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October 7, 2010

Mr. Sam Unger, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 W. Fourth Street, Suite 200
Los Angeles, CA 90013

Dear Mr. Unger:

FINAL IMPLEMENTATION PLAN FOR LOS ANGELES RIVER METALS TMDL

Thank you for your letter dated June 14, 2010 acknowledging the submission of the Los Angeles River Metals Draft Implementation Plan (Plan) and the acceptance of the City's proposed approached outlined in the document for compliance. We appreciate your staff's insightful comments on the document on how to improve it and have worked diligently in incorporating those into the final version of the plan.

Please find enclosed the revised sections of the Implementation Plan (Final Plan) for the Los Angeles River Metals Total Maximum Daily Load (LAR Metals TMDL), developed by City of Los Angeles for the Los Angeles River watershed in the City of Los Angeles' jurisdiction addressing your comments. The revisions incorporated into the Final Plan have been discussed with your staff in a meeting on September 9, 2010.

Once more, the City of Los Angeles appreciates your acceptance of our Plan and your participation to strengthen the document. If you have any questions regarding the Final Plan, please contact Alfredo Magallanes or Vijay Desai of my staff, at (213) 485-3958 or (213) 485-3931, respectively.

Sincerely,

SHAHRAM KHARAGHANI, Ph.D., P.E., BCEE
Program Manager

SK:AM:VD
WPDCR 8786

Attachment

c: Jenny Newman, Los Angeles Regional Water Board
Ching-Piau Lai, Los Angeles Regional Water Board
Adel Hagekhalil, City of Los Angeles, Bureau of Sanitation
Shahram Kharaghani, City of Los Angeles, Bureau of Sanitation
Alfredo Magallanes, City of Los Angeles, Bureau of Sanitation

Comment Response Matrix for the Los Angeles River Metals TMDL

Comment from Letter	Comment	Response	Document Section Revised (Page #, Section, etc)
1. Section 3, Bullet 1	The draft implementation plan states on page 3-32 that no regional opportunities exist in the City's jurisdiction in Reach 1 and Reach 2. The Regional Board appreciates the City's focus on distributed BMPs in Reach 1 and Reach 2 to compensate for the lack of regional BMP opportunities, but also encourages the City to collaborate with other responsible agencies to implement regional BMPs in these reaches, if necessary.	The City acknowledges the Regional Board's comment and will work towards identifying areas where collaboration with the other agencies can help implement regional BMPs in these reaches.	NA
2. Section 4, Bullet 1	Open channel diversions (North Hollywood Park, Compton Creek) are not recommended because water quality standards would not likely be met in the channel above the diversion. Regardless of the compliance point, water quality standards must be met throughout reaches and tributaries.	The Regional Board clarified this comment and North Hollywood Park is an acceptable site because the diversion is not from an impaired waterbody. Compton Creek was replaced with additional regional, distributed, and institutional BMPs.	Section 4.5.1, Section 4.7.3, Section 5, Section 6
3. Section 4, Bullet 2	The Regional Board received a letter from Pierce College dated January 5, 2010 stating that they would not be able to accommodate the proposed regional BMP at the college. Footnote 1 on ES-10 and 4-10 explains that the City may substitute another project if it is determined that one of the regional BMP sites is infeasible. The Regional Board encourages the City to work with Pierce College to determine if the proposed regional BMP at the college is feasible and, if not, to identify a substitute project(s) that would accomplish similar load reductions in the Reach 6 area.	Pierce College will be replaced with additional regional, distributed or institutional BMPs.	Section 4.5.1, Section 4.7.3, Section 5, Section 6
4. Section 5, Bullet 1	There are several BMP practices in each scenario run and every BMP practice is located at a different location in the watershed-scale model. It is not clear how the final percent reductions of metal indicated in Figures 5-6 through 5-8 and Table 5-11 are obtained through implementation of individual BMPs. The draft plan states on page 5-19	Figures 5-6 through 5-8 show pollutant loading at the compliance assessment point LA River at Wardlow St. Pollutant removal was summed with respect to the compliance assessment point and represent watershed-wide pollutant removal for all of the BMPs. Compliance assessment point at LA River at Wardlow.	Section 5.2.2.1 Load Reduction from Institutional BMPs, Section 5.3 Compliance Analysis Results

