	245.50	13,000
BC-9; Cochran	2.80	11.70	ND	19.20	6.87	0.90	87.60	ND	309.90	17,000

Metals are totals
DDT and PCB are nondetect

B.2. Dry-Weather Monitoring

Statistical summaries of dry-weather concentrations were developed for the selected LACDPW sites and for the MS4 water quality assessment (Table B-8 through Table B-12). The most relevant stations for understanding the effect of the unincorporated County TMDL Implementation Areas are TS08 and BC3 on the Sepulveda Channel (includes West Los Angeles) and TS07 and BC2 on Centinela Creek (includes Ladera Heights/Viewpark-Windsor Hills).

Dry-weather monitoring results for copper, lead, and zinc are often an order of magnitude less compared to wet weather. Metals concentrations at TS07, Centinela Creek, are typically higher than Sepulveda Channel (TS08) and mass emission sites (S01) in regular LACDPW sampling. Cadmium was nondetect at many stations in LACDPW data and was never found in the MS4 water quality assessment.

Fecal coliform counts are not as high as in wet-weather monitoring but remain elevated. They did tend to be lower in Centinela Creek compared to Sepulveda Channel. This can be seen in both sets of data: LACDPW and MS4 water quality assessment. Nutrient concentrations are also lower in dry-weather monitoring. TN values at Sepulveda are higher than Centinela and mass emission sites. Chlordane, DDT, and PCBs are not detected in any of the dry-weather data sets.

Table B-8. Dry-Weather Monitoring of Heavy Metals (Zinc, Copper, Lead, in µg/L) in the Ballona Creek Watershed

Station	Total Zinc					Total Copper					Total Lead				
	Count	Min	Max	Avg	Med	Count	Min	Max	Avg	Med	Count	Min	Max	Avg	Med
S01	10	9.96	149	44	31	10	7.6	43.6	19.9	16.6	10	0	24.6	3.6	1.2
TS07	3	20.5	201	83	28	4	15.1	57	31.4	26.7	4	1.4	20.7	6.3	1.6
TS08	4	21.2	87.7	44	33	4	9.31	40.6	21.7	18.5	4	1.3	8.9	3.7	2.3
TS09	3	14.5	17.7	16	15	4	10.2	18.9	13.7	12.9	4	1	1.4	1.2	1.2
TS10	4	82.7	146	113	113	4	17.4	38.3	26.7	25.6	4	2.1	2.8	2.5	2.6
TS11	4	24.8	37.8	29	27	4	10.9	19.7	14	12.7	4	0.8	1.8	1.3	1.3
TS12	4	23.7	61.8	43	44	4	11.8	19.3	14.6	13.7	4	1.4	7.6	3.3	2.2

Table B-9. Dry-Weather Monitoring of Cadmium and Selenium in the Ballona Creek Watershed (µg/L)

Station	Total Cadmium					Total Selenium				
	Count	Min	Max	Avg	Med	Count	Min	Max	Avg	Med
S01	2	0.25	0.49	0.37	0.37	9	3.1	15.2	5.70	4.15
TS07	1	0.56	0.56	0.56	0.56	4	2.1	10.7	4.56	2.71
TS08	0	Nondetect				4	4.1	8.7	5.79	5.21
TS09	0	Nondetect				4	3.7	9.54	6.01	5.38
TS10	3	0.35	0.58	0.44	0.40	4	1.4	6.14	3.29	2.80
TS11	0	Nondetect				4	2.0	3.13	2.57	2.56
TS12	0	Nondetect				4	6.5	11	8.35	7.96

Table B-10. Dry-Weather Monitoring of Fecal Coliform in the Ballona Creek Watershed (MPN/100mL)

Station	Fecal Coliform					
	Count	Min	Max	Avg	Median	GeoMean
S01	24	20	16,000,000	862,851	5,700	11,972
TS07	4	700	5,000	2,350	1,850	1,723
TS08	4	3,000	90,000	27,750	9,000	12,161
TS09	4	130	9,000	3,058	1,550	1,234
TS10	4	80	9,000	2,403	265	472
TS11	4	300	14,000	5,025	2,900	2,025
TS12	4	500	24,000	11,625	11,000	5,651

Table B-11. Dry-Weather Monitoring of Nutrients in the Ballona Creek Watershed (mg/L)

Station	TP					TN				
	Count	Min	Max	Avg	Med	Count	Min	Max	Avg	Med
S01	9	0.08	0.96	0.28	0.18	3	1.44	3.32	2.33	2.24
TS07	4	0.13	0.31	0.23	0.23	2	2.64	3.17	2.91	2.91
TS08	4	0.20	0.59	0.37	0.35	2	5.13	5.61	5.37	5.37
TS09	4	0.07	0.11	0.09	0.09	2	2.52	2.71	2.62	2.62
TS10	4	0.51	0.64	0.57	0.56	2	2.47	2.57	2.52	2.52
TS11	4	Nondetect				2	3.08	4.95	4.01	4.01
TS12	4	0.20	0.88	0.51	0.48	2	3.90	5.18	4.54	4.54

Table B-12. Ballona Creek Watershed Median Dry Weather Concentrations – MS4 Water Quality Assessment

Station	TN (mg/L)	TSS (mg/L)	Copper (ug/L)	Lead (ug/L)	Selenium (ug/L)	Zinc (ug/L)	PAHs (ng/L)	Fecal Coliform (MPN/100mL)
BC-1; Ballona Creek	2.3	14.0	10.60	1.60	4.80	21.40	31.60	5,000
BC-2; Centinela Creek	1.0	4.0	12.80	1.10	2.30	16.30	11.60	265
BC-3; Sepulveda Channel	2.4	13.0	12.40	1.40	3.80	19.30	15.80	2,000
BC -4; Ballona Creek LACDPW MES	1.0	11.0	9.60	0.90	4.20	26.50	34.40	2,550
BC-5; Benedict Canyon Channel	1.95	19.0	13.60	2.20	4.10	21.50	76.30	4,000
BC-6; Drain #84	2.30	8.0	15.80	8.0	2.80	99.50	20.60	1,950
BC-7; DDI 11	1.0	2.0	16.90	0.50	4.40	12.0	3.30	5,000
BC-8; Fairfax Channel	1.60	1.0	5.30	0.60	2.50	16.40	7.20	500
BC-9; Cochran	2.70	4.0	7.90	1.60	2.50	23.20	6.0	8,000

Metals are totals
Cadmium, chlordane, DDT, and PCB are nondetect

B.3. References

Ackerman, D., and K. Schiff. 2003. Modeling storm water mass emissions to the Southern California Bight. *Journal of Environmental Engineering* 129(4):308–317.

Stein, E.D., L.L. Tiefenthaler, and K. Schiff. 2006. Watershed-based sources of polycyclic aromatic hydrocarbons in urban storm water. *Environmental Toxicology and Chemistry* 25(2):373–385.

Weston. 2008. *Ballona Creek Watershed MS4 Water Quality Assessment*. Prepared for Los Angeles County Department of Public Works, Alhambra, CA, by Weston, Long Beach, CA.

Appendix C. Public Information and Participation Programs

The County has several Public Information and Participation Programs. Most of these programs are organized by the Public Relations Group, including the Stormwater/Urban Runoff Education Program, the Used Oil and Filter Recycling Program, Environmental Defenders, Generation Earth, Plan-It Earth, and the Restaurant Training Program. In addition to programs run by the Public Relations Group, the County also supports the Brake Pad Partnership. The Environmental Programs Division leads the 888-Clean-LA Program, which directs the public to all the County's environmental programs. Each of these programs is described in detail below.

C.1. Stormwater/Urban Runoff Education Program

C.1.1. Goals and Objectives

- Receive 35 million impressions annually
- Reach numerical behavior change targets
- K-12 education
- Comply with all additional public involvement and public participation requirements in the 2001 permit
- Behavior change targets
  - Dumping used motor oil into storm drains from 6 percent to 2 percent
  - Littering from 13 percent to 10 percent
  - Hosing leaves and dirt into the street from 12 percent to 9 percent
  - Dumping directly into the storm drains from 5 percent to 2 percent
  - Dropping cigarette butts on the ground from 16 percent to 12 percent
  - Leaving dog droppings on the ground from 4 percent to 1 percent
  - Rinsing out paint brushes into the street from 6 percent to 2 percent
  - Emptying car ashtrays into the street from 3 percent to 1 percent

C.1.2. Description

A comprehensive outreach campaign to target urban runoff and polluted stormwater runoff. The program was launched to educate the public about what they can do to prevent pollution and keep local waterways clean to help meet water quality requirements. The program uses a variety of different outreach efforts to demonstrate the effect of everyday activities on the environment.

C.1.3. Target Audience

Home mechanics, commercial industry, and the general public

C.1.4. Message Packaging or Supporting Materials

Current program outreach activities include paid advertising, community pilot programs, media relations, and corporate partnerships. In addition, the program provides technical assistance to the incorporated cities to help promote cohesive pollution prevention efforts throughout the region.

- Public service announcements (PSAs)
  - Dog waste Web banner advertisement
  - Pool Web banner advertisement
  - Cigarette Web banner advertisement

  - Bus king dog waste advertisement
  - Bus king pool advertisement
  - Bus shelter dog waste advertisement
  - Bus shelter pool advertisement
  - Bus shelter cigarettes advertisement
  - Yard waste Web banner advertisement
  - Over water Web banner advertisement
  - Spanish litter bug advertisement
  - LED ribbon board
  - Television PSA slate
  - Manhattan beach pool/spa flyer
  - Good cleaning practices—food and restaurant industry
  - Managing fats, oil, and grease BMP poster
  - Recycle used oil posters
  - Used oil filter exchange event posters
- Tip cards
  - Pick up after your pooch
  - Don't paint the town red
  - A yard is a terrible thing to waste
  - Are you a litter bug and don't know it?
  - Storm drains are for rain and recycling tips handout
- Press releases
  - It is a spring cleaning season: Keep the watershed clean too!
  - Cigarette butt litter is choking Los Angeles
  - Pick up after your pooch!
  - It's back to school time! The County of Los Angeles Department of Public Works reminds residents to teach kids an important lesson: Put trash where it belongs!
  - With storm season approaching, the County of Los Angeles advises residents to keep their street gutters clean!
- News clips
  - Cigarette butt litter is choking Los Angeles County
  - Street cleaning
  - Friday is take your dog to work day
- Reports and presentations
  - County of Los Angeles fiscal year 2007-08 summary of stormwater education activities
  - County of Los Angeles fiscal year 2007-08 assessment of in-school stormwater education programs
  - Stormwater public education program resident population—Tracking evaluation
- Billboards
- Movie theater advertisements
- Business outreach program
  - County departments
  - Independent pet stores, veterinary hospitals, County animal shelters
  - Private companies with more than 500 employees
  - Collateral materials
  - PSAs and newsletter articles
  - Corporate and community partnership programs
- Public participation events
  - Co-sponsor coastal cleanup day
    - Schools have competitions for picking up the most trash
  - Attend countywide outreach events on request

        - Organizations frequently request that Public Works attend community events to provide informational materials, collateral items, and a watershed model display
        - Usually staff from the Public Relations Group, Watershed Management Division, or Environmental Programs Division provide collateral materials and attend the events
    - Public education and participation advisory panel
        - Representatives from the environmental community, co-permittee cities, regional support staff, and public education and marketing experts
- A seasonal campaign for the proper disposal of sanitary waste from recreational vehicles (RVs)
    - The 2009 press release was distributed in July. The press release contains information on proper disposal of RV septage

C.1.5. Languages

All products are in English. The following materials/messages are in other languages:

- PSAs
    - Litter bug advertisement
        - Spanish
    - Managing fats, oil, and grease BMP poster
        - English
        - Spanish
        - Mandarin
- Tip Cards
    - A yard is a terrible thing to waste
        - English
        - Spanish

C.1.6. Evaluation Method

In 1997 before the start of the new public outreach campaign, the County collected baseline data concerning residents' attitudes and behaviors. An annual telephone interview of randomly selected County residents is used to collect information on the outreach campaign. The results are compared to the baseline data to determine if there was an increase or decrease in self-reporting of conducting polluting behaviors. The County also tracks hotline calls and Web site hits.

C.1.7. Program Cost

The contract amount for this program was $790,000 in fiscal year 2009–2010. Before fiscal year 2009–2010, the contract amount was $1.5 million.

C.1.8. Division

Public Relations Group

C.2. Used Oil and Filter Recycling Program

C.2.1. Goals and Objectives

Reduce the incidence of illegal disposal of used oil in landfills and storm drains by educating the public about used oil recycling options.

C.2.2. Description

This education campaign encourages home mechanics (i.e., do-it-yourselfers) to use used oil and filter events. It includes collection events, radio PSAs, Web site banner advertisements, and newspaper advertisements.

C.2.3. Target Audience

Home mechanics

C.2.4. Message Packaging or Supporting Materials

- 2009 Branding advertisement
- Used motor oil and filter collection events flyer with locations and dates
- 2009 Used motor oil and filter collection events flyer event flyer
- Used oil filter exchange event flyer with locations and dates
- 2009 Used oil filter exchange event flyer
- Certified collection support and outreach
  - Site visits
  - Oil container giveaway promotion
  - Used oil and oil filter collection
- Used oil and filter collection events
  - Temporary mobile collection event
  - Co-sponsorship of oil filter exchange events

C.2.5. Languages

English, Spanish, Chinese, Korean, Vietnamese, Cambodian

C.2.6. Evaluation Method

The amount of used oil collected, the amount of used oil filters collected, and a telephone survey is used to evaluate the program.

C.2.7. Program Cost

The contract amount for this program was $500,000 dollars in fiscal year 2009–2010. This program is mostly funded through a grant.

C.2.8. Division

Public Relations Group

C.3. Environmental Defenders

C.3.1. Goals and Objectives

Environmental Defenders educates and empowers elementary school children in the County to protect the local environment. The program offers a free school assembly and other programs to help local schools with a number of environmental issues.

C.3.2. Description

The program is a 30-minute school assembly program for elementary school children. The program involves two professional children's theatre actors and teaches children how to protect the environment.

C.3.3. Target Audience

Elementary school children

C.3.4. Message Packaging or Supporting Materials

- Teacher resource packet
- Activity book
- Lyrics and songs
- Tip sheets
- Pledge cards
- Certificates
- Program CDs

C.3.5. Languages

English

C.3.6. Evaluation Method

Teacher surveys, teacher focus groups, and student assessments are used to evaluate the program. Approximately 890 teachers were surveyed.

C.3.7. Program Cost

The contract amount for this program was $1 million dollars in fiscal year 2009–2010.

C.3.8. Division

Public Relations Group

C.4. Generation Earth

C.4.1. Goals and Objectives

The LACDPW partners with TreePeople, an environmental volunteer organization, to develop and implement an environmental education program primarily aimed at teens. Generation Earth was then created for the County's middle and high school students to educate them on how to reduce the amount of waste going to landfills and pollutants going into waterways. The program helps teachers, schools, and communities to implement campus and community projects that produce positive measurable effects on the environment.

C.4.2. Description

Generation Earth is an environmental education program from LACDPW. They offer workshops, mentorship, and do-it-yourself environmental projects that help youth make a positive difference at school, at home, and,

eventually, out in the world. This program is presented by TreePeople for secondary school children and encourages students to make a difference in their local environment through campus and eco-projects.

C.4.3. Target Audience

Secondary school children

C.4.4. Message Packaging or Supporting Materials

Generation Earth has organized its Web site into four sections: Students, Teachers, Schools, and Youth Groups. Materials related to each section are listed below.

For Students

- Publications
  - Waste audit
  - Water audit
  - Project manager action guide
  - Student action guide
  - Service project idea mapping

For Teachers

- Publications
  - Waste audit
  - Water audit
  - Teacher action guide
  - Student action guide
  - Project manager action guide
- Activities/Tools
  - Environmental behaviors bingo
  - Check this out activity
  - Make a difference activity
  - Service project idea mapping
  - Lesson plan builder
  - Pre/post test
  - Generation Earth project experience
- Lesson plans
- Field trip ideas
- Bus request form

For Schools

- Workshops

For Youth Groups

- What a waste action booklet
- From the streets to the sea action booklet
- Registration form
- Teen action project final report

C.4.5. Languages

English

C.4.6. Evaluation Method

Teacher surveys, teacher focus groups, and student assessments are used to evaluate the program.

C.4.7. Program Cost

The contract amount for this program was $1 million dollars in fiscal year 2009–2010.

C.4.8. Division

Public Relations Group

C.5. Plan-It Earth

C.5.1. Goals and Objectives

Educate students about environmental issues by providing a subscription to the *Los Angeles Times*.

C.5.2. Description

This program was started in 1993 and the current contract is pending. This program involves an 8-week subscription to the *Los Angeles Times* to improve student's knowledge on environmental issues by reading the paper. The program also involves a teacher's guide and lesson plans. Students can write an essay or create a piece of art related to environmental issues. The winner's essay or art is published in the *Los Angeles Times*.

C.5.3. Target Audience

6th to 9th grade children

C.5.4. Message Packaging or Supporting Materials

All materials are provided by the contractor who assumes all costs of development, production, and administration of the program.

- Teacher's guide
- Lesson plans
- *Los Angeles Times* subscription
- Program announcement cards
- Flyer and program updates
- Broadcast FAX
- Four quarter-page advertisements in the *Los Angeles Times*
- Certificates
- T-shirts
- Award ceremony
- Teacher packets
  - Parent letter in English and Spanish
  - Curriculum materials
  - Workshop flyer

C.5.5. Languages

All materials are in English, and the parent letter is presented in both English and Spanish.

C.5.6. Evaluation Method

Monthly report and post-program evaluation is performed by the contractor. The monthly report includes a summary of the following:

- Work completed during the month
- Work expected to be completed during the next month
- Name of schools, including location and grades registered for this program
- Names of teachers, school name, and grade level of teachers who attended the workshops
- Listing of schools that were contacted regarding this program
- Status of public outreach campaign
- Total number of schools enrolled
- Report is due the third Monday of each month
- An updated budget for each task

The contractor will provide a final analysis of the program within 2 months of the end of each program year that documents all work completed. The analysis will also include any program enhancement recommendations.

C.5.7. Program Cost

The contract amount for this program was $50,000 in fiscal year 2009–2010. Public Relations Group might not renew the contract.

C.5.8. Division

Public Relations Group

C.6. Restaurant Training Program

C.6.1. Goals and Objectives

The goal of the restaurant training program is to reduce the amount of oil and grease in runoff from restaurants.

C.6.2. Description

The County program for restaurant BMPs started in 2004 and includes restaurant BMP guidelines, a watershed model showing the potential for oil and grease to affect the watershed, a PowerPoint presentation that is available on its Web site, role playing, and collateral materials for owners including posters, buckets with BMPs printed on them, brochures, and the like. Public Relations Group circulates a letter inviting restaurants or retail gas owners in specific watersheds or cities to training events at least once a year.

C.6.3. Target Audience

Restaurant owners and employees

C.6.4. Message Packaging or Supporting Materials

- Restaurant BMP guidelines
- Watershed model showing the potential for oil and grease to affect the watershed
- PowerPoint presentation (available on the Web site)
- BMP training program
- Workshops
- Collateral materials including posters and buckets
- Partner with co-permittee cities for list of restaurants

C.6.5. Languages

English and Spanish

C.6.6. Evaluation Method

Environmental Programs Division staff conduct stormwater inspections for restaurants in the unincorporated areas of the County, and they handle appropriate follow-up for BMP violations.

Public Relations Group coordinates inviting restaurant or retail gas outlet owners/managers to BMP workshops in their community. Invitees are contacted after the workshop to confirm attendance and address requests for collateral materials. Public Works staff, a consultant, or the partnering cities perform the follow-up calls.

C.6.7. Program Cost

The Public Relations Group provided staff rates involved with the restaurant BMP trainings. Public Relations Group staff involved with BMP training include administrative assistants levels II ($51.93 per hour) and III ($57.88 per hour), program managers level I ($61.26 per hour) and II ($69.48 per hour), and management specialist level I ($76.86 per hour), as well as outside consultants. In the past it has taken the Public Relations Group three to 6 months to plan a training event. The County typically sends out approximately 600 letters for each annual training workshop. The cost to conduct a BMP workshop (which is done annually) is approximately $13,000, which includes the labor cost of the consultant, mailings, refreshments, and the like.

C.6.8. Division

Public Relations Group

C.7. 888-Clean-LA

C.7.1. Goals and Objectives

The Environmental Programs Division developed the 888-Clean-LA Web site to educate the public about the County's many environmental programs and to provide the public with important information about protecting the environment.

C.7.2. Description

The 888-Clean-LA Web site provides a wide variety of environmental information and services to the public in both English and Spanish and has grown to become a central clearinghouse for environmental information in the County. More than 150 different Web sites now link to the information presented there, such as Yard Waste

Recycling, Used Oil Centers, Household Hazardous Waste, Business Recycling and more. The Web site is well organized and easy to navigate.

C.7.3. Target Audience

General Public

C.7.4. Message Packaging or Supporting Materials

The Environmental Resources Hotline is part of the 888-Clean-LA program and is a tool for residents to use to learn more about the proper disposal of household hazardous waste, used oil recycling, stormwater pollution prevention, illegal dumping, and other environmental issues.

The 888-Clean-LA Web site provides information for several environmental issues including links to programs and information for trash collection, tire recycling/rubberized asphalt, yard waste management programs, 3 Rs (reduce, reuse, recycle), industrial waste, solid waste, household hazardous waste, used oil, underground storage tanks, construction and demolition debris, youth education, stormwater pollution prevention, water conservation, and illegal dumping.

C.7.5. Languages

The site is in English and Spanish

C.7.6. Division

Environmental Programs Division

Appendix D. Field Investigations for Distributed BMPs

Field investigations at each of the six identified parcel groups were performed to evaluate key soil and infiltration characteristics that are essential to understanding how distributed structural BMPs can take advantage of soil properties. The field investigations are described in the following sections.

D.1. Methods

D.1.1. Infiltration Rate

The County's *Low Impact Development Standards Manual* (LID Manual) (County of Los Angeles 2009) recommends that the infiltration rate be at least 0.5 in/hr for infiltration BMPs, such as bioretention. Soil infiltration rate was verified using the *Standard Test Method for Infiltration Rate in Field Soils Using Double-Ring Infiltrometer* specified in American Society for Testing and Materials (ASTM) D 3385 (ASTM 2009). That test measures infiltration rates for soils with a hydraulic conductivity between 10^{-6} centimeters per second (cm/s) and 10^{-2} cm/s. The double-ring infiltrometer (Figure D-1) used consists of two rings where the ratio of the diameter of the inner and outer rings is approximately two. Where possible, the soils were excavated to the approximate depth of the base of a potential distributed-type BMP. The rings were sealed by forcing them into the soil a few inches (Figure D-2).

Figure D-1. Double Ring Infiltrometer

Figure D-2. Sealing the Rings

The inner and outer rings were filled with water, and the initial level of water in the inner ring, outer ring, and current time (effectively time 0) were recorded (Figure D-3). All three parameters were measured and recorded approximately every 5 minutes. The test was completed when enough time elapsed, typically around 2 hours, to determine the surface infiltration rate (USEPA 1999). The infiltration rate is equivalent to the maximum-steady state or average incremental infiltration velocity (ASTM 2009).

For each site, the double-ring infiltrometer test was performed three times at different locations in close proximity (Figure D-4). The surface infiltration rate for each site was determined by averaging the results from the three test locations. By performing the tests at three locations, the variability of the infiltration rates at each site can be documented. A log of the soil borings performed in the water table analysis was recorded to assist in the classification of the soils, to verify the HSG, and to help determine the infiltration rates.

Figure D-3. Infiltrometer Test Setup

Figure D-4. Site investigation

D.1.2. Water Table

A combination of methods was used to determine the depth of the water table at each site. The County's *Hydrology Manual* (County of Los Angles 2006) and the Natural Resources Conservation Service (NRCS) soils data were referenced to estimate the depth of the water table corresponding to the soil type at the site. At least one boring with a soil log was performed at each site (Figure D-5). Typical water table indicators were indentified, such as soil mottling and reduced soils, to determine the seasonal high water table depth. Monitoring well data collected by the County's Water Resources Division was also compared to the observed water table depths to aid in estimating the water table.

Note: Depth to the water table is not a defining characteristic of the site.

Figure D-5. Soil Boring

D.1.3. Soils Classification

Soils were classified using the U.S. Department of Agriculture (USDA) Textural Triangle (USDA NRCS 2007). The distribution of the HSG classification for each soil boring is presented graphically in Table D-1, and Table D-2 provides a text version.

Table D-1. Soil Boring Composition

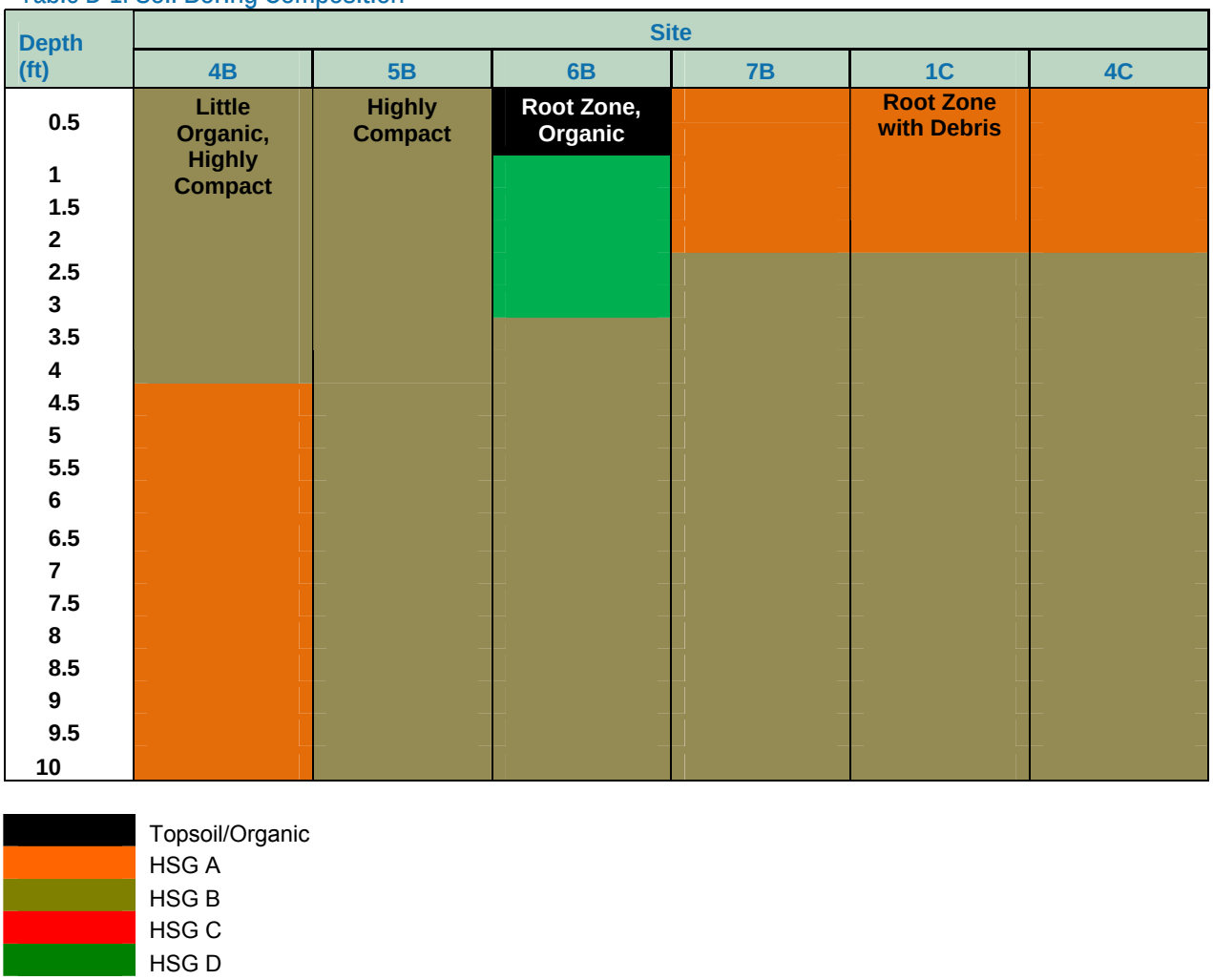


Table D-2. Soil Boring Log

Site	Boring Soil Sample Composition		
4B	0–4 ft, loam to sandy clay loam, medium plasticity, little organic (B–C)	4–10 ft sandy loam (A)	
5B	0–2 ft, silt loam (B)	2–5 ft, Loam (B)	5–10 ft, Loam to sandy loam (A–B)
6B	0–3 inches, root zone organic	3 inches–3 ft, clay loam (D)	3–10 ft, silt loam (B)
7B	0–2 ft, sandy loam, low plasticity (A)	2–4 ft, loam, low plasticity (B)	4–10 ft, silt loam (B)
1C	0–2 ft, Sandy Clay (D)	2–4 ft, clay or clay loam (D)	4–10 ft, clay (D)
4C	0–5 ft, sandy clay loam (C)	5–8 ft, sandy clay loam (C)	8–10 ft, clay loam (D)

D.2. Results and Discussion

D.2.1. Infiltration Rate

According to the USDA NRCS, each HSG exhibits the range of infiltration rates presented in Table D-3.

Table D-3. NRCS Hydrologic Soil Group

HSG	Min		Max
A	7.8 in/hr		
B	0.8 in/hr	to	7.8 in/hr
C	0.1 in/hr	to	0.8 in/hr

Source: Soil Survey Division Staff 1993

The infiltration rates presented in Table D-4 and the soil boring compositions shown in Table D-1 and Table D-2 were collected between June 12, 2009, and July 10, 2009. The reported management category at one of the sites is not accurate compared with the observations in the field. Site 1C was reported to be in management category D while field observations indicated that the management category is actually A. The site was evaluated with the observed management category. Each of the sites investigated show some variability in the measured infiltration rate. All six sites, with the exception of one HSG B sites, have an average measured infiltration rate greater than 0.5 in/hr—the minimum infiltration rate recommended by the County's LID Manual—making them suitable for infiltration style BMPs (County of Los Angeles 2009). Of the 6 sites investigated, 4 were reported to be HSG B soils in the expected range, while 1 of the sites had measured infiltration rates higher than expected, and 1 of the sites was lower than expected. Neither of the sites reported to be HSG C soils showed measured infiltration rates in the expected range, both were higher.

Table D-4. Measured Infiltration Rates

			Infiltrometer Results (in/hr)				
Site	Area	Management Category	Test 1	Test 2	Test 3	Avg.	Within HSG Range?
4B	Kenneth Hann Park	C	11.3	0.8	6.0	6.0	yes
5B	West Los Angeles Community College	E	0.8	0.5	0.1	0.4	<
6B	Barrington Recreation Area	A	2.3	2.6	4.1	3.0	yes
7B	Ladera Park	C	17.5	15.8	2.3	11.8	>
1C	Westwood Park	D/A	1.8	1.8	6.0	3.2	>
4C	West Los Angeles Community College	E	0.8	0.8	2.3	1.3	>

D.2.2. Hydrologic Soil Group Characteristics

Assessment of infiltration measurements, within HSG areas categorized by NRCS, revealed interesting results that assisted in the assessment of distributed BMPs within the areas. When the measurements are averaged by HSG (Table D-5), the soils reported to be in HSG A have an average infiltration rate below the range reported by the NRCS, the HSG B soils are within the range the NRCS range, and the HSG C soils are above the range. Several factors contribute to those results:

- As indicated by the standard deviation in measured infiltration rates substantial variability was recorded in the infiltration tests.
- Some uncertainty exists in the classification of the soil types contributing to the variability in the measured infiltration rates. For example, site 4A (George Carver Park) was reported by the NRCS to be HSG A; however, the field survey found HSG B soils for the entire profile. The NRCS data showed that this area of HSG A is within a surrounding area of predominately HSG B soils, which is the likely cause of the observed discrepancy.

- In the majority of the soil borings, the reported HSG soil was present at some depth in the profile. Some of the soils and resulting infiltration rates were affected by or a result of disturbance from construction or urban related activities and infill including restricting soil layers at varying depths below the surface.

Table D-5. Infiltration Rate Analysis by HSG

HSG	Mean	Median	Min	Max	Standard Deviation
A	6.2	4.2	0.9	17.0	5.5
B	5.3	3.0	0.4	12.6	4.8
C	4.0	2.3	0.8	10.8	4.6

HSG C soils are typically regarded as being unsuitable for infiltration BMPs because of low infiltration rates; however, the higher than expected infiltration rates indicate that HSG C soils might have more infiltration capacity that previously determined.

D.2.3. Management Category Characteristics

The measured infiltration rate can be correlated to the management category as an indication of the effect of urban related activity. Some of the discrepancies in the measured infiltration rates could be correlated to the following:

- Increased impervious configuration and road density. For example, site 8A has a measure infiltration rate below the range for HSG A soils. The site is in a space adjacent to several roads with loam to sandy clay loam soils, possibly fill material brought in for constructing the road.
- Several sites reported to be HSG B or C sites have sandy or urban complex soils at the surface from construction fill material resulting in higher than expected infiltration rates.
- Multiple sites in concentrated urban areas were highly compacted near the surface resulting in lower than expected infiltration rates.

Soils in areas with highly concentrated impervious configurations are more likely to have a mixture of several soil types, especially near the surface. BMPs should be designed with the imported soil characteristics in mind.

D.2.4. Water Table

None of the borings performed at each site showed any indication of the seasonal high water table within 10 feet of the surface. Well data[1] for Site 6-B (Well # 2535J) show an average depth of 32.3 feet. This is well beyond the 10-foot minimum recommended in the County's LID Manual.

D.3. References

ASTM (American Society for Testing and Materials). 2009. *Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer*. ASTM D 3385. American Society for Testing and Materials, West Conshohocken, PA.

County of Los Angeles. 2006. *Hydrology Manual*. Los Angles County Department of Public Works. January 2006.

[1] Well data could represent deeper water depths and not surface depths.

County of Los Angeles. 2009. *Low Impact Development Standards Manual*. January 2009. http://dpw.lacounty.gov/bsd/lib/fp/Drainage%20and%20Grading/dg_gd~~-LA%20County%20LID%20Manual%20(1-26-2009).pdf. April 2009.

Soil Survey Division Staff. 1993. *Soil Survey Manual*. Handbook 18. U.S. Department of Agriculture, Soil Conservation Service, Washington, DC.

USDA NRCS (U.S. Department of Agriculture, Natural Resources Conservation Service). 2007. *National Soil Survey Handbook*. Title 430-VI. http://soils.usda.gov/technical/handbook/. April 2009.

USEPA (U.S. Environmental Protection Agency). 1999. *Infiltration through Disturbed Urban Soils and Compost-Amended Soil Effects on Runoff Quality and Quantity*. EPA-600-R-00-016. U.S. Environmental Protection Agency, Washington, DC.

Appendix E. Field Investigation for Centralized BMPs

After the list of priority locations for centralized BMPs had been developed, field investigations were performed to collect information that might affect centralized BMP design, construction, and monitoring.

E.1. Field Investigation Methods

E.1.1. Infiltration Rate

The County's *Low Impact Development Manual* (County of Los Angeles 2009) recommends that the infiltration rate be at least 0.5 in/hr for infiltration BMPs, such as bioretention. Soil infiltration rate was verified using the *Standard Test Method for Infiltration Rate in Field Soils Using Double-Ring Infiltrometer* specified in ASTM D 3385 (ASTM 2009). That test measures infiltration rates for soils with a hydraulic conductivity between 10^{-6} centimeters per second (cm/s) and 10^{-2} cm/s. The double-ring infiltrometer (Figure E-1) consists of two rings where the ratio of the diameter of the inner and outer rings is approximately two. Soils were excavated to a depth of approximately one foot (Figure E-1). The rings were sealed by forcing them into the soil a few inches (Figure E-2).

Figure E-1. Double-Ring Infiltrometer

Figure E-2. Sealing the Rings

The inner and outer rings were then filled with water, and the initial level of water in the inner ring, outer ring, and current time (effectively time 0) were recorded (Figure E-3). All three parameters were measured and recorded approximately every 5 minutes. The test was completed when enough time elapsed, typically around 2 hours, to determine the surface infiltration rate (USEPA 1999). The infiltration rate is equivalent to the average incremental infiltration velocity or the infiltration rate once the test has stabilized (ASTM 2009).

For each site, the double-ring infiltrometer test was performed three times at different locations within approximately 30 feet of each other (Figure E-4). The surface infiltration rate for each site was determined by averaging the results from the three test locations. By performing the tests at three locations, the variability of the infiltration rates at each site can be documented. A record of the soil borings performed in the water table analysis was documented to help classify the soils, to verify the HSG, and to help determine the infiltration rates.

Figure E-3. Infiltrometer Test Setup

Figure E-4. Site Investigation

E.1.2. Water Table

A combination of methods was used to determine the depth of the water table at each site. NRCS soils data (USDA NRCS 2007) were referenced to estimate the depth of the water table corresponding to the soil type at the site. At least one boring with a soil log was performed at each site (Figure E-5). Typical water table indicators were indentified, such as soil mottling and reduced soils to determine the seasonal, high-water table depth. Monitoring well data collected by the County were also compared to the observed water table depths to help estimate the water table depth.

Note: Depth to the water table is not a defining characteristic of the site.

Figure E-5. Soil Boring

E.1.3. Soil Quality

It is important to determine if background levels of pollutants in the underlying soils could affect the performance of an infiltration BMP. Because of the nature of infiltration BMPs, it is also important to verify whether pollutants in the soils could be transported into the groundwater. Brownfield sites or areas that were landfills are not suitable sites for infiltration BMPs. Samples of the soil at each site were collected and were analyzed by an independent laboratory to determine background levels of pollutants. The analysis was used to determine the suitability of the soils for vegetation and if the soils need to be amended to be appropriate for a centralized BMP.

E.1.4. Site Slope

The slope of the site was verified visually to confirm that the slope is appropriate for a centralized BMP. Areas of the site where the slope is too steep for a BMP to be plausible were not considered in the estimate of available BMP area.

E.2. Field Investigation Results and Discussion

Two potential centralized BMP sites were identified using the GIS screening analysis outlined in Section 5, the characteristics of which are shown in Table E-1.

Table E-1. Potential Centralized BMPs

Area	Management Category	Parcel Area	Available BMP Area	Total Watershed Treatment Area	Unincor-porated County Watershed Treatment Area	Average % Impervious - Total Watershed Treatment Area	Average % Impervious Unincor-porated Lands BMP Drainage Area
West Los Angeles Community College	E	60.5	14.5	69.0	69.0	40.7%	41.6%
Ladera Park	C	14.4	14.0	200.0	200.0	30.4%	30.4%

Note: All areas are in acres.

Both of the watershed treatment areas are entirely or mostly within unincorporated County TMDL Implementation Area. The available BMP area includes any open areas that could be retrofitted for stormwater treatment including parking lots, tennis courts, athletic fields, and open space. Areas of dense or mature trees and building foundations that could be affected by infiltration were avoided. There are large sections of pervious areas in each watershed that caused the impervious percentage calculation to appear low. For instance, sections of West Los Angeles Community College are athletic fields, causing the impervious percentage to appear low even though there are large sections that are impervious. The headwaters of the subwatershed that would be treated by a BMP in Ladera Park contain several oil wells that are surrounded by porous area. These areas drain into highly concentrated impervious areas around Ladera Park.

E.2.1. Infiltration Rates

Infiltration rates and soil composition analysis were measured at each site on June 29 and 30, 2009 (Table E-2).

Table E-2. Measured Infiltration Rates

Area	Test 1 (in/hr)	Test 2 (in/hr)	Test 3 (in/hr)	Avg. (in/hr)	Reported HSG[a]
West Los Angeles Community College	0.8	0.5	0.1	0.4	B
Ladera Park	17.5	15.8	2.3	11.8	B

a. HSG as indicated by the Soil Survey Division Staff 1993

Variability was observed in the infiltration tests at each site. The USEPA found similar variability in a similar study (USEPA 1999). Surface infiltration is affected by compaction caused by land use activities, such as mowing or recreation, and can be variable. Compaction can vary based on activities such as the common path of mowing equipment. By taking the average of the three infiltration rates at each site the average conditions are reported.

West Los Angeles Community College is the only site where measured infiltration rates are below the minimum recommended by the County's LID Manual of 0.5 in/hr. The tests performed at the college are close enough to the minimum that infiltration would be possible with minimal soil amendments. The soil boring sample composition (Table E-3 and Table E-4) indicates that the soils are highly compacted at the surface, thus limiting infiltration; however, the soils below the surface are classified as HSG B (USDA NRCS 2007) and would be suitable for infiltration.

Table E-3. Soil Boring Composition

Depth (ft)	West Los Angeles Community College	Ladera Park
0.5	Highly Compacted	
1		
1.5		
2		
2.5		
3		
3.5		
4		
4.5		
5		
5.5		
6		
6.5		
7		
7.5		
8		
8.5		
9		
9.5		
10		

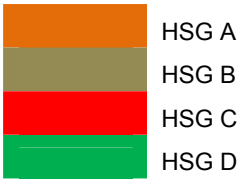


Table E-4. Soil Boring Log

Site	Boring Soil Sample Composition		
West Los Angeles Community College	0–2 ft, silt loam (B)	2–5 ft, Loam (B)	5–10 ft, Loam to sandy loam (A-B)
Ladera Park	0–2 ft, sandy loam, low plasticity (A)	2–4 ft, loam, low plasticity (B)	4–10 ft, silt loam (B)

E.2.2. Water Table

None of the borings performed at a site show any indication of the seasonal, high-water table within 10 feet of the surface. Well data collected by the County (Table E-5) closest to the sites investigated support the observations reported in the field. The historic record shows a range in water table depth from 32 to 328 feet—well beyond the 10-foot minimum recommended in the County's LID Manual.

Table E-5. LACDPW Well Data

Well #	Average Depth (ft)	Combined Average (ft)
5058H	90.9	115.0
5068C	139.1	
1446B	152.8	152.8
4113A	398.1	226.4
4122A	54.7	
4198C	128.8	131.0
4198G	126.7	
4198L	137.4	
1453D	174.7	169.6
1453E	164.5	
1446B	152.8	152.8
1451K	188.0	187.3
1451M	186.5	
1477J	110.2	110.2
1446B	152.8	152.8
*2669A	188.4	188.4
1453D	174.7	169.6
1453E	164.5	
*1311D	74.9	77.3
*1311E	79.7	
1445F	146.3	146.3
2535J	32.3	32.3
4081C	309.7	275.6
4081D	241.6	
4061A	183.1	194.8
4061B	206.4	
4096	221.6	221.6
4117	331.0	328.6
4117C	326.2	

* Wells closest to potential sites

E.2.3. Soil Quality

Soils analyses were performed for each site at the estimated depth of a centralized BMP, approximately 6 feet. Probable effect concentrations have been established by MacDonald et al. (2000) for metals listed as impairments in the Ballona Creek watershed (Table E-6). The probable effect concentration gives an indication of the concentration where an environmental effect can be observed. Each of the sites investigated has metals concentrations in the soils less that the probable effect concentration values.

Table E-6. Metals Concentrations for Investigated Sites

Source	Cadmium	Copper	Lead	Selenium	Silver	Zinc
EPA Probable Effect Concentrations[a]	4.98	149	128	N/A	1.06	459
Ladera Park	ND	12.8	7.69	ND	ND	50.5
West Los Angeles Community College	ND	8.38	2.58	ND	ND	30.4

Note: All numbers reported in mg/kg
a. MacDonald et al. 2000

Concentration of nutrients and pH in the soils was also analyzed for each site. Research has been conducted to determine the appropriate levels of nutrients in water, however, no research was found for the appropriate level of nutrients in the soils. Table E-7 presents the pH and nutrient concentrations at each site. The pH at each site is neutral and would not cause any effect on water quality or vegetation. This report will be updated once PEC levels are established for nutrients and pH in soils are established.

Table E-7. pH and Nutrient Concentrations for Investigated Sites

	pH	Phosphorous (Total)	Nitrate-Nitrite (as N)	Total Kjeldahl Nitrogen	Ammonia (as N)	Nitrogen (Total)
Ladera Park	7.80	370	0.81	420	22	442.81
West Los Angeles Community College	7.21	720	ND	98	5.6	103.60

Note: All nutrient numbers reported in mg/kg

E.3. Site Features and Observation

Existing site layouts and features can have an effect on where and what type of BMPs can be installed on a site. Existing site layouts and on-site structures were photographed and documented to support evaluation of the site for centralized BMPs. The considerations included the following:

- Effects on Surrounding Areas: Any nearby structures, including storm drains and utilities, were documented. Any effects that could occur to surrounding structures because of settlement issues were noted.
- Maintenance/Accessibility: Every BMP must be maintained at some level for the BMP to continue to function as it was designed. BMPs were considered that maximize access for maintenance purposes.
- Research Potential: Research of stormwater BMPs is ongoing and necessary to fill existing data gaps and to continue to support the County in developing BMP standards. Monitoring protocol would be considered and incorporated into the design of each BMP that is implemented.