	that metals load reductions from each of the elements of the plan were summed. Where they summed on a watershed-wide basis? Where is the compliance assessment point for each BMP scenario when evaluating the final predicted load reductions? In addition, it is not possible to recreate the summation of individual implementation elements given the information provided in Section 5. There is a load reduction summary table for distributed BMPs, regional BMPs, future SUSMP projects, and existing and planned BMPs, but not for institutional BMPs. It would help if a there was an explanation in the text or a table showing how each of the elements was summed.	Table 5-5 is a summary table detailing institutional BMP load reductions. On Figure 5-6 through 5-8, changed x-axis to inches of runoff.	
5. Section 5, Bullet 2	How did the city determine that there are 17,000 acres of residential rooftops that could be treated with downspout disconnections (page 5-13)?	Residential rooftops were obtained from LACO GIS parcel data. Added source in footnotes.	5.2.2.1, Downspout Disconnections
6. Section 5, Bullet 3	Docs Table 5-7 assume a constant runoff capture size for the distributed BMPs (as shown in Table 5-6) when calculating the load reductions achieved for a given storm event? If so, which capture size is used, since permeable pavement and cisterns have a different runoff capture size (0.75 inches) than bioretention (0.53 inches)?	0.75 in. is the capture depth for permeable pavement and 0.53 in. for bioretention. The reason for this difference is discussed in the methodology section.	Section 5.2.2.2 Quantification Methodology
7. Section 5, Bullet 4	The assumption that load reduction is proportional to MS4 drainage area (page 5-8) should be verified through monitoring in the early stages of implementation. The plan should also provide a cross reference between Table 4-3 and Table 4-9 (which show tributary area and treatment capacity) and Figures 5-6 through 5-8 and Table 5-11 to provide a visual confirmation that area-based compliance will be achieved.	Available data was not sufficient to determine wet weather pollutant concentrations (flow-weighted composites) for specific subwatersheds. Added text stating that once available, the new CMP wet weather composite samples can be used to assess area based compliance.	Section 5.2.2 Wet Weather Compliance, Section 5.3 Compliance Analysis Results

8. Section 5, Bullet 5	The terms “mean”, “worst case”, and “best case” presented in Table 5-12 need to be better defined. The variable analyzed in the uncertainty analysis need to be specified. For example, load reductions are especially sensitive to a different design storm scales (different rainfall intensity and duration), so this variable should be specified.	Now Table 5-13. Mean is average of Monte Carlo. Worst is 5th percentile from the Monte Carlo simulation, best is 95th percentile. Will revise Table to clarify. The impact of BMP treatment capacity is minimal, because exceedences are most likely in small storm events. Mass emission data show a dilution effect in larger storms. BMPs are sized to capture the initial portion of the storm, when the bulk to the event metals load is mobilized	Section 5.4 Uncertainty Analysis
9. Section 5, Bullet 6	The time scales used in the model simulation will significantly affect the final predicted load reductions. The time scales for different model parameters should be explained in the report. For example, it should be specified if precipitation is hourly or daily; if sediment removal for street sweeping is daily, weekly or monthly; or if simulation intervals for load reduction calculations are hourly, daily, or weekly.	The timescales used in the model simulation is daily data. Added discussion of how load reductions were developed on an event basis and not averaged over longer time-periods.	Section 5.2.2 Wet Weather Compliance

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Acronyms

µg/g	microgram per gram
µg/L	micrograms per liter
µg/m^2	micrograms per square meter
APN	Assessor's Parcel Number
bgs	below ground surface
BMP	Best Management Practice
BPP	Brake Pad Partnership
CCWMP	Compton Creek Watershed Management Plan
CEH	Center for Environmental Health
CEQA	California Environmental Quality Act
CF	conversion factor
cfs	cubic feet per second
City of Los Angeles	City
CMP	Coordinated Monitoring Plan
CNDDB	California Natural Diversity Database
CRA	Community Redevelopment Agency
CWA	Clean Water Act of 1972
DCT	D.C. Tillman
DFG	Department of Fish and Game
DIYs	do-it-yourselfers
EMCs	Event Mean Concentrations
EPA	Environmental Protection Agency
ft MSL	feet mean sea level
GIS	geographic information system
IBA	Important Bird Area
Implementation Plan	TMDL Implementation Plan
IRP	Integrated Resources Plan
IRWMP	Integrated Regional Water Management Plan
LACDPW	LA County Department of Public Works
LAG	Los Angeles Glendale
LAR	Los Angeles River
LARMP	Los Angeles River Master Plan
LARRMP	Los Angeles River Revitalization Master Plan
LARWQCB	Los Angeles Regional Water Quality Control Board
mg/km	milligrams per kilometer
mgd	million gallons per day
MS4	Municipal Separate Storm Sewer System
NCDC	National Climatic Data Center
NGO	non-governmental organizations
NOAA	National Oceanic and Atmospheric Administration

NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
Porter-Cologne Act	Porter-Cologne Water Quality Control Act of 1970
POTW	publicly owned treatment works
ppm	parts per million
RHSG	Rio Hondo Spreading Grounds
RWQCB	Regional Water Quality Control Board
S&T	Status and Trends
SBPAT	Structural BMP Prioritization Analysis Tool
SCAG	Southern California Area Governments
SEA	Significant Ecological Area
State	State of California
State Board	California State Water Resources Control Board
SUSMP	Standard Urban Stormwater Mitigation Plan
TMDL	total maximum daily load
TPWP	Tujunga/Pacoima Watershed Plan
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WQCMPUR	Water Quality Compliance Master Plan for Urban Runoff
WRP	Water Reclamation Plants

Executive Summary

ES.1 Introduction

The Los Angeles River (LAR) Metals Total Maximum Daily Load (TMDL) Implementation Plan (Implementation Plan) defines the approach and steps that the City of Los Angeles (City) will take to comply with the requirements of the *Los Angeles River and Tributaries Total Maximum Daily Loads for Metals* (Metals TMDL). The Implementation Plan follows the principles of the Water Quality Compliance Master Plan for Urban Runoff (WQCMPUR) and the Integrated Resources Plan (IRP). These principles include:

- *Integrated Plan:* Identify urban runoff management projects that have multiple benefits and treat multiple pollutants.
- *Green Solutions:* Wherever possible, implement solutions that are "green," sustainable, and work with the existing natural environment.
- *Build on Existing Programs:* Review existing urban runoff programs and identify opportunities to improve current water quality programs.
- *Stakeholder Involvement:* Identify the best projects and concepts through collaboration with the many active organizations and individual stakeholders in the watershed.
- *Adaptive Management:* Develop a plan that embraces the need to refine itself based on the information gathered over time through the implementation of both successful and unsuccessful programs and projects.

ES.2 Regulatory Requirements

The Los Angeles Regional Water Quality Control Board (LARWQCB) adopted the Metals TMDL for the LAR Watershed on June 2, 2005. Following State Board and State Office of Administrative Law approvals, EPA Region 9 approved the TMDL on December 22, 2005. The TMDL originally became effective on January 11, 2006. Following resolution of legal challenges to TMDL provisions, the LARWQCB approved a revised TMDL Resolution Basin Plan Amendment on September 6, 2007. After State and EPA Region 9 review, the revised TMDL effective date was October 29, 2008. This Implementation Plan is written in response to the TMDL's requirement to submit an Implementation Plan by January 11, 2010.

The Metals TMDL includes wasteload allocations applicable to urban runoff under both dry and wet weather conditions. These allocations are considered necessary to protect the beneficial uses expected be impacted by existing metals loadings to the LAR: wildlife habitat, warm freshwater water habitat, rare threatened or endangered species, wetland habitat, marine habitat, and groundwater recharge.

Implementation of the TMDL by MS4 permittees involves a phased approach. Compliance is mandated within 22 years of the TMDL effective date. Final and interim compliance dates include:

- **October, 2008 –** submit a Coordinated Monitoring Plan (CMP) that includes both TMDL effectiveness and ambient monitoring.
- **January 11, 2010 –** submit results of any special studies to the LARWQCB.
- **January 11, 2010** and **July 11, 2010 –** submit draft and final reports, respectively, summarizing how compliance with wasteload allocations will be achieved.
- **January 11, 2012 –** demonstrate 50 percent compliance with dry weather wasteload allocations, and 25 percent compliance with wet weather wasteload allocations.
- **January 11, 2020 –** demonstrate 75 percent compliance with dry weather wasteload allocations.
- **January 11, 2024 –** demonstrate 100 percent compliance with dry weather and 50 percent compliance with wet weather wasteload allocations.
- **January 11, 2028 –** demonstrate 100 percent compliance with both dry and wet weather wasteload allocations.