E.3.1. West Los Angeles Community College

West Los Angeles Community College is undergoing massive expansion. Much of the parcel is built out, with the only remaining open space being athletic fields and an adjacent parking lot. It is in the headwaters of a subwatershed that drains directly to Ballona Creek. The college represents the majority of the watershed treatment area that could be treated by a centralized BMP. Only a very small portion of the surrounding area, approximately 9 acres, drains toward the college (Figure E-6). Treating the drainage from the surrounding neighborhood would require alterations to the existing drainage infrastructure. Only flows calculated to be treated by the BMP would be diverted allowing higher flows to pass minimizing impacts to the surrounding drainage system. The storm drain that passes closest to the southwest side of the college would have to be rerouted for a centralized BMP to be effective.

Approximately 14.5 acres is available for the BMP (Figure E-7). The soils in the BMP area were reported to be HSG B; however, the measured infiltration rates are in the HSG C range. The soils composition showed that the soils below the surface were HSG B soils corresponding to the reported HSG. The soils at the surface were highly compacted from years of recreational use and consistent mowing most likely causing lower measure infiltration rates than expected. The observed soil boring indicate that higher infiltration rates can be expected near the base of a centralized BMP making this site suitable for an infiltration type BMP. The available BMP area is currently an athletic field and parking lot with ample access for maintenance. Current observed maintenance would include regular mowing similar to the required maintenance for a centralized BMP. Considering the current usage there would be ample space for construction activities as well as regular maintenance. The dry extended detention could still be used for recreation activities between storm evens and during the dry season.

Analysis of the site indicates that a dry extended detention basin would be most appropriate for the site. The open area of the site would allow for the storage space required for a dry extended detention basin. The low measured infiltration rates would also indicate that infiltration is possible but will require more time than expected for an infiltration basin. The parking lot could also be used as a centralized BMP if more space is required for treatment. Storm chambers installed below the parking lot would be used similarly to a dry extended detention facility below ground providing storage capacity and time for infiltration. Storm chambers are currently being utilized by the LACDPW in areas around the County.

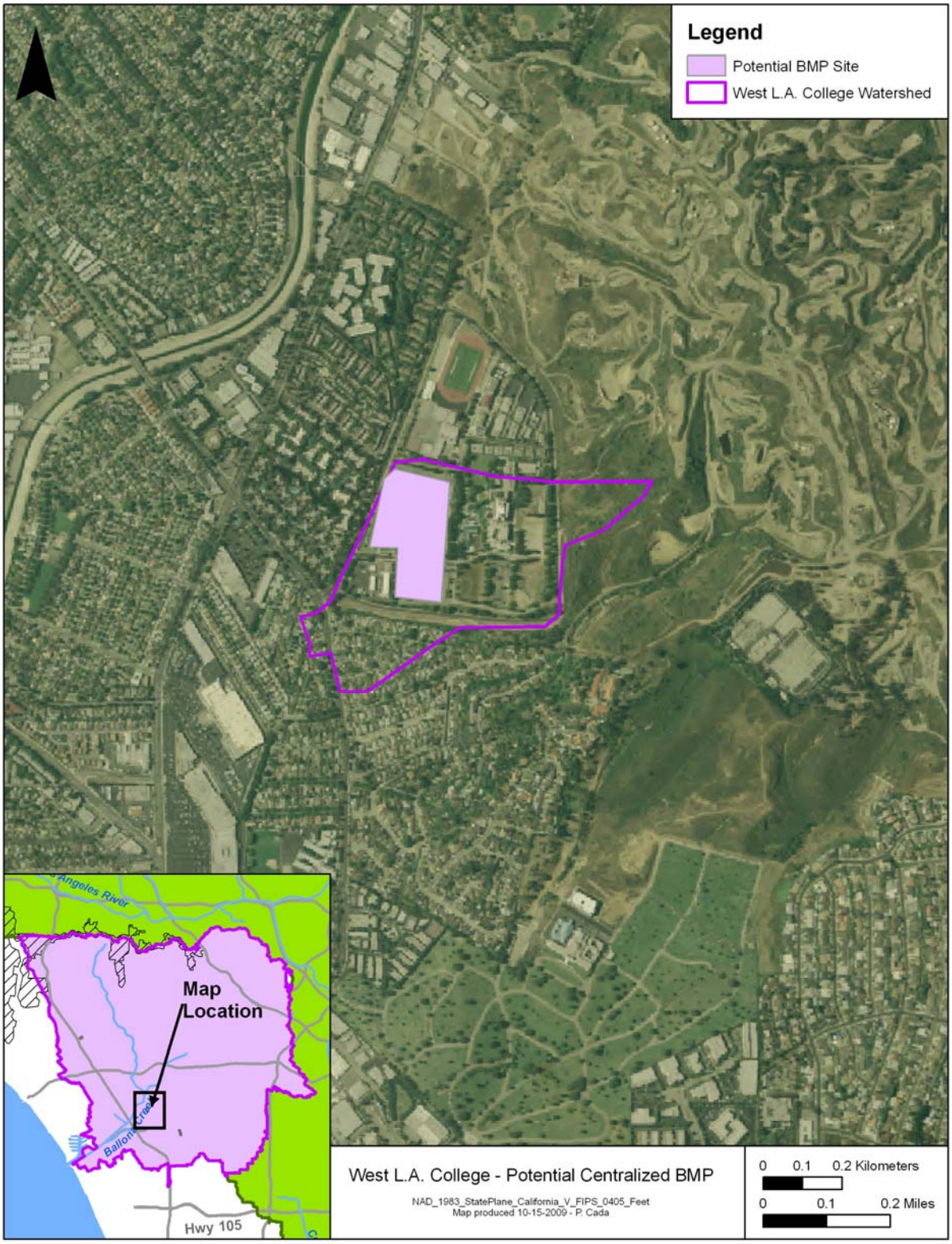


Figure E-6. West Los Angeles Community College Drainage Area

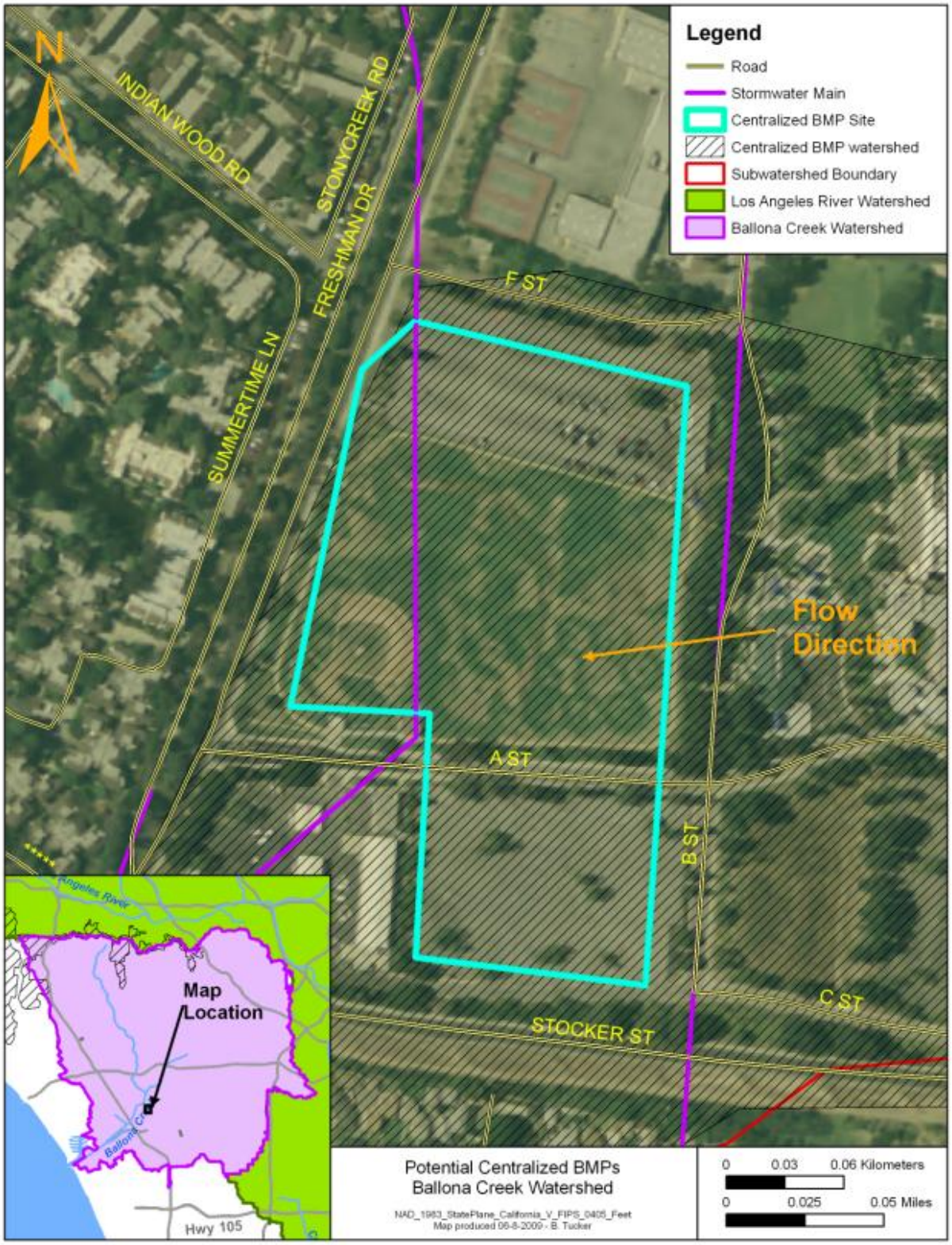


Figure E-7. West Los Angeles Community College Available BMP Area

Figure E-8. West Los Angeles Community College Residential Drainage Area

Figure E-9. West Los Angeles Community College Curb Drains

E.3.2. Ladera Park

Ladera Park is in what appears to be a gully that formed as a part of the historic drainage pattern that has been altered from years of development and added impervious areas. The first 2 feet of soil appeared to be fluvial material with the reported HSG B soils below. The soil boring shows HSG B soils in the top 10 feet with no restricting layers indicating infiltration rates appropriate for a centralized BMP. All 200 acres (approximate) that drain to the north end of the park (Watershed 1) are in the TMDL Implementation Area (Figure E-10). Approximately 14 acres are available for the BMP (Figure E-11). A large storm drain passes through the park with curb drains at the northern and southern ends of the park (Figure E-12 and Figure E-13).

The park is maintained by the County's Parks and Recreation Department with regular mowing and tree trimming. Similar maintenance would be required for a centralized BMP indicating that there is ample access to the area for maintenance.

The watershed consists of single-family residential and commercially zoned areas and is drained with curb drains along the major roads and at the north side of the park (Figure E-14 and Figure E-15).

Several structures in the park could be affected including a restroom, an amphitheater, a basketball court, and a tennis court (Figure E-16 and Figure E-17). The area below the basketball court and tennis court could be used as a subsurface storage and infiltration BMP. The amphitheater and restroom facilities were avoided in the estimate of the available BMP area to avoid effects on the structures.

Mature sycamore trees are throughout the park that would make implementing a centralized BMP challenging (Figure E-18) from a design aspect as well as public support. The size of the trees would indicate that they have extensive root systems that would be affected by any construction activities in the park. Removing the trees would be costly and time intensive. The trees also provide shade throughout the park making them an asset that is most likely highly valued by the surrounding community making any effect on the trees very unpopular with the surrounding residents. They are also effective at rainfall interception when leafed out.

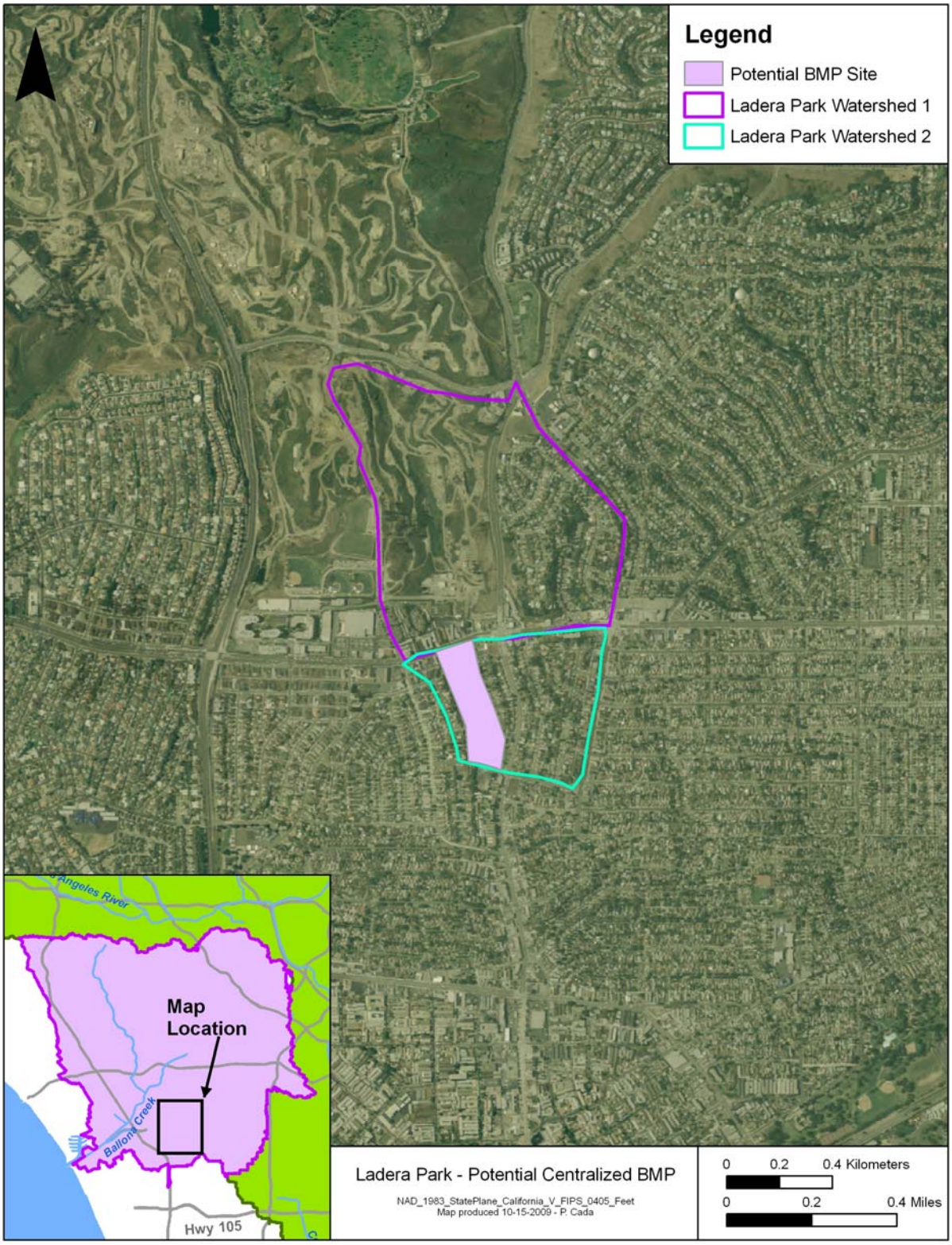


Figure E-10. Ladera Park Watershed

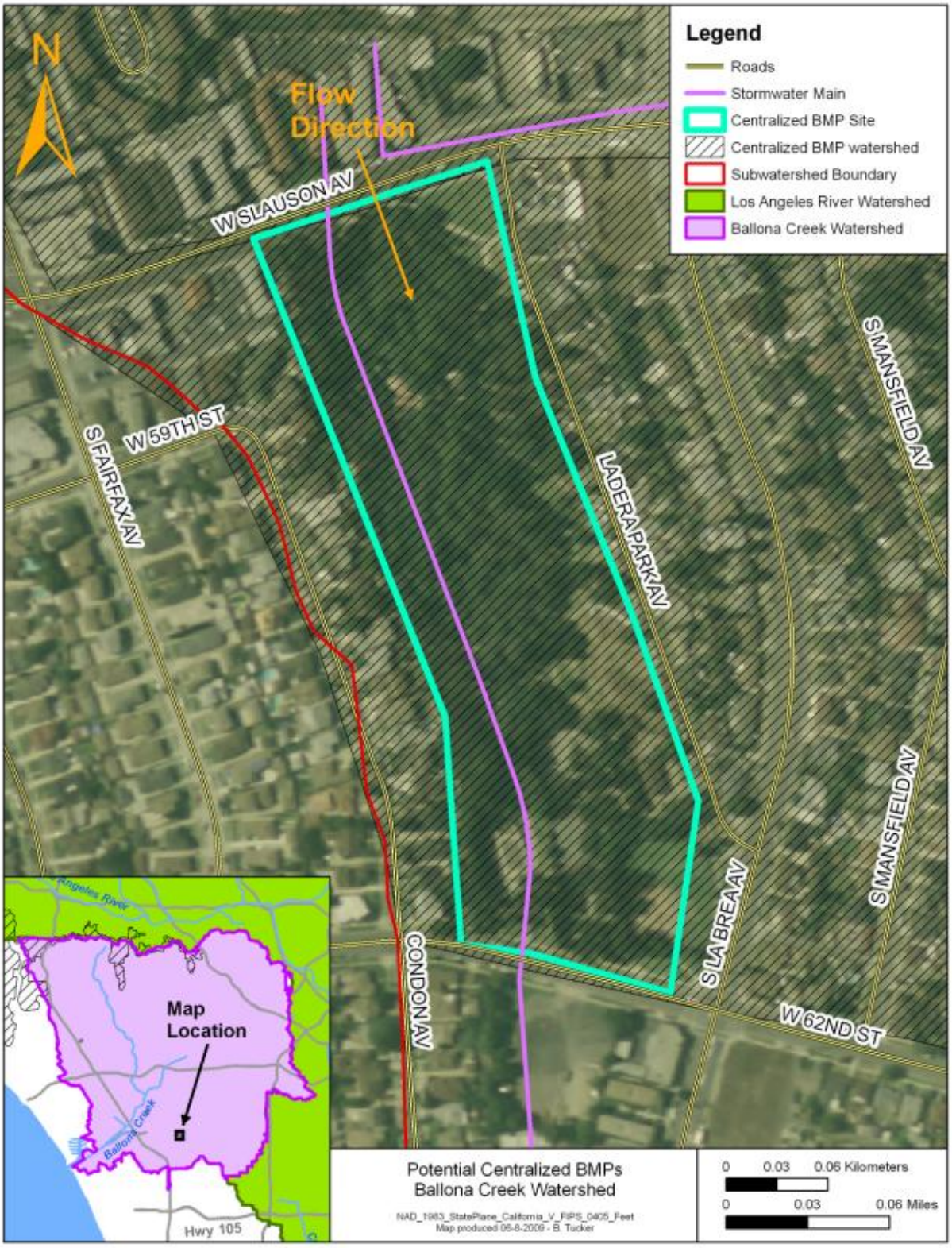


Figure E-11. Ladera Park Available BMP Area

Figure E-12. Ladera Park North Drain

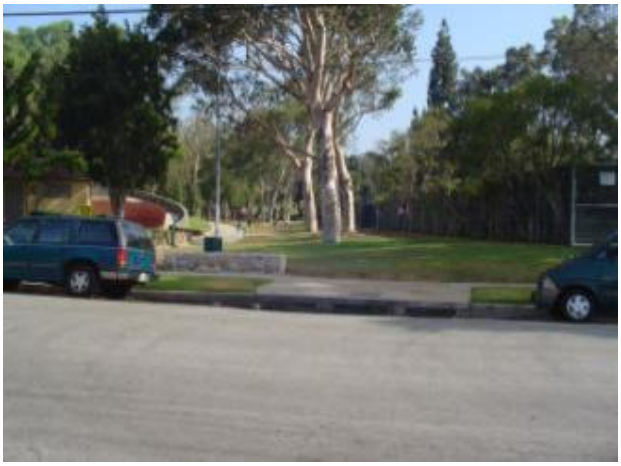


Figure E-13. Ladera Park South Drain

Figure E-14. Ladera Park Commercial Area of the Watershed

Figure E-15. Ladera Park Residential Area of the Watershed

Figure E-16. Ladera Park Amphitheater

Figure E-17. Ladera Park Amphitheater and Tennis Courts

Figure E-18. Ladera Park Sycamore Trees

An additional 75 acres (Watershed 2) of predominantly residential land use drain to the curb inlet at the southern end of the park. The drainage system could be altered to force that drainage back into the park.

Analysis of the site indicates that an infiltration basin would be the most appropriate centralized BMP. The higher surface infiltration rates at the site and HSG B soils below the surface indicate there is a large capacity for infiltration. Infiltration areas could be used throughout the park using the infiltration capacity of the soil while minimizing effects on the numerous sycamore trees. Storm chambers installed below the basketball court and tennis court would provide additional treatment while still allowing the areas to be used for basketball and tennis. Storm chambers would be used similarly to a dry extended detention facility below ground providing storage capacity and time for infiltration. LACDPW is using storm chambers in other areas around the County. Because the infiltration basin would be designed to infiltrate in a short amount of time, the community would likely experience little to no effects. The increase in infiltration would most likely benefit the park by providing added irrigation for the trees. The infiltration basin could still be used for recreation between storm events and during the dry season.

E.4. Summary

Both of the sites investigated were selected using a GIS screening process. The sites are publicly owned parcels with sufficient space to treat the area that could be drained to the site. Each site has HSG B or C soils, indicating that the infiltration rate would be sufficient for an infiltration BMP. Each site provides a multi-use benefit including parks, athletic fields, and a parking lot.

E.4.1. West Los Angeles Community College

Approximately 69 acres could be treated in a centralized BMP installed in the 14.5-acre area of the athletic fields and the adjacent parking lot on the campus of West Los Angeles Community College. The BMP area is reported to have HSG B soils. Field investigations show that the surface infiltration rates at the site are in the range of HSG C; however, the soils at the site are HSG B soils according to the soil boring composition. The BMP would treat 60 acres of the campus and 9 acres of the surrounding residential area. To treat the full 69 acres, the stormwater main at Overland Avenue and Freshman Drive would have to be altered to reroute the water to the athletic field and parking lot—a distance of approximately 600 feet.

E.4.2. Ladera Park

Approximately 200 acres could be treated by daylighting the stormwater main that flows through Ladera Park. The stormwater is collected in a stormwater main that runs along West Slauson Avenue and enters the north end of the park. Soils at the site are reported to be HSG B soils; however, the measured surface infiltration rates are within the HSG A range. The soil boring composition showed HSG A soils at the surface with HSG B soils approximately 2 feet below the surface. Multiple mature sycamore trees in the park would pose a challenge for design and public support of a centralized BMP.

E.5. References

ASTM (American Society for Testing and Materials). 2009. *Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer*. ASTM D 3385. American Society for Testing and Materials, West Conshohocken, PA.

County of Los Angeles. 2009. *Low Impact Development Standards Manual*. http://dpw.lacounty.gov/bsd/lib/fp/Drainage%20and%20Grading/dg_gd~~-LA%20County%20LID%20Manual%20(1-26-2009).pdf. April 2009.

MacDonald, D.D., C.G. Ingersoll, and T. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. *Archives of Environmental Contamination and Toxicology.* 39:20–31

Soil Survey Division Staff. 1993. *Soil Survey Manual*. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. U.S. Department of Agriculture, Washington, DC.

USDA NRCS (U.S. Department of Agriculture, Natural Resources Conservation Service). 2007. *National Soil Survey Handbook*. Title 430-VI. http://soils.usda.gov/technical/handbook/. April 2009.

USEPA (U.S. Environmental Protection Agency). 1999. *Infiltration through Disturbed Urban Soils and Compost-Amended Soil Effects on Runoff Quality and Quantity*. EPA-600-R-00-016. U.S. Environmental Protection Agency, Washington, DC.

(This page intentionally left blank.)

Appendix F. BMP Fact Sheets

(This page intentionally left blank.)

Ladera Park
Centralized BMP Fact Sheet

Design and Site Overview

Ladera Park is in a mainly residential area in the Ballona Creek watershed. The 200-acre area that drains through the park is mostly residential (46 percent), with some industrial (34 percent) and commercial (6 percent) areas. An infiltration basin (Figure C-1a) approximately 2.25 acres and 5 feet deep would be necessary to treat the park's drainage area. Soils data collected at the site indicate that the subsoils would provide infiltration rates appropriate for an infiltration basin. Stormwater could also be treated in underground storage below the basketball and tennis courts. LACDPW is using storm chambers (Figure 1b) or a similar product for that purpose. The area required for the BMP is outlined in Figure 2.

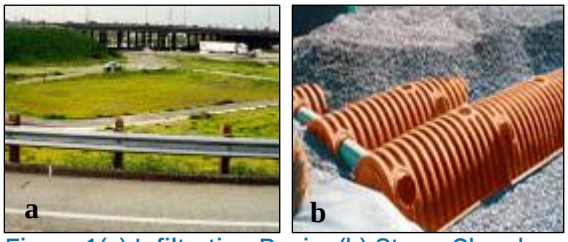


Figure 1(a) Infiltration Basin. (b) Storm Chambers

Photos: Figure 1(a): County of Los Angeles
Figure 1(b): www.stormchambers.com

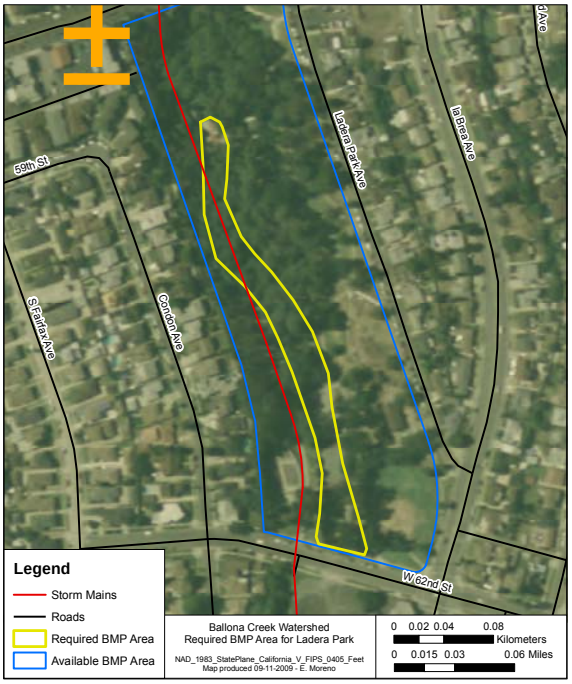


Figure 2. Required BMP Area

About 1,600 feet of pipe would be removed in the construction process. The infiltration basin could be installed using available space around select trees in the park. The land uses around the park are sources of metals, nutrients, pathogens, and PAHs. The BMP would result in the load reductions presented in Table 1 (Note: Values are based on rainfall events occurring in Water Year 2003).

Table 1. Expected Pollutant Reductions

Pollutant	Watershed Load (lb or counts/yr)	Percent Load Reduction
Zinc	51.5	100%
Copper	5.5	100%
Lead	5.3	100%
TSS	12,989.4	100%
Fecal coliform counts	9.5E+12	100%

Additional Design Considerations

BMP design information for Ladera Park is summarized in Table 2. Estimated implementation costs are presented in Table 3.

Table 2. BMP Design Information Summary

Infiltration Basin	
Watershed Treatment Area (acres)	271.0
BMP Area (acres)	2.4
Maximum Ponding Depth (ft)	5.0
Treatment Volume Capacity (ac-ft)	13.0

Table 3. Implementation Costs

Cost	
Planning	$80,000
Design	$475,000
Permits/Studies	$50,000
Construction	$1,582,000
Operation and Maintenance	$1,320,000
Post-Construction Monitoring	$69,000
Total (rounded)	$3,600,000

(This page intentionally left blank.)

West Los Angeles Community College Centralized BMP Fact Sheet

Design and Site Overview

A dry extended detention basin (Figure 1) measuring approximately 1.3 acres and 4 feet deep could be installed in the athletic fields to treat stormwater runoff from the college and surrounding residential area. Soils data indicate that infiltration rates in the sublayers would provide adequate infiltration for a dry extended detention basin. The required BMP area is outlined in Figure 2. Institutional areas, such as West Los Angeles Community College, are typically a source of metals, nutrients, and PAHs, while residential areas are known to generate high levels of nutrients.

Figure 1. Example of Dry Extended Detention Basin
Photo: County of Los Angeles

Figure 2. Required BMP Area

The watershed treatment area draining into the BMP (67 acres) is mostly composed of institutional (68 percent), residential (21 percent), and open space (10 percent) areas. To treat the residential area south of the college, flow in the storm drain passing near the southwest corner of the college would have to be diverted. The pollutant load reductions that would result from BMP implementation are summarized in Table 1 (Note: Values are based on rainfall events occurring in Water Year 2003).

Table 1. Expected Pollutant Reductions

Pollutant	Watershed Load (lb or counts/yr)	Percent Load Reduction
Zinc	18.1	100%
Copper	1.6	100%
Lead	1.1	100%
TSS	6358.5	100%
Fecal coliform counts	1.10E+12	100%

Additional Design Considerations

BMP design information for West Los Angeles Community College is summarized in Table 2. Estimated implementation costs are presented in Table 3.

Table 2. BMP Design Information Summary

Dry Extended Basin	
Watershed Treatment Area (acres)	67.0
BMP Area (acres)	1.3
Maximum Ponding Depth (ft)	4.0
Treatment Volume Capacity (ac-ft)	5.1

Table 3. Implementation Costs

Cost	
Planning	$40,000
Design	$239,000
Permits/Studies	$50,000
Construction	$800,000
Operation & Maintenance	$400,000
Post-Construction Monitoring	$70,000
Total (rounded)	$1,600,000

(This page intentionally left blank.)

Pilot Roadside BMP Project Fact Sheet

Design and Site Overview

The Ballona Creek Watershed Management Plan identifies and recommends a demonstration site integrating the use of roadside BMPs, such as linear bioretention areas, to treat stormwater runoff from surface streets. Linear Bioretention (Figure 1) measuring approximately 0.06 acre could be installed in the right-of-way of publicly owned streets to treat stormwater from 1 acre of road surface. Soils data has been collected in two areas directly adjacent to roads—one in a median area and one in the right-of-way. The data indicate that infiltration rates at the surface and in the sublayers would provide adequate infiltration for a bioretention area. An example of a roadside BMP implemented in the Sun Valley area of Los Angeles along Elmer Avenue is shown in Figure 2. Roads are typically a source of metals, nutrients, and PAHs.

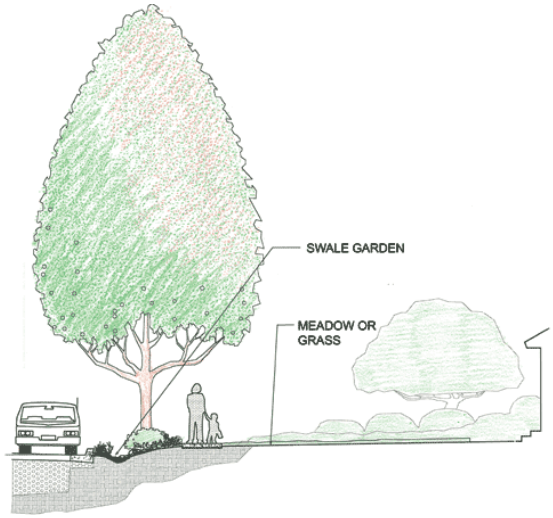


Figure 1. Example of a Linear Bioretention Area

Figure 2. Elmer Avenue Linear Bioretention Area

Photos: Figure 1: Los Angeles Basin Water Augmentation Study – Neighborhood Retrofit Concept Plan; Figure 2: Water World

The watershed treatment area that would drain into a roadside BMP was estimated to be 1 acre and would be composed entirely of the road surface. The pollutant load reductions that would result from BMP implementation are summarized in Table 1 (Note: Values are based on rainfall events occurring in Water Year 2003).

Table 1. Expected Pollutant Reductions

Pollutant	Watershed Load (lb or counts/yr)	Percent Load Reduction
Zinc	0.91	99%
Copper	0.10	99%
Lead	0.10	99%
TSS	241.34	99%
Fecal coliform counts	1.28E+10	97%

Additional Design Considerations

BMP design information for a typical roadside BMP is summarized in Table 2. Estimated implementation costs are presented in Table 3.

Table 2. BMP Design Information Summary

Dry Extended Basin	
Watershed Treatment Area (acres)	1.00
BMP Area (acres)	0.06
Maximum Ponding Depth (ft)	0.50
Substrate Depth (ft)	3.00
Substrate Porosity (ft)	0.40
Treatment Volume Capacity (ac-ft)	0.10

Table 3. Implementation Costs

Cost	
Planning	$30,000
Design	$30,000
Construction	$35,000
Operation & Maintenance	$15,000
Post-Construction Monitoring	$124,000
Total	$234,000

(This page intentionally left blank.)

Centralized BMPs on Private Property
Project Fact Sheet

Overview

Implementing BMPs on public property can achieve a 31% reduction in zinc. (Of all of the metals TMDL pollutants, zinc requires the greatest reduction. Therefore, if the zinc requirements are met, all other pollutant targets are assumed to be met.) To meet the target of 48% zinc reduction, a combination of BMPs on public and private property will be necessary. Therefore, private properties will need to be evaluated for potential BMP construction based on certain site requirements.

Evaluating Private Parcels for BMP Suitability

The following criteria must be met for a site to be considered:

Proximity to the drainage network: A drainage network should be located in close proximity to the parcel where stormwater can be routed to minimize the cost of modifying the drainage system.

Percent impervious area: Locations with a higher percent of impervious area should be targeted for greater potential volume reduction and water quality improvements.

Watershed treatment area: there should be sufficient space on the parcel for BMPs to adequately treat, store, and infiltrate runoff from the Unincorporated County drainage area.

Soil type: Soil type serves as a proxy for infiltration rate and water holding capacity. Sites with Hydrologic Soil Group A, B, or C soils have suitable infiltration for infiltration BMPs and should be further investigated. Soil types should be verified in the field.

Slope: Sites should be screened for moderate slopes (less than 10%). If moderate slopes are present (as verified in the field), the sites can be considered for centralized BMPs.

Multi-benefit use: Centralized BMPs can offer multiple benefits. For example, infiltration basins can be used for stormwater management and community park space. Parks or open space can be altered to enhance stormwater treatment and storage.

Other site characteristics: Surface infiltration rate and depth to the seasonal high groundwater table should be verified in the field.

Selecting Centralized BMP Type

The two BMP types that can be installed are infiltration basins and dry extended detention basins (Figure 1). Table 1 summarizes the site requirements for each BMP type.

Figure 1. (a) Infiltration Basin (b) Dry Extended Detention Basin

Table 1. BMP Construction Requirements

Site Feature	Infiltration Basin	Dry Extended Detention Basin
Hydrologic Soil Group	A or B	Low B or C
Surface Infiltration Rate	>2 in/hr	>0.5 in/hr
Depth to Groundwater	>10 ft	>10 ft

BMP Costs and Effectiveness

Table summarizes additional costs and BMP storage required to add the necessary treatment to meet the reduction targets. Table 3 shows the additional pollutant reductions that can be achieved.

Table 2. Costs and Storage Requirements

Parameter	Reduction of Zinc		
	31%–48%	31%–80%	31%–91%
Cost ($ million)	$21.08	$70.75	$139.76
Storage (ac-ft)	15.3	55	110.6
Surface Area (ac)	3.6	12.3	24.8

Table 3. Pollutant Reductions

Pollutant	Existing Load	Reduction of Zinc		
		31%–48%	31%–80%	31%–91%
TSS (lb/yr)	268,422	15%	44%	54%
Copper (lb/yr)	97	17%	49%	60%
Lead (lb/yr)	85	19%	56%	68%
Zinc (lb/yr)	944	17%	49%	60%
FC Exceedance (days/yr)	35	4%	4%	4%
FC Count (#/yr)	1.4 E+14	33%	61%	73%

TSS – total suspended solids, FC – fecal coliform

(This page intentionally left blank.)

Distributed Structural BMPs Fact Sheet
Catch Basin Inserts

Overview

Catch basins are storm drain inlets with sumps that capture some debris before it enters the storm drain pipe. Full capture devices (≤ 5 mm mesh size) are currently being installed in catch basins to prevent additional trash and debris from entering storm drains.

Full capture devices are designed to capture trash but do not provide for sediment capture. The efficiency of a catch basin can be greatly improved by installing an insert (Figure 1) that not only captures trash, oil/grease, organics, and other pollutants, but also can remove a significant fraction of sediment and associated metals.

Figure 1. Catch Basin Insert

Catch Basin Insert Implementation

Catch basin inserts are a simple but effective distributed structural practice for treating wet weather flows. The Ballona Creek watershed has a high density of catch basins, making catch basin inserts a good choice to treat substantial drainage areas.

Two phases of catch basin insert implementation are proposed:

Phase I: Install catch basin inserts for 30 percent of all catch basins in the County TMDL Implementation Area.

Phase II: Install catch basin inserts in the remaining 70 percent of catch basins in the implementation area.

Implementation of these catch basin retrofits would involve internal planning, a pilot study to gain approval from the RWQCB for meeting trash TMDL requirements, device installation, and ongoing maintenance (sediment and debris removal) as part of existing catch basin inspection and cleaning activities.

BMP Cost and Effectiveness

The costs associated with installing catch basin inserts throughout the Ballona Creek watershed are summarized in Table 1. The estimated costs include planning, design, operation, maintenance, and monitoring costs.

Table F-1. Catch Basin Insert Costs

Phase	Estimated Cost
Phase I	$950,000
Phase II	$1,870,000

Catch basin insert pollutant removal performance for the Ballona Creek watershed treatment area is summarized in Table 2.

Table F-2. Expected Pollutant Reductions

Pollutant	Watershed Load (lb/yr)	Percent Load Reduction
Total Copper	97.2	7.3%
Total Lead	82.6	8.5%
Total Zinc	951.9	7.0%
Total Nitrogen	10,095.0	1.5%
Total Phosphorus	7,533.9	1.8%

(This page intentionally left blank.)

Nonstructural BMP Fact Sheet

Overview

As a result of the review of existing programs that address the TMDL pollutants, several program enhancements and one new program are recommended and will offer additional water quality benefits and contribute to load reductions to meet the TMDL WLAs.

Implementing Nonstructural BMPs

The proposed BMPs include

- **Smart gardening program enhancements** that will extend the reach of the water conservation and pollution prevention messages to the Ballona Creek watershed (Figure 1). This BMP includes holding workshops in the Ballona Creek watershed and developing a stormwater-focused tip card for distribution to workshop attendees.
- **TMDL-specific stormwater training** emphasizing BMPs that can mitigate the TMDL pollutants of concern for employees whose activities can affect stormwater pollution.
- **Enhancement of commercial and industrial facility inspections** to strengthen oversight and ensure that activities associated with these businesses does not become sources of pollutants.
- Development of **enforcement escalation procedures** that can be enhanced to more effectively address known sources of pollution.

Figure 1. Smart Gardening Learning Center

- Incentives programs that can be developed to **reduce irrigation return flow**, including rebates for smart irrigation controller use, a xeriscaping conversion incentives program, and demand-side management practices that charge high-volume irrigators more for water.

BMP Costs and Effectiveness

Table 1 shows costs, relative pollutant removal effectiveness, and whether dry and wet weather flows are addressed. All of the proposed BMPs address the highest-priority pollutants: bacteria, metals, and non-metal toxics. All of the existing BMP enhancements address both wet and dry weather flows, while reduction in irrigation return flow addresses dry weather flows only.

Table 1. Nonstructural BMP Costs and Pollutants and Flows Addressed

BMP	Cost[a]	Pollutants Addressed[b]				Flow Addressed[b]	
		Bacteria	Metals	Non-Metal Toxics	Trash	Wet Weather	Dry Weather
Smart Gardening Program Enhancements	$52,600	◗	◗	◗	○	●	●
TMDL-specific Stormwater Training	$325,700	◗	◗	◗	◗	●	●
Enhancement of Commercial & Industrial Facility Inspections	$10,800	◗	◗	◗	○	●	●
Enforcement Escalation Procedures	--[b]	◗	●	◗	○	●	●
Reduction of Irrigation Return Flow	$1,162,100	●	●	◗	○	○	●

● addresses the pollutant; ◗ partially addresses the pollutant; ○ does not address the pollutant

a. Present value costs are included for planning, permitting, and other upfront costs, as well as annual and long-term costs, including program operation and evaluation.

b. A reasonably accurate cost could not be estimated for the enforcement escalation procedures BMP.

(This page intentionally left blank.)

Appendix G. BMP Model Configuration for the County TMDL Implementation Area

The County has developed a comprehensive BMP decision support system based on a combination of LSPC and BMP simulation and optimization tools. The following provides a description of this tool and its application to the County TMDL Implementation area to guide structural BMP selection.

G.1. Watershed Model: LSPC Model Development

Through a joint effort of the Regional Board, USEPA, SCCWRP, and Tetra Tech, a regional modeling approach was developed to simulate the hydrology and transport of sediment and metals. The approach is based on HSPF and the LSPC, a version of HSPF, recoded into C++. The regional approach has been used to support metals TMDLs for Ballona Creek.

The County has consolidated the models into a uniform model configuration and calibration approach as part of the effort to support development of a comprehensive watershed-scale BMP Decision Support System (BMPDSS) for the County. The LSPC watershed modeling system simulates hydrology, sediment, and general water quality on land and is combined with a stream fate and transport model. This model was used to generate wet-weather loading for the unincorporated County areas, as described in the Pollutant Source Characterization and Prioritization in Section 3. Wet-weather loading estimates were developed using the modeled constituents including copper, zinc, lead, TN, TP, fecal coliform, and TSS. For the other pollutants (chlordane, DDT, PCBs, selenium, cadmium, and PAHs), loading estimates were developed as a function of runoff volume or TSS load, also described in Section 3.

G.2. Description of BMPDSS and the BMPDSS Pilot Study

To demonstrate how data from the watershed models can be used in combination with detailed BMP modeling and cost functions, the Los Angeles County Flood Control District (LACFCD) and USEPA Region 9 collaborated on a pilot study to test a methodology for quantifying and evaluating cost-effective BMP implementation alternatives for achieving TMDL targets. The primary objectives of the pilot study were to do the following:

- Investigate and review the performance of BMP optimization solution techniques using County data sets
- Evaluate the benefits and costs of various proposed management options, focusing on structural BMP solutions

A two-step approach was performed. Step One identified the optimal distributed (site-scale) BMP types and configurations for each land use type. In Step Two, the results from Step One were applied to a pilot watershed that involved simulating the entire watershed and centralized BMP sites, as well as watershed-level optimization, to determine the cost-effective BMP implementation plans to achieve WLA targets set forth by the TMDL. This approach evaluated both distributed BMPs at a larger watershed scale, as well as centralized BMP options where possible, to facilitate BMP implementation decision making. Given the defined objectives and constraints, the original pilot study identified the near-optimal structural solutions at various WLA targets that could lead to significant cost saving. Those solutions were composed of centralized BMP sizes, distributed BMP treatment capacity, and percent of area treated for each land use category within the delineated subwatersheds.

Centralized BMPs were generally favored because of their relatively lower costs, as defined by the given cost functions and the exclusion of land acquisition cost. Also the land uses that had higher unit area pollutant loading rates and occupied a larger percentage of the study area received a higher level of treatment. While the results

were seemingly intuitive, the use of a comprehensive, process-based model permitted characterization of BMP implementation details under various watershed physiographical and meteorological conditions to achieve specific management goals.

This study demonstrated the application of BMPDSS, linking with watershed model output through the use of land use time series, to support stormwater management decision making and to determine the most cost-effective BMP implementation plan—both at the land-use-site scale and watershed level. It is important to note that optimization analysis in general heavily relies on the accuracy of BMP cost estimation and BMP effectiveness representation.

One distinction between the approach used in the original pilot and this application is that the current approach includes both structural and nonstructural BMPs for complete assessment of potential load reductions that can be achieved. A combination of both structural and nonstructural BMPs provides additional load reduction opportunity that might help with meeting TMDL WLAs.

A complete discussion of the configuration of BMPDSS for the County TMDL Implementation Area is provided in below.