The City met its requirement to prepare a CMP by October 2008. This Implementation Plan fulfills the requirements of the January 11, 2010 deadline to submit a report summarizing how the City will achieve compliance with wasteload allocations.

ES.3 Implementation Plan Development Process

This Implementation Plan was developed through the execution of the following four key steps:

- Characterize watershed system conditions and conduct watershed-wide analyses to support water quality planning and BMP alternatives development activities;
- Identify range of green BMP opportunities for managing urban runoff in the City of Los Angeles;
- Select structural and institutional BMPs for phased implementation to comply with TMDL targets; and
- Quantify nexus between BMPs selected and compliance with TMDL targets.

Throughout the Implementation Plan development process City staff collaborated with other city agencies, jurisdictions, non-governmental organizations (NGOs), and other stakeholders to identify opportunities for collaboration. This process included three community stakeholder workshops held in March, July and September 2009.

ES.4 Watershed Characterization

The LAR Watershed covers an area of 834 square miles bounded by the Santa Monica, Santa Susana, and San Gabriel mountain ranges to the north and west. The lower part of the watershed captures runoff from highly urbanized areas surrounding downtown Los Angeles. The total length of the LAR is approximately 52 miles from headwaters to mouth, where it flows into the Pacific Ocean.

The LARWQCB's *Water Quality Control Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan) identifies six reaches of the LAR as well as several major tributaries (e.g., Tujunga Wash, Arroyo Seco, Rio Hondo and Compton Creek). Various Metals TMDL requirements apply to all of these waterbodies.

The LAR Watershed is comprised of many jurisdictions with responsibilities under the TMDL, including the City of Los Angeles, County of Los Angeles, and 42 other cities. Including natural undeveloped lands, the City represents 33 percent of the total area of the LAR Watershed. Excluding natural lands, the City comprises approximately 50 percent of the LAR Watershed.

Precipitation and Flow

There is a wide range of variability in event-specific and annual rainfall across the LAR Watershed, due to the orographic effects of the mountain ranges. Mean annual rainfall ranges from 12.2 to 17.6 inches, and the 85th percentile storm event depth ranges from 1.3 to 2.0 inches. The majority of rainfall occurs between October and May.

Flow in the LAR Watershed is highly variable. This variability is due to the nature of typical rain events (i.e., short–duration high-intensity), urbanized and highly impervious conditions, and presence of steep mountain slopes surrounding valley areas. Dry weather flows fluctuate from upstream to downstream along the LAR mainstem and in tributaries due to effluent discharges from the D.C. Tillman, Los Angeles-Glendale, and Burbank Water Reclamation Plants. Average dry weather flow increases with increased distance downstream. During wet weather, river flows may increase by two to three orders of magnitude above dry weather flow conditions.

Water Quality

On-going water quality monitoring programs include the City of Los Angeles Status and Trends Monitoring, CMP, and the Municipal Separate Storm Sewer System (MS4) monitoring program. The water quality monitoring results show that dry weather exceedances of TMDL targets occasionally occur, especially for total copper and total zinc. During wet weather, metals concentration exceedances occur more frequently, again especially for total copper and total zinc.

ES.5 BMP Evaluation

The process to identify BMPs for implementation that support the City's efforts to comply with the Metals TMDL requirements included both detailed technical analyses and stakeholder input. Numerous potential BMP opportunities were considered, including both institutional and structural. In addition, existing BMP activities were evaluated for their potential to support compliance with TMDL targets, including Proposition O projects and other watershed projects regardless of whether they are being implemented by the City or other stakeholders.

Institutional BMPs

Institutional BMPs focus on preventing and removing stormwater volumes and pollutant loads at their source. When used in conjunction with green structural BMPs as part of a comprehensive stormwater management program, they may improve overall pollutant removal and help reduce maintenance requirements. Institutional BMPs range from activities, such as land use planning and infrastructure maintenance, to more site-specific activities, such as targeted inspections or enforcement actions for businesses considered likely to be significant sources of metals. Many of these BMPs can be implemented at different levels ranging from individual actions to municipal, state, or business initiatives. Benefits of institutional BMPs include:

- *Potential cost savings*—Institutional BMPs typically do not require large capital expenditures to construct facilities; however, long-term operating costs can be significant for educational, inspection, and enforcement programs.