G.3. BMPDSS Configuration for the County TMDL Implementation Area

The LACDPW subwatershed layer used in the watershed model divides the Ballona Creek watershed into 114 hydrologically connected subwatersheds. The sizes of those subwatersheds range between 15 and 4,750 acres, with an average of approximately 700 acres. To isolate the contributing loads from unincorporated County areas from other contributors, the 114 subwatersheds of Ballona Creek were intersected with the unincorporated boundary layer. Federally owned lands in the unincorporated County boundaries were also excluded from consideration. Drainage areas for potential centralized BMPs identified in Section 5.2 were also delineated within the unincorporated County boundaries. Figure G-1 illustrates the relevant areas.

For the subwatersheds that intersect with unincorporated County area, unincorporated and incorporated areas were divided into two separate modeled land segments. The two separate land segments are routed to the same reach. Figure G-2 is a conceptual schematic for the original and the modified model configuration used for evaluating flow and pollutant load contributions from unincorporated County area. Only contributions from unincorporated County areas (those that pass the intermediate evaluation point) were evaluated for this implementation plan.

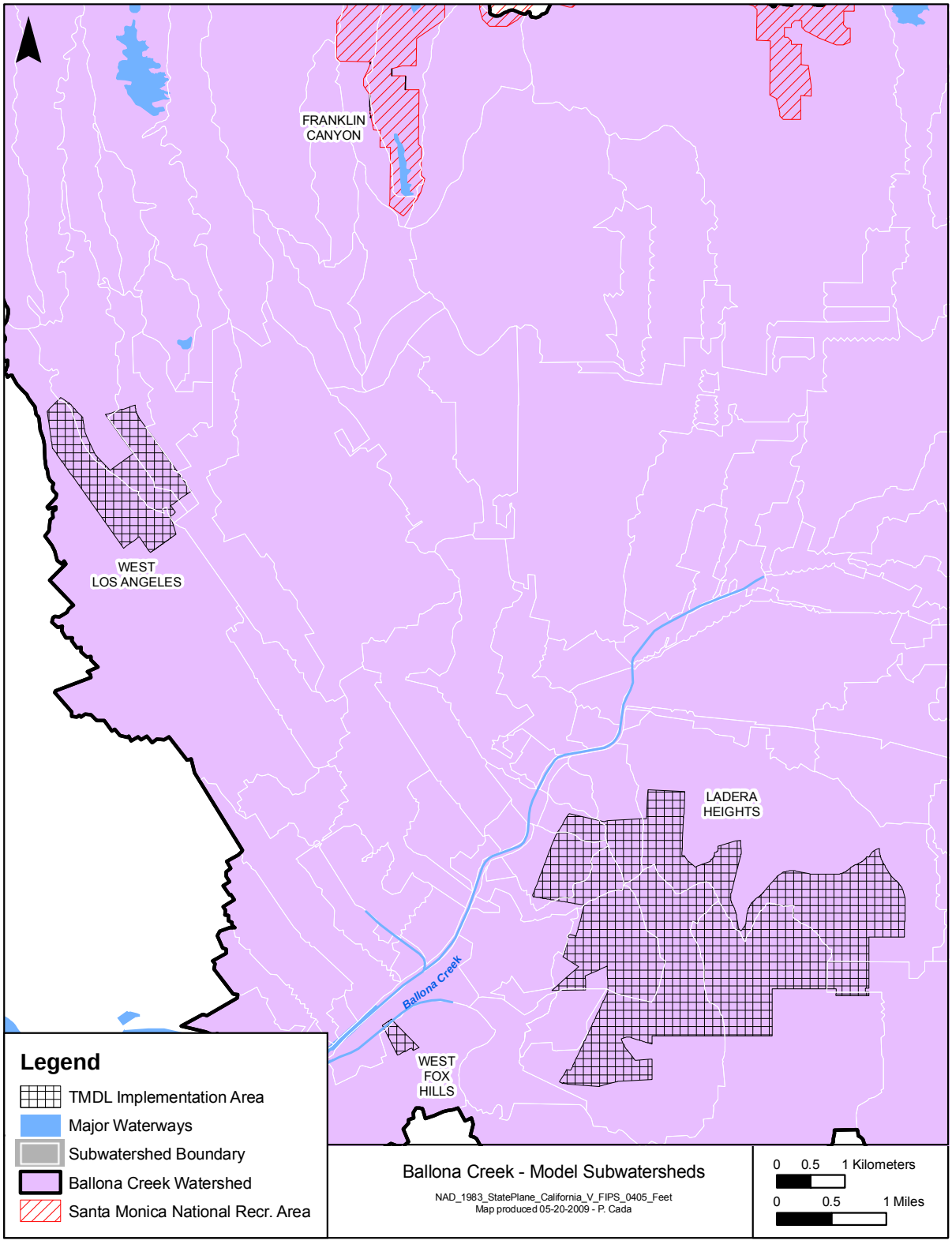


Figure G-1. Modeled Subbasins and TMDL Implementation Areas

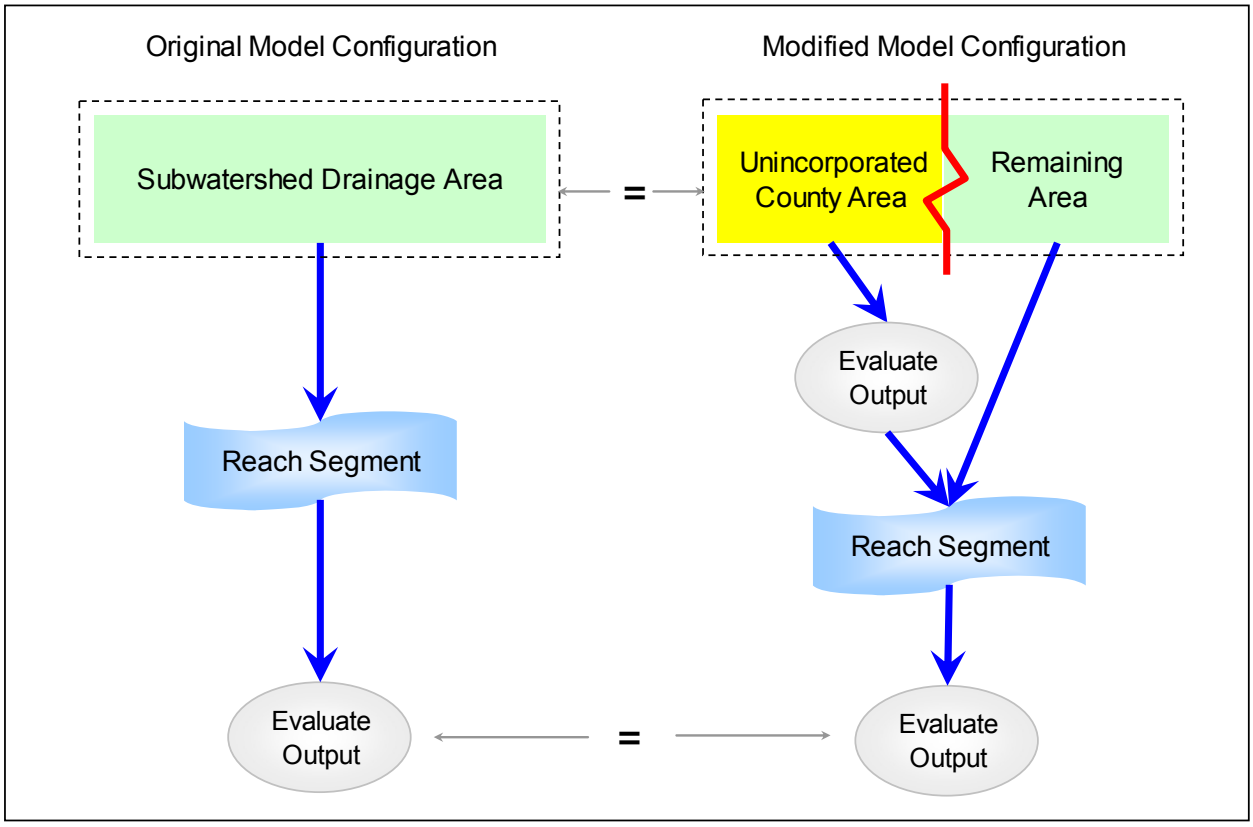


Figure G-2. Conceptual Schematic for Original and Modified Model Configuration

Hydrologic Response Units (HRUs) in the County's watershed model represent various combinations of land use, soil type, and slope. Hydrologic and pollutant loading varies by HRU. The HRU is the smallest modeling unit in the watershed model. Table G-1 presents a list of the 21 modeled HRUs and describes their classification into broader groups of urban impervious, urban pervious or non-urban areas. Within urban land use parcels, all the pervious areas were divided between urban grass irrigated and urban grass non-irrigated, and then summed. In the Calleguas Creek and Santa Clara River watersheds, Aqua Terra (2005, 2008) developed an approach for simulating irrigation application for watershed modeling. Values for percent irrigated in the Ballona Creek watershed by land use are assumed to be similar to those derived in those nearby regional watersheds. The amount of urban grass that is assumed irrigated is 50 percent for low-density residential, 70 percent for medium-density residential, 80 percent for high-density residential, and 85 percent for commercial or industrial or transportation land uses.

Using the intersected subwatershed and unincorporated County areas GIS layer and the HRU layer, the distribution of HRU areas per land segment was determined. Having separate land segments for unincorporated and incorporated areas per subwatershed allowed for application of BMPs to only the unincorporated County areas.

Table G-1. Modeled HRUs by Unincorporated County Area

HRU Code	HRU Description	General Cover Type	West Fox Hills (acres)	Ladera Heights/ Viewpark-Windsor (acres)	West Los Angeles (Sawtelle VA) (acres)
1	HD single-family residential	Urban Impervious	5.6	406.3	0.0
2	LD single-family residential moderate slope	Urban Impervious	0.0	3.2	11.2
3	LD single-family residential steep slope	Urban Impervious	0.0	3.1	1.0
4	Multifamily residential	Urban Impervious	0.2	65.1	0.7
5	Commercial	Urban Impervious	1.6	122.3	15.0
6	Institutional	Urban Impervious	3.6	62.0	259.5
7	Industrial	Urban Impervious	0.0	12.5	4.1
8	Transportation	Urban Impervious	0.5	0.0	35.4
9	Secondary roads	Urban Impervious	6.2	226.2	20.6
10	Urban grass Irrigated	Urban Pervious	10.8	1,520.8	135.2
11	Urban grass Non-irrigated	Urban Pervious	2.4	408.5	69.1
12	Agriculture moderate slope B	Non-Urban Pervious	0.0	0.0	0.0
13	Agriculture moderate slope D	Non-Urban Pervious	0.0	0.0	0.0
14	Vacant moderate slope B	Non-Urban Pervious	0.0	0.0	0.0
15	Vacant moderate slope D	Non-Urban Pervious	0.0	64.8	7.9
16	Vacant steep slope A	Non-Urban Pervious	0.0	0.0	0.0
17	Vacant steep slope B	Non-Urban Pervious	0.0	0.0	0.0
18	Vacant steep slope C	Non-Urban Pervious	0.0	0.0	0.0
19	Vacant steep slope D	Non-Urban Pervious	0.0	184.0	18.1
20	Water	Non-Urban Pervious	0.0	0.0	0.0
21	Water Reuse	Non-Urban Pervious	0.0	0.0	0.0
TOTAL			30.8	3,079.0	577.8

The irrigation water demand is a function of the potential evapotranspiration (ET). To calculate the irrigation demand, potential ET must be adjusted according to crop or cover type and irrigation efficiency. Table G-2 shows how the model coefficient is computed using (1) the crop/cover coefficient and (2) average irrigation efficiency values for both irrigated urban grass and agricultural land segments in the model.

Table G-2. Effective Irrigation Coefficients Used in the Model

HRU	Crop/Cover Coefficient (K_c)	Irrigation Efficiency (IE)	Model Coefficient ($ET_c = K_c / IE$)
Irrigated Urban Grass	0.60	0.85	0.71
Agriculture (all slopes and soils)	0.75	0.75	1.00

G.4. Identification of Options for Distributed Structural BMPs

A number of implementation options for distributed structural BMPs have been identified through review of County and regional stormwater reference materials. This section describes each of the distributed structural BMPs being considered, with the exception of catch basin distributed BMPs which were represented in LSPC and included in the baseline scenario. The following section explains how each of these structural BMPs are configured for modeling purposes, both in terms of the sizing criteria, as well as spatial orientation and configuration within their respective drainage areas.

G.4.1. Description of Distributed Structural BMPs Considered

Distributed stormwater BMPs are installed to treat runoff on-site before it reaches storm drain systems. The design volume for BMPs can be determined using the 85th percentile 24-hour rainfall event (LACDPW 2002, 2004a, 2009a, 2009b). The County (LACDPW 2009a) has defined an order of preference in the selection and application of BMPs as follows:

1. Infiltration systems
2. Biofiltration/retention systems
3. Stormwater capture and reuse
4. Mechanical/hydrodynamic units

Infiltration is not possible in all development scenarios, specifically in locations where seasonal high groundwater is within 10 feet of the surface, where the base soil infiltration rates are less than 0.5 inch per hour, and where there are site-specific restrictions (LACDPW 2009a). In general, where natural undisturbed soil infiltration rates are less than 0.5 inch per hour, an underdrain system should be considered.

Three types of BMPs are prioritized for evaluation in this project: bioretention, porous pavement, and linear bioretention trenches. Those BMPs were selected by considering applicability, cost-effectiveness, and the climate conditions of the project area.

Bioretention

Bioretention is a shallow vegetated depression that provides storage, infiltration, and encourages evapotranspiration. A bioretention system is essentially a surface and subsurface water filtration system. Bioretention systems incorporate both plants and underlying filter soils for removal of contaminants. The practice is effective in removing sediments and attached pollutants by filtration through the underlying filter media layer and plant uptake. For areas with low infiltrating soils, bioretention can be designed with an underdrain system that routes treated runoff that passes through soil medium back to the storm drain system.

It is critical in designing a bioretention system to consider soil characteristics and amendments, depth to groundwater, storage capacity, and plant selection. Bioretention provides storage above ground (i.e., ponding area) and in the voids of the planting media soil. The County's *Storm Water Best Management Practice Design and Maintenance Manual* requires that the runoff entering a bioretention system completely drain the ponding area and the planting soil within 48 hours (LACDPW 2009b). In addition, the design percolation rate can be calculated by applying correction factors to the field-measured percolation rate. The County also suggests that a percolation testing correction factor of 0.25 be applied for bioretention sizing, providing a safety factor of four (LACDPW 2009b).

Suggested bioretention sizing criteria are summarized below:

- Ponding depth: maximum of 1.5 feet (LACDPW 2009b)
- Media depth: minimum of 2 feet, but 3 feet is preferred (LACDPW 2009b)

- Porosity of planting media: Planting media shall consist of 60 to 70 percent sand, 15 to 25 percent compost, and 10 to 20 percent clean topsoil (LACDPW 2009b). Porosity of the media can be assumed to be 40 percent.

Porous Pavement

Porous pavement practices are usually a combination of a filter system through surface materials and an underground reservoir for water storage. Porous pavement includes permeable asphalt, pervious concrete, interlocking concrete pavers, and permeable pavers. This BMP can be used for infiltrating stormwater while simultaneously providing a stable load-bearing surface. On the basis of site conditions, it might allow further infiltrating water. Porous pavement can be used in walkways, patios, plazas, driveways, parking lots, and some portions of streets. According to the County's *Low-Impact Development Standards Manual*, at least 50 percent of the pavement on the lot must be porous in all new development and redevelopment under the jurisdiction of the County (LACDPW 2009a).

The manual also states that porous pavement must not be used on sites with a likelihood of high oil and grease concentrations (LACDPW 2009a). This includes vehicle wrecking or impound yards, fast food establishments, automotive repair and sales, and parking lots that receive a high number of average daily trips (> 1,000). Although this practice is appropriate for all soil types, it requires an underdrain system for soils that do not infiltrate well (less than 0.5 inches per hour). Runoff from unpaved areas should not be directed toward porous pavement because of the potential for sediment particles clogging the pores in the pavement (LACDPW 2009a).

Suggested porous pavement sizing criteria are summarized below:

- Ponding depth: not applicable in general.
- Media depth: 2 to 4 feet (LACDPW 2009a).
- Porosity of reservoir: The reservoir subbase consists of 1.5 to 3 inches of crushed stone (LACDPW 2009a). Porosity of the reservoir can be assumed to between 40 percent and 50 percent.

Linear Bioretention Trench

Linear bioretention trenches are strip bioretention areas designated to treat sheet flow runoff from adjacent paved areas. California Department of Transportation (Caltrans) presented this practice as an on-site BMP option for narrow rights-of-way typical of roadside areas, where space availability might be a limiting factor of implementing distributed BMPs (Caltrans 2008). However, Caltrans does not provide quantitative specifications on sizing this BMP (e.g., depth). Instead, it recommends that site-specific factors be considered during sizing and design. This practice is functionally identical to bioretention.

Suggested bioretention sizing criteria are summarized below:

- Ponding depth: 0.1 to 0.5 feet
- Media depth: minimum of 1 to 3 feet
- Porosity of planting media: can be assumed to be 40 percent

G.4.2. Representation of Distributed Structural BMPs for BMP Modeling

BMP Sizing by Water Quality Control Volume

Water quality treatment requirements state that the runoff from the water quality design storm event (85th percentile 24-hour rainfall event) associated with the developed site hydrology must be treated before discharge in compliance with the NPDES Municipal Storm Water Permit for the County (LACDPW 2009a). Volume-based BMP sizing can be done by applying the 85th percentile 24-hour storm depth. Figure G-3 shows the 85th percentile 24-hour storms for the County. If distributed BMPs are designed to control 100 percent runoff from impervious

surfaces on-site, the size of on-site distributed BMPs can be determined by balancing the runoff volume from the 85th percentile storm with the storage volume of distributed BMPs. If we conservatively assume that depression storage on impervious surfaces is negligible, and that all imperviousness is directly connected in a given drainage area, then the design runoff volume can be approximated as follows:

$$\text{Design Runoff Volume} = (\text{85th Percentile Rainfall Depth}) \times (\text{Impervious Area})$$

The storage volume of a distributed BMP can be estimated as follows:

$$\text{BMP Storage Volume} = \sum \text{Surface Area} \times (\text{Ponding Depth} + [\text{Media Depth} \times \text{Porosity}])$$

Where Ponding Depth is the allowable water storage depth *above* the surface of the BMP, and the total subsurface storage depth is estimated as the soil Media Depth times the Porosity, which is the void ratio of the planting media.

For each BMP, the total required BMP surface area can also be calculated by rearranging the terms of the two previous equations as follows:

$$\text{BMP Surface Area} = \frac{\text{Design Runoff Volume}}{\text{Ponding Depth} + (\text{Media Depth} \times \text{Porosity})}\text{, or}$$

$$\text{BMP Surface Area} = \frac{\text{85th Percentile Rainfall Depth} \times \text{Impervious Area}}{\text{Ponding Depth} + (\text{Media Depth} \times \text{Porosity})}$$

Appropriate unit conversion should be applied to all the above calculations.

Design Storms for the County TMDL Implementation Area

As shown in Figure G-3, the entire County TMDL Implementation Area falls between the 1.1- and 1.2-inch isohyets, with a majority of the area close to the 1.1-inch isohyet. As a result, the 85th percentile 24-hour design storm depth was conservatively estimated as 1.15 inches. Total runoff volume generated by the design storm events can be used as stormwater volume control targets for the distributed BMPs.

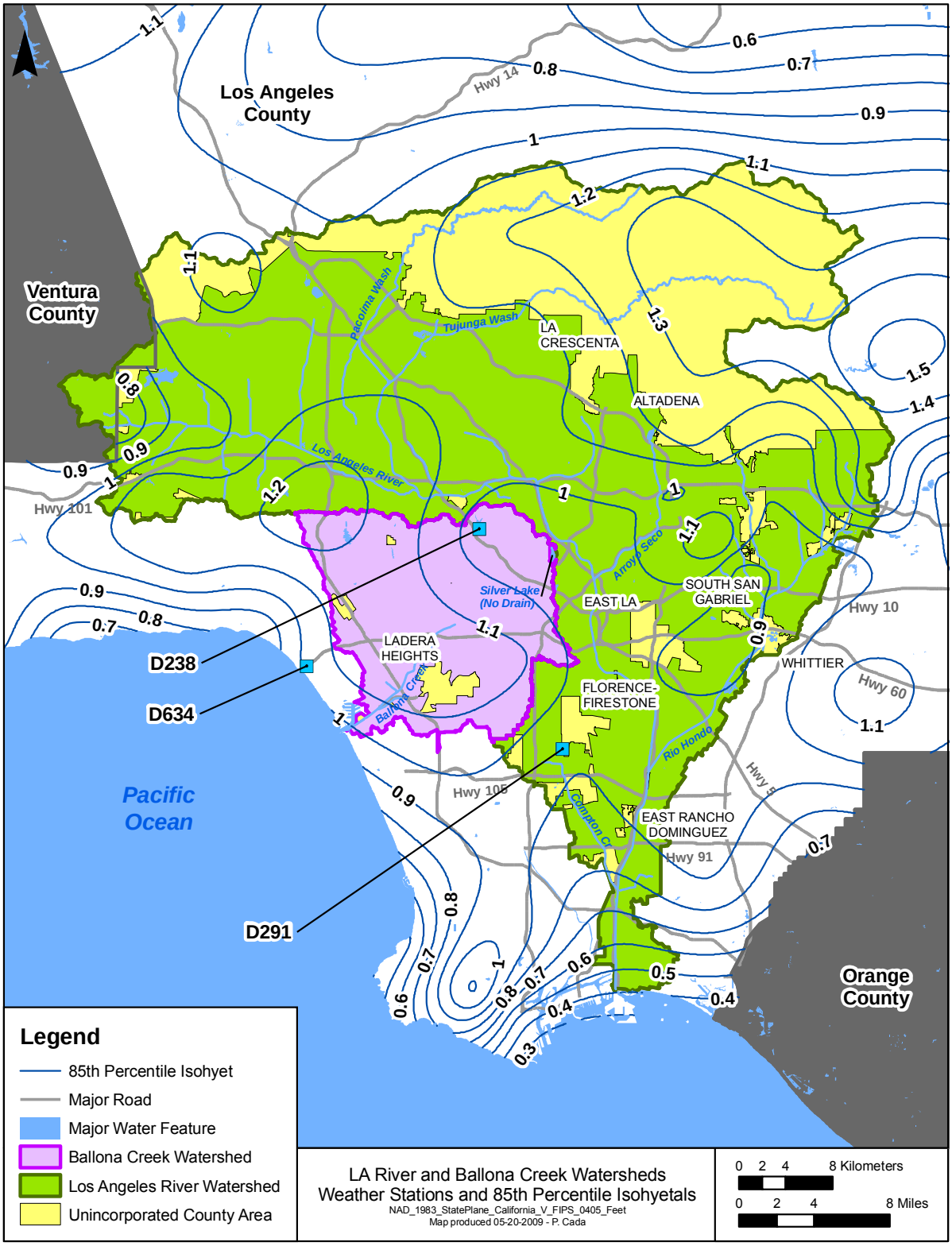


Figure G-3. 85th Percentile 24-Hour Isohyets for the County of Los Angeles

BMP Implementation by Land Use Group

Each drainage area can be characterized by the prevailing land cover and configuration. From a modeling perspective, this configuration determines the types of BMPs that can be implemented, as well as the potential flow routing configuration through the BMP or BMP network. As mentioned in Section 5 distributed structural BMPs are proposed for two types of areas in the County TMDL Implementation Area: (1) publicly-owned parcels and (2) one-acre of road surface for a pilot project. These areas have been divided into two representative types of land use areas, each with its own flow routing schematic. They are (1) Institutional Areas and (2) Public Transportation Areas.

Institutional Areas

Institutional areas consist of building rooftops, parking areas, roads, and pervious landscaped areas. From the Los Angeles County Land Use and Zoning Code (http://planning.lacounty.gov/luz), these areas must have a minimum of 10 percent of the net area landscaped with a lawn, shrubbery, flowers or trees. Bioretention can be installed in the landscaped areas, but available space for bioretention might not be large enough to control 100 percent runoff from all impervious surfaces. Porous pavement can be implemented in the parking areas to control runoff from the other paved parking areas. Porous pavement overflow is routed to bioretention. Schematic representation of BMP implementation and flow pathway for institutional areas are presented in Figure G-4.

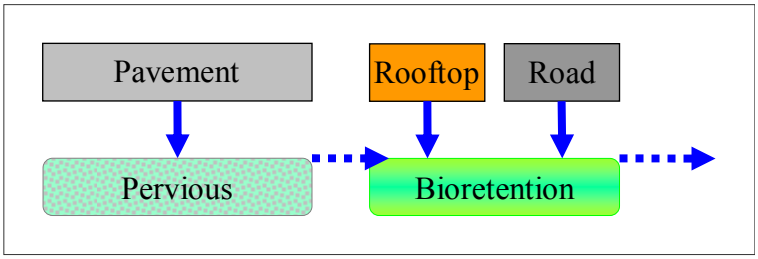


Figure G-4. Distributed BMPs and Flow Pathway for Institutional Areas

Public Transportation Areas

Public transportation areas consist of paved roads and narrow landscaped areas within the right-of-way. The County does not control the runoff from interstate highways, only the secondary roads. Because the secondary roads normally do not have wide right-of-way areas, linear bioretention trenches (i.e., vegetated swale or buffers with underground media storage) might be the only option for on-site distributed BMPs. Schematic representation of BMP implementation and flow pathway for public transportation areas are presented in Figure G-5.

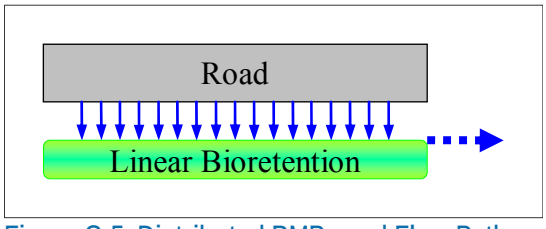


Figure G-5. Distributed BMPs and Flow Pathway for Public Transportation Areas

Three different types of distributed BMPs were used in this analysis. Table G-3 shows the vertical physical configurations for each BMP type. Table G-4 lists the model parameter values that were used for each BMP type.

Table G-3. Distributed BMP Physical Configurations

Parameter	Bioretention	Porous Pavement	Linear BR Trench
Substrate depth (ft)	3	2	3
Underdrain depth (ft)	1 (optional)	1	0
Maximum ponding depth (ft)	0.8	0.1	0.5

Source: Prince George's County 2001; USEPA 1999a, 1999b, 1999c

Table G-4. Distributed BMP Simulation Parameters

Parameter	Bioretention	Porous Pavement	Linear BR Trench
Infiltration[a]			
Substrate layer porosity	0.4	0.45	0.4
Underdrain gravel layer porosity	0.5	0.5	N/A
Vegetative parameter, A	0.6	0	0.6
Underdrain background infiltration rate[c] (in/hr), f_c	Varies by Soil Type[d]: C-soils: 0.5 in/hr, B-soils: 2.25 in/hr		
Media final constant infiltration rate (in/hr), f_c	4	8	4
Water Quality[b]			
TSS 1st order decay rate (1/day), *k*	0.2	0.2	0.2
TSS filtration removal rate[e], P_{rem} (%)	80%	60%	80%
Copper 1st order decay rate (1/day), *k*	0.2	0.2	0.2
Copper filtration removal rate[e], P_{rem} (%)	70%	50%	70%
Lead 1st order decay rate (1/day), *k*	0.2	0.2	0.2
Lead filtration removal rate[e], P_{rem} (%)	60%	40%	60%
Zinc 1st order decay rate (1/day), *k*	0.2	0.2	0.2
Zinc filtration removal rate[e], P_{rem} (%)	90%	70%	90%
Fecal Coliform 1st order decay rate (1/day), *k*	0.8	0.8	0.8
Fecal Coliform filtration removal rate[e], P_{rem} (%)	50%	30%	50%

a. Source: Prince George's County 2001; LACDPW 2006
b. Based on calibration using University of Maryland monitoring data (Prince George's County 2003)
c. Soil map shows the majority background soil has HSG of C or D, therefore 0.2 in/hr background infiltration rate is assumed.
d. Derived from field investigation for distributed BMPs in Appendix D
e. For simplicity, the rate of pollutant particulate removal by filtration at soil particles is represented in terms of ratio of liquid phase concentrations between inflow into and outflow out of BMPs soil medium. However, Phase II of the study will use more process-based expression for filtration such as first order irreversible rate expression.

G.4.3. Distributed BMP Model Representation Upstream of Centralized BMPs

While distributed BMPs can be evaluated individually within their respective areas of application, they might also be considered within areas upstream of centralized BMPs. Furthermore, depending on land ownership (public versus private), other implications could come into consideration. For this project, on the basis of land ownership where potential BMPs reside, structural BMPs can be classified into three general categories:

- Centralized on public land
- Distributed on public land (institutional public parcels, and County-owned roadside right-of-way spaces)
- Centralized on private land (requires land acquisition)

That grouping allows further evaluation of various implementation scenarios that address management considerations other than cost. Figure G-6 is an example BMP model representation and network configuration to accommodate areas where distributed treatment occurs upstream of centralized BMPs.

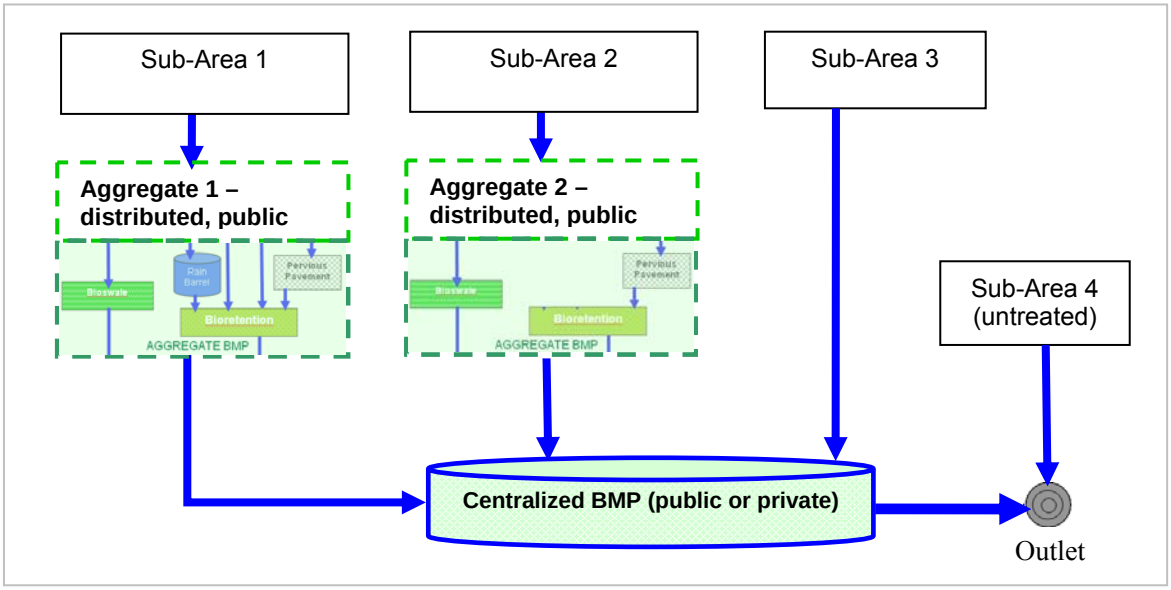


Figure G-6. Example BMP Model Network Representation for Distributed BMPs Upstream of Centralized BMP Facilities

G.5. Description of Centralized Structural BMPs Considered

Centralized BMPs have been shown to provide a cost-effective way of treating runoff collected from larger areas of mixed land use characteristics. Two centralized structural BMP types are considered in the modeling analysis: (1) Extended Dry Detention Basins, and (2) Infiltration Basins.

G.5.1. Extended Dry Detention Basin

Extended dry detention basins are basins whose outlets have been designed to detain the runoff from a water quality design storm for 36 to 48 hours to allow sediment particles and associated pollutants to settle and be removed (LACDPW 2009a). Extended dry detention basins do not have a permanent pool; they are designed to drain completely between storm events. They can be designed for both pollutant removal and flood control, but the basin must not interfere with flood control functions of existing conveyance and detention structures. The practice removes pollutants primarily through gravitational settling of suspended solids and through infiltration. Clay or impervious soils should not affect pollutant removal effectiveness because the main removal mechanism is settling.

Main extended dry detention basin sizing criteria can be summarized as follows (LACDPW 2009b):

- Side slopes: Not to exceed 3:1
- Depth for water quality design stage: max. 5 feet
- Volume of sediment forebay: 25 percent of the total basin volume

G.5.2. Infiltration Basin

Infiltration basins are shallow surface basins that are designed to infiltrate stormwater through permeable soils (LACDPW 2009a, 2009b). Infiltration basins retain runoff until it gradually infiltrates through the soil and eventually into the groundwater. Infiltration basins are similar in function to infiltration trenches except that an infiltration basin's stored volume is held above ground, while an infiltration trench's stored volume is held below

ground. The practice removes sediments and attached pollutants, reduces runoff volumes, and reduces downstream peak flows and velocities. However, the practice is not recommended at sites receiving high sediment loadings because of the potential for clogging and the associated maintenance burden. Infiltration basins require a minimum soil infiltration rate of 0.5 inch per hour (LACDPW 2009b). If infiltration rates exceed 2.4 inches per hour, the runoff should be fully treated in an upstream BMP before infiltration to protect groundwater quality. Pretreatment for coarse sediment removal is required in all instances (see Table G-5 and Table G-6).

Main infiltration basin design criteria can be summarized as follows (LACDPW 2009b):

- Ponding depth: 4 feet min. to 8 feet max., plus 1 foot minimum sediment storage depth
- No topsoil may be added to the basin bed
- Top 1-foot of soil media must either be replaced or amended uniformly without compaction
- Amending excavated material with 2–4 inches of coarse sand is recommended for soils with borderline infiltration capacity

Table G-5. Centralized BMP Simulation Parameters

Parameter	Extended Dry Detention Basin	Infiltration Basin
Infiltration[a]		
Substrate layer porosity	0.4	0.4
Underdrain gravel layer porosity	N/A	N/A
Vegetative parameter, *A*	0.6	0.6
Background infiltration rate[b] (in/hr), f_c	0.4	Varies by soil type
Media final constant infiltration rate (in/hr), f_c	1	4
Water Quality[c]		
TSS 1st order decay rate (1/day), *k*	0.2	0.2
TSS filtration removal rate[d], P_{rem} (%)	N/A	80%
Copper 1st order decay rate (1/day), *k*	0.2	0.2
Copper filtration removal rate[d], P_{rem} (%)	N/A	70%
Lead 1st order decay rate (1/day), *k*	0.2	0.2
Lead filtration removal rate[d], P_{rem} (%)	N/A	60%
Zinc 1st order decay rate (1/day), *k*	0.2	0.2
Zinc filtration removal rate[d], P_{rem} (%)	N/A	90%
Fecal Coliform 1st order decay rate (1/day), *k*	0.8	0.8
Fecal Coliform filtration removal rate[d], P_{rem} (%)	N/A	50%

a. Source: Prince George's County 2001; LACDPW 2006
b. Derived from field investigation for distributed and centralized BMPs under Task 4.1.2 and Task 4.2.2
c. Based on calibration using University of Maryland monitoring data (Prince George's County 2003)
d. For simplicity, the rate of pollutant particulate removal by filtration at soil particles is represented in terms of ratio of liquid phase concentrations between inflow into and outflow out of BMPs soil medium. However, Phase II of the study will use more process-based expression for filtration such as first order irreversible rate expression.

Table G-6. Centralized BMP Physical Configurations

Parameter	Extended Dry Detention Basin	Infiltration Basin
Substrate depth (ft)	1	1
Underdrain depth (ft)	N/A	1
Maximum ponding depth (ft)	4	5

Source: LACDPW 2002, 2004b, 2009b.

G.6. BMP Cost Functions

Cost estimation is a critical component in the optimization process, as the optimization process is all about evaluating and comparing the cost effectiveness of various BMP alternatives. Cost functions for the most commonly used BMP types, i.e., infiltration trenches/bioretention, porous pavement, vegetative swales, rain barrels/cisterns, wet ponds, and detention basins are presented below. The same cost functions were used in developing *An Innovative Stormwater Best Management Practice Decision Support System for Quantifying and Optimizing Load Reductions and Costs in Los Angeles—Sun Valley Watershed Case Study* (Tetra Tech 2007) and a study performed by Cutter et al. (2008). In general, the cost equations are presented as functions of unit volume or unit surface area. The unique features of the cost functions include the following:

- Considering the economies of scale by using different marginal cost at different scales
- Including the BMP's life span maintenance cost adjusted to present value

Land costs for centralized BMPs on private land are also considered in the BMP cost estimation.

G.6.1. Distributed Structural BMP Cost Functions

Infiltration Trenches/Pits and Bioretention Units

Construction Cost

Marginal costs are near constant at 7,000 gallons. Therefore, costs are divided into two categories:

(a) For capacities < 7,000 gallons of void space

$$\ln(\text{cost}) = \beta_1 \ln(\text{capacity}) + \beta_2[\ln(\text{capacity})]^2 + \theta' x$$

or

$$\text{cost}=(\text{capacity})^{\beta_1} e^{\theta' x+\beta_2[\ln(\text{capacity})]^2}$$

where $\theta' x = 1.547$; $\beta_1 = 1.330175$; $\beta_2 = -0.04916$.

(b) For capacities > 7,000 gallons of void space

$$Cost = (cost\ @\ 7{,}000\ gallons) + (marginal\ cost\ @\ 7{,}000\ gallons) \times (capacity - 7{,}000)$$

where *cost @ 7,000 gallons* = \$12,974; *marginal cost @ 7,000 gallons* = \$0.85 / gallon void space.

Maintenance Cost

Mid-range of maintenance costs is approximated to be \$0.05/gallon void capacity/year. As a result, the present value (*PV*) of the maintenance cost over the life of the project is

$$PV = 0.05 \times [(1 - (1 / (1 + i)^n)) / i]$$

where n = number of years in the life of the project (assumed 20 years in this study); i = interest rate (0.05 is standard for project analysis).

Porous Pavement

Construction Cost

Porous concrete is assumed to cost $10 per square foot, includes cost of removing existing asphalt and installing porous concrete (Smith 2006).

Maintenance Cost

The mid-range maintenance cost is assumed $0.0076 per square foot per year. As a result, the *PV* of the maintenance cost over the life of the project is

$$PV = 0.0076 \times [(1 - (1 / (1 + i)^n)) / i]$$

where n = number of years in the life of the project (assumed 20 years in this study); i = interest rate (0.05 is standard for project analysis).

Vegetated Swales

Construction Cost

The cost of construction will depend on local conditions and management objectives. A unit cost of $5.3 per cubic feet excavation volume is assumed.

Maintenance Cost

Because swales are normally blended into the grassed open space, it is assumed that it does not require additional maintenance cost.

Rain Barrels and Cisterns

For barrels > 60 gallons of capacity, average cost is $1.67/gallon. Maintenance costs are negligible.

G.6.2. Centralized BMP Cost Functions

Centralized BMPs often have lower unit cost because of economies of scale. Therefore the cost functions of centralized BMPs are a critical part of the comparison between centralized facilities and decentralized BMPs. The cost functions for centralized infiltration trenches and infiltration basins are adapted from Cutter et al. (2008). The cost functions for wet ponds and detention basins are adapted from CASQA (2003).

Infiltration Trench

Construction Cost

$$Cost = 49.5 \times capacity^{0.63}$$

where *capacity* is the void capacity in gallons.

Maintenance Cost

Mid-range of maintenance costs is approximated to be 8.63 percent of capital cost per year. As a result, the *PV* of the maintenance cost over the life of the project is

$$PV = 0.0863 \times capital\ cost \times [(1 - (1 / (1 + i)^n)) / i]$$

where n = number of years in the life of the project (assumed 20 years in this study); i = interest rate (0.05 is standard for project analysis).

Infiltration Basin

Construction Cost

$$Cost = 4.37 \times capacity^{0.69}$$

where *capacity* is the void capacity in gallons.

Maintenance Cost

Mid-range of maintenance costs is approximated to be 6.72 percent of capital cost per year. As a result, the *PV* of the maintenance cost over the life of the project is

$$PV = 0.0672 \times capital\ cost \times [(1 - (1 / (1 + i)^n)) / i]$$

where n = number of years in the life of the project (assumed 20 years in this study); i = interest rate (0.05 is standard for project analysis).

Wet Pond

Construction Cost

$$Cost = 24.5 \times V^{0.705}$$

where *Cost* is the cost associated with construction, design and permitting; *V* is the volume in the pond to include the 10-year storm (cubic feet).

Maintenance Cost

Mid-range of maintenance costs is approximated to be 4 percent of capital cost per year. As a result, the *PV* of the maintenance cost over the life of the project is

$$PV = 0.04 \times capital\ cost \times [(1 - (1 / (1 + i)^n)) / i]$$

where n = number of years in the life of the project (assumed 20 years in this study); i = interest rate (0.05 is standard for project analysis).

Detention (Dry) Basin

Construction Cost

$$Cost = 12.4 \times V^{0.760}$$

where *Cost* is the cost associated with construction, design and permitting; *V* is the volume of the basin in cubic feet.

Maintenance Cost

Mid-range of maintenance costs is approximated to be 4 percent of capital cost per year. As a result, the *PV* of the maintenance cost over the life of the project is

$$PV = 0.04 \times capital\ cost \times [(1 - (1 / (1 + i)^n)) / i]$$

where n = number of years in the life of the project (assumed 20 years in this study); i = interest rate (0.05 is standard for project analysis).

G.6.3. Land Costs

The typical cost for vacant land in Los Angeles is shown in Table G-7 (reproduced from Cutter et al. 2008).

Table G-7. Costs for Vacant Land in Los Angeles

	Land Type[a]			
	Commercial	Industrial	Residential	Total
Southwest Los Angeles County				
Cost ($/m^2)	$1,344	$493	$1,801	$1,385
Observations	$3,100	$1,033	$2,519	$6,652
San Fernando West of Pasadena				
Cost ($/m^2)	$717	$348	$747	$696
Observations	$721	$226	$1,270	$2,217
San Gabriel Area				
Cost ($/m^2)	$637	$280	$659	$580
Observations	$1,518	$517	$861	$2,895
Total				
Cost ($/m^2)	$1,058	$413	$1,301	$1,057
Observations	$5,339	$1,776	$4,650	$11,765

Source: Cutter et al. 2008
a. Vacant land sales listed in the Costar sales database from 2003 to 2005, adjusted to 2005 dollars.

G.7. Simulation Period

To determine a representative year for optimization, a statistical evaluation of a few selected rainfall gages was performed. The updated County watershed model recognizes the highly variable nature of precipitation across the entire County by using data from 148 local rainfall gages. The objective of this analysis was to select a regionally representative average year. Four rainfall gages were selected from among the available regional rainfall gages for the analysis:

- Los Angeles Intl AP (045114)
- Los Angeles Downtown (045115)
- Pasadena (046719)
- Mt Wilson No 2 (046006)

The gages were selected to provide both a spatial variation and topographic relief. Figure G-7 shows the four stations relative to other available rainfall gages in the region. The isohyetal contours and annual average precipitation gradient in the figure were previously summarized for the 20-year period 1/1/1987–12/31/2006. Figure G-8 shows average hydrologic year (HY) rainfall measurement together with gage elevation at the four selected stations.

The selected gages capture a wide range of rainfall variability within the region. The gages are also among some the most populated areas of the watershed, making them fairly well representative of the prevailing environmental conditions in the region. The analysis was done in two steps.

1. Identify a number of individual water years (3) within the 20-year period that have total rainfall volumes that are closest to the average rainfall volume over the 20-year period. The results from step 1 are shown in Figure G-9. Water years 1996, 2003, and 1997, respectively, were the three closest years in terms of having the smallest absolute difference between total annual precipitation volume and the 20-year average at all four stations.

2. At each gage, perform rainfall volume duration and intensity duration analyses to determine which of the selected years with the closest average rainfall volume also has a well distribution in terms of volume and intensity.
    a. The first step is to summarize 20 years of precipitation records into *precipitation events*, where an event is defined as a rainfall series preceded by a 72-hour dry antecedent period. This storm separation approach is similar to the TMDL definition of a wet interval for fecal coliform exceedence evaluation.
    b. Next, the storms are sorted by increasing volume. At each gage location, storms occurring within each of the selected years from step 1 are highlighted for comparison relative to the other remaining storms.
    c. Average storm intensity is also plotted and ranked in ascending order for comparison.