- *Areal treatment coverage*—Many institutional BMPs are implemented through city-wide programs. Unlike a structural BMP facility, the coverage and subsequent benefits of these institutional BMPs are not limited to the catchment area served.

- *Retrofit potential*—Many institutional BMPs target existing development and can be implemented under the space constraints prevalent in built-out urban environments.

- *Target specific pollutants or sources*—BMPs can target a specific pollutant of concern or the specific source of the pollutant. For example, the brake pad replacement initiative targets both a specific metal (copper) and a significant source of the pollutant in urban runoff.

Green Structural BMPs

The Los Angeles County-wide Structural BMP Prioritization Analysis Tool (SBPAT) provided the means for identifying potential structural BMP locations and types for implementation. SBPAT uses a GIS-based decision tool that relies on four steps for identifying BMP implementation opportunities (Figure ES-1):

SBPAT screens areas based on need (i.e., pollutant load generation and downstream impairments), and then identifies opportunities (i.e., appropriateness of the area, adjacent storm drains) for BMP implementation. These opportunities are ranked based on factors such as effectiveness, cost, and maintenance requirements. The BMP rankings were used to assist with the selection of the best regional and distributed green BMPs for each potential BMP location. The selection process also considered the opportunity to use an Integrated Water Resources Approach or implement BMPs that provide multiple benefits at a potential BMP location.

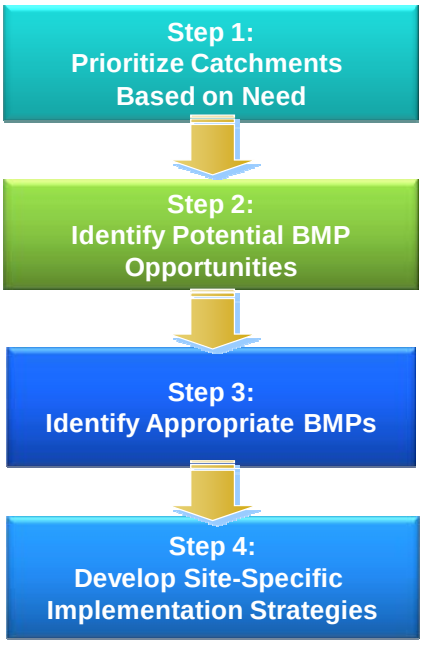

Figure ES-1
Steps for Selection of Structural BMPs

Structural BMPs include one of two types:

- *Regional BMPs:* Defined as centralized stormwater facilities designed to treat urban runoff from a relatively large drainage area (drainage areas ranging from 20 acres to several hundred acres). These BMPs include infiltration facilities, detention basins, subsurface flow wetlands (including detention), surface flow wetlands, treatment facilities, manufactured separation systems (e.g., hydrodynamic separators and trash nets/screens), and channel naturalization (e.g., storm drain daylighting, revegetation, and wetland channel establishment).

- *Distributed BMPs:* Defined as stormwater collection devices and landscaping practices dispersed throughout a catchment that serve relatively small drainage areas (typically 10 acres or less). These BMPs include, for example, cisterns, bioretention, vegetated swales, green roofs, porous/permeable pavements, gross solids removal devices, media filters, and catch basin inserts.

A screening methodology consisting of the following four general screening categories (each of which has additional screening factors) was applied to evaluate BMP opportunities:

- Cost
- Effectiveness
- Ease of implementation
- Other environmental factors

The results of the assessment based on the above screening categories were refined to evaluate the feasibility of establishing infiltration basins at candidate regional BMP locations. Analyses considered distance from contaminated sites, depth to

groundwater, minimum saturated hydraulic conductivity (K_{sat}), and location relative to landslide and liquefaction zones.

Planning and siting of potential regional and distributed structural BMPs is particularly challenging because of the highly developed conditions in the watershed. Because the majority of structural regional BMPs will need to be retrofitted into developed areas of the watershed, the BMP analysis required significant site-specific BMP evaluations, including additional data collection and field inspections in order to screen, prioritize, and finally select sites.