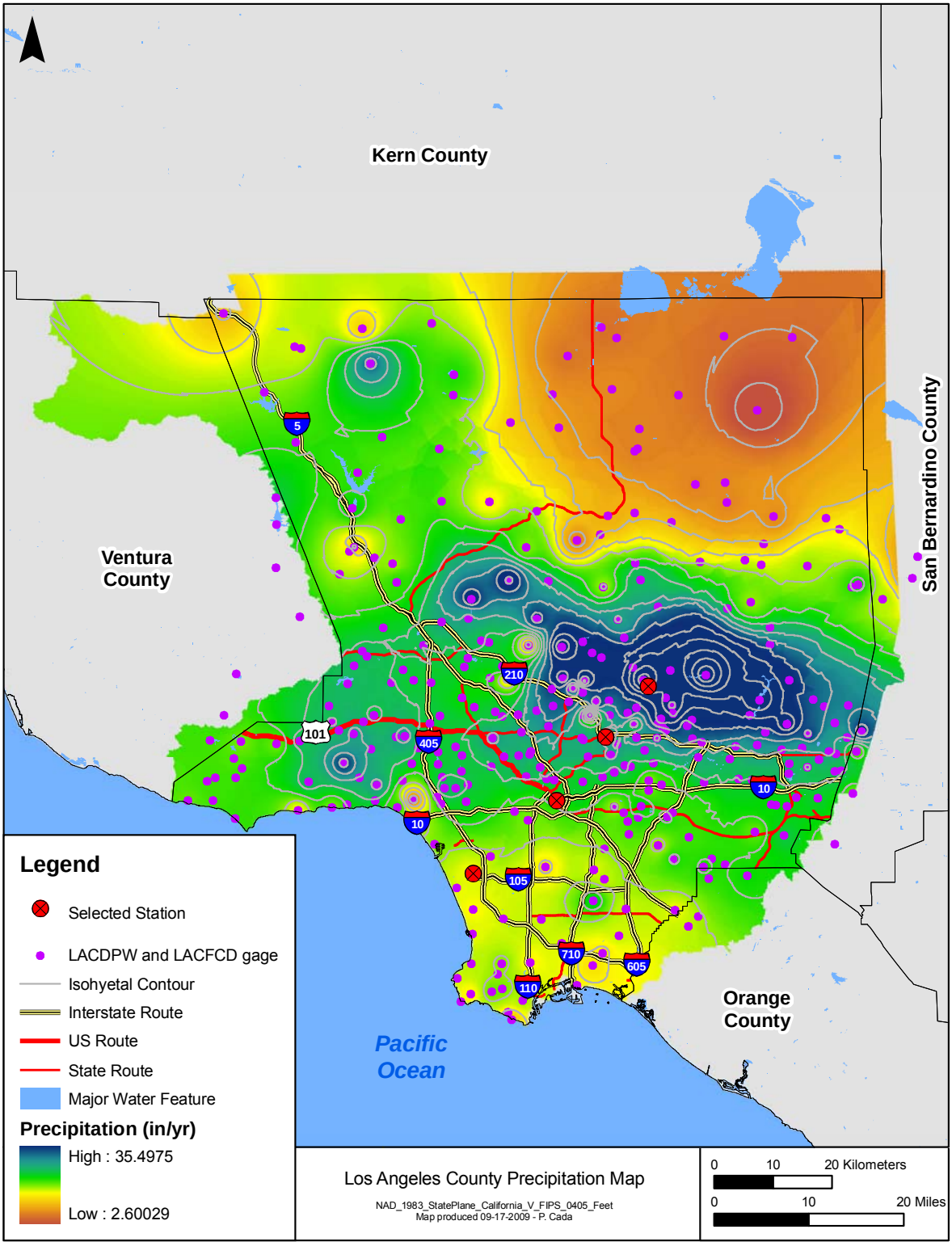


Figure G-7. Selected Stations for Regional Rainfall Volume and Intensity Duration Analysis

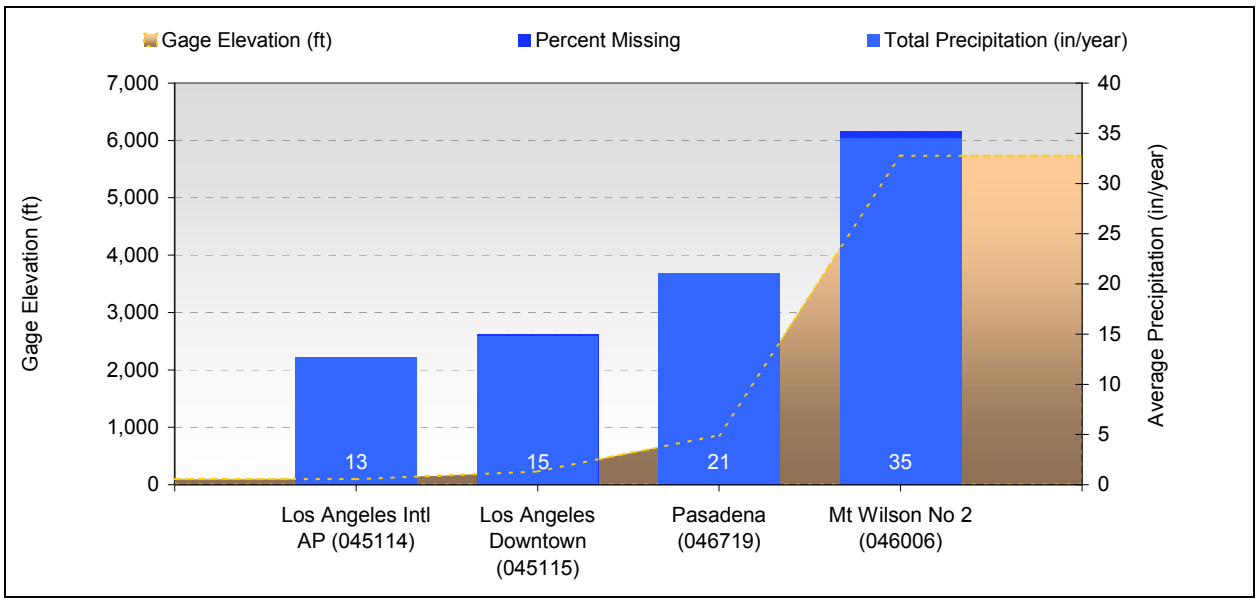
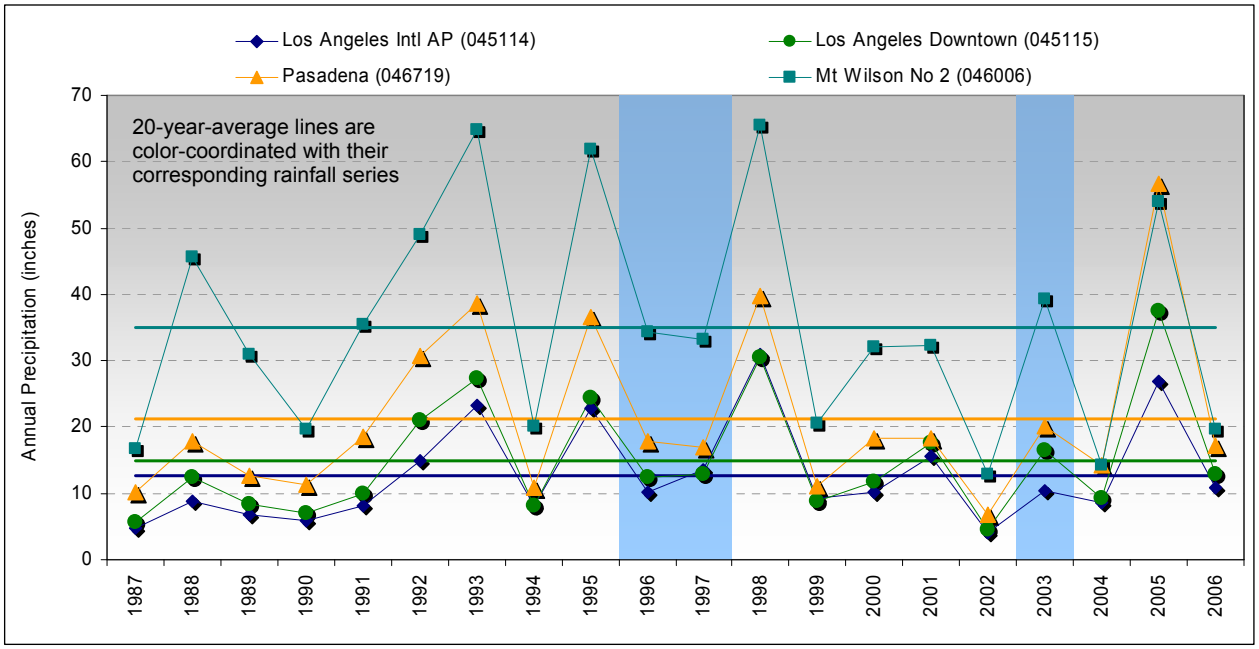


Figure G-8. Average Rainfall and Elevation at Selected Stations (10/1/1987–9/30/2006)



Highlighted years have the smallest absolute difference from the 20-year average.

Figure G-9. Total Annual Precipitation Volumes vs. 20-Year Annual Average Precipitation at Four Gages in the Los Angeles Region

Figure G-10 through Figure G-13 show the Step 2 analysis graphs of rainfall volume and intensity duration at each of the four selected precipitation gages. In the graphs, rainfall event totals are read on the left axis, and average rainfall intensities are read on the right axis. The intensities for the selected years are highlighted from among the rest of the data. On a rainfall duration graph, the x-axis indicates the percent of events that have a magnitude (or intensity) that is lower than the corresponding event. The color-coordinated dots correspond to points along the rainfall volume curve for selected storms, for the selected years.

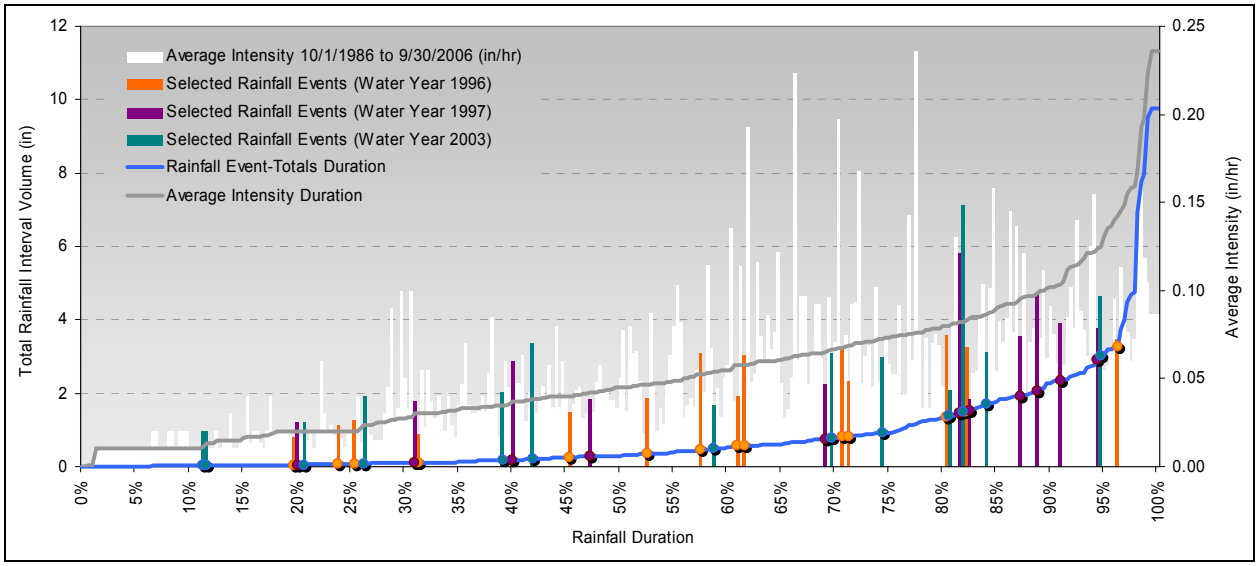


Figure G-10. Rainfall Volume and Intensity Duration Analysis at Los Angeles International AP gage (045114)

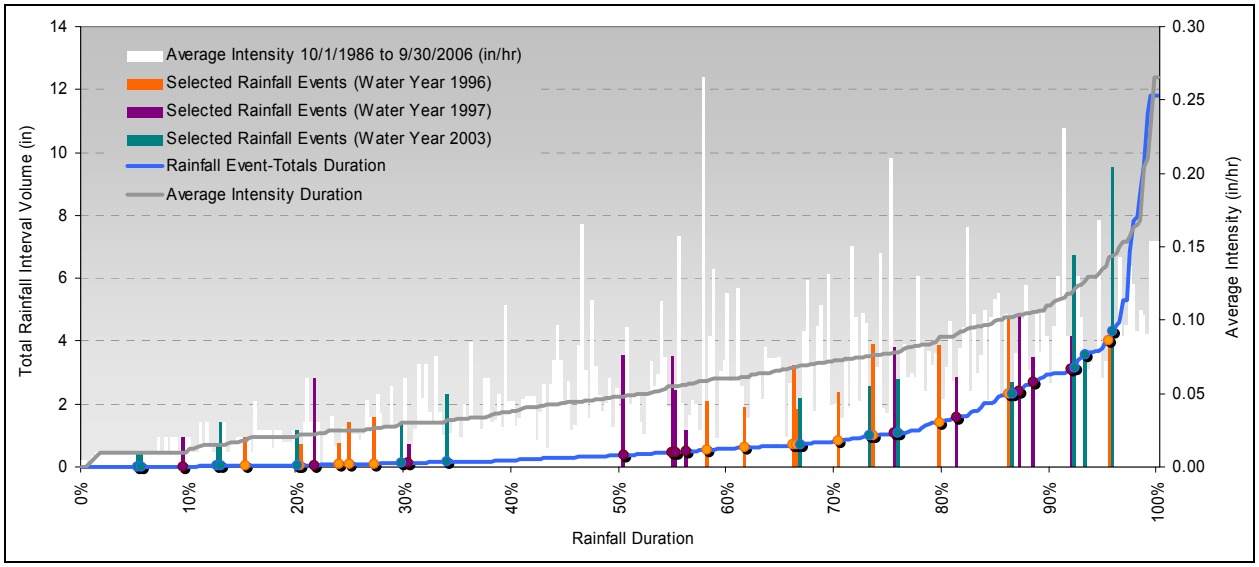


Figure G-11. Rainfall Volume and Intensity Duration Analysis at Los Angeles Downtown Gage (045115)

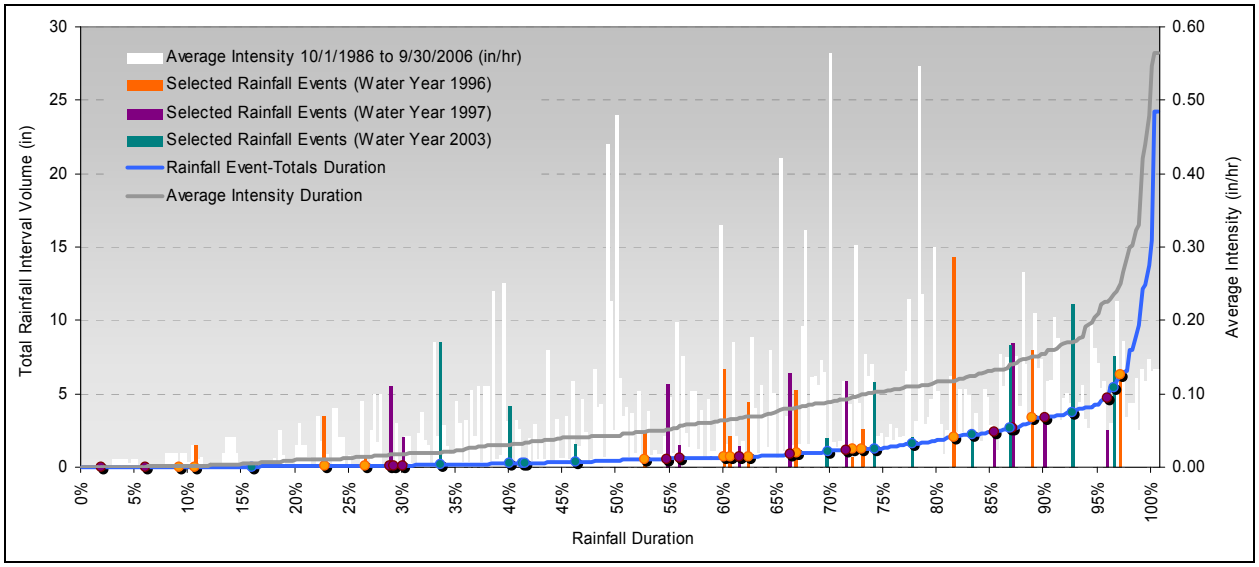


Figure G-12. Rainfall Volume and Intensity Duration Analysis at Pasadena Gage (046719)

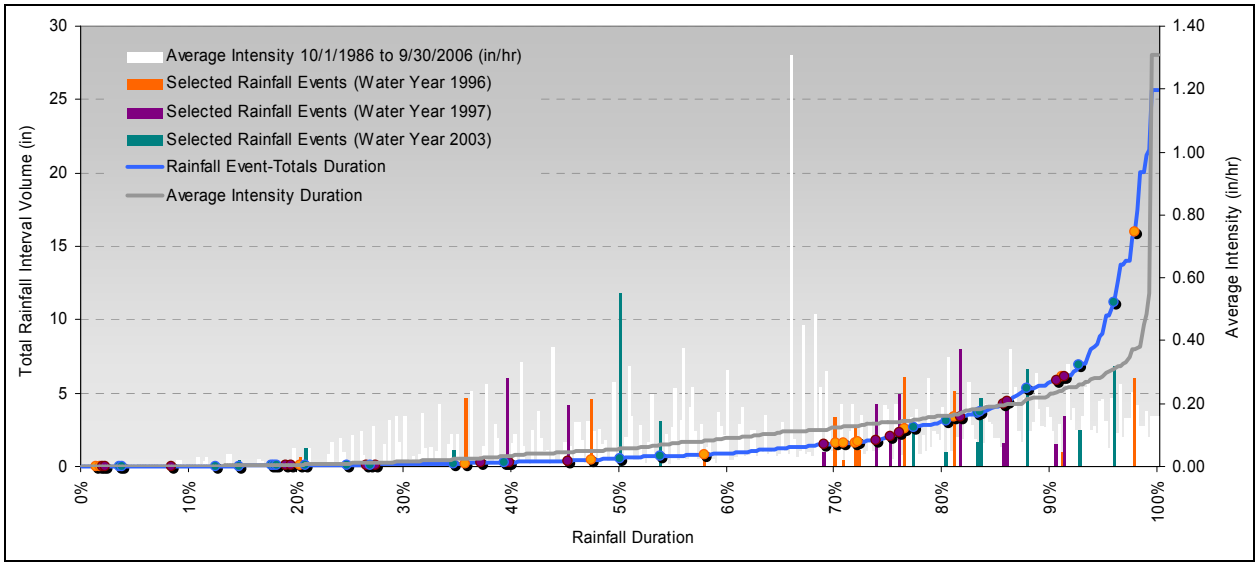
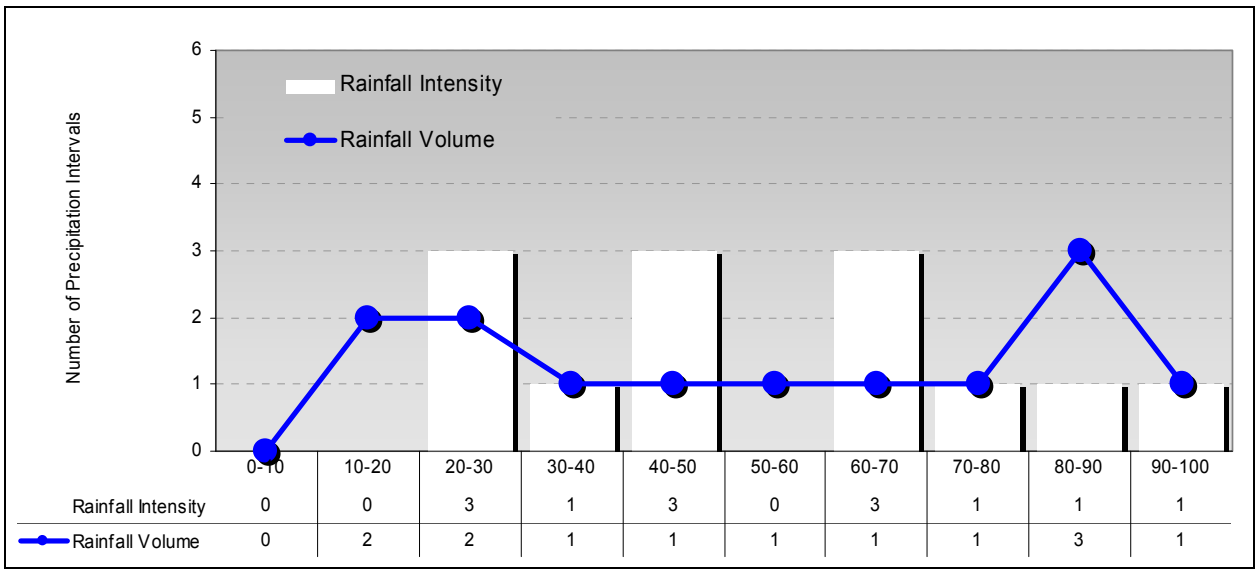


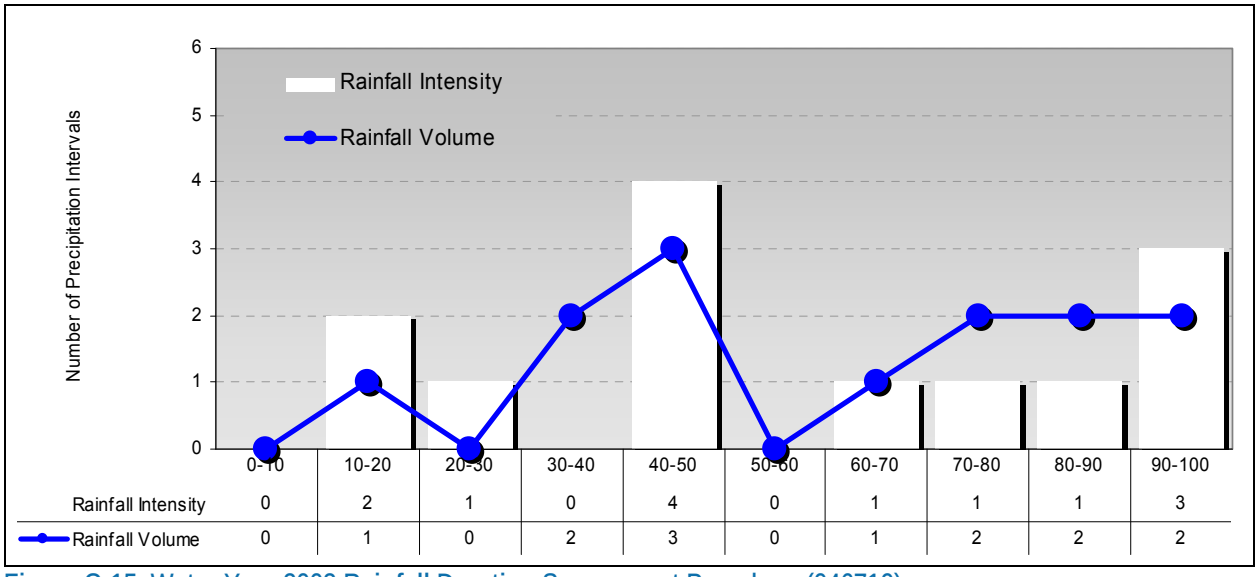
Figure G-13. Rainfall Volume and Intensity Duration Analysis at Mt Wilson No 2 Gage (046006)

The rainfall duration analysis showed that of the three selected years with the smallest absolute difference between total annual precipitation and the 20-year average rainfall values, HY 2003 also had the most evenly distributed storms among the percentile ranges. While 1996 was the closest in terms of total volume, more than 50 percent of the storms in that year at all the gages were above the 70th percentile range. Figure G-14 and Figure G-15 show water year 2003 rainfall duration summary results at Los Angeles Intl AP and Pasadena, respectively. These graphs show the number of events occurring in each percentile bin (which are divided into 10 percentile ranges). As previously defined, a precipitation interval (or event) is a wet interval that is Figure G-12, respectively.



	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Rainfall Intensity	0	0	3	1	3	0	3	1	1	1
Rainfall Volume	0	2	2	1	1	1	1	1	3	1

Figure G-14. Water Year 2003 Rainfall Duration Summary at Los Angeles International AP (045114)



	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Rainfall Intensity	0	2	1	0	4	0	1	1	1	3
Rainfall Volume	0	1	0	2	3	0	1	2	2	2

Figure G-15. Water Year 2003 Rainfall Duration Summary at Pasadena (046719)

Of the years evaluated in this analysis, HY 2003 has the most normally distributed storms in terms of volume and intensity duration. While an attempt was made to select a naturally occurring average water year, the analysis process also highlighted the strong variability in rainfall patterns, both in terms of total volume and intensity, within the Los Angeles regional watersheds.

G.8. Additional Discussion of Structural BMP Optimization Results

As discussed in Section 6, Figure G-16 the results of optimization of structural BMPs to achieve increasing load reductions. The following sections provide additional discussion of these results.

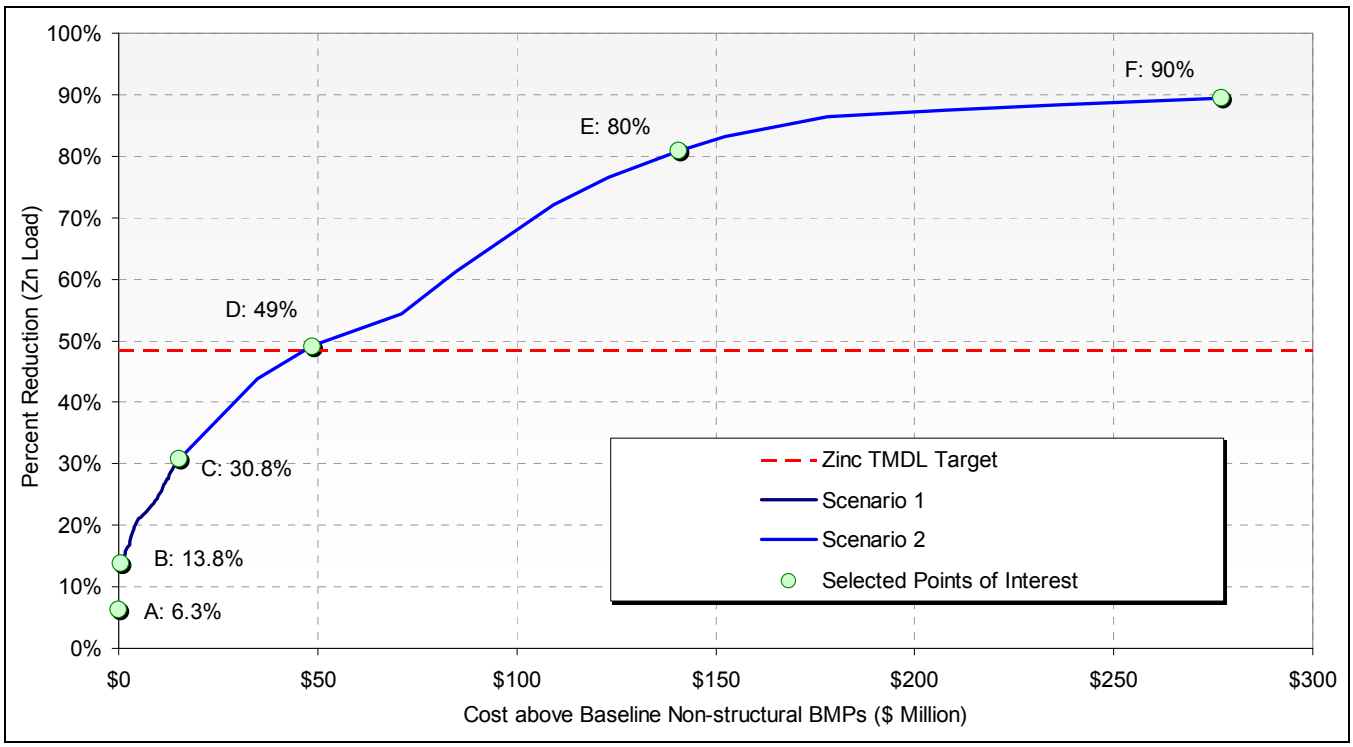


Figure G-16. Pollutant Reduction vs. Minimum Cost Relationship Derived from Scenarios 1 and 2

G.8.1. BMPs on Public Land (Points B and C)

Point B represent the cost-benefit of public centralized BMPs (i.e., Ladera Park infiltration basin and West Los Angeles Community College extended detention pond), and Point C represents both the public centralized and distributed BMPs.

Figure G-17 is a map showing the location of public land within the County TMDL Implementation Areas. The following two sections describe the BMP implementation details for centralized and distributed BMPs, respectively.

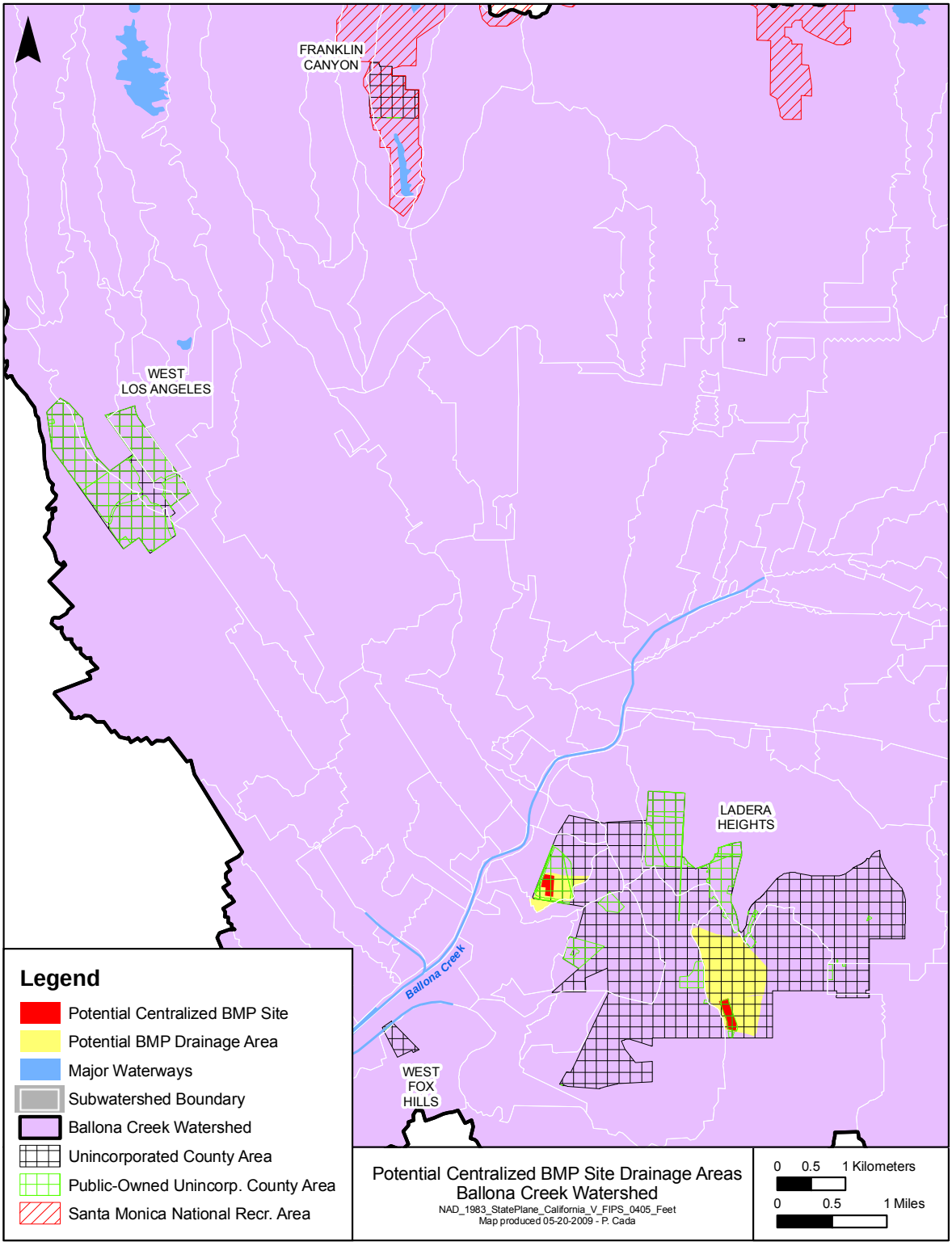


Figure G-17. Public Land in the County TMDL Implementation Area

Centralized BMPs on Public Land

Two public centralized BMP sites selected for evaluation were described in Section 5.2: (1) West Los Angeles Community College site, and (2) the Ladera Park site. The drainage areas for the locations are shown in Figure G-17 in yellow, with the red areas highlighting the potential BMP locations.

The potential (available) BMP surface areas for West Los Angeles Community College and Ladera Park are about 14.5 and 14 acres, respectively. The optimal centralized BMP sizes are summarized in Table G-8. Note that the actual drainage areas selected are far less than the maximum potential area that is available. That is because above a certain runoff level, given the ratio of drainage area to BMP surface area, stormwater volume would be sufficiently contained to meet the optimization target so that sizing a larger BMP would not provide any additional benefit for the additional cost. Table G-9 lists the pollutant reductions achieved by the two public centralized BMPs.

Table G-8. Optimal Maximum Centralized BMPs Size on Public Land Derived from Optimization Scenarios 1

Public Centralized BMP Sites	Ladera Park Infiltration Basin	West Los Angeles Community College Extended Detention Pond
Total Drainage Area (acres)	271	67.2
Total Impervious Drainage Area (acres)	70.0	27.8
Estimated Cost ($)	$359,190	$294,485
Surface Area (acres)	2.4	1.3
Maximum Ponding Depth (ft)	5	4
Substrate Depth (ft)	2	n/a
Substrate Porosity (ft)	0.4	n/a
Total Storage Capacity (acre-ft)	14.2	5.1

Table G-9. Pollutant Reductions Achieved by Optimal Maximum Centralized BMPs Size on Public Land Derived from Optimization Scenarios 1

	Ladera Park Infiltration Basin		West Los Angeles Community College Extended Detention Pond	
Pollutants	Load Reduction (lb or counts/yr)	Reduction % of Total	Load Reduction (lb or counts/yr)	Reduction % of Total
Zinc	51.5	5.5%	18.1	1.9%
Copper	5.5	5.7%	1.6	1.6%
Lead	5.3	6.3%	1.1	1.3%
TSS	12,989.4	4.8%	6,358.5	2.4%
Fecal Coliform	9.5E+12	6.8%	1.1E+12	0.8%

Distributed Structural BMPs on Publicly Owned Land

The publicly owned portion of the County TMDL Implementation Area consists of mainly institutional, urban open space (i.e., parks and recreational area) and secondary roads, as shown in Table G-10. Distributed BMPs were implemented on publicly owned institutional parcels, as well as a 1-acre secondary road segment as a pilot demonstration project (see Section 5).

Table G-11 is a summary of BMP details for the optimal public distributed structural BMPs at Point B. The associated BMP physical configurations are listed in Table G-12. It shows that the optimal solutions used more porous pavement area in the low-infiltration area than the high-infiltration area.

Table G-10. Land Use Composition of Public-Owned County TMDL Implementation Area

HRU Description	Area (acre)	% of Total Area	Impervious Area (acre)	% of Total Impervious Area
Institutional	373.3	35.7%	266.4	49.8%
Secondary roads[a]	251.7	24.0%	249.9	46.7%
Urban open space	355.8	34.0%	18.4	3.4%
Vacant moderate slope D	23.8	2.3%	0.0	0.0%
Vacant steep slope C	0.0	0.0%	0.0	0.0%
Vacant steep slope D	42.1	4.0%	0.0	0.0%
Total	1,046.6	100.0%	534.7	100.0%

a. All secondary roads are assumed County property.

Table G-11. Optimal Distributed BMPs Size on Public Land Derived from Optimization Scenarios 1 (Point C, with Nonstructural BMP, Excluding Area Draining to Public Centralized BMP Sites)

Soil Infiltration Rate	BMP Type[a]		BMP Impervious Drainage Area			BMP Cost ($Mil)	BMP Surface Area (acre)	Load Reduction (Zinc)	
			Max (acre)	Treated (acre)	% Treated			(lb/yr)	% Total Existing Load
High	Institutional	PP	3.9	0	0%	0.00	0.00	--	--
		BR	6.4	6.4	100%	0.35	0.29	3.60	0.4%
Low	Road Pilot	L-BR	1	1	100%	0.06	0.06	0.91	0.1%
	Institutional	PP	160	10	6.3%	0.29	0.66	5.04	0.5%
		BR	260	260	100%	13.72	12.46	152.64	16.2%

a. PP = Porous Pavement, BR = Bioretention, L-BR = Linear Bioretention

Table G-12. Distributed BMP Physical Configurations

Parameter	Bioretention	Porous Pavement	Linear BR trench
Substrate depth (ft)	3	2	3
Underdrain depth (ft)	1 (low infiltration area) 0 (high infiltration area)	1	0
Maximum ponding depth (ft)	0.8	0.1	0.5

Comparison of Cost Effectiveness

The cost effectiveness (cost per unit zinc load removed) of the distributed BMPs on public land, including both centralized and distributed, are compared in Figure G-18. It shows that the centralized BMPs are more cost-effective than distributed structural BMPs because of the economy of scale, with the infiltration basins outperforming the extended detention pond. The Pilot Distributed BMP Project for a County Road (road) has the next lowest cost per unit load reduction because the road runoff has relatively higher zinc unit-area loading. When the results are aggregated and normalized in terms of percent removal, it is easier to achieve a higher load reduction in higher-loading areas than in lower-loading areas. Distributed BMPs (bioretention and porous pavement) on high-infiltration soils, treating runoff from institutional impervious area, outperform those that are on low-infiltration soils. The latter have the highest unit load reduction cost.

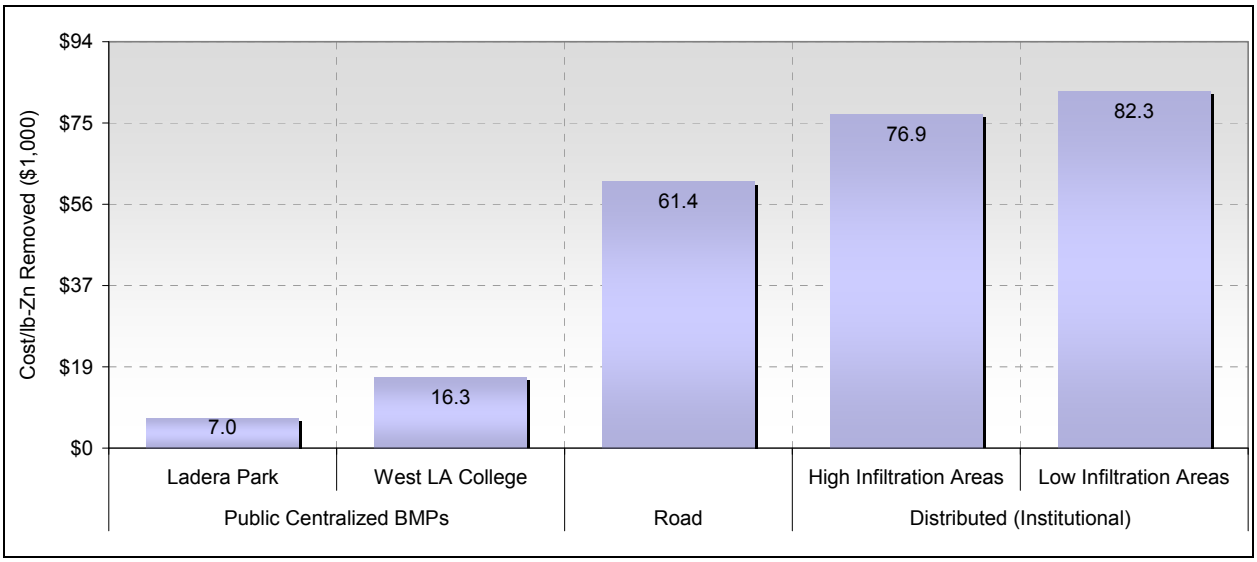


Figure G-18. Comparison of Public BMP Cost-Effectiveness

G.8.2. Centralized BMPs on Private Land (Points D, E and F)

Points D, E, and F on the curve in Figure G-16 indicate that the cost-benefit at three selected private centralized BMP implementation levels. It is important to note that all three solutions share the same assumption of treating 100 percent of the drainage area using the two potential centralized structural BMP types of infiltration basins and extended detention ponds. Table G-13 lists the unit cost and the vertical configurations for each of the two centralized BMP types. Table G-14 summarizes the optimization details at the three selected points of interest (D, E, and F). That information includes the following:

- Drainage area information
- BMP surface area to impervious drainage area ratio
- Load reduction per unit impervious area treated
- Cost per pound of zinc removal
- Treatment capacity, expressed as runoff depth captured and treated

Results show that the Point D solution has the lowest BMP surface area to drainage area ratio and, consequently, the lowest treatment storage capacity, while Point F has the highest. As a result, Point D presents the lowest pollutant removal per unit impervious drainage area treated, while Point F shows the highest. For Point D, this means to reduce the same amount of pollutant load as seen at Point F, more drainage area needs to be treated using the Point D BMP design specifications.

Table G-13. Centralized BMPs on Private Land - Cost and Configurations

Public Centralized BMP Sites	Infiltration Basin	Extended Detention Pond
Total Unit Cost ($ million/acre BMP)	$5.8	$5.8
Estimated Land Acquisition Cost ($ million/acre BMP)	$5.6	$5.6
Maximum Ponding Depth (ft)	5	4.4
Substrate Depth (ft)	1	n/a
Substrate Porosity (ft)	0.4	n/a
Underdrain Depth (ft)	0	n/a

Table G-14. Optimal Centralized BMPs of Private Land - Derived from Optimization Scenario 2 (Points D, E, and F)

Applicable Centralized BMP Type		Infiltration basin	Extended Detention Pond
Drainage Area	Total Area (ac.)	429	2,265
	Impervious Area (ac.)	210	620
	Total Pollutant Load (zinc lb/yr)	151.5	430.9
	Unit Imp Area Pollutant Load (zinc lb/ac-yr)	0.72	0.69
BMP Surface Area/Imp DA (%)	Point D	1.67%	0.37%
	Point E	1.67%	2.96%
	Point F	3.44%	6.22%
Load Reduction per Unit Impervious Area Treated (zinc lb/ac treated Imp)	Point D	0.59	0.11
	Point E	0.59	0.59
	Point F	0.71	0.68
Cost-effectiveness ($1,000/lb zinc reduced)	Point D	163.5	194.3
	Point E	163.5	289.3
	Point F	279.5	527.6
Treated Runoff Depth (in)	Point D	1.18	0.18
	Point E	1.18	1.42
	Point F	2.44	2.99

G.9. References

Aqua Terra Consultants. 2005. Hydrologic Modeling of the Calleguas Creek Watershed with the U.S. EPA Hydrologic Simulation Program–FORTRAN. Final Report. Prepared for Larry Walker Associates, Ventura County Watershed Protection District, and Calleguas Creek Watershed Management Plan by Aqua Terra Consultants, Mountain View, CA.

Aqua Terra Consultants. 2008. Hydrologic Modeling of Santa Clara River Watershed with the U.S. U.S. Environmental Protection Agency Hydrologic Simulation Program–FORTRAN (HSPF). Final Draft. Prepared for Ventura County Watershed Protection District, Ventura, CA, by Aqua Terra Consultants, Mountain View, CA.

Caltrans. 2008. *Treatment BMP Technology Report*. Final Report. CTSW-RT-08-167.02.02. California Department of Transportation, Division of Environmental Analysis, Sacramento, CA.

CASQA (California Stormwater Quality Association). 2003. *Stormwater Best Management Practice Handbook, New Development and Redevelopment.* California Stormwater Quality Association.

Cutter, B., K. Baerenklau, A. DeWoody, R. Sharma, and J. Lee. 2008. Costs and Benefits of Capturing Urban Runoff with Competitive Bidding for Decentralized Best Management Practices. *Water Resources Research*, 44, W09410, doi:10.1029/2007WR006343.

LACDPW (Los Angeles County Department of Public Works). 2002. *A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP).* September 2002 Revision. Los Angeles County Department of Public Works, Los Angeles, CA.

LACDPW. 2004a. *Analysis of 85th Percentile 24-hour Rainfall Depth Analysis within the County of Los Angeles*. February 2004. Los Angeles County Department of Public Works, Los Angeles, CA.

LACDPW. 2004b. *Technical Manual for Stormwater Best Management Practices in the County of Los Angeles*. Los Angeles County Department of Public Works, Los Angeles, CA.

LACDPW. 2006. *Hydrology Manual*. Department of Public Works, Los Angeles County. Alhambra, CA.

LACDPW. 2009a. *County of Los Angeles Low-Impact Development Standards Manual*. Los Angeles County Department of Public Works, Los Angeles, CA.

LACDPW. 2009b. *Stormwater Best Management Practice Design and Maintenance Manual: For Publicly Maintained Storm Drain Systems*. Los Angeles County Department of Public Works, Los Angeles, CA.

Prince George's County. 2001. *Bioretention Manual*. Programs & Planning Division, Department of Environmental Resources, Prince George's County, Maryland.

Prince George's County. 2003. *Validating the Low–Impact Development Management Practices Evaluation Computer Module*. Report prepared for Prince George's County, Department of Environmental Resources, by Tetra Tech, Inc., Fairfax, VA..

Tetra Tech. 2007. *An Innovative Stormwater Best Management Practice Decision Support System for Quantifying and Optimizing Load Reductions and Costs in Los Angeles—Sun Valley Watershed Case Study.* Prepared by Tetra Tech, Inc., for City of Los Angeles Department of Public Works.

Smith, David R. 2006. *Permeable Interlocking Concrete Pavements: Selection, Design, Construction, Maintenance*, Washington, DC: ICPI 3rd ed., 2006.

USEPA (U.S. Environmental Protection Agency). 1999a. *Storm Water Technology Fact Sheet: Bioretention*. EPA 832-F-99-012. Washington, DC: U.S. Environmental Protection Agency, Office of Water, 1999a.

USEPA. 1999b. *Storm Water Technology Fact Sheet: Porous Pavement*. EPA 832-F-99-023. Washington, DC: U.S. Environmental Protection Agency, Office of Water, 1999b.

USEPA. 1999c. *Storm Water Technology Fact Sheet: Vegetated Swales*. EPA 832-F-99-006. Washington, DC: U.S. Environmental Protection Agency, Office of Water, 1999c.

Appendix H. Summary of Groundwater Basin Characteristics

H.1. Central Groundwater Basin

The Central Basin is bounded to the north by a divide formation known as *La Brea High*, a geological feature of impermeable rocks driven from the subsurface. The La Brea High serves to divide the Central Basin from the Hollywood Basin directly north. Groundwater enters the Central Basin through surface and subsurface flow and by direct percolation of precipitation, stream flow, and applied water in the forebay areas. Those areas are primarily in the northern and northeastern portion of the basin with unconfined groundwater conditions that have historically been the primary areas of groundwater replenishment. The artificial recharge of imported and reclaimed water into the forebays provides the allowable pumping allocation for the basin. The forebay areas, however, are outside the Ballona Creek watershed.

Table H-1 provides a summary of the water storage, production, and recharge for the Central Basin. It should be noted that only a small portion of the County TMDL Implementation Area overlies the Central Basin, within the Ladera Heights/Viewpark-Windsor Hills unincorporated County area. That area is in the northeastern portion of the Ladera Heights/Viewpark-Windsor Hills area.

Table H-1. Summary of Groundwater Storage and Recharge Parameters for Central Basin

Groundwater Basin	Groundwater Production (Avg. 1985–2004)	Active Recharge (Avg.1985–2004)	Spreading Ground Recharge Capacity	Unused Storage Available
Central Basin[a]	189,597 AFY	141,000 AFY	398,000 AFY	330,000 AF

Source: Metropolitan Water District of Southern California (2007)
a. The data for this table indicates storage and recharge parameters primarily for the Los Angeles River watershed (AFY = acre-feet per year; AF = acre-feet)

H.2. Hollywood Groundwater Basin

The Hollywood Basin covers the northeastern region of the watershed and is bounded to the north and east by the Santa Monica Mountains and to the west by the Inglewood Fault zone, separating it from the Santa Monica Basin. The Hollywood Basin is not beneath the County TMDL Implementation Area and is therefore outside the objectives of this effort and will not be addressed.

H.3. West Coast Groundwater Basin

The West Coast Basin covers the smallest portion of the watershed. The basin is bound by the Pacific coastline along its west side, the Ballona Escarpment to the north, the Newport-Inglewood fault zone to the east, and rock formations of the Palos Verdes Hills to the south. The basin underlies a small portion of the County TMDL Implementation Area at the southwestern portion of Ladera Heights/Viewpark-Windsor Hills.

The aquifers that compose the West Coast Basin consist of unconsolidated and semi-consolidated marine and alluvial sediments. The aquifers are generally confined and extend to a depth of up to 2,000 feet. Of those aquifers, the formation known as the Silverado aquifer is the most productive and produces 80 to 90 percent of the groundwater extracted from the basin annually. The average precipitation over the basin is 12 to 14 inches a year.

Storage capacity of the basin is estimated to be about 6,500,000 acre-feet. Of the 1.1 million acre-feet of unused storage space, 120,000 acre-feet is assumed to be available for groundwater storage (Table H-2). Natural recharge to the basin occurs through subsurface inflow from the adjacent Central Basin from the east and also through infiltration of surface inflow from the rivers. Seawater intrusion occurs along some aquifers exposed to the coast, and injection wells are used to create intrusion barriers to protect the basin.

Groundwater in the basin is extracted from 111 municipal groundwater production wells, 63 of which are active and 48 are inactive. There are also 761 other wells that include injection wells for the seawater intrusion barriers and monitoring wells. There are no aquifer storage and recovery wells or spreading basins in the basin.

Table H-2. Summary of Groundwater Storage and Recharge Parameters for West Coast Basin

Groundwater Basin	Groundwater Production (Avg. 1985–2004)	Active Recharge (Avg.1985–2004)	Spreading Ground Recharge Capacity	Unused Storage Available
West Coast	48,797 AFY	24,400 AFY	none	120,000 AF

Source: Metropolitan Water District of Southern California (2007)

Groundwater within the West Coast Basin is generally considered to be of good quality with localized areas of poor quality. Areas of poor water quality are mainly from seawater intrusion. Constituents of concern throughout the basin include TDS, TCE, PCE, perchlorate, nitrate, iron, manganese, and chloride.

H.4. Santa Monica Groundwater Basin

The Santa Monica Basin lies in the northwestern portion of the Los Angeles Coastal Plain Basin. It is bounded by the Santa Monica Mountains to the north, the Ballona Escarpment on the south, the Pacific Ocean on the west, and the Newport-Inglewood fault on the east. The basin underlies portions of the County TMDL Implementation Area at the unincorporated County communities of West Fox Hills, West Los Angeles, and Ladera Heights/ Viewpark-Windsor Hills.

Groundwater is mainly confined with some areas of unconfined or perched groundwater. Groundwater flows generally southward from the Santa Monica Mountains toward the Ballona gap, which then flows to the ocean. Alluvium covers much of the surface of the central portion of the basin. Precipitation in the Santa Monica Basin averages about 13.7 inches per year.

The total groundwater storage capacity of the basin is estimated to be about 1.1 million acre-feet. Replenishment of the groundwater is mainly by percolation of precipitation and surface runoff from the Santa Monica Mountains. The basin has not been adjudicated, and there are only five drinking water wells and four irrigation wells that are active. No aquifer storage and recovery wells are in the basin. Since 1996, a number of wells have been shut down because of MTBE and VOC contamination, and that has greatly reduced the area's ability to store and extract groundwater in the basin. Additionally, well production is limited because water levels are at or below sea level, and the risk of seawater intrusion is high for the area. The unused storage space and the portion of the storage space available for storage are unknown. No spreading grounds are in the Santa Monica Basin (Table H-3).

Table H-3. Summary of Groundwater Storage and Recharge Parameters for Santa Monica Basin

Groundwater Basin	Groundwater Production (Avg. 1985–2004)	Active Recharge (Avg.1985–2004)	Spreading Ground Recharge Capacity	Unused Storage Available for Storage
Santa Monica	1,838 AFY	none	none	unknown

Source: Metropolitan Water District of Southern California (2007)

H.5. References

Metropolitan Water District of Southern California. 2007. *Groundwater Assessment Study – Report No. 1308*. Metropolitan Water District of Southern California, Los Angeles, CA.

(This page intentionally left blank.)

Appendix I. Pertinent Regulations and Permits

I.1. Federal Regulations

I.1.1. Clean Water Act

The Federal Water Pollution Control Act of 1948 was promulgated to "enhance the quality and value of our water resources and to establish a national policy for the prevention, control and abatement of water pollution." The act defines *Waters of the United States* as all surface waterbodies of the United States, including all rivers, streams, lakes, wetlands, estuaries and territorial seas (see CWA section 502[7] and 40 CFR 122.2). The act was amended in 1972 and again in 1977, when it became known as the CWA (33 *United States Code* 25). The amendments establish a system for regulating pollutant discharges into the Waters of the United States including

- A permit structure designed to control and eventually eliminate pollutant discharges
- The requirement to develop water quality standards and pollution control programs
- The requirement to implement grant programs to install infrastructure intended to prevent pollutant discharges

The CWA established the baseline goal of attaining fishable, swimmable waters throughout the United States.

In California, the Porter-Cologne Water Quality Control Act of 1962 (Porter-Cologne Act) is the principal law governing water quality, and it establishes state authority over water rights and policy. The Porter-Cologne Act is codified under Title 23 of the California Code of Regulations (CCR) and, unlike the CWA, applies to both surface water and groundwater. The Porter-Cologne Act designates the SWRCB as the statewide water quality planning agency and gives authority to nine partially self-directed RWQCBs.

The County is within the regulatory jurisdiction of the LARWQCB, Region 4 (a map of the jurisdiction is at www.waterboards.ca.gov/waterboards_map.shtml). The LARWQCB developed the *Water Quality Control Plan: Los Angeles Region Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan) (LARWQCB 2009) to establish and protect current and future *beneficial uses* of surface water and groundwater within the region through narrative and numerical objectives and to comply with the state's anti-degradation policy. Implementation of water quality objectives is accomplished through planning activities, inspections and enforcement, and by regulating discharges through permitting. The LARWQCB is authorized to regulate any discharges to waters of the state that can affect water quality. *Waters of the state* are defined by the Porter-Cologne Act as, "any surface water or groundwater, including saline waters, within the boundaries of the state."

The County's BMP implementation activities may be subject to provisions of the following three CWA sections:

- Section 401, which is administered by the SWRCB and the LARWQCB
- Section 402, which is administered by the SWRCB, the LARWQCB, and the County of Los Angeles
- Section 404, which is administered by the U.S. Army Corps of Engineers (USACE).

Section 401

Under CWA section 401, every applicant for a federal permit or license for any activity that could result in a discharge to a waterbody must obtain State Water Quality Certification (401 Certification) to ensure that the proposed activity will comply with state water quality standards (USEPA 2009a). In general, a 401 Certification is required for all projects in which a USACE CWA section 404 permit (described below) is obtained or will discharge dredged or fill material to Waters of the United States, including removing vegetation or channel materials for flood control, constructing levees, and filling wetlands. If the LARWQCB deems a project exempt

from the provisions of section 401, it may regulate the dredge and fill activity under state authority in the form of Waste Discharge Requirements (WDRs) or Certification of WDRs (Ventura County Planning Division 2006).

To initiate the 401 Certification process, a biological assessment is typically performed in which any potential effect on Waters of the United States, adjacent wetlands, and receiving waters is determined. Coordination between the County and the LARWQCB is recommended before the application is submitted. An LARWQCB Section 401 Water Quality Certification Application Form should then be prepared and submitted (LARWQCB 2004). On average, the 401 Certification application process takes 3 to 4 months to complete from the time of application to the time of approval.

Section 402: National Pollutant Discharge Elimination System

The NPDES regulates the discharge of pollutants into the Waters of the United States. Stormwater discharges from the County MS4s to Waters of the United States are permitted under the Los Angeles County Municipal Storm Water NPDES Permit as Amended by Regional Board Order R4-2007-0042 on August 9, 2007 (Board Order 01-182; NPDES Permit No. CAS004001) (www.swrcb.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/ms4_permits/los_angeles/2001-2007/LA_MS4_Permit2001-2007.pdf). The permit requires the County to develop a Stormwater Quality Program to control stormwater pollution to the maximum extent practicable. The County program has the following components:

- Public Information and Participation
- Industrial/Commercial Facilities Control
- Development Planning
- Development Construction
- Public Agency Activities
- IC/ID Elimination Program

The County's Municipal Storm Water Permit does not define specific requirements for selecting and installing BMPs; however, when designing and selecting BMPs, the ordinances and guidelines described below should be considered.

A stormwater ordinance was adopted in accordance with the Municipal Storm Water NPDES Permit and under Los Angeles, California County Code Title 12, Chapter 12.80, Stormwater and Runoff Pollution Control (http://ordlink.com/codes/lacounty/_DATA/TITLE12/Chapter_12_80_STORMWATER_AND_R.html). The ordinance regulates discharges to the MS4, prohibits illicit discharges, requires runoff management such as good housekeeping practices, describes inspections, and identifies violations and enforcement procedures.

In addition to the ordinance, the County has prepared the following guidance documents for developers, planners, engineers, and those involved in the project design and permitting process:

- *Standard Urban Stormwater Mitigation Plan* (SUSMP) was developed to control the post-construction discharge of stormwater pollutants from new development and significant redevelopment projects (County of Los Angeles 2000).
- *Stormwater Best Management Practice Design and Maintenance Manual* provides design criteria and guidance for installing stormwater treatment systems and maintaining public systems (LACDPW 2009a).
- *Los Angeles County-Wide Structural BMP Prioritization Methodology* provides a systematic way of prioritizing structural BMP projects within Los Angeles County watersheds to optimize pollutant reductions in a cost-effective manner (LACDPW 2006a).

- *Technical Manual for Stormwater Best Management Practices in the County of Los Angeles* was prepared to assist with the selection and development of post-construction BMPs within Los Angeles County (LACDPW 2004).

Discharges of stormwater to Waters of the United States from construction projects that result in soil disturbance of at least one acre are regulated under General Permit for Waste Discharge Requirements for Discharges of Storm Water Associated with Construction Activity (NPDES General Permit CAS000002) Water Quality Order 98-08-DWQ (www.waterboards.ca.gov/water_issues/programs/stormwater/docs/finalconstpermit.pdf) (General Permit). Additionally, projects of less than one acre but that are part of a larger common plan of development that encompasses one or more acres of soil disturbance are also regulated under the General Permit. The General Permit requires a SWPPP that describes BMPs to prevent pollutant and sediment discharges from the construction site, as well as an inspection and monitoring program. A Notice of Intent (NOI), in Attachment 2 of the General Permit, is to be submitted to the SWRCB along with a project site map and fee at least 2 weeks before construction initiation.

The SWPPP must remain on-site at all times, and regular inspections must be performed to assess the effectiveness of the BMPs. Stormwater samples must be collected if there is reason to suspect that non-visible pollutants have come into contact with stormwater or the site discharges to a waterbody listed on the *2006 CWA Section 303(d) List of Water Quality Limited Segments Requiring TMDLs.* If permit coverage is not terminated within a year, an annual report must be completed and submitted to the LARWQCB. To terminate permit coverage, a Notice of Termination (NOT) is to be completed and submitted to the SWRCB. The Construction Storm Water General Permit is being revised and is at www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.shtml.

When submitting grading plans to the County, a local SWPPP must also be provided that describes erosion and sediment control measures that will be implemented on the construction site. A Wet Weather Erosion Control Plan must also be submitted annually.

California Water Code section 13263(i) allows the LARWQCB to prescribe general WDRs for a category of discharges if it finds that all the following criteria apply to the discharges in that category:

- The discharges are produced by the same or similar operations.
- The discharges involve the same or similar types of waste.
- The discharges require the same or similar treatment standards.
- The discharges are more appropriately regulated under general discharge requirements than individual discharge requirements.

The LARWQCB regulates specific discharges using WDRs. A Report of Waste Discharge must be filed with the LARWQCB.

The following WDRs could apply to the implementation of structural BMPs in the County:

- General NPDES Permit No. CAG994004 applies to any discharges of groundwater from construction sites or dewatering discharges to surface waters.
- Order No. 93-010, General WDRs for Specified Discharges to Groundwater in Santa Clara River and Los Angeles River Basins applies to construction dewatering discharged to groundwater.

Section 404

The primary federal program regulating activities in wetlands is section 404 of the CWA. It provides USEPA and the USACE regulatory and permitting authority over activities that result in the discharge of dredged or fill material into navigable Waters of the United States. The limits of USACE jurisdiction following the U.S.

Supreme Court's decision in *Rapanos v. United States* and *Carabell V. United States* are (1) traditional navigable water, (2) wetlands adjacent to traditional navigable waters, (3) non-navigable tributaries of traditional navigable waters that are relatively permanent when the tributaries flow year-round or have continuous flow at least seasonally (typically 3 months), and (4) wetlands that directly abut such tributaries (USEPA 2008).

The USACE has developed standard methods and data reporting forms contained in the *Interim Regional Supplement to the Corps of Engineering Wetland Delineation Manual: Arid West Region*, a supplement to the USACE's *Wetland Delineation Manual* (USACE 1987), to determine the presence or absence of wetlands and Waters of the United States. The procedures described in the supplement are used to identify wetlands and Waters of the United States at a project site that are potentially subject to regulation under CWA section 404.

Most projects conducted in or adjacent to streams or wetlands will require a section 404 permit. A section 404 permit is required if materials, including dirt, rocks, geotextiles, concrete, or culverts, are moved or placed into or within USACE jurisdictional areas. Permit coverage may be granted if the following are performed: (1) actions are taken to avoid wetland impacts, (2) potential impacts are minimized, and (3) compensation for any unavoidable impact is provided.

Proposed activities are regulated through a permit review process. An individual permit is required for potentially significant impacts. Individual permits are reviewed by the USACE and evaluated under a public interest review, as well as the environmental criteria set forth in the CWA section 404(b)(1) Guidelines. However, for most discharges that will have only minimal adverse effects, a general permit could be suitable. The section 404 general permit process is more streamlined than the individual permit process because of the elimination of the individual review, provided that the general or specific conditions for general permit coverage are met. General permits are issued on a nationwide, state, or regional basis for categories of activities.

- Regional General Permits are issued for common maintenance-type activities with minimal effect on the environment and often include preapproval from the LARWQCB section 401 certification or from the U.S. Fish and Wildlife Service (USFWS) and the NOAA Fisheries Service for Endangered Species Act (ESA) consultations. Permit coverage takes approximately 1 to 6 months for existing activity categories or 6 months to 1 year for new and unique activity categories.
- Nationwide Permits are written for categories of projects that occur nationwide, such as road crossings, bank stabilization, repairs to existing structures, flood control maintenance, and wetland restoration for wildlife habitat. Permit coverage takes from three to nine months.
- An Individual Permit may be required if more than one-half acre of permanent impacts could occur. Public review is required for an IP, which lengthens the amount of time between permit application and permit coverage (6 months to a year under the best circumstances, but can be multiple years).

The 404 Permit process should begin with a consultation with USACE. Before applying for a section 404 permit, a wetland delineation and estimation of USACE jurisdictional area should be performed. LARWQCB 401 Water Quality Certification must also be obtained when applying for a Nationwide Permit or Individual Permit, and a California Coastal Commission Letter of Concurrence must be obtained for projects in the Coastal Zone. After any pre-application steps are completed, the USACE *Application for Department of the Army Permit* should be prepared and submitted (Ventura County Planning Division 2006).

The USACE section 404 permit also requires that a section 106 review be conducted as part of the permit application. Section 106 is a document review of the project site for historical significance. On the basis of the results, additional studies could be required, such as an additional Historical/Archaeological Report or mitigation to protect the historical significance of the site. The review search and approval duration varies on the project scope.

Rivers and Harbors Appropriation Act of 1899

Although not part of the CWA, the Rivers and Harbors Appropriation Act of 1899 (Rivers and Harbors Act) preceded the CWA in protecting navigable Waters of the United States The law prohibits dumping refuse into navigable waters or the creation of any navigational obstruction. It also regulates the construction of wharves, piers, jetties, bulkheads, and similar structures in ports, rivers, canals, or other areas used for navigation (USFWS undated). Upon state legislature approval, structures can be constructed in navigable waterways if the affected waters are entirely within one state and provided that the plans are approved by the Chief of Engineers and the Secretary of Army. Discharges of refuse or fill material or construction activities in waterways require a permit from the USACE as described in the section 404 discussion above.

I.1.2. Endangered Species Act

(See State Regulations section, subsection Wildlife: State and Related Federal Requirements.)

I.1.3. Forest Service Permits

The U.S. Forest Service (USFS) allows special uses of USFS land through a permitting process. An applicant may obtain a special-use authorization from the USFS by completing the required documentation and presenting a request that is consistent with USFS regulations and other policies. The application requires a project description, environmental protection plan, map or plat of the site, documentation of technical and financial capability, and a description of nonfederal alternatives considered. Applications can be obtained from local USFS offices. For developers and businesses, an application fee will be required, and once the permit is obtained, using the land could require an annual rental fee (USFS 2009). The County has historically been exempt from paying USFS fees.

I.1.4. Migratory Bird Treaty Act

(See State Regulations section, subsection Wildlife: State and Related Federal Requirements.)

I.1.5. National Environmental Policy Act

EPA administers the National Environmental Policy Act (NEPA). Title I of NEPA contains a Declaration of National Environmental Policy, which requires the federal government to use all practicable means to create and maintain conditions under which man and nature can exist in productive harmony. Section 102 requires federal agencies to incorporate environmental considerations in their planning and decision making through a systematic interdisciplinary approach. Specifically, all federal agencies are to prepare detailed statements assessing the environmental effect of, and alternatives to, major federal actions significantly affecting the environment. Such statements are commonly referred to as environmental impact statements (EISs) (USEPA 2009b).

The role of a federal agency in the NEPA process depends on the agency's expertise and relationship to the proposed undertaking. The agency carrying out the federal action is responsible for complying with the requirements of NEPA. Federal agencies, together with state, tribal, or local agencies, may act as joint lead agencies. A federal, state, tribal, or local agency having special expertise with respect to an environmental issue or jurisdiction by law may be a cooperating agency in the NEPA process (USEPA 2009b).

The NEPA process consists of evaluating the environmental effects of a federal undertaking including its alternatives. There are three levels of analysis depending on whether an undertaking could significantly affect the environment. Those three levels include categorical exclusion determination; preparation of an environmental assessment/finding of no significant impact (EA/FONSI); and preparation of an EIS (USEPA 2009b).

At the first level, an undertaking may be categorically excluded from a detailed environmental analysis if it meets certain criteria that a federal agency has previously determined as having no significant environmental impact. A

number of agencies have developed lists of actions that are normally categorically excluded from environmental evaluation under their NEPA regulations. For example, the nationwide section 404 permits issued by the USACE have integrated a NEPA categorical exclusion in them. At the second level of analysis, a federal agency prepares a written EA to determine whether a federal undertaking will significantly affect the environment. If the answer is no, the agency issues a FONSI. The FONSI may address measures that an agency will take to reduce (mitigate) potentially significant impacts. If the EA determines that the environmental consequences of a proposed federal undertaking could be significant, an EIS is prepared. An EIS is a more detailed evaluation of the proposed action and alternatives. After a final EIS is prepared and at the time of its decision, a federal agency will prepare a public record of its decision addressing how the findings of the EIS, including consideration of alternatives, were incorporated into the agency's decision-making process (USEPA 2009b).

USEPA (Region 9 for California projects) is required to review and publicly comment on the environmental impacts of major federal actions including actions that are the subject of EISs. If USEPA determines that the action is environmentally unsatisfactory, it is required by section 309 to refer to the Council on Environmental Quality (USEPA Region 9 2009b). Approval can take a minimum of 6 to 12 months up to several or more years.

I.2. State Regulations

I.2.1. California Air Resources Board Regulations

The California Air Resources Board (CARB) regulates air pollution sources in California, including construction vehicle emissions. All self-propelled off-road diesel vehicles over 25 horsepower used in California—except personal use vehicles, vehicles used solely for agriculture, vehicles that are awaiting sale (rental vehicles are not exempt), vehicles covered by the cargo-handling rule, and vehicles that can be moved only on rail—are covered by the regulations. The regulations impose limits on idling, buying older off-road diesel vehicles, and selling vehicles beginning in 2008; require all vehicles to be reported to CARB and labeled in 2009. In 2010 the regulations begin gradual requirements for fleets to clean up their fleet by getting rid of older engines, using newer engines, and installing exhaust retrofits. The overall purpose of the regulation is to reduce emissions of oxides of nitrogen and particulate matter from off-road diesel vehicles (CARB 2009a).

The purpose of this airborne toxic control measure is to reduce diesel particulate matter emissions from portable diesel-fueled engines having a rated brake horsepower of 50 and greater (> 50 bhp). The regulations specify fuel type, particulate matter standards and fleet requirements for portable generators. Fleet managers are required to keep adequate records showing compliance with the requirements and to submit to the Regional Board (CARB 2009b.)

The Portable Equipment Registration Program (PERP) is a voluntary, statewide program to register portable equipment such as air compressors, generators, concrete pumps, tub grinders, wood chippers, water pumps, drill rigs, pile drivers, rock drills, abrasive blasters, aggregate screening and crushing plants, concrete batch plants, and welders. With certain limited exceptions, portable equipment registered in PERP may be operated throughout the state without obtaining permits from any of California's 35 air quality management or air pollution control districts (air districts). Nothing is required to be registered in PERP. Registration in PERP is completely voluntary. The permit requirement at the local air district is mandatory, however. The type of portable equipment that needs a permit is determined by the local air districts only. An owner/operator of portable equipment that needs a permit may then choose to register in PERP in lieu of having to get a permit from the air districts (CARB 2009c).

I.2.2. California Environmental Quality Act

The specific goals of the California Environmental Quality Act (CEQA) are for California's public agencies to identify the significant environmental effects of their actions and either avoid those significant environmental

effects or mitigate those significant environmental effects where feasible. CEQA applies to *projects* proposed to be undertaken or requiring approval by state and local government agencies (State of California Office of Planning and Research 2001). According to CEQA, projects are, "activities [that] have the potential to have a physical impact on the environment and [might] include the enactment of zoning ordinances, the issuance of conditional use permits and the approval of tentative subdivision maps." If a project requires approvals from more than one public agency, one public agency must serve as the *lead agency*.

The lead agency is, "the public agency [that] has the principal responsibility for carrying out or approving a project [that might] have a significant effect on the environment." The lead agency is responsible for completing an environmental review process defined by CEQA. This review process includes (1) determining if the activity is a *project* subject to CEQA, (2) determining if the project is exempt from CEQA, and (3) performing an Initial Study to identify the environmental impacts of the project and determine whether the identified impacts are *significant* (State of California Office of Planning and Research 2001). On the basis of the findings of significance, one of the following documents must be prepared:

- Negative Declaration if the review finds no significant impacts
- Mitigated Negative Declaration if the review finds significant impacts but the project can be altered to avoid or mitigate those significant impacts
- Environmental Impact Report if the review finds significant impacts.

Some projects may be determined to be exempt (http://ceres.ca.gov/ceqa/guidelines/art18.html%20or%20http:/ceres.ca.gov/ceqa/guidelines/art19.html) from CEQA by law because the project could fall under a category of projects that have already been determined to generally not have significant environmental impacts (State of California Office of Planning and Research 2001). Examples include resource and environmental protection actions by regulatory agencies, wildlife habitat acquisition, habitat restoration on 5 acres or less, maintenance activities, or emergencies. Retrofits to existing structures may be considered an exception. Article 18 (http://ceres.ca.gov/ceqa/guidelines/art18.html) and Article 19 (http://ceres.ca.gov/ceqa/guidelines/art19.html) of the act contain details on exemptions and exceptions to CEQA.

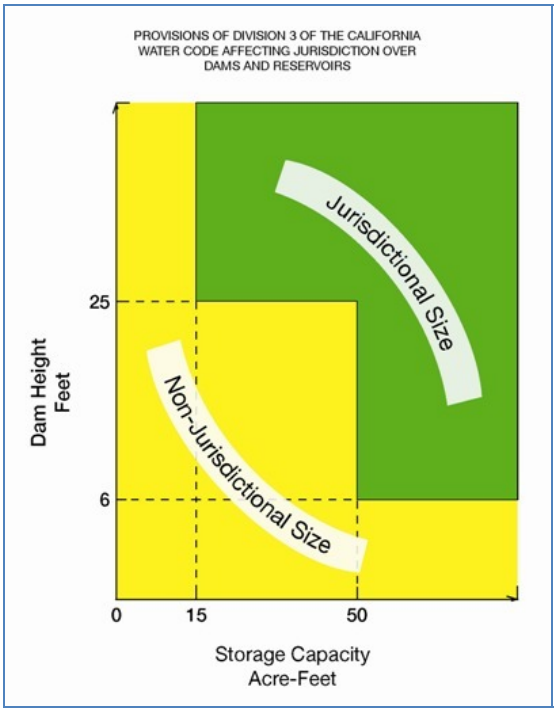
BMP implementation could require consideration of cultural resources as part of CEQA documentation. The purpose of a cultural resources study is to identify significant impacts and potentially significant impacts of a proposed project to cultural resources, and to provide mitigation measures to reduce effects on a level less than significant. Procedures outlined in CEQA regulations are typically used to conduct the studies.

I.2.3. Dam Safety Laws

California dam safety laws and regulations are administered by the California Department of Water Resources, Division of Safety of Dams (DSOD). The Statutes and Regulations Pertaining to Supervision of Dams and Reservoirs (www.water.ca.gov/damsafety/docs/statutes-regulations.pdf) California Water Code, Division 3, Dams and Reservoirs, Part 1, Supervision of Dams and Reservoirs, Chapter 1, Definitions, 6000-6008) are in place to protect people against loss of life and property from dam failure. The DSOD implements the statutes and regulations. Division engineers and engineering geologists review and approve plans and specifications for the dam design and oversee their construction to ensure compliance with the approved plans and specifications. Reviews include site geology, seismic setting, site investigations, construction material evaluation, dam stability, hydrology, hydraulics, and structural review of appurtenant structures (DSOD 2009).

The statutes and regulations define a *dam* as any artificial barrier, together with appurtenant works, that does or could impound or divert water, and that either (a) is or will be 25 feet or more in height from the natural bed of the stream or watercourse at the downstream toe of the barrier, as determined by the department, or from the lowest elevation of the outside limit of the barrier, as determined by the department, if it is not across a stream

channel or watercourse, to the maximum possible water storage elevation or (b) has or will have an impounding capacity of 50 acre-feet or more (DSOD 2009). Figure I-1 illustrates the jurisdictional height of dams.



Jurisdictional height of a dam is the vertical distance measured from the lowest point at the downstream toe of the dam to its maximum storage elevation, which is typically the spillway invert elevation. This same approach is also used for calculating the dam height for determining the annual fee.

Figure I-1. Jurisdictional Sizing of Dams

The following exemptions apply to this definition:

- Obstructions in a canal to raise, lower or divert water there from
- Levees, railroad fills
- Road or highway fills
- Circular tanks
- Tanks elevated above the ground
- Certain noncircular tanks in San Diego County
- Barriers off-stream for agricultural use or use as sewage sludge drying facilities
- Obstructions in channels or watercourses that are 15 feet or less in height, with the single purpose of spreading water within the bed of the stream or watercourse upstream for percolation underground
- Wastewater control facility ponds, which are 15 feet or less in height, have a maximum storage capacity of 1,500 acre-feet or less, are off-stream, and the operating public agency adopts certain resolutions
- Federal dams

To construct or enlarge, repair or alter, or remove a dam, an applicant must submit the appropriate application (www.water.ca.gov/damsafety/forms/index.cfm) to the DSOD. If work on an existing dam requires more than routine maintenance and significantly affects the dam, a permit is likely needed. Some examples of work requiring an alteration application include abandoning or replacing the outlet conduit, modifications to the outlet system that will affect emergency draw down requirements, significant penetration(s) of the water barrier, and excavating more than a few feet into the embankment (DSOD 2009).

Each application requests basic information regarding ownership, location, dam type, proposed work, and such. Detailed information about the proposed work is typically provided in plans and specifications that can be submitted later. An applicable fee should be submitted at the time of the application. DSOD engineers and geologists inspect the site and the subsurface exploration to learn firsthand of the geologic conditions. The DSOD thoroughly reviews the plans and specifications prepared by the owner to ensure that the dam is designed to meet minimum requirements and that the design is appropriate for the known geologic conditions. Technical resources (www.water.ca.gov/damsafety/techreference/index.cfm) are used to conduct these reviews (DSOD 2009).

I.2.4. Lake and Streambed Alteration Program

California Department of Fish and Game (DFG) administers the regulations under the Lake and Streambed Alteration Program. The Fish and Game Code (section 1602) requires that any person, business, state or local government agency, or public utility notify DFG of any proposed activity that will substantially divert or obstruct the natural flow of any river, stream or lake; substantially change or use any material from the bed, channel, or bank of any river, stream, or lake; or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it could pass into any river, stream, or lake. If DFG determines that the activity could substantially adversely affect fish and wildlife resources, a Lake or Streambed Alteration Agreement will be prepared. The agreement includes reasonable conditions necessary to protect those resources and must comply with CEQA. The entity may proceed with the activity in accordance with the final agreement (DFG 2009a).

The notification requirement applies to any work undertaken in or near any river, stream, or lake that flows at least intermittently through a bed or channel in California. That includes ephemeral streams, desert washes, and watercourses with a subsurface flow. It might also apply to work undertaken within the floodplain of a body of water. Projects that require notification include construction projects that could substantially modify a river, lake or stream; gravel, sand and rock extraction; timber harvesting; water diversion, obstruction, extraction or impoundment; and routine maintenance activities of a number of existing private or public facilities, such as canals, channels, culverts, and ditches (DFG 2009a).

If a project requires notification, the applicant will need to complete the Notification of Lake or Streambed Alteration Form (www.nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=3754) (Form FG 2023 (Rev. 7-06)) and submit the form, with the appropriate fee, to the appropriate DFG regional office. The notification form must describe the project, its potential impacts, and any measures planned to mitigate the impacts of the project (e.g., erosion control, other impact avoidance measures and any mitigation or compensation that is proposed). In addition, the DFG may require the applicant to submit a biological or hydrological study (DFG 2009a). The time required to complete the notification form will depend on the size and complexity of the project.

If DFG determines that a Lake or Streambed Alteration Agreement is required, DFG will submit an agreement to the applicant for review within 60 days of receiving the completed application. The draft agreement will include measures the DFG determines are necessary to protect fish, wildlife, and plant resources while conducting the project. After receiving the draft agreement, the applicant has 30 days to notify the DFG whether the measures in the draft agreement are acceptable. After the DFG receives the signed draft agreement, the DFG confirms it has received the correct notification fee, has complied with CEQA, and has received written proof that the filing fee (specified in Fish and Game Code section 711.4) has been paid, if a filing fee is required. If those have occurred, DFG signs the agreement, and the project described in the notification and covered by the agreement may begin, provided the applicant has obtained all necessary local, state, and federal permits or other authorizations (DFG 2009a). The time required to process the notification form and agreement will vary according to the complexity of the project, the completeness of the original notification form, and the negotiation time between the DFG and the applicant should an agreement be required.

I.2.5. Porter-Cologne Water Quality Control Act

(See the Federal Regulations section, subsection: Clean Water Act.)

I.2.6. Recycled Water Laws

(See Local Regulations section, subsection: Recycled Water Laws.)

I.2.7. State Lands Leasing and Permits Regulation

The California State Lands Commission (CSLC) was created to manage and protect the important natural and cultural resources on certain public lands in the state and the public's rights to access those lands. The public lands under the CSLC's jurisdiction are of two types—sovereign and school lands. Sovereign lands include the beds of California's naturally navigable rivers, lakes, and streams, as well as the state's tide and submerged lands along the state's more than 1,100 miles of coastline, extending from the shoreline out to three miles offshore (CSLC 2009a).

The CSLC may lease sovereign lands for any public trust purpose. CSLC leases of sovereign lands generally fall into several categories: recreational, commercial, industrial, right-of-way, and salvage. Specific examples of such leases include private recreational piers, commercial marinas, yacht clubs, marine terminals, industrial wharves, oil and gas pipelines, fiber optic cables, outfalls, bank stabilization, and wetlands and habitat management projects (CSLC 2009a).

Public and private entities can apply to the CSLC for leases or permits on state lands for many purposes. Applications (www.slc.ca.gov/Online_Forms/LMDApplication/APPLICATION_GUIDELINES.pdf) for the use of any of these lands can be made to the CSLC. They must include an outline of the proposed project, supporting environmental data, and payment of appropriate fees. CSLC staff then review the applications and make recommendations to the CSLC for action (CSLC 2009b).

The issuance by the CSLC of any lease, permit or other entitlement for use of state lands is first reviewed for compliance with the provisions of CEQA. The CSLC will not consider proposed projects until the requirements of CEQA have been satisfied, and the commission may not issue a lease for use of *Significant Lands* (defined at PRC section 6370 *et seq*) if such proposed use is detrimental to the identified values. Most leases or other entitlements for use of state lands could require approvals from other federal, state, or local agencies. On many proposed projects, the CSLC is the lead agency under CEQA (the public agency with the principal responsibility for carrying out or approving a project) and is therefore responsible for preparing the environmental documentation appropriate to each project (CSLC 2009b).

Not later than 30 calendar days after CSLC receives an application for a development project, the staff will notify the applicant in writing whether the application is complete. If the application is determined not to be complete, the staff specify what additional information is required. After receiving any additional material, the staff respond within 30 days as to whether the application is complete. Where the CSLC is the lead agency and a CEQA environmental impact review is prepared, CSLC must approve or disapprove a development project within one year from the date on which the application was received and accepted as complete by the CSLC staff. Where a negative declaration is prepared or if the development project is exempt from CEQA, the development project will be approved or disapproved within 6 months from the date the application was received and accepted as complete by the staff. One extension of that period of up to 90 days may be allowed if mutually agreed to by the staff and the applicant. Where the commission is a responsible agency, it must approve or disapprove a development project within 180 days from the date the lead agency approves the project, or within 180 days from the date the application was received and accepted as complete by the staff of the CSLC, whichever is later (CSLC 2009b).

The requirements apply to state park land as well. California law allows for disturbance of park land if a special use permit is obtained under 14 CCR section 4309 (http://weblinks.westlaw.com/result/default.aspx?cnt=Document&db=CA-ADC-TOC%3BRVADCCATOC&docname=14CAADCS4309&findtype=W&fn=_top&ifm=NotSet&pbc=4BF3FCBE&rlt=CLID_FQRLT24458283615157&rp=%2FSearch%2Fdefault.wl&rs=WEBL9.07&service=Find&spa=CCR-1000&vr=2.0).

I.2.8. Wildlife: State and Related Federal Requirements

Effects on endangered or threatened species are regulated under both the California Endangered Species Act (CESA) administered by California DFG and the federal ESA administered by USFWS. Species that are protected under these laws are designated on the state and federal endangered and threatened species lists. The term *take* is used to describe the effect on a species. Under section 2081 of the DFG code, a development project that coincides with the occurrence of a listed species must have an incidental take permit. To obtain this permit, the applicant must meet the following criteria (DFG 2009b):

1. The authorized take is incidental to an otherwise lawful activity.
2. The impacts of the authorized take are minimized and fully mitigated.
3. The measures required to minimize and fully mitigate the impacts of the authorized take
    a. are roughly proportional in extent to the impact of the taking on the species
    b. maintain the applicant's objectives to the greatest extent possible
    c. are capable of successful implementation
4. Adequate funding is provided to implement the required minimization and mitigation measures and to monitor compliance with and the effectiveness of the measures.
5. Issuance of the permit will not jeopardize the continued existence of a state-listed species.

A mitigation plan is attached to a permit that outlines how those criteria will be met. Measures for meeting the criteria vary and could include avoidance measures or acquisition and transfer of habitat management lands (including funds for protecting and maintaining land in perpetuity). Applicants must avoid all take for *fully protected* species and *specified birds* as defined in Fish and Game Code sections (www.leginfo.ca.gov/cgi-bin/calawquery?codesection=fgc&codebody=&hits=20) 3505, 3511, 4700, 5050, 5515, and 5517 (DFG 2009b). All take of bird species protected under the Migratory Bird Treaty Act (USFWS 2009a; administered by the USFWS) must also be avoided, as stated in section 3515 of the DFG code.

An applicant determines whether an incidental take permit and Habitat Conservation Plan (HCP) are required by contacting the nearest DFG office. The potential need for a permit can be assessed by using the DFG's online mapping resources (www.dfg.ca.gov/biogeodata/). In the case of the County, DFG's South Region office should be contacted. If a listed species is present on the property and the project will result in a take of that species, a permit is required. Permit processing is likely to take between 3 and 12 months or longer depending on the project circumstances and whether a federal permit is required.

To meet federal ESA requirements for a take of federally listed species, an incidental take permit (www.dfg.ca.gov/habcon/cesa/incidental/CodeRegT14_783.pdf) must also be obtained by developing an HCP that outlines plans to offset effects on the species listed as threatened or endangered (www.fws.gov/Endangered/wildlife.html; USFWS 2009b). HCP must meet the following criteria (USFWS 2009c):

1. Taking will be incidental.
2. The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of the taking.

3. The applicant will ensure that adequate funding for the plan will be provided.
4. Taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.
5. Other measures, as required by the Secretary, will be met.

Like CESA, mitigation measures for ESA vary by the project and could include the following:

- Payment into an established conservation fund or bank
- Preservation (via acquisition or conservation easement) of existing habitat
- Enhancement or restoration of degraded or a former habitat
- Establishment of buffer areas around existing habitats
- Modifications of land use practices and restrictions on access

Under ESA, an incidental take permit is not required for plant species. However, if a permit is required for other endangered or threatened species and an HCP must be prepared, the HCP must analyze the effects of the action on any endangered or threatened plant species. Accordingly, if a plant is on the California threatened or endangered list, a permit must be obtained through DFG (USFWS 2009c).

The timeline for federal incidental permit processing varies by project complexity and whether USFWS must require NEPA documentation. Minor, or *Low Effect*, HCPs do not require USFWS to prepare NEPA documentation, and the target processing time for those HCPs is 3 months. HCPs that require an EA under NEPA have a target processing time of 4 to 6 months, and for HCPs requiring an EIS, processing might take up to 12 months or longer (USFWS 2005).

A section 7 Consultation might also be required under the ESA if the project has a *federal nexus*, usually in the form of another federal permit or federal funding, at some stage of the project and with any federal agency. The type of consultation will be either informal or formal, depending on whether the project affects listed or protected species (USFWS 2009d). If the project has a federal nexus, it will also require NEPA documentation, which is described under the Federal Regulations section of this report.

Data on endangered and threatened species observations are available from the California Natural Diversity Database, which the Biogeographic Data Branch of DFG developed, and these data estimate the approximate spatial range of the species (BDB 2009). Using these data, a simple index was developed as a measure of the likelihood that a BMP site location will require CESA/ESA documentation and permitting. The index is based on the count of extant endangered or threatened species observations in a subbasin divided by the subbasin's area. The sole purpose of the index is to gage the likelihood that an endangered or threatened species will be found on a proposed BMP site. The index should not be interpreted as a measure of population density or other biological factors. Figure I-2 illustrates the spatial distribution of this index in Ballona Creek watersheds. The burden of CESA/ESA is evaluated further in later sections of this report, but the index indicates that most of the County TMDL Implementation Area has a small likelihood of required CESA/ESA documentation compared to other jurisdictions.

As noted above under the CESA requirements, species for which no take is allowed include those listed as *fully supported*, *specified* bird species, and bird species protected under the Migratory Bird Treaty Act.

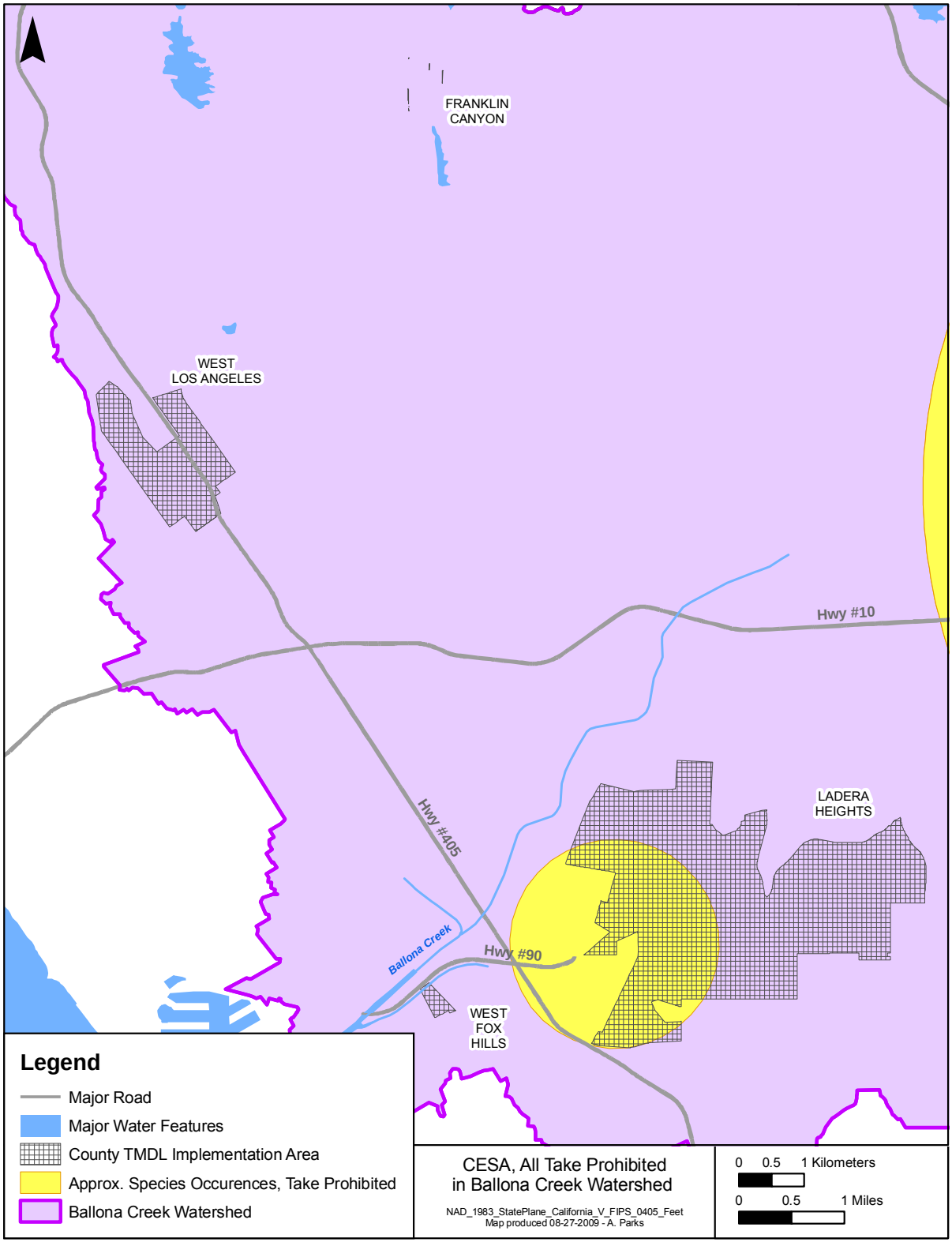


Figure I-2. Potential Locations of All Take Prohibited Species under CESA

I.3. Local Regulations

I.3.1. Drought-Tolerant Landscaping Requirements

Drought-tolerant landscaping requirements became effective on January 1, 2009 (County of Los Angeles 2009c; County of Los Angeles Department of Regional Planning 2009). The requirements apply to all development projects within County TMDL Implementation Areas except

- Any project involving construction on a lot with an existing single-family residence not involving the complete replacement of that residence
- Registered historical sites
- Public recreational lawns
- Any new or renovation project for a park
- Any area of a project dedicated solely and permanently to edible plants, such as orchards and vegetable gardens.

The following may be exempt from the provisions:

- Landscaping for a manufactured cut or fill slope equal to or exceeding a gradient of 3:1, when LACDPW makes a determination that an exemption is necessary to comply with the requirements of the building code regulating engineered grading.
- Landscaped areas required for LID, water quality facilities such as vegetated swales, rain gardens, detention ponds or basins, areas of the project used to contain pollutants, or areas irrigated by reclaimed water, when LACDPW makes a determination that an exemption is necessary for compliance with the LID standards.

The requirements for development sites are as follows:

- A minimum of 75 percent of the total landscaped area must contain plants from the drought-tolerant plant list (http://planning.lacounty.gov/assets/upl/project/green_drought-tolerant-plants.pdf).
- A maximum of 25 percent of the total landscaped area can consist of turf. Turf cannot be planted in strips that are less than 5 feet wide, and the total landscaped area cannot contain more than 5,000 square feet of turf.
- All turf in such total landscaped area must be water-efficient. The green building technical manual contains a list of turf that meets this requirement (http://planning.lacounty.gov/assets/upl/project/green_water-efficient-turf-list.pdf).
- The plants in the total landscaped area must be grouped in hydrozones in accordance with their respective water, cultural (soil, climate, sun, and light), and maintenance requirements.
- Single-family residences must include turf in the residence's rear and side yards in the measurement of turf used for the total landscaped area.

To comply with the drought-tolerant landscaping requirements, as part of the development site plan review, the site plan and landscape plans for the project must depict or list any drought-tolerant and non-drought-tolerant landscaping that will be incorporated into the project. In addition, the site plan must outline the areas of the project to be landscaped with drought-tolerant plants or turf, and calculations need to be provided showing the percent of landscaped area devoted to each. During installation, plants may be replaced without additional approval as long as the same relative percentage of drought-tolerant plants to turf as originally designed is maintained.

A covenant needs to be recorded indicating that the owner is aware of the drought-tolerant landscaping requirements and how the requirements apply to the owner's project. The County Fire Department may place planting restrictions on the project on the basis of that department's fuel modification plan guidelines.

A modification may be granted when topographic features, lot size, or other conditions make it unreasonable, impractical, or otherwise creates an unnecessary hardship to require compliance with the landscaping requirements or when the nature of a large-scale or multi-lot project necessitates flexibility in the project design that affects the landscaping for the project.

A flowchart for Los Angeles County's drought-tolerant landscaping requirements is at http://planning.lacounty.gov/green.

I.3.2. Geotechnical Reporting Requirements

Engineering Geology Reports

Different types of engineering geology reports are required depending on the stage of development review or approval requested, such as environmental impact, tentative subdivision, building or grading permit, rough grading, final map recordation, and such. The proposed development, site conditions, and most importantly, the nature and extent of potential geotechnical hazards ultimately dictate the scope of the investigation and the applicability of these or any other guidelines. Varying geologic conditions, purposes, and project proposals will require reports of different length, scope, and orientation. Nevertheless, for a report to be considered adequate for a typical hillside site and plan it should, at a minimum, include the following:

- An evaluation of at least one set of stereo aerial photographs for the potential presence of landslides or faults.
- A review of published maps of the California Geological Survey, U.S. Geological Survey, State Seismic Hazard Mapping Act, and Alquist-Priolo Earthquake Fault Zoning Act.
- A review of LACDPW's development files of adjoining property(ies), and published and unpublished maps of the U.S. Geological Survey and California Geological Survey. Discrepancies between researched data and data obtained by the consultant must be resolved.
- An accurate site location map.
- A regional geology map or cross sections as applicable to depicting site stability.
- A site geology map and geologic cross sections to illustrate local geologic structure.
- Exploration data to substantiate geometry and geologic conditions relative to stability.
- Geology cross sections for use by a soils engineer for stability analyses.
- Plot of geology versus depth of data obtained in exploration borings on geology maps and cross sections for assessment of site stability.
- An explanation of how the geologic data presented substantiates conclusions drawn.

The following are the types of reports required for purposes of the various development stages, all of which are described in detail in the County's *Manual for Preparation of Geotechnical Reports* (LACDPW 2006b):

- Environmental Impact Reports
- Tentative Subdivision Map Reports
- Grading Plan Reports
- Building Plan Reports
- In-Grading Geology and Soils Reports

- Final Geology and Soils Reports
- *Restricted Use Area* Letter/Report
- Report for Reconstruction (Damage due to Geologic Hazard)
- Change of Consultants Letter
- Fault Investigation
- Seismic Hazard Investigation

Soils Engineering Report

The report must demonstrate that life or limb, property, and public welfare will be safeguarded in accordance with the provisions of the current edition of the County's Building Code, which requires that the building site be free of geotechnical hazards such as landslide, settlement, or slippage, and that the proposed work will not adversely affect off-site areas. The following are minimum standards/contents of a soils engineering report:

- The report must have been prepared within one year before submittal. For soils reports older than one year before submittal, an update report/letter will be required, as a minimum, to verify the validity and applicability of the original report.
- The report must contain the description of the site (e.g., location, size, topography) to be developed and the description of the proposed grading/building for the development.
- The report must describe the current site environment and the effect of the development on the site. The past use of the area must also be noted. If the site is suspected to have environmental concerns, a copy of the permit, letter of nonobjection, processed application, and such, as applicable, will be required from the appropriate state agencies (e.g., Division of Oil, Gas, and Geothermal Resources; Department of Toxic Substances Control; South Coast Air Quality Management District; RWQCB; and others).
- The report will provide a general geologic summary as it affects the project development. If applicable, the report should reference an engineering geology report.
- The report will describe the encountered materials during the subsurface exploration. Reference will be made to the boring logs, trenches, pits, and other information.
- The historical groundwater highs and lows must be included in the report. A discussion as to the possible effect of groundwater on the project construction will be presented.
- The report will describe all laboratory testing conducted along with any other substantiating data used in the engineering analyses. Reference will be made to all laboratory test results contained in the Appendix.
- The report will describe and address all engineering analyses conducted, including slope stability analyses, liquefaction analyses, settlement analyses, and the like. Supporting analyses, calculations, computer printouts, diagrams, and such, will be contained in the Appendix, as necessary.
- The report must clearly state all conclusions and recommendations by the soils engineer. All mitigation measures must have supporting engineering analyses, and figures and diagrams as necessary.
- The soils engineer of record must provide a statement in compliance with section 111 of the County of Los Angeles Building Code. The statement must clearly make a finding regarding the proposed building/grading construction against hazard from future landsliding, settlement, or slippage and a finding regarding the effect the proposed building/grading construction will have on the stability of property outside the building site. The finding must be substantiated by appropriate data and analyses.
- The report must include a geotechnical map showing location of subsurface exploration, geology of the site, lot lines, existing and proposed grades, locations of sewage disposal systems, existing and recommended remedial measures, and recommended restricted use area(s).

The following are the types of soil engineering reports that could be required, all of which are described in detail in the County's *Manual for Preparation of Geotechnical Reports* (LACDPW 2006b):

- Environmental Impact Documents
- Geotechnical Site Inspection Report
- Tentative Subdivision Report
- Grading Plan Report
- Building Plan Report
- In-Grading Soils Engineering Report
- Rough Grading Soils Engineering Report
- Infrastructure Report

The County's Flood Control District finds that improvements and modifications to district facilities are exempt from the requirements of the County's Building and Grading Code. The County's Building Code is contained in Title 26 of the Los Angeles County Code. The following is an excerpt from the Code pertinent to the operations of the Flood Control District facilities: "…101.3 Scope. The provisions of this Code shall apply to the construction, alteration, moving, demolition, repair, use of any building or structure and grading within the unincorporated territory of the County of Los Angeles and to such work or use by the County of Los Angeles in any incorporated city not exercising jurisdiction over such work or use. The provisions of this code shall not apply to certain governmental agencies, special districts, and public utilities as determined by the building official…and hydraulic flood control structures…"

I.3.3. Green Building Requirements

The County's Green Building requirements became effective January 1, 2009, and apply to all projects in the County TMDL Implementation Areas. Exceptions include agricultural accessory structures, registered historic sites, and first-time tenant improvements with a gross floor area of less than 10,000 square feet. Areas of a project that include warehouse/distribution buildings, refrigerated warehouses, and industrial/manufacturing buildings are exempt from the energy-conservation and third-party standards and rating system requirements. Any office space, non-refrigerated, non-warehouse, and non-industrial/manufacturing areas of a building that are physically separated from the exempted area described above, must comply with all green building requirements. Table I-1 summarizes the green building requirements for different types of projects and different application filing dates.

The green building standards include energy conservation, indoor and outdoor water conservation, resource conservation (i.e., waste minimization/recycling), tree planting, and, in some cases for projects after January 1, 2010, third-party certification standards. The two categories of requirements most pertinent to water quality, outdoor water conservation, and tree planting are described below:

- Outdoor water conservation involves installing a smart irrigation controller for any area of a lot that is landscaped or designated for future landscaping and meets the drought-tolerant requirements described above.
- The tree planting requirements vary depending on the land use. Single-family residence lots are required to plant and maintain two 15-gallon trees, at least one of which must be from the drought-tolerant plant list. Multi-family building lots require a minimum of one 15-gallon tree planted and maintained for every 5,000 square feet of developed area, at least 50 percent of which must be from the drought-tolerant plant list. Hotel/motel, lodging house, and nonresidential building lots are required to plant and maintain a minimum of three 15-gallon trees for every 10,000 square feet of developed area, at least 65 percent of which must be from the drought-tolerant plant list.

Table I-1. Green Building Requirements for Projects

Project Description	Building Permit Application Filing Date	
	Before January 1, 2010	On or After January 1, 2010
Residential projects with < 5 dwelling units	County Green Building Standards	County Green Building Standards
Residential projects with ≥ 5 dwelling units	County Green Building Standards	County Green Building Standards & (GPR or CGB or LEED™ Certified)
Hotels/motels, lodging houses, nonresidential, and mixed-use buildings, with a gross floor area of < 10,000 square feet	County Green Building Standards	County Green Building Standards
Hotels/motels, lodging houses, nonresidential, and mixed-use buildings, and first-time tenant improvements, with a gross floor area of ≥ 10,000 square feet and < 25,000 square feet	County Green Building Standards	County Green Building Standards & LEED Certified
Hotels/motels, lodging houses, nonresidential, and mixed-use buildings, and first-time tenant improvements, with a gross floor area of ≥ 25,000 square feet	County Green Building Standards	County Green Building Standards & LEED Silver
High-rise buildings > 75 feet in height	County Green Building Standards	County Green Building Standards & LEED Silver

Source: County of Los Angeles Department of Regional Planning 2009
Note: If a project falls within more than one project description in this table, the project description with the more stringent green building requirements applies.

Exceptions are allowed for impracticality according to lot size or other site condition, in which case, twice the required number of trees may be planted off-site. Any existing mature tree on the lot can count toward the tree planting requirements even if it is not on the drought-tolerant plant list, and it must be shown on the site plan submitted to the County.

Developers can comply with the green building requirements as part of the development site plan review as long as the site plan or building plans/specifications clearly depict or list any green building elements that will be incorporated into the project. A separate site plan does not need to be developed to meet the green building requirements.

A flowchart for the County's green building requirements can be found at http://planning.lacounty.gov/green.

I.3.4. LID Requirements/LID Manual

The County's LID standards were in effect starting January 1, 2009, and apply to all development projects within the unincorporated County TMDL Implementation Areas for which permits were submitted on or after January 1, 2009 (County of Los Angeles 2009a). Public road and flood projects use a different set of standards, the LACDPW standards, which also incorporate LID. The requirements are triggered on the basis of the extent to which a development site's impervious surface is altered, as follows:

- Where the development results in an alteration of at least 50 percent of the impervious surfaces of an existing developed site, the entire site must be brought into compliance with the standards and requirements of this Chapter
- Where the development results in an alteration of less than 50 percent of the impervious surfaces of an existing developed site, only such incremental development must meet the standards and requirements of this Chapter

- Where a development results in an alteration of less than 50 percent of the impervious surfaces of an existing developed site consisting of four or fewer residential units, the development will be exempt from this Chapter.

The standards specify that developers must mimic undeveloped stormwater and urban runoff rates and volumes in any storm event up to and including the "50-year capital design storm event," as defined by LACDPW. They also require that pollutants of concern be prevented from leaving the development site in stormwater as the result of storms, up to and including a water quality design storm event. Finally, the standards require that hydromodification effects on natural drainage systems be minimized.

To meet the standards described above, developments are required to install and maintain minimum site design features as follows:

- A development consisting of four or fewer residential units must implement at least two LID BMP alternatives listed in the County's LID Manual (County of Los Angeles 2009b).
- A development consisting of five or more residential units, or a nonresidential development, is required to infiltrate the excess runoff volume generated either at the lot level or for the entire development site. The tributary area of a subregional facility is limited to 5 acres, but may be exceeded on a case-by-case basis with approval. If infiltration of all excess volume is not technically feasible, on-site storage, reuse, or other water conservation uses of the excess volume is required as specified in the County's LID Manual.

Developers are required to undergo a site plan review and an LID plan review. The site plan review is conducted by the County's Department of Regional Planning. The site plan submitted for the development must clearly depict all LID standards that will be incorporated into the development. Regional Planning approves compliance with the standards in concept only, subject to the setback and development standards set forth in Title 22 of the Los Angeles County Code. LACDPW makes the final approval and reviews the site plan for green building requirements (Title 22, Chapter 22.52, Part 20) and drought-tolerant landscaping requirements (Title 22, Chapter 22.52, Part 21) to the extent that those requirements apply to the development.

In addition to the site plan, developers also must submit an LID plan for review and approval that provides a comprehensive, technical discussion of how the development will comply with the LID Manual. A deposit and fee are required. The time for obtaining LID plan approval is as follows:

- For subdivisions, the LID plan needs to be approved before the tentative map approval.
- For any development requiring a conditional use permit, the LID plan needs to be approved before the issuance of any such conditional use permit or other entitlement.
- For all other development, the LID plan needs to be approved before issuance of a grading permit, and when no grading permit is required, before the issuance of a building permit.

A site's LID features need to be maintained and remain operable at all times and must not be removed unless replaced with other LID features in accordance with the LID standards. A covenant or agreement must be recorded indicating that the owner is aware and agrees to the LID standards, including a diagram of the site indicating the location and type of each LID feature incorporated into the development. The covenant or agreement must be recorded before final map approval for subdivisions and before issuing a grading permit or building permit if no grading permit is required, for all other developments.

A flowchart for Los Angeles County's green building requirements can be found at http://planning.lacounty.gov/green.

I.3.5. Stormwater Requirements

The County stormwater ordinance prohibits non-stormwater discharges to the municipal separate storm drain system and receiving waters. This includes a ban on littering, dumping of hazardous materials, toxic chemicals, landscape debris, and sanitary/septic waste. Construction site operators are required to implement runoff pollution mitigation measures, and public facilities are required to obtain NPDES permit coverage if applicable. Good housekeeping and other stormwater BMPs are required for industrial and commercial facilities.

The ordinance (part 12.80.530) specifies that installation of structural BMPs requires approval from the director and may require a plan review. Additionally, application and issuance of operating permits may be required if industrial stormwater is being treated (see County Code Title 20 Utilities, Chapter 20.36 Industrial Waste). The ordinance (part 12.80.540) also stipulates that BMPs cannot transfer pollutants to air, groundwater, surface soils, or other media in a manner that is not consistent with environmental laws and regulations. Finally, BMPs (12.80.580) are required to have inspection access, and the ordinance grants the County inspection authority for any BMP or stormwater management structure (County of Los Angeles 2009a).

I.3.6. Tree Protection Requirements

The Los Angeles County Oak Tree Ordinance (Los Angeles County Code Title 22 Planning and Zoning, Chapter 22.56 Conditional Use Permits, Variances, Nonconforming Uses, Temporary Uses and Director's Review, Part 16 Oak Tree Permits) has been established to recognize oak trees as significant historical, aesthetic, and ecological resources (County of Los Angeles Fire Department 2005). The Los Angeles County Oak Tree Ordinance applies to all County TMDL Implementation Areas. It specifies that a person may not cut, destroy, remove, relocate, inflict damage, or encroach into the protected zone of any tree of the oak tree genus that is 8 inches or more in diameter at 4.5 feet above mean natural grade, or in the case of oaks with multiple trunks, combined diameter of 12 inches or more of the two largest trunks, without first obtaining a permit. A permit is also required for any activity that might affect any oak tree, regardless of size, that was provided as a replacement tree pursuant to the Los Angeles County Oak Tree Ordinance.

Exceptions include the following (County of Los Angeles 2009d):

- Cases of emergency caused by an oak tree being in a hazardous or dangerous condition, or being irretrievably damaged or destroyed through flood, fire, wind or lightning, as determined after visual inspection by a licensed forester with the department of forestry and fire warden
- Emergency or routine maintenance by a public utility necessary to protect or maintain an electric power or communication line or other property of a public utility
- Tree maintenance, limited to medium pruning of branches not to exceed two inches in diameter in accordance with guidelines published by the National Arborists Association intended to ensure the continued health of a protected tree
- Trees planted, grown, or held for sale by a licensed nursery
- Trees within existing road rights-of-way where pruning is necessary to obtain adequate line-of-sight distances or to keep street and sidewalk easements clear of obstructions, or to remove or relocate trees causing damage to roadway improvements or other public facilities and infrastructure within existing road rights-of-way, as required by the director of LACDPW
- Removal of limbs within 10 feet of a chimney to maintain fire clearances (County of Los Angeles Fire Department 2005)

Obtaining an oak tree permit requires filling out an application form (http://planning.lacounty.gov/apps/—see the Oak Tree Permit section) and preparing an Oak Tree Report (this must be prepared by an approved expert) (County of Los Angeles Department of Regional Planning 2008; County of Los Angeles Fire Department 2005).

A hearing may be scheduled on a case-by-case basis, and the hearing may be combined if other applications have been filed for the property. Neither a public notice nor public hearing is required when removal or relocation of only one tree is proposed in conjunction with a single-family residence listed as a permitted use in the zone.

I.3.7. Additional County Permits

Additional permits from the LACDPW may be required depending on the design of a BMP. Applications for flood permits (http://dpw.lacounty.gov/spats/public/spatsfaq/forms/Road_Permit_Application.pdf) and road permits (http://dpw.lacounty.gov/spats/public/spatsfaq/forms/Flood_Permit_Application.pdf) are available online. Those application processes are likely to be more streamlined than typical because the projects will likely originate from LACDPW.

I.3.8. Recycled Water Laws

The Cross Connection and Water Pollution Control Program is responsible for overseeing new and converted recycled water reuse sites from the planning stage through final approval. This responsibility extends to consulting with project managers and engineering staff regarding plan check; attending construction meetings; conducting on-site field reviews; and granting the final approval for the safe use of recycled water. The objective is to convert new and existing major landscape irrigation systems and selected industrial facilities to recycled water using water quality criteria and guidelines for new construction found in the *Purple Book*, California Health Laws Related to Recycled Water.

Recycled water is limited to use that is approved by the California Department of Public Health, the LARWQCB, and the County's Department of Public Health. Any unauthorized use of recycled water is prohibited. Recycled water may be used only in those areas approved by the local water utility company. Approval by the local water utility company will be granted only when the applicable regulatory agencies complete all requirements (County of Los Angeles Department of Public Health 2009). Applicants must complete forms and guidelines (www.lacsd.org/civica/filebank/blobdload.asp?BlobID=4251) provided by the County.

I.3.9. Regional Planning

The County planning policies that can affect proposed BMPs are the General Plan (Land Use Element), Zoning Ordinance, Community Standards District requirements, Coastal District requirements, and Significant Ecological Areas (SEA) requirements. An update to the General Plan, developed in 2008, is in draft form (County of Los Angeles 2008). The Land Use Element of the County's General Plan outlines the general location and intensity of land use. The plan acts as a *guide* to regional decision making and directs some planning elements that include incorporated jurisdictions. When reviewing community plans as well as proposed zoning and rezoning within County TMDL Implementation Areas, the County ensures that planned development and proposed zoning is consistent with the goals and objectives and Land Use Element of the General Plan.

While the General Plan provides guidance and policy on land use matters, the County's Zoning Code (Title 22) regulates land use through six major categories of zoning districts (County of Los Angeles 2009d)

- **Residential**—Residential uses, including single-family, multi-family, mixed residential and agriculture, and planned residential development.
- **Agricultural**—Light and heavy agriculture, including varying intensities of crops and livestock.
- **Combining**—Allows for a mix for uses, including residential, commercial, office, and parking, depending on the specific zone.
- **Commercial**—Districts vary in the types of commercial uses allowed, from unlimited commercial uses to specific types, like neighborhood business.

- **Industrial**—Includes various manufacturing districts and buffer districts that specify limits to land uses.
- **Special Purpose**—A number of districts fall under this category, including institutions, mixed-use development, open space, and resort and recreation.

In addition, the Zoning Code divides the County TMDL Implementation Areas into Community Standards Districts, each of which contains development standards. Each district has a separate plan that agrees with the General Plan but outlines detailed requirements.

The Baldwin Hills Community Standards District is within the Ballona watersheds. The extent of the Community Standards District in the Ballona Creek watersheds is shown in Figure I-3.

Figure I-4 illustrates those areas in the County that apply to the general categories. Zoning districts are specified within each of the categories. The districts that the Ballona Creek watershed represent fall within all above categories. The large area within the agricultural zoning category in the Ballona Creek watershed coincides with the oil and gas mining area, which are permitted uses within the Heavy Agriculture (A-2) zoning district.

The General Plan also defines SEAs where the County seeks to maintain biological diversity. Planning within the SEAs does not involve area-wide preservation but instead focuses on maintaining a sustainable balance between new development and resource conservation. The Ballona Creek SEA is within the Ballona Creek watersheds (County of Los Angeles 2008). The extent of the SEAs in the Ballona Creek watershed is shown in Figure I-5.

If a development is proposed within an SEA, an additional level of County review is required before approval, and an applicant is required to complete documentation (http://planning.lacounty.gov/apps) in addition to the site plan application. This review is conducted by the SEA Technical Advisory Committee (SEATAC), which is a seven-member advisory committee to the Regional Planning Commission specializing in the species and ecosystems of the County. During the permitting process, SEATAC will review the proposed project and make recommendations intended to reduce or avoid impacts, particularly in the most sensitive areas of the site (County of Los Angeles 2008).

Applicants whose site plans have a natural slope of 25 percent or greater may be required to obtain a Hillside Management Conditional Use Permit (Los Angeles County Code 22.56.215). Required documentation includes a Burden of Proof (http://planning.lacounty.gov/assets/upl/apps/hillside-management_bop_20080619.pdf) that the project is designed to protect public safety.

For all sites subject to a site plan review, the County zoning code contains site dimension and setback requirements that vary depending on the location and use of the property. Those requirements are outlined in Title 22 of the Los Angeles County Code (http://ordlink.com/codes/lacounty/_DATA/TITLE22/index.html) and must be reflected in the site plan unless a variance is obtained.

In addition to the above requirements, the General Plan also outlines districts subject to the California Coastal Act. Any development within specified coastal zones must apply for a permit (www.coastal.ca.gov/cdp/CDP-ApplicationForm-scc.pdf), meet additional site design requirements, and complete additional documentation (http://planning.lacounty.gov/apps) required by the County. The Coastal Act protects a number of uses within the coastal zone, including public access to recreation and environmentally sensitive habitats (California Coastal Commission 2009). Although the California Coastal Commission is the ultimate agency with authority under the California Coastal Act, the regulations are administered locally according to the County's Local Coastal Program. Citizens who have concerns about proposed developments complying with the Coastal Act and who have already raised their concerns locally can file an appeal (www.coastal.ca.gov/cdp/CDP-ApplicationForm-scc.pdf) directly to the California Coastal Commission concerning the proposed developments (County of Los Angeles 2008).

Figure I-6 shows the boundary of the coastal zone in the vicinity of the Ballona Creek watershed. The Ballona Creek SEA is the only land in the County TMDL Implementation Area that intersects with the coastal zone.

Site plan review by the County's Regional Planning is typically completed within 6 to 8 weeks of the date of application. If the site is within a Community Standard District or SEA or within the coastal zone, the review period will be longer, and the County's Regional Planning Commission may request additional adjustments to the site plan. It could take 6 to 8 months to obtain a coastal zone development permit. Because the projects implemented through the TMDL implementation plans will originate from within the County, review time will be reduced from the typical estimates. County project review time typically takes 2 weeks.

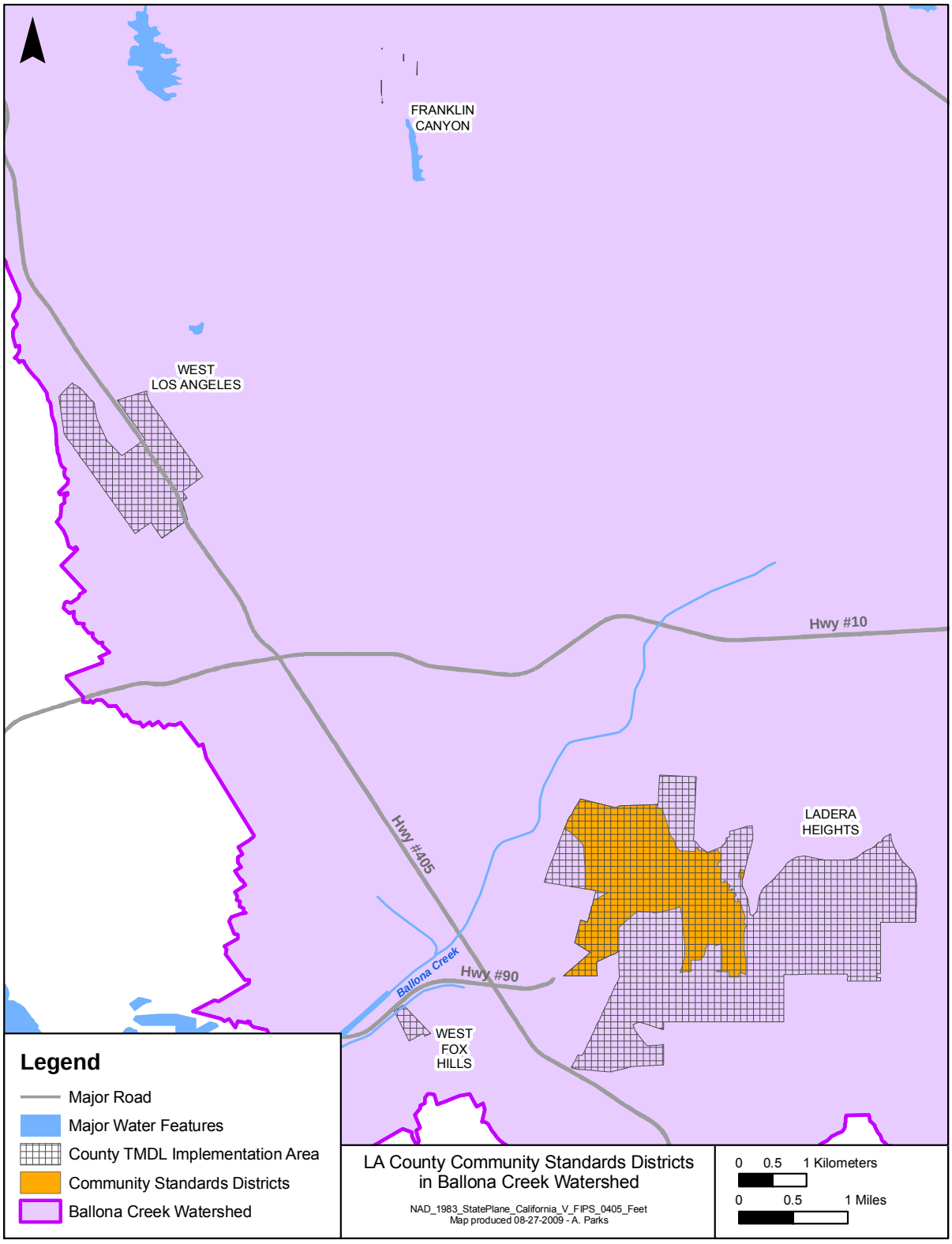


Figure I-3. Ballona Creek Community Standards Districts

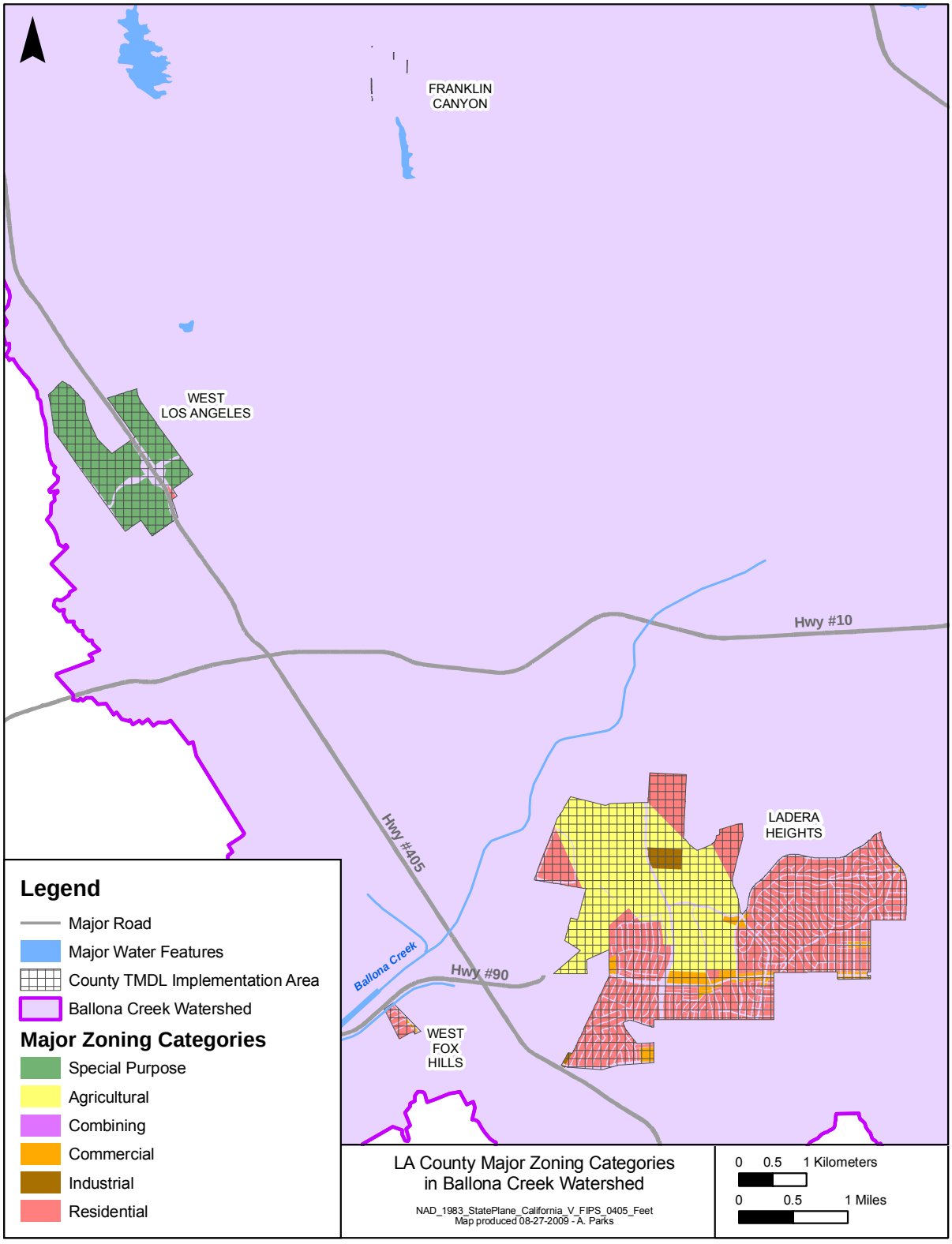


Figure I-4. Ballona Creek Major Zoning Categories

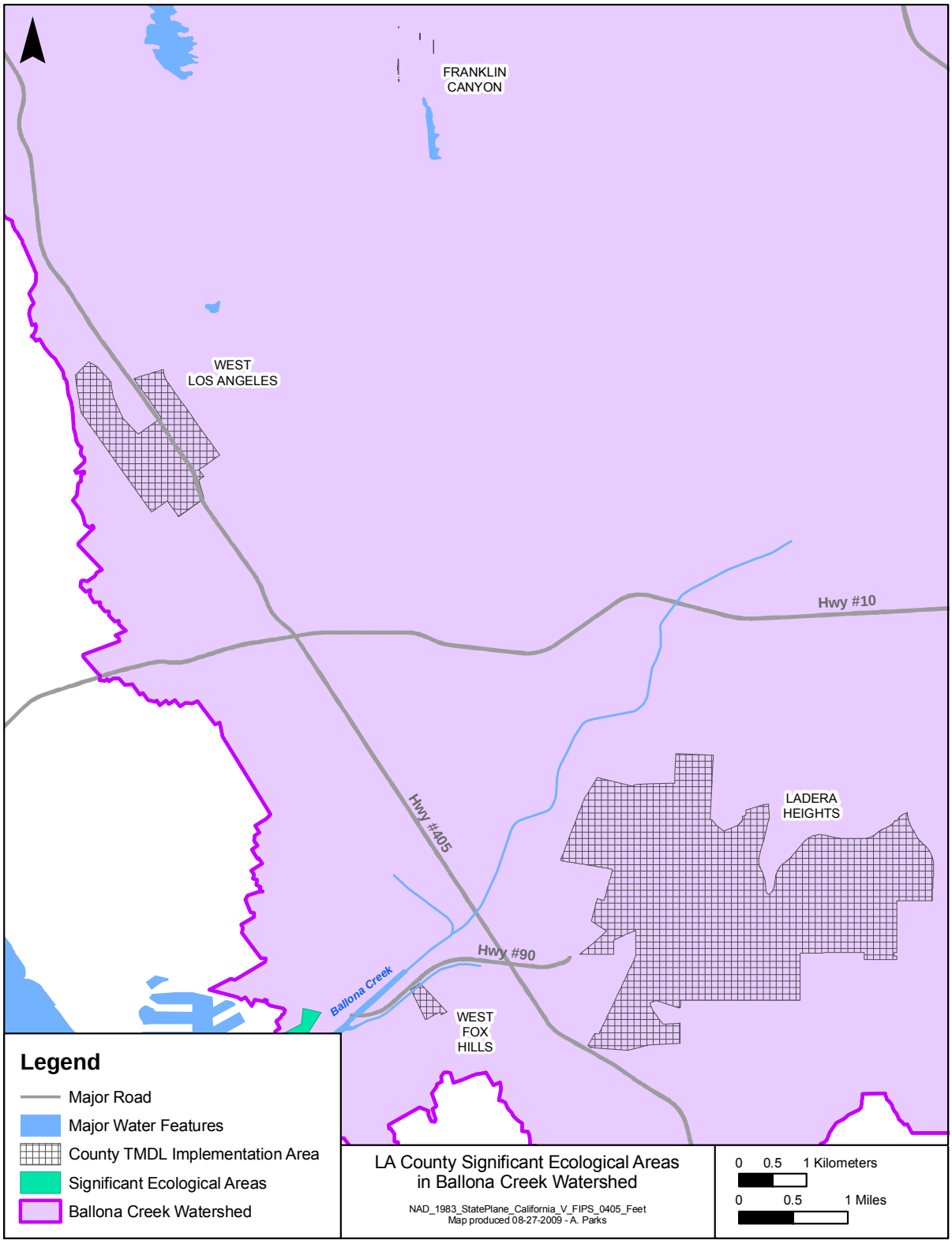


Figure I-5. Ballona Creek Significant Ecological Areas

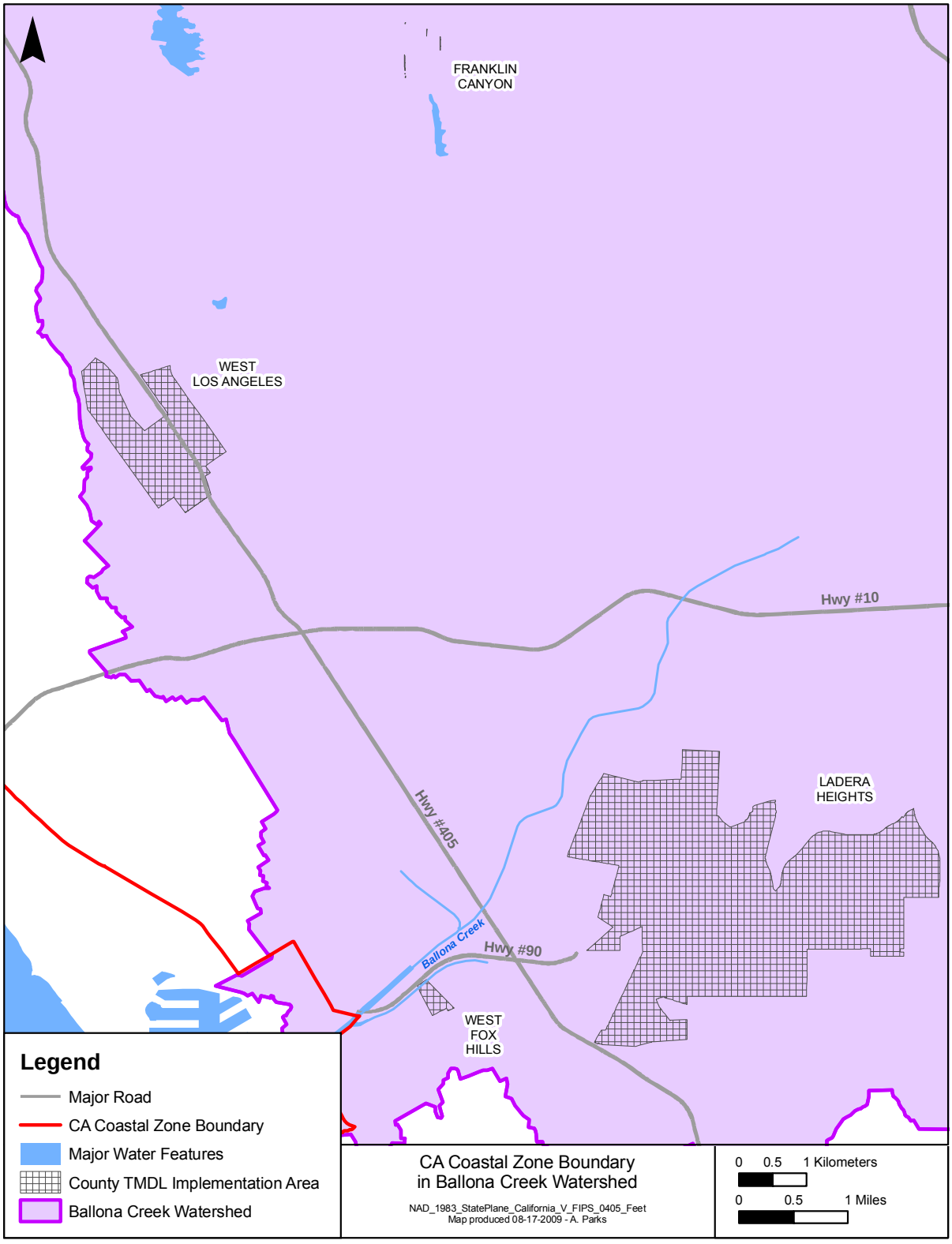


Figure I-6. Coastal Zone in the Ballona Creek Watershed

I.3.10. Sanitation Districts of Los Angeles

The Sanitation Districts are a partnership of 24 independent special districts serving about 5.3 million people in the County. The Sanitation Districts' service area covers approximately 800 square miles and encompasses 78 cities and unincorporated territory in the County. The Sanitation Districts regulate industrial dischargers. The Wastewater Ordinance (www.lacsd.org/info/industrial_waste/wastewater_ordinance.asp) requires any business that desires to discharge industrial wastewater to the districts' sewerage system to first obtain an Industrial Wastewater Discharge Permit. Businesses that discharge only domestic wastewaters (wastewaters from restrooms, drinking fountains, showers, or air conditioners used for human comfort), or businesses that are determined to have an insignificant impact on the districts' facilities might not be required to obtain an Industrial Wastewater Discharge Permit. However, exemption from obtaining a permit does not relieve a company of the responsibility to comply with conditions regulating prohibited and restricted waste discharges, or rainwater diversion requirements specified in the districts' wastewater ordinance. Businesses with no other industrial discharge that use a rainwater switch to divert rainwater from the sanitary sewer to the storm drain could be required to obtain a permit.

The criteria listed below are to be used in determining if a facility is exempt from obtaining an Industrial Wastewater Discharge Permit. That determination is to be made only by Sanitation District personnel. Facilities determined by the districts to have a potential adverse effect on the sewerage system could be required to obtain a permit.

Exempt companies include the following:

1. All restaurants and hotels
2. Small food-processing establishments with wastewater flows less than 500 gallons per day (exception: facilities discharging excessive oil and grease, excessive dissolved sulfides, or high-strength waste)
3. All retail grocery stores (exception: centralized food processing facilities for distribution to other grocery stores)
4. All 1-hour photo shops and small photo-processing facilities (exception: centralized film processing facilities)
5. School and commercial laboratories
6. Medical and professional buildings (exception: hospitals with overnight beds)
7. All pet shops, animal kennels, animal hospitals, and animal shelters
8. Warehouses
9. Auto dealers and auto repair shops (exception: radiator shops)
10. Car washes with flows less than 6 million gallons per year
11. All automotive service stations
12. Recreational vehicle dump stations
13. Other companies might be exempt as determined on a case-by-case basis

Permit applications are reviewed by engineering staff to determine if the pretreatment equipment proposed is adequate to meet appropriate discharge limits and to determine compliance with the Sanitation Districts' spill containment, flow monitoring, rainwater diversion, and combustible gas monitoring policies.

An applicant must complete an adequate permit submittal. The complete permit submittal must then be sent to the local agency (i.e., the local city or the LACDPW) for initial processing before districts' review. Contact the

applicable local agency for the appropriate permit processing fee that might be required. County contract cities are those cities that contract with the LACDPW for sewerage services. Companies in the contract cities or County TMDL Implementation Areas should send permit submittals to the LACDPW.

The permit submittal has three main parts: (1) Permit Application Form (www.lacsd.org/civica/filebank/blobdload.asp?BlobID=2459) (2) Plans, and (3) Supporting Information. Once the permit application package has been received, the permit is logged in and checked for completeness. If the submittal is determined to be incomplete, it will be automatically rejected. If determined to be complete, the permit application package will be reviewed by an Industrial Waste Section project engineer. As part of the engineer's review, additional information may be required. In some cases this can be done by phone or mail, although if necessary a company representative may be asked to meet at the Districts' Joint Administration Office to clarify certain points. If the required information is not provided, the permit application package will be rejected and returned with a list of specific corrections. Once the corrections are made, the resubmittal must be made directly to the Districts within the specified time or enforcement actions will be initiated. Once the application is determined to be complete and correct, a connection fee evaluation will be performed (LACSD 2009a).

Once the connection fee payment has cleared, the approved permit will be issued. The approved permit will include a list of requirements. The company is required to comply with all indicated items on this list as a condition of the permit approval. Failure to comply with permit requirements leads to enforcement actions and possible revocation of the Industrial Wastewater Discharge Permit (www.lacsd.org/info/industrial_waste/permit.asp).

As a condition for approval of an Industrial Wastewater Discharge Permit, an applicant might be subject to participation in the districts' Self Monitoring Program. This program requires a company to regularly furnish chemical analyses of its industrial wastewater to the districts. The type and frequency of tests to be performed are determined on a case-by-case basis depending on the quality and quantity of the industrial discharge and are included as requirements in the permit.

Regarding the connection to sanitary sewers for industrial waste discharge, the LACSD requires that an application (www.lacsd.org/civica/filebank/blobdload.asp?BlobID=2445) and a complete set of plans be submitted to connect to the sanitary sewer system. The fee will vary by District (www.lacsd.org/info/wastewater_services/default.asp) (LACSD 2009b).

Under the jurisdiction of LACDPW, oil/water separators might be required to treat discharges to the sanitary sewer from food establishments (LACDPW 2009b) or industrial facilities (LACSD 2009b). Installation of oil/water separators into the storm sewer system to treat runoff will be considered a standard urban stormwater mitigation plan BMP and will need prior approval by LACDPW as well (LACDPW 2009b).

I.4. References

BDB (Biogeographic Data Branch). 2009. California Natural Diversity Database. California Department of Fish and Game, Biogeographic Data Branch. www.dfg.ca.gov/biogeodata/cnddb/. Accessed July 2009.

California Coastal Commission. 2009. California Coastal Act. California Coastal Commission. www.coastal.ca.gov/coastact.pdf. Accessed July 2009.

CARB (California Air Resources Board). 2009a.Mobile Source Emission – Off-Road Construction Vehicles. www.arb.ca.gov/msprog/ordiesel/knowcenter.htm. Accessed July 14, 2009.

CARB (California Air Resources Board). 2009b. Portable Diesel Equipment - Airborne Toxic Control Measure for Diesel Particulate Matter From Portable Engines Rated At 50 Horsepower And Greater. http://www.arb.ca.gov/diesel/peatcm/peatcm.htm. Accessed July 14, 2009.

CARB (California Air Resources Board). 2009c. State-wide Portable Equipment Registration Program (PERP). http://www.arb.ca.gov/portable/portable.htm. Accessed July 14, 2009.

County of Los Angeles. 2000. *Development Planning for Stormwater Management: A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP).* www.ladpw.com/wmd/NPDES/SUSMP_MANUAL.pdf. Accessed July 2009.

County of Los Angeles. 2008. 2008 - Draft General Plan. Los Angeles County Department of Regional Planning. http://planning.lacounty.gov/generalplan#anc-download. Accessed July 2009.

County of Los Angeles. 2009a. Title 12 Environmental Protection. http://ordlink.com/codes/lacounty/_DATA/TITLE12/. Accessed July 2009.

County of Los Angeles. 2009b. *Low Impact Development Standards Manual*. January 2009. http://dpw.lacounty.gov/bsd/lib/fp/Drainage%20and%20Grading/dg_gd~~-LA%20County%20LID%20Manual%20(1-26-2009).pdf. Accessed July 2009.

County of Los Angeles. 2009c. Los Angeles County Code, Title 22 Planning and Zoning, Chapter 22.52 General Regulations. http://ordlink.com/codes/lacounty/_DATA/TITLE22/Chapter_22_52_GENERAL_REGULATI.html. Accessed July 2009.

County of Los Angeles. 2009d. Los Angeles County Code Title 22 Planning and Zoning, Chapter 22.56 Conditional Use Permits, Variances, Nonconforming Uses, Temporary Uses and Director's Review, Part 16 Oak Tree Permits. www.ordlink.com/codes/lacounty/_DATA/TITLE22/Chapter_22_56_CONDITIONAL_USE_.html#226. Accessed July 2009.

County of Los Angeles. 2009e. Plans and Ordinances. Los Angeles County Department of Regional Planning, Los Angeles, CA. http://planning.lacounty.gov/plans/ord. Accessed July 2009.

County of Los Angeles, Department of Public Health. 2009. County of Los Angeles Department of Public Health. Cross Connection and Water Pollution Control Program – Recycled Water. http://publichealth.lacounty.gov/eh/progs/envirp/cross_con/cross_con_recycle.htm. Accessed July 14, 2009.

County of Los Angeles Department of Regional Planning. 2008. Applications & Forms. http://planning.lacounty.gov/apps/. Accessed July 2009.

County of Los Angeles Department of Regional Planning. 2009. Los Angeles County Green Building Program. http://planning.lacounty.gov/green. Accessed July 2009.

County of Los Angeles Fire Department. 2005. Environmental Review Oak Tree Ordinance. www.fire.lacounty.gov/Forestry/EnvironmentalReview_OakTreeOrdiance.asp. Accessed July 2009.

CSLC (California State Lands Commission). 2009a. Land Management Brochure. California State Lands Commission, Sacramento, CA. www.slc.ca.gov/Division_Pages/LMD/Documents/lmd_brochure.pdf. Accessed July 13, 2009.

CSLC (California State Lands Commission). 2009b. *Land Management Home Page*. California State Lands Commission, Land Management Division, Sacramento, CA. www.slc.ca.gov/Division_Pages/LMD/LMD_Home_Page.html. Accessed July 13, 2009.

DFG (California Department of Fish and Game). 2009a. California Habitat Conservation. Department of Fish and Game, Sacramento, CA. www.dfg.ca.gov/habcon/1600/. Accessed July 2009.

DFG (California Department of Fish and Game). 2009b. California Endangered Species Act (CESA). California Department of Fish and Game, Sacramento, CA. www.dfg.ca.gov/habcon/cesa/. Accessed July 2009.

DSOD (Division of Safety of Dams). 2009. *Our Mission*. Division of Safety of Dams, Department of Water Resources, Sacramento, CA. http://www.water.ca.gov/damsafety/index.cfm. Accessed July 2009.

USACE. 1987. *Corps of Engineers Wetlands Delineation Manual.* Wetlands Research Program Technical Report Y-87-1. U.S. Army Corps of Engineers, Waterways Experiment Station, Environmental Laboratory, Vicksburg, MS. http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf.

LACDPW (Los Angeles County Department of Public Works). 2004. *Technical Manual for Stormwater Best Management Practices in the County of Los Angeles*. ftp://swrcb2a.swrcb.ca.gov/pub/rwqcb4/Stormwater/Draft_Technical_Manual/. Accessed July 2009.

LACDPW (Los Angeles County Department of Public Works). 2006a *Los Angeles County-Wide Structural BMP Prioritization Methodology.* www.labmpmethod.org/. Accessed July 2009.

LACDPW (Los Angeles County Department of Public Works). 2006b. *Manual for Preparation of Geotechnical Reports*. December 2006. http://dpw.lacounty.gov/gmed/permits/docs/manual.pdf. Accessed July 2009.

LACDPW (Los Angeles County Department of Public Works). 2009a. *Stormwater Best Management Practice Design and Maintenance Manual*. http://ladpw.org/des/Design_Manuals/StormwaterBMPDesignandMaintenance.pdf. Accessed July 2009.

LACDPW (Los Angeles County Department of Public Works). 2009b. County of Los Angeles Department of Public Works. Industrial Waste, Pretreatment. http://ladpw.org/epd/industrial_waste/pretreatment.cfm. Accessed July 14, 2009.

LACSD (Sanitation Districts of Los Angeles County). 2009a. *Connection Fees*. Sanitation Districts of Los Angeles County. www.lacsd.org/default.asp. Accessed July 14, 2009.

LACSD (Sanitation Districts of Los Angeles County). 2009b. *Industrial Waste Regulations/Permit*. Sanitation Districts of Los Angeles County, Los Angeles, CA. www.lacsd.org/info/industrial_waste/permit.asp. Accessed July 13, 2009.

LARWQCB (Los Angeles Regional Water Quality Control Board). 2004. *Section 401 Water Quality Certification Application Form*. www.swrcb.ca.gov/rwqcb4/water_issues/programs/401_water_quality_certification/401wqc_apform.pdf. Accessed July 2009.

LARWQCB (Los Angeles Regional Water Quality Control Board). 2009. *Water Quality Control Plan: Los Angeles Region Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan). www.swrcb.ca.gov/rwqcb4/water_issues/programs/basin_plan/basin_plan_documentation.shtml. Accessed July 2009.

State of California Office of Planning and Research. 2001. *Circulation and Notice under the California Environmental Quality Act*. http://ceres.ca.gov/planning/ceqa/. Accessed July 2009.

USEPA (U.S. Environmental Protection Agency) Region 9. 2009. U.S. Environmental Protection Agency, Region 9. Region 9: National Environmental Policy Act. www.epa.gov/region09/nepa/index.html. Accessed July 2009.

USEPA (U.S. Environmental Protection Agency). 2008. Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in *Rapanos v. United States* and *Carabell v. United States.* www.epa.gov/owow/wetlands/pdf/CWA_Jurisdiction_Following_Rapanos120208.pdf. Accessed July 2009.

USEPA (U.S. Environmental Protection Agency). 2009a. *Clean Water Act, Section 401 Certification*. www.epa.gov/owow/wetlands/regs/sec401.html. Accessed July 2009.

USEPA (U.S. Environmental Protection Agency). 2009b. U.S. Environmental Protection Agency. Compliance and Enforcement. www.epa.gov/compliance/basics/nepa.html. Accessed July 2009.

USFS. 2009. *U.S. Forest Service Special Uses*. U.S. Department of Agriculture, Forest Service. www.fs.fed.us/specialuses/. Accessed July 2009.

USFWS (U.S. Fish and Wildlife Service). undated. *Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service.* www.fws.gov/laws/lawsdigest/RIV1899.HTML. Accessed July 2009.

USFWS (U.S. Fish and Wildlife Service). 2005. *Habitat Conservation Plans Section 10 of the Endangered Species Act*. U.S. Fish and Wildlife Service, Endangered Species Program, Washington, DC. www.fws.gov/endangered/pdfs/HCP/HCP_Incidental_Take.pdf. Accessed July 2009.

USFWS (U.S. Fish and Wildlife Service). 2009a. Birds Protected by the Migratory Bird Treaty Act. U.S. Fish and Wildlife Service, Endangered Species Program, Washington, DC. www.fws.gov/migratorybirds/RegulationsPolicies/mbta/mbtandx.html. Accessed July 2009.

USFWS (U.S. Fish and Wildlife Service). 2009b. *Endangered Species Habitat Conservation Planning*. U.S. Fish and Wildlife Service, Endangered Species Program, Washington, DC. www.fws.gov/endangered/hcp/index.html. Accessed July 2009.

USFWS (U.S. Fish and Wildlife Service). 2009c. *Habitat Conservation Plans Under the Endangered Species Act*. U.S. Fish and Wildlife Service, Endangered Species Program, Washington, DC. www.fws.gov/endangered/factsheets/hcp.pdf. Accessed July 2009.

USFWS (U.S. Fish and Wildlife Service). 2009d. *Consultations with Federal Agencies*. U.S. Fish and Wildlife Service, Endangered Species Program, Washington, DC. www.fws.gov/endangered/consultations/index.html. Accessed July 2009.

Ventura County Planning Division. 2006. *Permitting Stream and Wetland Projects in Ventura County and along the Santa Clara River in Los Angeles County*. www.ventura.org/RMA/planning/pdf/bio/FinalPDF.pdf. Accessed July 2009.

Appendix J. Structural BMP Conceptual Monitoring Plan

Performance monitoring of stormwater BMPs is an important component of any watershed restoration program. Monitoring provides the BMP designer a mechanism to validate certain design assumptions and to quantify compliance with pollutant-removal performance objectives. The following conceptual monitoring plan was developed as a general guide for how centralized BMPs should be monitored as part of the Ballona Creek watershed TMDL implementation.

J.1. Pollutants of Concern

Selecting constituents for laboratory analysis primarily considered the TMDL pollutants of concern. The table below summarizes the pollutants recommended for structural BMP monitoring (Table J-1).

Table J-1. Pollutants Recommended for Structural BMP Monitoring

Metals	Nutrients	Other	Pathogens
Cadmium, copper, lead, selenium, silver, and zinc	Ammonia-N, TKN, nitrite/nitrate-N, TP, and orthophosphate	TSS, pH, PAH, Total PCBs, and oil and grease	*E. Coli*, *Enterococcus*, fecal coliform, and total coliforms

J.2. Monitoring Assumptions

To develop the conceptual monitoring plan and cost estimate, several assumptions were made about the anticipated designs of structural BMPs. Incorporating primary devices (i.e., weirs, flumes, culverts operating under inlet control) to allow for measuring inflow and outflow rates is assumed to be included in BMP designs. It was also assumed that construction costs of primary devices is included in construction estimates, and access to sample collection locations would not require confined space entry precautions such as hoists, forced air, or air quality meters.

J.3. Monitoring Approach for Centralized Structural BMPs

When specific monitoring plans are developed for each structural BMP, the approach should adhere to the American Society of Civil Engineers (ASCE)/USEPA *Stormwater BMP Performance Monitoring Manual* (ASCE and USEPA 2002). That manual provides guidelines for developing sampling protocols for determination of BMP performance. Adhering to the guidelines described in the manual would better enable the County to meet requirements for including the sites into the ASCE/USEPA international BMP database and participate in local, regional, and national discussions on stormwater BMP performance. In addition, the results of the monitoring approach would provide quantifiable measures as to the compliance of BMP discharge with receiving water standards and BMP pollutant removal with TMDL objectives.

The monitoring approach suggested by ASCE/USEPA uses an upstream/downstream sample location setup. The upstream sampler should be at the upstream limit of the BMP before any pretreatment devices such as forebays or filter strips. The downstream sampler should be at the outlet control device just upstream of the discharge of treated runoff to receiving waters. Samplers should be at a primary device to allow the use of a flow-monitoring device and use of the sampler for flow-paced sampling.

Monitoring should be conducted before and after construction. For the pre- and post-monitoring periods, the monitoring program should be implemented to collect samples from a minimum of four storm events per year for

a period of no less than 3 years (12 storms total). Events should be representatively distributed throughout the average precipitation regime. As noted in Section 11, the TMDL implementation schedules might not allow for the full 3 years of pre-construction monitoring; in such cases, the maximum time available for pre-construction monitoring should be used.

Grab samples should be collected at the same locations as the flow-paced samples. Samplers should be programmed to collect single-event, flow-weighted samples. It is assumed that a dedicated automatic sampler would be purchased for each site. However, it might be possible to use the samplers at other sites that do not need to be monitored during the same storm event. Additionally, grab samples should be collected for those constituents with critical, hold-time requirements. Sample analysis should be conducted by a lab that is certified to conduct the analyses of interest.

Appropriate collection of stormwater runoff samples is a labor-intensive process. It is assumed that the County would provide the staffing for implementing and executing the monitoring plan.

J.4. Monitoring Approach for Distributed Structural BMPs

For distributed BMPs on public property, a paired watershed approach is proposed in which two drainage areas of similar land use, soils, topography, and other features are monitored during pre-construction, and a distributed BMP is constructed to treat one of the drainage areas. Post-construction monitoring is then performed for both drainage areas. The results should be compared to assess the pollutant reduction provided by the treated drainage area. One pair of drainage areas would be chosen to represent each distributed BMP type.

Aside from the unique characteristics of the paired approach, the monitoring guidelines for the centralized BMPs, outlined above, should be applied to the distributed BMPs. The recommended time frame is 3 years of pre-construction monitoring; however, the implementation schedules are unlikely to allow for that time frame for the first distributed BMP projects. Post-construction monitoring is assumed to occur 3 years after construction is complete.

J.5. References

ASCE (American Society of Civil Engineers) and USEPA (U.S. Environmental Protection Agency). 2002. *Stormwater BMP Performance Monitoring Manual*. American Society of Civil Engineers, Reston, VA, and U.S. Environmental Protection Agency, Washington, DC.

Appendix K. Cost Assumptions and Estimates

For structural BMP projects, cost assumptions and estimates are included for planning, design, permits, construction, O&M, and post-construction monitoring, where applicable. Costs were estimated for each of the centralized BMPs on public property, and the costs were used to estimate an approximate cost per acre drainage area for the centralized BMPs on private property. Unit area costs were developed for the three types of distributed structural BMPs on public property identified in Section 5: porous pavement, bioretention and linear bioretention trenches. For each of these BMP types, separate costs were developed for both high- and low-infiltration rates in soil.

The costs estimated for the optimization are based on cost functions derived from literature sources and not specific to proposed sites or conditions within the County. The costs estimated in this appendix provide a more detailed consideration of components and steps involved. As a result, the more detailed methods estimated much higher costs than provided by the optimization. The relative comparison between BMPs is consistent with the optimization results. This applies to all structural BMP costs estimates, distributed and centralized.

The cost estimates in this appendix represent the *Probable Program Cost* only. These figures are supplied as a guide only and could deviate from the actual program cost. The accuracy of these cost estimates is affected by the fluctuation in cost of material, labor, components, or unforeseen contingencies within the market place. The acronyms used in the tables are defined as follows:

CY: Cubic yard
LF: Linear foot
LS: Lump sum
SF: Square foot
SY: Square yard

The following tables report the components considered, their cost, and the total cost estimate for each BMP or BMP type. All costs are in 2009 dollars and present value terms.

K.1. Catch Basin Distributed BMPs: Cost Assumptions and Estimates

Two phases of catch basin inserts are proposed. In Phase 2, catch basin inserts for sediment and trash removal would be installed in 30 percent of the catch basins in the County TMDL implementation Area. In Phase 3, near the end of TMDL implementation, catch basin inserts would be installed in the remaining catch basins in the implementation area. Costs were based on the County's experience with the full capture device installation program, vendor prices for sediment removal inserts, and best professional judgment.

The purchase and installation costs were based on the average cost of catch basin inserts from several vendors and USEPA (2009). In addition to the insert cost, the purchase of a vacuum truck was included, which would be required for removing sediment during maintenance (USEPA 2009). Design costs are assumed to be 10 percent of purchase and installation costs.

Maintenance of the sediment-removal portion of the inserts would likely occur in the maintenance schedule that is being planned for the full capture devices. Therefore, the full cost of maintenance is not attributed to this BMP, and only the additional cost attributed to the sediment-removal portion of the inserts is included. That additional cost includes operating the vacuum truck, which was assumed to cost similar to the operation of the County's street sweepers at $80 per hour. Depending on the type of insert, materials might need to be replaced periodically at an approximate cost of $125 per year. Staff and disposal costs are assumed not to increase significantly from

what is needed for the full capture devices. Necessary monitoring is assumed to be included in the O&M activities for the full capture devices.

Table K-1. Nonstructural BMPs: Catch Basin Inserts Phase 2

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	3	Meeting	$1,000	$3,000
2	**Design**	1	LS	--	$4,500
3	**Permits/Studies**	1	LS	--	$45,000
4	**Purchase and Installation**				
	Catch Basin Insert Purchase and Installation	115	Each	$3,000	$345,000
	Vacuum Truck Purchase	1	Each	$150,000	$150,000
	Purchase and Installation Total				$495,000
5	**Operation, Maintenance, and Monitoring**	1	LS	--	$410,000
	Project Total				$953,000
	Total Estimate (rounded)				$950,000

Table K-2. Nonstructural BMPs: Catch Basin Inserts Phase 3

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	3	Meeting	$1,000	$3,000
2	**Design**	1	LS	--	$4,500
3	**Permits/Studies**	1	LS	--	$45,000
4	**Purchase and Installation**				
	Catch Basin Insert Purchase and Installation	255	Each	$3,000	$765,000
	Vacuum Truck Purchase	1	Each	$150,000	$150,000
	Purchase and Installation Total				$915,000
5	**Operation, Maintenance, and Monitoring**	1	LS	--	$910,000
	Project Total				$1,873,000
	Total Estimate (rounded)				$1,870,000

K.2. Other Structural BMPs: Cost Assumptions and Estimates

Below are general cost assumptions developed for public property distributed BMPs (such as porus pavement and biorention areas) and for centralized BMPs on public and private property. More detailed assumptions are provided, as needed, by subsection.

Planning

Costs for planning include the effort required to further develop the project concept, which, depending on the complexity of the project, could result in preparing a Project Concept Report. Additionally, administrative costs for the County to administer, manage and coordinate the project's implementation are included with the planning costs. Administrative costs can vary widely with the complexity of the project, but for purposes of comparison, a value of 5 percent of the capital costs is assumed for planning.

Permitting

Section 8 identifies regulatory requirements and environmental permits required to implement potential BMPs. The section addresses the regulations that apply to general types of structural BMPs and notes that the applicability of many of the regulations for a specific project depends on its site or design characteristics. Because the requirements imposed by regulatory agencies often have an effect on the project cost, permits were assessed for each of the centralized BMP projects on public property, and the associated cost is included in the analysis.

Because the opportunities identified for distributed structural BMPs in Section 5 are for areas of impervious cover and not applied to vacant or open spaces, the permitting effort anticipated for such projects is minimal, if any. Therefore, no separate costs are identified in the analysis for permitting. It is assumed that any permitting costs associated with the construction phase, such as erosion and sedimentation control, are included with the construction costs.

Design

Designing structural BMPs requires collecting data, analyzing it, and preparing documents that can be used for constructing a project. Data collection could include geotechnical investigations, field investigation of existing utilities (potholing), and a topographic survey for mapping. The design deliverables are project plans and specifications that can be bid by a contractor for construction. Engineering costs can vary widely depending on the complexity of the project. For the purposes of the cost estimates, fixed rates of 5 and 30 percent were applied to the distributed and centralized BMP construction costs, respectively, to estimate the design/engineering cost. A lower percent was used for distributed BMP design costs because those BMPs are expected to have less time-intensive designs compared to centralized BMPs.

Construction

The typical levels of construction cost estimates are as follows:

- **Preliminary/Order of Magnitude**—provide a range of costs at the planning level for a conceptually defined project
- **Budget**—cost estimates based on layouts and specific quantities
- **Final/Definitive**—prepared after the design documents are complete

Because of the preliminary nature of the projects, the estimates developed for the proposed centralized BMPs on public property lie between the preliminary/order of magnitude and budget level estimates, with an expected accuracy of about plus 40 percent to minus 25 percent. The estimates for centralized BMPs on private property and distributed BMPs are expected to have a lower accuracy because such cost estimates are not site-specific and are in the preliminary/order of magnitude category.

To the extent possible, construction costs are based on approximate quantifications of the BMPs major components. Because some of the project components have not been fully defined at this preliminary stage, contingency factors of 15 percent for distributed and 25 percent for centralized BMPs are applied to the construction cost subtotal to estimate the total construction costs and capture expected but as yet unidentified additional costs. The costs could arise from site-specific field conditions such as those associated with utility relocations, dewatering, and erosion and sedimentation control. At this stage of project development, the contingency also includes an allowance for such items as mobilization, field facilities, and construction scheduling, which might be required but are not specifically itemized. Note that a higher contingency of 25 percent is applied to the centralized structural BMP project estimates, compared to the 15 percent applied to the distributed BMPs, because the centralized structural projects are considered more complex in nature with a greater risk for increased costs.

Operation and Maintenance

Consistent with the O&M assumptions used in the optimization (Appendix G), the following assumptions were used:

- Infiltration Basin Annual Maintenance Cost: 6.72 percent of the construction cost
- Extended Detention Basin Annual Maintenance Cost: 4 percent of the construction cost
- Porous Pavement Annual Maintenance Cost: $0.0076 per square foot
- Bioretention Annual Maintenance Cost: $0.05 per gallon void capacity

As noted in the general cost assumptions for all BMPs above, the planning through construction phases for individual cost estimates is assumed to occur in year 0, and O&M costs are assumed to begin in year 1 and end in year 20.

Post-Construction Monitoring

Appendix H outlines the recommended monitoring plan for the structural BMPs. For centralized BMPs (either on public or private property), pre-construction monitoring is assumed to occur up to 1 year before construction. The recommended time frame is 3 years of pre-construction monitoring; however, the implementation schedules are unlikely to allow for that time frame. Post-construction monitoring is assumed to occur 3 years after construction is complete. The cost of pre- and post-construction monitoring for each centralized BMP is estimated as about $69,000, including the cost of automatic samplers, lab analysis, and labor.

For distributed BMPs on public property, a paired watershed approach is proposed in which two drainage areas of similar land use, soils, topography, and other features are monitored during pre-construction, and a distributed BMP is constructed to treat one of the drainage areas. Post-construction monitoring would be performed for both drainage areas. The results would be compared to assess the pollutant reduction provided by the treated drainage area. Pre-construction monitoring is assumed to occur up to 1 year before construction. The recommended time frame is 3 years of pre-construction monitoring; however, the implementation schedules are unlikely to allow for that time frame for the first distributed BMP projects. Post-construction monitoring is assumed to occur 3 years after construction is complete. The cost estimate assumes that for each type of distributed BMP, one site would be monitored as a representative site. The cost of pre- and post-construction monitoring for both centralized BMPs on public property is estimated as about $124,000, including the cost of automatic samplers, lab analysis, and labor.

The planning-level cost estimates for porous pavement BMPs were developed using the above-stated assumptions that apply to all distributed, structural BMPs. The construction cost component of the estimate was developed specifically for porous pavement with the following additional assumptions:

1. Existing asphalt removal is required.
2. BMPs in low infiltration soil areas require additional excavation, deeper substrate material and installation of an underdrain system consisting of perforated PVC pipe.
3. The design parameters include a 2-foot depth for the substrate and a 1-foot depth for the underdrain.

Costs for bioretention BMPs were developed similarly to those for porous pavement, with the following construction cost considerations:

1. Existing asphalt removal is required.
2. BMPs in low-infiltration soil areas require additional excavation, deeper substrate material, and installing an underdrain system consisting of perforated PVC pipe spaced at 5 feet on center.
3. The design parameters include a 3-foot depth for the substrate and an additional 1-foot depth for the underdrain in low-infiltration soil areas.

4. A ponding depth of 0.5 foot is assumed for the excavation quantity take-off.

Construction costs were developed for a 1-acre surface area. Planning and design costs, which represent a percentage of the capital costs, are summed with O&M and post-construction monitoring costs to develop a planning-level unit cost for each type of BMP. To estimate the alternatives costs, the unit cost per acre is applied toward the total implementation surface area to estimate a total project cost for each type of distributed BMP.

Because the components for linear bioretention trench BMPs are similar to those for bioretention BMPs, the unit costs are assumed to be the same for both BMPs.

K.2.1. Cost for Distributed BMPs on Public Land

Table K-3 presents the square foot costs estimated for each type of distributed BMP. The assumptions for each BMP are described below. Because monitoring would not be conducted at each BMP site, the square foot unit costs are reported with and without monitoring costs. The cost analysis for the distributed BMPs on public property is presented in the tables below. Because bioretention and linear bioretention trenches are estimated to have the same cost, one table of detailed costs is provided for both BMPs per soil type.

Table K-3. Unit Cost Estimates for Other Distributed BMPs on Public Land

Description	Square Foot Unit Price without Monitoring	Square Foot Unit Price with Monitoring
Porous Pavement (low-infiltration soils)	$21.00	$24.00
Porous Pavement (high-infiltration soils)	$18.00	$21.00
Bioretention (low-infiltration soils)	$21.00	$24.00
Bioretention (high-infiltration soils)	$18.00	$21.00
Linear Bioretention (low-infiltration soils)	$21.00	$24.00
Linear Bioretention (high-infiltration soils)	$18.00	$21.00

Table K-4. Distributed BMPs on Public Land: Bioretention and Linear Bioretention Cost Estimate, Low Infiltration

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	1	LS	--	$29,027
2	**Design**	1	LS	--	$29,027
3	**Permits/Studies**	1	LS	--	$0
4	**Construction**				
	Asphalt/Base Removal	4,840	SY	$8	$38,720
	Excavation/Haul (4.5 ft. depth)	7,260	CY	$25	$181,500
	Media (3 ft. depth)	4,840	CY	$30	$145,200
	Underdrain	8,712	LF	$6	$52,272
	Planting	43,560	SF	$2	$87,120
	Construction Total for 1 acre (43,560 SF)				$504,812
	Contingency for Planning Stage Estimate (15%)				$75,722
	Construction Total				$580,534
5	**O&M**	1	LS	--	$243,633
6	**Pre- and Post-Construction Monitoring**	1	LS	--	$124,000
	Project Total				$1,006,220
	Total Estimate (rounded)				$1,010,000
	Unit Cost without monitoring	1	SF	$21	
	Unit Cost with monitoring	1	SF	$24	

Table K-5. Distributed BMPs on Public Land: Bioretention and Linear Bioretention Cost Estimate, High Infiltration

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	1	LS	--	$23,702
2	**Design**	1	LS	--	$23,702
3	**Permits/Studies**	1	LS	--	$0
4	**Construction**				
	Asphalt/Base Removal	4,840	SY	$8	$38,720
	Excavation/Haul (3.5 ft.)	5,647	CY	$25	$141,175
	Media (3 ft. depth)	4,840	CY	$30	$145,200
	Planting	43,560	SF	$2	$87,120
	Construction Total for 1 acre (43,560 SF)				$412,215
	Contingency for Planning Stage Estimate (15%)				$61,832
	Construction Total				$474,047
5	**O&M**	1	LS	--	$243,633
6	**Pre- and Post-Construction Monitoring**	1	LS	--	$124,000
	Project Total				$889,085
	Total Estimate (rounded)				$890,000
	Unit Cost without monitoring	1	SF	$18	
	Unit Cost with monitoring	1	SF	$21	

Table K-6. Distributed BMPs on Public Land: Porous Pavement Cost Estimate, Low Infiltration

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	1	LS	--	$40,020
2	**Design**	1	LS	--	$40,020
3	**Permits/Studies**	1	LS	--	$0
4	**Construction**				
	Asphalt/Base Removal	4,840	SY	$8	$38,720
	Excavation/Haul (3 ft. depth)	4,840	CY	$25	$121,000
	Underdrain	8,712	LF	$6	$52,272
	Gravel Sub-base (2.5 ft.)	4,840	SY	$35	$169,400
	Porous Pavement (.5 ft. thickness)	4,840	SY	$65	$314,600
	Construction Total for 1 acre (43,560 SF)				$695,992
	Contingency for Planning Stage Estimate (15%)				$104,399
	Construction Total				$800,391
5	**O&M**	1	LS	--	$4,126
6	**Pre- and Post-Construction Monitoring**	1	LS	--	$124,000
	Project Total				$1,008,556
	Total Estimate (rounded)				$1,010,000
	Unit Cost without monitoring	1	SF	$21	
	Unit Cost with monitoring	1	SF	$24	

Table K-7. Distributed BMPs on Public Land: Porous Pavement Cost Estimate, High Infiltration

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	1	LS	--	$34,695
2	**Design**	1	LS	--	$34,695
3	**Permits/Studies**				$0
4	**Construction**				
	Asphalt/Base Removal	4,840	SY	$8	$38,720
	Excavation/Haul (2 ft. depth)	3,227	CY	$25	$80,675
	Gravel Sub-base (1.5 ft.)	4,840	SY	$35	$169,400
	Porous Pavement (.5 ft. thickness)	4,840	SY	$65	$314,600
	Construction Total for 1 acre (43,560 SF)				$603,395
	Contingency for Planning Stage Estimate (15%)				$90,509
	Construction Total				$693,904
5	**O&M**	1	LS	--	$4,126
6	**Pre- and Post-Construction Monitoring**	1	LS	--	$124,000
	Project Total				$891,420
	Total Estimate (rounded)				$900,000
	Unit Cost without monitoring	1	SF	$18	
	Unit Cost with monitoring	1	SF	$21	

K.2.2. Centralized BMPs on Public Land: Ladera Park BMP Cost Estimate

The 15-acre Ladera Park is on the south side of West Slauson Avenue, west of La Brea Avenue in the Ladera Heights/Viewpark-Windsor Hills community of unincorporated County area. About 184 acres drain to the park. From the BMP optimization results in Section 6, a 2.25-acre infiltration area with a 13.3-acre-feet storage capacity is identified to meet TMDL requirements. Assuming that the infiltration area runs along the length of the park (about 1,600 feet), a width of about 60 feet would be required.

Planning

Planning costs are as described in general terms above and are represented as 5 percent of the construction costs.

Permits

The permit requirements identified in Section 8 for the infiltration basins were assessed for applicability to the specific project. The following permits might be necessary:

- **CARB Regulations**—It is likely that the air quality requirements would pertain only to the construction phase and could be readily met by the contractor.
- **Geotechnical Reporting Requirements**—A soils investigation would be required for the project's design. It is not anticipated that it would be required before this phase, and its costs are included with the design.
- **Sedimentation and Erosion Control Requirements**—These elements would be implemented with the project's design. BMPs during construction to control erosion and stormwater runoff would be the

responsibility of the contractor, and the costs for implementation are included in the estimate's contingency.

- **CEQA and Tree Protection Requirements**—Although no ordinances in the County are similar to the County's Oak Tree Ordinance for protecting sycamores, it is anticipated that the public would challenge the removal of existing mature sycamores for the project's construction. In essence, the project could receive either a Negative Declaration, a Mitigated Negative Declaration, or an EIR. A preliminary opinion from the County is that that a Mitigated Negative Declaration under CEQA might be required where changes to the project, or mitigative measures could be required, to reduce or eliminate impacts before a Negative Declaration can be issued. The review process and determination is estimated to cost about $50,000 and is likely to take about 6 months to complete (possibly up to one year).
- **Permits Related to Endangered and Threatened Species**—The County reviewed GIS data on endangered and threatened species observations from the California Natural Diversity Database, which is developed by the Biogeographic Data Branch of DFG (BDB 2009). Very few species protected by either the federal ESA or the CESA have been observed in the vicinity of Ladera Park, and the project boundary does not overlap with the estimated locations for listed species that have been observed and are believed to inhabit the area. The approximate observed location of the federal and state endangered plant *Astragalus tener var. titi* intersects with the site; however, the data indicate that the species is possibly extirpated from the location. The preferred habitat of the species is sand dunes, which are not present on the site. The biological survey included in the CEQA process would provide the necessary determination, and the mitigated negative determination could be provided to California Fish and Game for verification. Because the species is unlikely to be present, no additional permitting cost is assumed.

All anticipated regulations, except for the anticipated Mitigative Negative Declaration, can be addressed during design; therefore, the costs for compliance are included in that phase.

Design

Design fees include topographic survey and mapping, geotechnical investigation and recommendations, field location of utilities, and preparing plans and specifications. Design costs are estimated as 30 percent of construction costs.

Construction

Quantities for some of the major components were estimated on the basis of the park layout, i.e., length of storm drain. Other costs for some of the LID improvements are based on nominal quantities that serve as a placeholder for their associated costs. A substantial cost is included for replacing mature sycamore trees to daylight the park storm drain through the low-lying areas of the park.

Maintenance

The general assumptions and methods for O&M were applied as described above. The annual maintenance cost for the infiltration basin is assumed as 6.72 percent of the construction cost.

Pre- and Post-Monitoring

The general assumptions and methods for pre- and post-construction monitoring were applied as described above.

Table K-8. Centralized BMPs on Public Land: Ladera Park BMP Cost Estimate

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	1	LS	--	$79,100
2	**Permits/Studies**	1	LS	--	$50,000
3	**Design**	1	LS	--	$474,500
4	**Construction**				
	Mobilization	1	LS	--	$60,000
	Tree Removal	20	Each	$2,000	$40,000
	Storm Drain (24-inch RCP)	100	LF	$200	$20,000
	Junction Structure	2	Each	$5,000	$10,000
	Inlet/Outlet Structure	2	Each	$25,000	$50,000
	Excavation for Infiltration Basin (7' x 60' x 1,600')	25,000	CY	$25	$625,000
	Infiltration Basin Preparation	7,260	SF	$20	$145,200
	Pedestrian Bridge for Stream Crossing	5	Each	$5,000	$25,000
	Porous Pavement	1,000	SF	$15	$15,000
	Native Landscaping	1,000	SF	$25	$25,000
	Tree Replacement	20	Each	$12,000	$240,000
	Planter Boxes	10	Each	$1,000	$10,000
	Subtotal				$1,265,200
	Contingency for Planning Stage Estimate (25%)				$316,300
	Construction Total				$1,581,500
5	**O&M**	1	LS	--	$1,320,000
6	**Pre- and Post-Construction Monitoring**	1	LS	--	$69,000
	Project Total				$3,574,100
	Total Estimate (rounded)				$3,600,000

K.2.3. Centralized BMPs on Public Property: West Los Angeles Community College Cost Estimate

From the BMP optimization results in Section 6, a 1.3-acre detention basin with a 5.1-acre-feet storage capacity is identified for the needed TMDL benefit. The only remaining open space in the mostly built-out West Los Angeles Community College is composed of an athletic field and parking lot in the southwestern corner of the site. Assuming that the detention basin can be constructed in the parking area, a storm drain about 600 feet long would be required to divert water from the existing County storm drain paralleling Freshman Drive.

Planning

Planning costs are as described in general terms above and are represented as 5 percent of the construction costs.

Permits

The permit requirements identified in Section 8 for the structural BMPs—stormwater treatment or storage facilities, centralized—are thought to be similar to those that would be required for detention ponds. Such requirements were assessed for applicability to the specific project. The following permits might be necessary:

- **CARB Regulations**—It is likely that the air quality requirements would pertain only to the construction phase and could be readily met by the contractor.
- **Geotechnical Reporting Requirements**—A soils investigation would be required for the project's design. It is not anticipated that it would be required before this phase and its costs are included with the design.
- **CEQA and Tree Protection Requirements**—No CEQA or Tree Protection requirements are anticipated as the BMPs would be located on existing ballfields.
- **Sedimentation and Erosion Control Requirements**—These elements would be implemented with the project's design. BMPs during construction to control erosion and stormwater runoff would be the responsibility of the contractor.
- **Permits Related to Endangered and Threatened Species**—The County reviewed GIS data on endangered and threatened species observations from the California Natural Diversity Database which is developed by the Biogeographic Data Branch of DFG (BDB 2009). The project site intersects with two approximate observed locations of listed species. The approximate observed location of the federal and state endangered plant *Astragalus tener var. titi* intersects with the site; however, the data indicate that the species is possibly extirpated from this location. The preferred habitat of the species is sand dunes, which are not present on the site. The approximate observed location of the federal threatened bird *Polioptila californica californica* intersects with the site. During permitting, the likelihood of the species to occur adjacent to the site would need to be assessed. If occupied habitat is discovered on the edge of the project, the species could be affected indirectly by the project. If potential habitat exists but no recent surveys exist, protocol surveys might need to be conducted to confirm the presence or absence of the species. From aerial photographs, it appears unlikely that suitable habitat is adjacent to the project. If the species is observed adjacent to the site, significant effects would probably occur, and a mitigation measure could be proposed to avoid construction during the nesting period for the species. A mitigated negative determination would need to be submitted to the U.S. Fish and Wildlife Service, but an incidental take permit is unlikely to be needed. The survey work and determination for both species are estimated to cost about $50,000 and are likely to take about 6 months to complete (possibly up to one year).

All anticipated regulations can be addressed during design; therefore, the costs for compliance are included in that phase, and no separate cost is assigned for permits.

Design

Design fees include the cost for topographic survey and mapping, geotechnical investigation and recommendations, field location of utilities, and preparing plans and specifications. The cost of design is estimated as 30 percent of construction costs.

Construction

Quantities for some of the major components were estimated on the basis of the facility layout, i.e., detention area, storm drain lateral, junction structure.

Maintenance

Per Task 4.2.3, the annual maintenance cost was estimated for a detention basin assuming 4 percent of capital cost. PV is based on a 20-year project life and an interest rate of 5 percent. This equates to 0.498 times the capital cost. Maintenance of a detention basin would involve routinely inspecting for erosion of the slopes or bottom, monitoring sediment accumulation, and removing trash. Less frequently, the basins would be cleaned out.

Pre- and Post-Monitoring

The general assumptions and methods for pre- and post-construction monitoring were applied as described above.

Table K-9. Centralized BMPs on Public Land: West Los Angeles Community CollegeBMP Cost Estimate

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	1	LS	--	$39,800
2	**Design**	1	LS	--	$239,100
3	**Permits/Studies**	1	LS	--	$50,000
4	**Construction**				
	Mobilization	1	LS	--	$30,000
	Storm Drain	1,200	LF	$200	$240,000
	Junction Structure	2	Each	$5,000	$10,000
	Inlet/Outlet Structure	2	Each	$50,000	$100,000
	Excavation	8,300	CY	$25	$207,500
	Landscaping	10,000	SF	$5	$50,000
	Subtotal				$637,500
	Contingency for Planning Stage Estimate (25%)				$159,400
	Construction Total				$796,900
5	**O&M**	1	LS	--	$397,200
6	**Pre- and Post-Construction Monitoring**	1	LS	--	$69,000
	Project Total				$1,592,000
	Total Estimate (rounded)				$1,600,000

K.2.4. Costs for Centralized Structural BMPs on Private Property

To estimate planning-level costs estimates for centralized structural BMPs on private property, the costs for the Ladera Park and West Los Angeles Community College BMPs were divided by their respective storage capacities. This yielded a cost per storage capacity, in acre-feet, which was applied to the recommended storage capacity for centralized BMPs on private property. Cost assumptions for the planning through monitoring phases are similar to the Laedera Park and West Los Angeles Community College projects described above.

Because this is privately owned land, estimated land acquisition costs were also included. Fee simple acquisition of the BMP site was assumed. Acquisition through purchase of conservation easements would likely be possible on some sites, in which case the cost estimates would be lower.

Initial steps in the land acquisition include identification of potential parcels for BMPs and landowner outreach. Criteria would be developed to prioritize parcels and landowner information would be obtained from the property tax database for high and medium priority parcels. Once landowner contact information is compiled into a priority parcel database, a landowner outreach strategy should be developed. The strategy should include at minimum:

- Development of Information Packet
  - Develop a cover letter explaining the purpose and contents of the packet.
  - Provide a narrative of BMP construction process; sequential pictures of BMP construction process, showing various stages of excavation, construction, and vegetation growth; copies of 30

percent design drawings of the site for one or more BMP; and several examples of BMP finished products.
    - Determine if construction easement is needed and what options are available for the easement, and possible location of maintenance easement.
    - Determine which acquisition options are available (e.g. fee simple acquisition may not be possible if the BMP is not located on the edge of a property).
    - Include the following example documents: Option Agreement Template, BMP Easement Template, and Temporary Construction Easement Template.

- Initial Landowner Contact
    - Develop the message and information that will be provided during the initial contact, including brief explanation of BMP design and potential benefits of project.

- First On-site Meeting with the Landowner
    - Develop key talking points for first on-site meeting with landowner.
    - Develop form to document landowner interest including but not limited to landowner's concerns and questions, landowner's provisions for agreeing to the project (e.g., requires a fence around the BMP), and level of interest.

- Maintain Database of Priority Parcels
    - Update priority parcel database at least annually, including updating new parcel identification, progress on landowner contacts, and status of negotiation/agreement.

Table K-10. Centralized BMPs on Private Land Estimated Costs

Description	Infiltration Basin Cost	Detention Basin Cost
Land Acquisition	$5.6 million/acre	$5.6 million/acre
Planning through Construction	$220,000/acre-ft	$290,000/ac-ft
Maintenance	$131,000/year	$63,100/year
Pre-Construction Monitoring	$35,000/year	$56,100/year
Post-Construction Monitoring	$16,500/year	$26,500/year
Total PV Cost	**$16,720,755**	**$10,147,569**

K.3. Nonstructural BMPs: Cost Assumptions and Estimates

For nonstructural BMP projects, costs are included for planning, permitting, and other upfront costs. In addition, annual and long-term costs are estimated, which include program operation and evaluation costs. The general assumptions made in developing the cost estimates are described in the following section.

K.3.1. General Cost Assumptions for Nonstructural BMPs on Public Property

Planning

For most nonstructural BMPs, planning costs include the approximate cost of staff time to attend planning meetings toward implementing the BMP. The same assumptions for meeting cost were used for each nonstructural BMP. Each meeting length was assumed to be 2 hours, and it was assumed that four staff members would attend each meeting: administrative assistant level II, program manager level I, program manager level II, and management specialist level I. Hourly rates for the staff used approximately represent staff rates from County departments. Each meeting cost is estimated as $500. The number of meetings varies for some nonstructural

BMPs, but it was assumed that at least three planning meetings would be required: (1) initial discussion involving brainstorming, questions, and planning assignments; (2) presenting and discussing initial plans; and (3) finalizing implementation plans.

Permitting

As discussed in Section 8, very few permitting requirements are likely to be required for nonstructural BMPs. For most of the nonstructural BMPs, the permitting cost is assumed to be zero.

Other Upfront Costs

Each nonstructural BMP varies as to the type of materials, labor, and other costs required to implement the program. Such cost assumptions were developed separately for each BMP.

Program Operating Costs

Annual costs to operate programs were estimated for each nonstructural BMP.

Program Evaluation

For each nonstructural BMP, approximate costs for monitoring or program evaluation are included. For some BMPs, program evaluation was already being conducted for an existing program and additional costs evaluation costs would not be necessary.

Table K-11. Nonstructural BMPs: TMDL-specific Stormwater Training

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	3	Meeting	$800	$2,400
2	**Training Material Preparation**	1	LS	--	$8,000
3	**Program Operation (20 years)**				
	Training Materials	1	LS	--	$6,000
	Material Updates	1	LS	--	$26,000
	Staff Attendance at Training	1	LS	--	$62,000
	Individual Division Training (first three years)	1	LS	--	$203,000
	Program Operation Total				$297,000
4	**Program Evaluation**	1	LS	--	$8,000
	Project Total				$315,400
	Total Estimate (rounded)				$320,000

Table K-12. Nonstructural BMPs: Enhancement of Commercial and Industrial Facility Inspections

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	2	Meeting	$1,000	$2,000
3	**Program Operation (20 years)**				
	Conduct Audits (every 5 years)	1	LS	--	$3,000
	Communicate Audit Results (after every audit)	1	LS	--	$2,000
	Program Operation Total				$5,000
4	**Program Evaluation (every 5 years, 20 years total)**	1	LS	--	$7,000
	Project Total				$14,000
	Total Estimate (rounded)				$14,000

Table K-13. Nonstructural BMPs: Smart Gardening Program Enhancements: Workshops in the Ballona Creek Watershed

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Initial Workshops**				
	Department and division planning meetings	3	Meeting	$500	$1,500
	Conduct 1 workshop per year for 3 years	1	LS	--	$3,800
	Initial Workshops Total				$5,300
2	**Information Center**				
	Department and division planning meetings	3	Meeting	$500	$1,500
	Design of information center	1	Each	$500	$500
	Construction of information center	1	Each	$4,500	$4,500
	Conduct workshops at information center (3 workshops per year for 17 years)	1	LS	--	$33,800
	Information center maintenance	1	LS	--	$10,100
	Information Center Total				$50,400
3	**Post-Implementation Evaluation**	1	LS	--	$0
	Project Total				$55,700
	Total Estimate (rounded)				$56,000

Table K-14. Nonstructural BMPs: Smart Gardening Program Enhancements: Workshop Tip Cards on Water Quality

Item	Description	Estimated Quantity	Unit	Unit Price	Total
1	**Planning**	3	Meeting	$700	$2,100
2	**Tip Card Development**	1	LS	--	$1,200
3	**Tip Card Printing (distribute at 54 workshops over 20 years)**	1	LS	--	$400
	Project Total				$3,700
	Total Estimate (rounded)				$4,000

Table K-15. Nonstructural BMPs: Reduction in Irrigation Return Flow + Xeriscaping

Item	Description	Estimated Quantity	Unit	Unit Price	Total
A. Smart Controller Rebates Program					
1	**Planning and Initial Marketing**				
	Initial Planning	800	Hours	$65	$52,000
	Marketing Tools	1	LS	--	$40,000
	Planning and Initial Marketing Total				**$92,000**
2	**Program Operation (20 years)**				
	Program Maintenance	1	LS	--	$244,000
	Direct Mailings (50 letters, once per year)	1	LS	--	$1,000
	Rebates (12 per year)	1	LS	--	$45,000
	Contractor Installation	1	LS	--	$18,000
	Program Operation Total				**$308,000**
3	**Post-Implementation Evaluation (20 years)**				
	Participant Surveys (12 per year)	1	LS	--	$300
	Staff Hours	1	LS	--	$10,000
	Post-Implementation Evaluation Total				**$10,300**
	Project Total				**$410,300**
	Total Estimate (rounded)				**$410,000**
B. Xeriscaping Incentives Program					
1	**Planning and Initial Marketing**				
	Initial Planning	800	Hours	$65	$52,000
	Marketing Tools	1	LS	--	$40,000
	Planning and Initial Marketing Total				**$92,000**
2	**Program Operation (20 years)**				
	Program Maintenance	1	LS	--	$186,000
	Direct Mailings (50 letters, once per year)	1	LS	--	$1,000
	Incentives (12, 3,000 SF conversions per year)	1	LS	--	$673,000
	Program Operation Total				**$860,000**
3	**Post-Implementation Evaluation (20 years)**				
	Participant Surveys (12 per year)	1	LS	--	$300
	Staff Hours	1	LS	--	$10,000
	Post-Implementation Evaluation Total				**$10,300**
	Project Total				**$962,300**
	Total Estimate (rounded)				**$960,000**

K.4. References

BDB (Biogeographic Data Branch). 2009. California Natural Diversity Database. Biogeographic Data Branch, California Department of Fish and Game. www.dfg.ca.gov/biogeodata/cnddb/. Accessed July 2009.

USEPA (U.S. Environmental Protection Agency). 2009. *National Pollutant Discharge Elimination System (NPDES) Menu of BMPs*. U.S. Environmental Protection Agency, Office of Wastewater Management. www.epa.gov/npdes/stormwater/menuofbmps. Accessed September 2009.

Appendix L. Detailed TMDL Plan Evaluation

This appendix provides the detailed evaluation of the recommended TMDL Implementation Plan on the basis of the decision criteria outlined in Section 10.

L.1. Detailed Evaluation Criteria

Evaluation criteria were identified that fall into six categories:

- **Certainty of Meeting TMDL Requirements**— As the BMPs are phased in over time, are TMDL requirements met for the County's County TMDL Implementation Area?
- **Cost Effectiveness**—How do the life cycle costs and cost effectiveness compare among phases?
- **Complementary Integration**—How well do the BMPs complement each other in meeting water quality objectives (e.g., a vegetated swale draining to a bioretention cell)? Are certain projects time-sensitive or phase-sensitive (e.g., an upstream BMP might need to be implemented for a downstream BMP to function sustainably over time)?
- **Feasibility**—What constraints exist on-site or in the community that affect the feasibility of implementation?
- **Integrated Water Resources Planning**—How well do the BMPs meet the County's integrated water resources planning objectives?
- **Other Sustainability Benefits**—Do the BMPs provide other sustainability benefits or affect sustainability negatively?

The first four evaluation criteria were applied to evaluate and recommend BMPs for the TMDL Implementation Plan. The category Complementary Integration was used as a guide to the timing of BMP implementation. All the categories of the criteria were used to evaluate the recommended TMDL Implementation Plan to identify areas of strength and as well as areas that might be strengthened in the future through adaptive management.

Table L-1 provides more detail on the six criteria, specific criteria.

Table L-1. Decision Criteria and Rankings

Evaluation category/criteria	Description
Certainty of Meeting TMDL Requirements	
Meets Phased Load Reduction Requirements	Different phases of implementation have different goals in terms of necessary load reduction. BMPS were evaluated on the basis of which have the highest certainty of meeting TMDL requirements.
Cost	
Life Cycle Cost	This draws from Tasks 3, 4, and 6 evaluations and the optimization analysis. For structural BMPs, the life cycle costs are initial installation costs as well as maintenance and replacement costs. For nonstructural BMPs, components of life cycle costs vary depending on the BMP.
Cost-effectiveness	This criterion draws on the structural BMPs cost-effectiveness data and the perceived cost-effectiveness for nonstructural BMPs.

Evaluation category/criteria	Description
Feasibility	
Natural constraints	Natural constraints were considered such as slope, soils, and water table.
Physical constraints	Existing or planned physical constraints were considered, including utility easements, existing or planned roads or park facilities, and existing BMP placement.
Ownership (type and # of owners)	For structural BMPs, the site's land ownership characteristics can significantly affect BMP feasibility. Publicly owned lands in the County TMDL Implementation Area would receive the highest priority for siting BMPs (excluding the public forest area land).
Administrative	Relative administrative feasibility of implementing different structural and nonstructural BMPs are assessed.
Political/Public Support	For a given site, which BMPs would likely have strong public support, which would raise opposition, and which would be neutral?
Degree of Certainty/Uncertainty	Because feasibility is based on qualitative assessments and what is known about existing technologies, this criterion notes the degree of certainty or uncertainty regarding BMP implementation feasibility. The uncertainty of obtaining regulatory and permit requirements was considered.
Complementary Integration	
Supports/Conflicts/Neutral	The suite of potential BMPs were evaluated according to which are supportive of each other or complementary in meeting water quality objectives, which are neutral, and which pose conflicts in functional integration.
Timing/Phase Sensitive/Neutral	BMPs were evaluated on the basis of whether they are time sensitive or phase sensitive in meeting water quality objectives (i.e., which BMPs should be implemented first for other BMPs to function as intended over time).
Integrated Water Resources Planning (Leadership Committee 2006)	BMPs were assessed on the basis of how well they meet the Greater Los Angeles County IRWMP objectives.
Improve Water Supply	Optimize local water resources to reduce the region's reliance on imported water.
Improve Water Quality	Comply with water quality regulations (including TMDLs) by improving the quality of urban runoff, stormwater, and wastewater.
Enhance Habitat	Protect, restore, and enhance natural processes and habitats.
Enhance Open Space and Recreation	Increase watershed friendly recreational space for all communities.
Sustain Infrastructure for Local Communities	Maintain and enhance public infrastructure related to flood protection, water resources and water quality.
Other Sustainability Benefits	BMPs were assessed on the basis of how well they provide additional sustainability benefits.
Integration of Natural and Built Environment	Reduces and treats runoff from the built environment close to its source using green infrastructure and natural processes.
Integration of Water Cycle	Employs practices that mimic and integrate the natural water cycle (rainfall, evaporation, runoff, infiltration, groundwater recharge, maintenance of stream baseflow).

Evaluation category/criteria	Description
Energy Reduction/Neutral	Employs practices that reduce energy requirements or do not add to energy demand.
Neutral or Positive Air Quality Benefits	Uses practices, such as natural green infrastructure and greenways, or processes that are neutral or positive for air quality.
Hydrologically Neutral or Restorative	Does not affect the volume, peak, or duration of the stream hydrographs, or restores a more natural stream hydrology.
Supports Healthy and Enjoyable Living, Working, and Recreation Space	Uses practices such as green infrastructure that are aesthetically pleasing, incorporated into the living and working environment, or add to recreation area.
Supports/Enhances Social Consecutiveness	Use of linear green infrastructure, which provide connectivity through walking or biking, or other aesthetically pleasing BMPs that can be used to create outdoor spaces.

L.2. TMDL Plan Evaluation

The recommended TMDL Implementation Plan was evaluated using the criteria described above. Each BMP was reviewed on the basis of the criteria. Then, it was determined whether the recommended Implementation Plan generally met, partially met, or did not meet the criteria. The following sections summarize the results of the evaluation.

L.2.1. Certainty of Meeting TMDL Requirements

As discussed in Section 6 the BMP phasing recommended by the optimization is estimated to achieve the metals TMDL requirements for wet weather. The BMPs proposed in the optimization also would provide some progress in meeting bacteria and toxics (TSS) reduction requirements. The TMDL Implementation Plan provide further opportunities to meet multiple TMDL requirements through the nonstructural BMPs. Section 4 discusses the pollutant removal benefits of the nonstructural BMPs. This decision criteria category relates to the certainty that the Implementation Plan and its BMPs would meet the phased load reduction requirements in the Ballona Creek watershed for multiple TMDLs. How each BMP meets these criteria is discussed below.

- **Structural BMPs**
    - The certainty that structural BMPs meet TMDL requirements are largely dependent on how these BMPs are designed and maintained. The optimization assumed that the structural BMPs would be designed according to standard engineering practices and maintained throughout their lifetime such that the expected treatment would be achieved. With those conditions in place, structural BMPs tend to provide more certainty than nonstructural BMPs because they represent permanent treatment facilities that can be designed according to requirements.

- **Nonstructural BMPs**
    - When the Implementation Plan was developed, most nonstructural BMPs were placed in Phase 1 unless it was unlikely that a BMP could be accomplished in that time frame. This helps increase the certainty of meeting TMDL requirements.
    - Some nonstructural BMPs provide greater certainty than others. Those that rely on voluntary participation, such as the smart gardening program, have a lower certainty, or higher risk, than those BMPs that involve regulatory requirements, such as inspections of commercial and industrial facilities.

It is assumed that the TMDL Implementation Plan meets this criteria category because, despite uncertainties, it was developed to maximize the available opportunities for meeting TMDL requirements.

L.2.2. Cost

The cost estimates developed in Section 9 were used to estimate the present value costs of the Implementation Plan BMPs. The individual BMP costs were entered into a cash flow spreadsheet according to when costs occur in the proposed schedules (Section 11). Zinc was selected to represent the general cost-effectiveness for wet-weather pollutant removal. The load reduction, cost, and cost-effectiveness of each implementation phase are summarized in Table L-2 for BMPs addressing wet-weather metals pollutant reduction. The costs presented are higher than those provided in the optimization because the TMDL Implementation Plan costs are based on more detailed, site-specific cost estimates. However, the cost-effectiveness results are similar to those of the optimization. Cost-effectiveness increases over time from the first phase through the third phase. As expected, Phase 3 is much less cost-effective than Phases 1 and 2.

Table L-2. Wet-Weather Metals Cost-Effectiveness Comparison of Phases and Alternatives

Phase	Metric	Load Reduction/Costs
1	Load Reduction (lbs zinc /yr)	122
	Cost of Quantified BMPs	$7,600,000
	Cost-effectiveness ($ per lb reduced)	$3,000
2	Load Reduction (lbs zinc /yr)	126
	Cost of Quantified BMPs	$9,000,000
	Cost-effectiveness ($ per lb reduced)	$4,000
3	Load Reduction (lbs zinc /yr)	209
	Cost of Quantified BMPs	$176,100,000
	Cost-effectiveness ($ per lb reduced)	$42,000
Total	Load Reduction (lbs zinc /yr)	457
	Cost of Quantified BMPs	$192,700,000
	Cost-effectiveness ($ per lb reduced)	$21,000

For wet-weather reduction of bacteria and toxics, cost-effectiveness conclusions are expected to be similar to the conclusions for wet-weather metals. Phases 1 and 2 are expected to be much more cost-effective than Phase 3, and Alternative 1 in Phase 3 is likely to be more cost-effective than Alternative 2.

Reduction in irrigation return flow is expected to achieve the greatest dry-weather pollutant removal (both metals and bacteria) compared to the other proposed BMPs. This BMP is proposed for Phase 2, and because the cost for Phase 2 is only slightly higher than Phase 1, Phase 2 is likely to be the most cost-effective at addressing wet-weather pollutant removal. Phase 1 seeks to accomplish a number of nonstructural BMPs that would provide dry-weather pollutant reduction, especially the smart gardening workshops and tip cards. Catch basin inserts in Phase 3 would provide some metals and bacteria reduction if dry weather flows reach storm drains. However, Phase 3 is likely to be least cost-effective for dry weather because of its high cost.

It was determined that both alternatives partially meet the cost criteria because of the cost-effectiveness of the earlier implementation phases.

L.2.3. Feasibility

Under the feasibility decision criteria, the TMDL Implementation Plan was evaluated on the basis of what constraints exist on-site or in the community that would prevent or slow implementation or render implementation less effective. Feasibility is considered separately for each type of proposed BMP below.

- **Ladera Park Centralized BMP**
  - In relation to natural and physical site constraints, the Ladera Park site has suitable slopes, soils, and depth to water table, although the presence of mature sycamore trees could limit the siting of the infiltration basin and other BMPs and might reduce public support. A mitigated negative declaration (included in the cost estimate) that would result in tree replacement could also help to reduce public opposition. An amphitheater, restroom, and basketball and tennis courts might be affected by installing an infiltration basin. These effects could be mitigated by installing underground storage vaults beneath the courts and avoiding the restroom and amphitheater; however, that would present an additional cost.
  - Administratively, coordination between the Public Works and Parks and Recreation departments would be needed to ensure that both departments' goals would be met by the proposed changes to the site. The recreational amenities at the site are not likely to be negatively affected over the long term; although, during construction, some areas could be inaccessible.
  - The site is on County-owned land, so there are no ownership barriers or property acquisition costs associated with the options. Also, it would be considered a capital improvement project similar to construction projects that the County undertakes regularly. Obtaining permits for BMP construction should not be problematic, particularly because the area is already disturbed, and the project is a retrofit that offers additional environmental benefits.

- **West Los Angeles Community College Centralized BMP**
  - Regarding site constraints, soil amendments would be required to restore infiltration to rates needed for a dry extended detention basin and a stormwater main would need to be rerouted.
  - Similar to the Ladera Park site, administrative coordination would be needed between the County and college administrators to ensure that college operations would not be adversely affected by construction, operation, and maintenance of the new BMP. Enough space is available at the site that, with adequate planning, the proposed BMP is not likely to affect college operations to a great extent. If modifications to the parking lot are necessary to accommodate the BMP, provision might need to be made for additional parking for college employees and students.
  - The site is on publicly owned land, so there are no ownership barriers or property acquisition costs associated with the options. Also, it would be considered a capital improvement project similar to construction projects that the County undertakes regularly. Obtaining permits for BMP construction should not be problematic, particularly because the area is already disturbed, and the project is a retrofit that offers additional environmental benefits.

- **Centralized BMPs on Private Land**
  - The extent to which BMPs can be implemented on private property depends on a number of factors. Site characteristics such as slope, soil, water table, available space, and existing structures and uses would be important. Voluntary or incentivized participation in a private property BMP program is assumed for this BMP. Therefore, successful implementation depends on landowner willingness to sell or donate land for the BMPs.
  - A major constraint for feasibility of centralized BMPs on private land is the ability to identify available and strategically located sites to treat 100 percent of the County TMDL Implementation

Area per requirements of the phased WLAs for Ballona Creek TMDLs. However, as report in Section 6, the County has performed a robust quantitative analysis that suggests alternative strategies for centralized BMP implementation could treat less than 100 percent of the drainage area and still meet TMDL reduction targets. Although implementation of these or similar strategies that address a portion of the drainage area will be more expensive, these could result in more feasible implementation of centralized BMPs on public land.

- **Pilot Distributed BMP Project for a County Road**
  - The public roads 1-acre pilot project site should be selected to minimize natural constraints, although soil amendments or other design elements might be needed. Utilities and existing roads/driveways might require additional design or coordination and cooperation among public agencies and utility companies. The project would require significant interdepartmental communication to ensure that departments and divisions whose operations could be affected (e.g., road maintenance, flood maintenance, and construction divisions; fire department) understand and agree to the proposed changes.
  - The selected site would be publicly owned, so there would be no ownership barriers or property acquisition costs. Nearby residents and business owners might object to the pilot project because of effects during and after construction if the street configuration changes and affects access, traffic flow, or parking. Vegetated swales and bioretention areas along road right-of-ways should have public support if they are designed with aesthetics in mind. To minimize public opposition, designs should maintain or enhance walkability and accessibility for people with disabilities and should not impede sight lines for traffic or pedestrians.
  - Because the site has not yet been chosen, it is difficult to assess what types of feasibility issues would be encountered. LID practices are designed to fit into existing urban spaces, so it is likely that a design could be developed that minimizes public impacts. The lead department for the pilot project should ensure that other agencies' and departments' concerns are addressed in the individual designs to minimize intraorganizational opposition.

- **Distributed BMPs on Public Land**
  - These BMPs would have similar physical constraints as described for the road BMP pilot project above. Some of the sites could be on property owned by governments different from the implementing agency, so interdepartmental or interagency coordination would likely be needed. Because individual sites have not yet been identified, the question of permits needed cannot be addressed. Although, individual sites could be selected to minimize such concerns, and the types of BMPs used are not likely to present substantial permitting requirements.

- **Catch Basin Inserts**
  - The major feasibility consideration for this BMP is that the implementation time frame would depend on gaining approval by the Regional Board to use catch basin inserts instead of, or in addition to, full capture devices.
  - The BMP retrofits are not likely to cause public opposition because they are not visible and be designed to minimize maintenance or flooding issues that would affect the public. Nor are the retrofits expected to require environmental permits. Uncertainty exists regarding the performance and maintenance needs of these devices, but a design could be chosen that would not significantly increase current maintenance efforts.

- **TMDL-specific Stormwater Training**
  - This BMP is expected to present few feasibility issues. It can be based partially on existing training programs and would require staff coordination mostly within a single department. Public opposition would not be a factor because this BMP solely involves County staff.

- **Enhancement of Commercial and Industrial Facility Inspections**
  - Inspection audits would be relatively easy to implement if interdepartmental coordination of this nature is supported by management. Additional staff time would need to be dedicated to inspections, increasing the per-inspection cost and potentially diverting staff resources from other tasks. To ensure success, proper communication should be given to the auditees, explaining the reasons for the audits.

- **Smart Gardening Program Enhancements: Smart Gardening Workshops**
  - The information center proposed could replace open space at parks, so building and environmental permits would be required. The center would likely garner public support; however, the process of modifying an existing park facility to accommodate it could be opposed by neighborhood residents and park users. The ideal circumstance with regard to changing land use would be to identify an underused, already built area in a park and replace it with an information center and demonstration garden to minimize effects on existing recreation infrastructure and valued park amenities.

- **Smart Gardening Program Enhancements: Smart Gardening Tip Cards**
  - This BMP would be relatively easy to execute and would require coordination between LACDPW divisions. The County has developed tip cards in the past, and feasibility constraints are expected to be minimal. No public opposition is expected, as this merely provides a public service.

- **Enforcement Escalation Procedures**
  - It is feasible to assume that a staff member from the District Attorney's office can be dedicated to pursuing stormwater violations, particularly if fines collected as a result of the increased effort offset the cost of the staff member's time. Possible barriers would be coordination with the District Attorney's office, lack of resources (staff or funding) for an additional staff member, and costs associated with processing and tracking the additional enforcement actions.
  - Facility operators would likely object to increased enforcement, and enforcing against small businesses could be politically unpalatable. The enforcement actions could result in negative press for the stormwater program depending on the circumstances of individual cases. The costs associated with increased staff and administrative burdens might not be offset by the additional fines collected as a result of increased enforcement follow-up.

- **Reduction of Irrigation Return Flows**
  - In addition to the aforementioned BMPs, this BMP involves programs to reduce irrigation return flow. Because the focus of the BMPs would be on private property, they would rely on incentives for voluntary participation. The water customers in the watershed receive their water from a private company, and the programs proposed are typically operated by a water supply agency. Implementing the BMP would be administratively difficult because the County would not have a direct relationship with water supply customers, though a partnership with the water supply agency might allow for data sharing to target advertising and incentives to key water consumers (the feasibility of a partnership between the County and the water supply agency is unknown). The County could establish its own incentive programs, but it would not be able to target its advertising to the largest-volume irrigators without information from the water supply agency.

All BMPs above are expected to at least partially meet the feasibility criteria. Where feasibility constraints exist, planning and implementation methods are available to minimize the constraints. The BMPs were selected for the alternatives on the basis of a reasonable likelihood that they could be feasibly implemented. Until the planning stages are begun, further determination of feasibility is limited. It was determined that the TMDL Implementation Plan partially meets the feasibility criteria.

L.2.4. Complementary Integration

The purpose of this evaluation criterion is to detect projects that are time- sensitive or phase-sensitive in achieving long-term sustainability or functionality of a BMP. It also defines the degree to which the proposed BMPs are complementary in meeting water quality objectives, either the design or installation of BMPs *working together*, or programs that are synergistic. It was determined that the timing of the BMPs hinges more on feasibility rather than its long-term function or sustainability. Most of the recommended BMPs complement two or more proposed BMPs, and no implementation conflicts are posed among the BMPs recommended. Table L-3 summarizes the complementary integration of BMPs. The complementary features of each proposed BMP are

Table L-3. Complementary Integration of BMPs

BMPs Included in the TMDL Implementation Plan	Ladera Park	West Los Angeles Community College	Public Road Distributed BMP	Catch Basin Inserts	TMDL-Specific Stormwater Training	Enhancement of Commercial and Industrial Facility Inspections	Smart Gardening Workshop & Tips	Reduced Irrigation Return Flow	Enforcement Escalation Procedures	Institutional Distributed BMPs	Private Property Centralized BMPs
Ladera Park Centralized BMP					✓	✓					
West Los Angeles Community College Centralized BMP					✓	✓					
Pilot Distributed BMP Project for a County Road					✓		✓	✓		✓	
Catch Basin Inserts					✓		✓				
TMDL-specific Stormwater Training	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enhancement of Commercial and Industrial Facility Inspections	✓	✓			✓	✓		✓	✓	✓	
Smart Gardening Program Enhancements			✓	✓	✓			✓			
Reduction of Irrigation Return Flows			✓		✓	✓	✓				
Enforcement Escalation Procedures					✓	✓					
Distributed BMPs on Public Land			✓		✓	✓					
Centralized BMPs on Private Land					✓						

L.2.5. Integrated Water Resources Planning

This criterion evaluates the degree to which the BMPs recommended for the TMDL Implementation Plan contribute to or conflict with the IRWMP objectives, including the following:

- Improved water supply
- Improved water quality
- Enhanced habitat
- Enhanced open space and recreation
- Sustained infrastructure for local communities

It was determined that BMPs for the TMDL Implementation Plan provide multiple water resources benefits. As discussed in Section 7, the characteristics of watershed—both in the County TMDL Implementation Area and surrounding city jurisdiction—are not conducive to significant artificial recharge. Also, shallow depth to groundwater at the downstream end of Ballona Creek prohibits infiltration. Given these natural constraints, few existing or planned water resources projects are in the watershed that could be leveraged for TMDL implementation.

Table L-4 highlights the how each recommended BMP supports the County's integrated water resources policy.

Table L-4. Support of Integrated Water Resources Policy

BMPs Included in the TMDL Implementation Plan	Improved Water Supply	Improved Water Quality	Enhanced Habitat	Enhanced Open Space and Recreation	Sustained Infrastructure
Ladera Park BMP		✓	✓		✓
West Los Angeles Community College BMP		✓	✓		✓
Public Road Distributed BMPs		✓	✓	✓	✓
Catch Basin Inserts		✓	✓		
TMDL-specific Stormwater Training	✓	✓	✓		
Enhancement of Commercial and Industrial Facility Inspections	✓	✓	✓		
Smart Gardening Workshops & Tips	✓	✓	✓		
Reduction in Irrigation Return Flow	✓	✓	✓		
Enforcement Escalation Procedures	✓	✓	✓		
Distributed Institutional BMPs		✓	✓	✓	
Private Property Centralized BMPs: Infiltration Basins		✓	✓	✓	✓
Private Property Centralized BMPs: Extended Detention Basins		✓	✓	✓	✓

L.2.6. Other Sustainability Benefits

The TMDL Implementation Plan was evaluated on the basis of whether the proposed BMPs provide other sustainability benefits or affect sustainability negatively. As described in Table J-1 criteria included the following:

- Integration of Natural and Built Environment
- Integration of Water Cycle
- Energy Reduction/Neutral
- Neutral or Positive Air Quality Benefits
- Hydrologically Neutral or Restorative
- Supports Healthy and Enjoyable Living, Working, and Recreation Space
- Supports/Enhances Social Consecutiveness

The proposed BMPs are discussed below in relation to how they address these criteria. Table L-5 indicates which BMPs provide sustainability benefits.

- **Centralized BMPs on Public and Private Property**
  - The centralized BMPs on both public and private property would integrate the water cycle. As regional BMPs, Ladera Park, West Los Angeles Community College, and other, centralized BMPs on private land would treat runoff from the surrounding neighborhood area and the site itself. The proposed BMPs are green infrastructure practices that would enhance the infiltration of rainfall from surrounding impervious areas, mitigating the negative impact of existing development and promoting groundwater recharge. The BMPs would help to restore natural stream hydrology by returning runoff to the ground and promoting groundwater recharge and stream baseflow. Therefore, they would help integrate the natural and built environment and would be hydrologically restorative.
  - The centralized BMPs would affect energy use and air quality during the construction phase and during maintenance activities that require heavy machinery. However, the West Los Angeles Community College BMP and BMPs on private property replacing impervious surfaces would help reduce the heat island effect and related energy expenditures. Because the Ladera Park BMP is not replacing impervious surface, it does not meet the energy criterion.
  - The Ladera Park infiltration basin would replace existing open space and therefore would neither create nor alter recreation space, especially because the infiltration basin would be designed to be dry within 72 hours and useable for recreation between storms. Underground storage can be used without affecting recreation facilities on the surface, although it would present an additional cost. Because both the Ladera Park and West Los Angeles BMPs would generally support enjoyable recreational space, it was determined to meet the Supports Healthy and Enjoyable Living, Working, and Recreation Space criterion. The private centralized BMPs would also meet that criterion.
  - The two public centralized BMP sites are not expected to contribute to social consecutiveness, though opportunities to enhance greenspace connectivity might exist at private property sites, and the centralized BMPs can be designed to maximize this benefit.

- **Distributed BMPs**
  - The distributed BMPs proposed are all green infrastructure practices that would reduce and treat runoff from the built environment close to its source using natural processes. The BMPs mimic and integrate the natural water cycle (rainfall, evaporation, runoff, infiltration, groundwater recharge, maintenance of stream baseflow) and would have a positive effect on the volume, peak, or duration of the stream hydrographs, restoring a more natural stream hydrology.
  - Cumulatively, implementing green infrastructure practices, especially retrofits that replace elements of the built environment with green space, contribute to a reduction in the urban heat island effect,

which could result in energy savings over the long term. Such practices should have a slight positive or neutral effect on air quality. Aesthetics would be enhanced by the distributed BMPs, particularly if the BMPs are replacing paved areas with little aesthetic quality.

- The extent to which the distributed BMPs would provide a social benefit other than aesthetics has yet to be determined and would depend on the site and the chosen BMP design. Some pilot project locations would lend themselves more to public use than others, such as if the BMPs are near park space or in areas with heavy pedestrian use.

- **Nonstructural BMPs**
  - The nonstructural BMPs are expected to be relatively neutral in terms of energy use and air quality. The majority of the nonstructural BMPs, however, do not offer any sustainability or social benefits, with the exception of the Smart Gardening Program Workshops and Tip cards. The workshops and tip cards would encourage the creation of garden landscapes (either from impervious areas or lawns, which tend to be compacted in urban areas) and would benefit hydrology by enhancing stormwater infiltration.
  - Additionally, the Smart Gardening techniques demonstrated at the workshops encourage the creation of natural, low-impact landscaping and smart watering. They might slightly reduce energy demand through reduced water use at residences and businesses. Smart Gardening techniques also encourage the creation of green space, both at the information center and at residences and businesses if attendees of the workshops put the techniques into practice, which would increase green space and contribute to a reduction in the urban heat island effect. Home gardens that might result from the workshops would also enhance neighborhood appearance and foster time spent outdoors tending to gardens.
  - Reduction in irrigation and return flow through reduced irrigation water use offers the sustainability benefits of water conservation and integration of the water cycle. If xeriscaping is encouraged, it can reduce energy and nutrient inputs in addition to conserving water. Xeriscaping that replaces elements of the built environment can reduce the urban heat island effect, enhance property aesthetics, and encourage residents to spend more time outside, either through gardening or recreation. However, it is expected that most reduction in irrigation and return flow would involve existing landscaped areas, and, therefore, this BMP does not meet the remaining sustainability criteria, including integration with the built environment.

Table L-5. Other Sustainability Benefits of Alternatives 1 and 2

BMPs Included in the TMDL Implementation Plan	Integration of Natural and Built Environment	Integration of Water Cycle	Energy Reduction/Neutral	Neutral or Positive Air Quality Benefits	Hydrologically Neutral or Restorative	Supports Healthy and Enjoyable Living, Working, and Recreation Space	Supports/Enhances Social Consecutiveness
Ladera Park BMP	✓	✓			✓	✓	
West Los Angeles Community College BMP	✓	✓	✓		✓	✓	
Public Road Distributed BMPs	✓	✓	✓	✓	✓	✓	
Catch Basin Inserts			✓	✓			
TMDL-Specific Stormwater Training			✓	✓			
Enhancement of Commercial and Industrial Facility Inspections			✓	✓			
Smart Gardening Workshops & Tips	✓	✓	✓	✓		✓	
Reduction in Irrigation Return Flow		✓	✓	✓			
Enforcement Escalation Procedures			✓	✓			
Distributed Institutional BMPs	✓	✓	✓	✓	✓	✓	
Private Property Centralized BMPs: Infiltration Basins	✓	✓	✓		✓	✓	
Private Property Centralized BMPs: Extended Detention Basins	✓	✓	✓		✓	✓	

L.2.7. Summary of Evaluation

The most important criterion, Certainty of Meeting TMDL Requirements, is fully met, while the next most important criteria, cost and feasibility, are partially met. The latter calls for adaptive management approach to identify and employ new, cost effective BMPs or strategies if they become available in the future. On the whole, the recommended BMPs do a good job of meeting multiple benefits and supporting other County policies and initiatives.

Appendix M. Assumptions for Development of TMDL Implementation Schedules

The following provides summarizes BMP implementation assumptions that informed the TMDL implementation schedule reported in Section 11.

M.1. Project Schedules for Nonstructural BMPs

The schedules for each nonstructural BMP are based on time frame recommendations from case study research and best professional judgment. Generally, two schedule components are estimated: (1) Planning, and (2) Program Operation and Evaluation. Best professional judgment was used as to the minimum planning time frames for all BMPs as follows:

- Program involving a small number of training events: 6 months minimum
- Program involving a bid package for construction: 9–12 months minimum
- Program involving multiple County departments: 2 years minimum
- Program involving studies: 9 months minimum

Planning considerations for specific BMPs include the following:

- **TMDL-specific Stormwater Training**—Because the stormwater training program involves planning for a training event, the minimum 6-month planning duration is assumed.
- **Enhancement of Commercial and Industrial Facility Inspections**—An auditing program should take a relatively small time to set up because it involves brief coordination between two divisions and does not require developing training materials or any formal review or approval. The required planning time frame is estimated as 3 months.
- **Smart Gardening Program Enhancements: Workshops in Ballona Creek Watershed**—The schedule for the BMP is broken into the Initial Workshops and Information Center components, and each component has separate time frames for planning and program operation and evaluation. The schedule follows the time frame outline for the program as outlined in the cost estimate of the program enhancements in Appendix K. Planning for the information center begins 1.5 years after the initial training workshops begin and is expected to take about 6 months. Constructing the information center would occur during the third and final year of the initial training workshops.
- **Smart Gardening Program Enhancements: Workshop Tip Cards on Water Quality**—The planning component for water quality tip cards is assumed to include the design of the tip cards. Planning through design of the materials is assumed to take about 6 months; although, it could occur faster, depending on staff availability.
- **Reduction of Irrigation Return Flow**—A long planning time frame (5 years) is assumed for reducing irrigation return flows because it involves coordinating multiple County departments and building partnerships with other agencies. All three example programs would require substantial time to develop the program strategies and structure.
- **Enforcement Escalation Procedures**—Because the BMP involves coordinating multiple County departments, the planning time frame was assumed to be 3 years. More time could be needed to reach an agreement between departments or implement necessary administrative changes.

For all nonstructural BMPs, unless otherwise noted above, program operation and evaluation is assumed to occur over a 20-year time frame. Frequency of program evaluations varies depending on the BMP, but for the purposes of the schedules, it was assumed that the evaluations would occur generally in the 20-year time frame.

M.2. Project Schedules for Distributed BMPs on Public Land

As outlined below, separate considerations were made for scheduling distributed BMPs on public land, which differed for catch basin inserts and structural BMPs on public parcels.

Catch Basin Inserts Phases 2 & 3

Catch basin inserts would require about 9 months to develop design specifications, test devices, conduct a department review, prepare a report, and gain Regional Board approval for using the devices to comply with trash TMDLs. The planning component is titled *planning through construction* to account for installing the devices in the same schedule component. It is assumed that 30 percent of the catch basins in the drainage area could have inserts installed in one year, which would help meet Phase 2 requirements. That schedule might require that priority be given to installing the inserts over other installations outside the Ballona Creek watershed. Installing the Phase 3 catch basin inserts is assumed to occur over a 3-year period.

Distributed Structural BMPs on Public Land

Implementation time frames were developed for the distributed structural BMP projects, which include the phases for planning, data collection, design, permits, bidding, construction, O&M, and pre- and post-construction monitoring. Durations were assigned to each phase on the basis of an understanding of the activities required for each. Because of the large number of distributed BMPs requiring implementation in the County TMDL Implementation Area, a tiered and rolling scheduling approach was used to organize and realistically plan for successful BMP implementation.

As a basis for project scheduling, the number of distributed BMPs was estimated that would treat the minimum drainage areas required for each BMP type and location. By doing so allows the workload to be distributed across the project target dates using different implementation tiers to lessen the workload at the beginning (2009) and end (2021) dates. Each of the tiers, which are phased in one-year increments, represents a number of BMPs to be implemented in a single planning/construction/bidding process. The implementing department or agency would choose the number of bids allocated to the projects in each tier. The following assumptions were used to estimate the number of BMPs and implementation tiers:

- Bioretention cells rarely exceed between 4,000 and 5,000 square feet in surface area. For example, a 5,000-square-foot bioretention cell can treat a 2-acre watershed with 90 percent impervious surface for a 0.75-inch rainfall event. Because land area is very limited in the Ballona Creek watershed, 2,500 square feet of average surface area is more realistic for a bioretention cell. As a result, it is assumed that one bioretention cell would treat one acre of drainage area.
- Roadside bioretention has a higher drainage area to treatment area ratio than regular bioretention cells because they provide conveyance treatment in addition to infiltrative treatment. In the Ballona Creek watershed, a typical roadside bioretention cell is assumed to expand several blocks and treat approximately 5 acres of impervious roadway.
- Porous pavements most often have 1:1 drainage to treatment area ratios. Because larger parking lots should be targeted for porous pavement asphalt, it was assumed that each acre of parking lot would constitute one porous pavement BMP.
- Project phases (discussed below) from planning through construction require the same amount of time for all three distributed BMP types.

The preliminary project phases are as described below. Note that the project phases for distributed BMPs vary slightly from the centralized BMP project schedule, and the total project time from planning through construction for a distributed BMP is assumed to be 14 months. The schedules are based on the following assumptions:

- **Planning**—The planning phase requires further development of the project concept resulting in a Project Concept Report. Preliminary sizing and watershed delineation could also be included in the planning phase. If project approval is recommended during the planning phase, the implementing agency or department would move forward with necessary environmental documentation. The duration is assumed to be one month.
- **Data Gathering**—Before detailed BMP design, site data such as topographical surveys, soil tests, geotechnical analyses, and the like would need to be collected. The duration is assumed to be one month.
- **Permits**—Compared to the centralized BMPs, a shorter duration for the distributed BMP permitting phase is assumed because the permitting process often occurs simultaneously with the design phase, especially for smaller structural projects. The duration is assumed to be 2 months.
- **Design/Bid/Award**—Because preliminary design was conducted during the data gathering phase, the design phase develops the project concepts into finished drawings, including specifications and a project manual (often supplied by the local municipality). The design phase could include several submittal processes so the County's hydraulic/hydrology group could be involved for the proposed modifications to its storm drain facilities. Having final design documents allows the project to be competitively bid. The schedule assumes a 30-calendar-day bid period, followed by another 30 days for bid review, selection, and contract award. The duration is assumed to be 5 months.
- **Construction**—The construction phase duration is based on a generalized breakdown of the activities required for its completion. Construction starts with the contractor's mobilization, including vendor and subcontractor procurement, materials submittals, permit acquisitions, and temporary facilities. Although distributed BMPs are much smaller than centralized ones and take less time to construct, infiltrative BMPs like porous pavement and bioretention cells require extra time for excavation and bed-media preparation. Roadside bioretention could require temporary road closings that can also influence the construction schedule. The duration is assumed to be 5 months.
- **O&M**—It is assumed that maintenance is required throughout the project lifetime of 20 years.
- **Monitoring**—Pre-construction monitoring would take place at least one year before construction, and post-construction monitoring would take place 3 years following construction.

M.3. Project Schedules for Centralized Structural BMPs

The project schedules for the proposed centralized structural BMPs, Ladera Park and West Los Angeles Community College, include phases for planning, design, permits, construction, O&M, and post-construction monitoring. Durations are assigned to each phase on the basis of an understanding of the activities required for each. The schedules are based on the following assumptions:

- **Planning**—The planning phase requires further development of the project concept resulting in a Project Concept Report. If project approval is recommended during the planning phase, the agency would move forward with the design.
- **Permits**—On the basis of an assessment of the permits and regulatory compliance measures that might be necessary for the project, the schedule includes time for preparing environmental documents and the minimum 6-month review time anticipated for application approval.
- **Design/Bid/Award**—The schedule for the design phase begins with preliminary design to further develop the project concepts and establish the basis for design. A geotechnical investigation and report and utility research would occur toward the beginning of the design phase. During the design phase, the County's hydraulic/hydrology group would be involved for the proposed modifications to its storm drain facilities.

Having final design documents allows the project to be competitively bid. The schedule assumes a 30-calendar-day bid period, followed by another 30 days for bid review, selection, and contract award.

- **Construction**—The construction phase duration is based on a generalized breakdown of the activities required for its completion. Construction starts with the contractor's mobilization, including vendor and subcontractor procurement, materials submittals, permit acquisitions, and temporary facilities. For the Ladera Park project, a relatively substantial amount of time would be required for the excavation and surface preparation of the infiltration basin. Working around the existing park facilities and in an area that is normally accessed by the public would also factor into the schedule. The total construction duration is estimated to be about 8 months. For the West Los Angeles Community College project, the most time would be required for excavating the basin and constructing the appurtenances. The total construction duration is estimated to be about 8 months.
- **O&M**—It is assumed that maintenance is required throughout the project life of 20 years.
- **Pre- and Post-Construction Monitoring**—Pre-construction monitoring would take place at least one year before construction, and post-construction monitoring would take place 3 years following construction.

M.4. Project Schedules for Centralized BMPs on Private Property

The schedules for centralized BMPs on private property are based on the overall periods estimated for the public property centralized BMPs. Six months were added to the project time frame to account for the process of acquiring land from private owners.