Completion of the site-specific evaluation steps resulted in 17 potential regional and 100 distributed BMP locations. These potential BMP projects were further evaluated for inclusion and prioritization within the Implementation Plan.

ES.6 Implementation Plan

Compliance with TMDL targets can be achieved through the implementation of a BMP program that takes into account the combined water quality benefits achieved through different BMP programs. Figure ES-2 illustrates the framework used to build this Implementation Plan. The following sections summarize the key elements of this framework. Implementation of all of these components is subject to available funding to cover capital, operation and maintenance, program management, and administration costs. It is also important to note that the time provided by the TMDL to achieve the first milestone for wet weather is not adequate in light of resource shortages, the required number of projects to be constructed, and the length of time required to properly complete a project. For example, a review of City projects and regional BMP projects shows that the time to complete pre-design, design, bid/award, construction, and post-construction activities is typically 32 months for a distributed BMP and 60 months for a regional BMP.

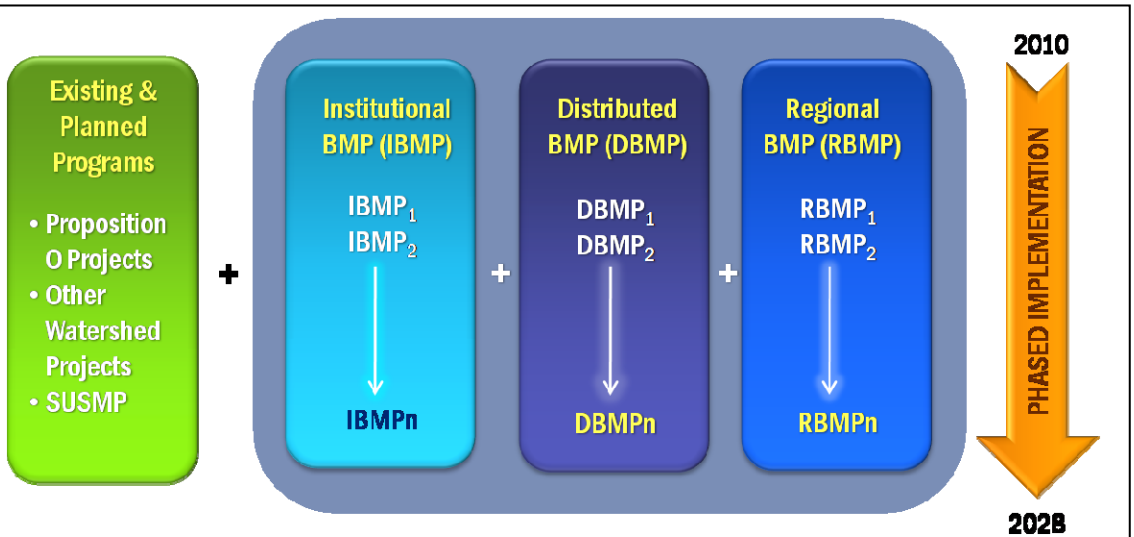

Figure ES-2
Overview of Proposed Comprehensive BMP Program

Existing and Planned BMP Projects

A number of major Proposition O projects will be completed prior to the Metals TMDL compliance target dates. Each of these projects provides a significant water quality benefit. Additional smaller projects (e.g., Oros Green Street) also provide benefits. The urban runoff from approximately 3,100 acres is expected to receive treatment as a result of the completion of the major Proposition O projects in the LAR Watershed.

A number of other major watershed projects are in development or planned for completion prior to the Metals TMDL compliance target dates. Additional smaller projects (e.g., Riverdale and Elmer Green Streets) also provide benefits. Similar to the Proposition O projects, each of these major projects provides a significant water quality benefit. The urban runoff from approximately 13,300 acres is expected to receive treatment as a result of the completion of the major watershed projects.

Standard Urban Stormwater Mitigation Plan (SUSMP)

Throughout TMDL implementation period, new development and redevelopment activities will continue in the City of Los Angeles. Many of these development activities are subject to MS4 permit SUSMP requirements for managing urban runoff. Where SUSMP requirements apply, the BMPs installed on-site must be able to infiltrate, capture and reuse, or treat all of the runoff from an 85th percentile storm, which is equivalent to a 3/4-inch, 24-hour storm event. New City guidelines approved on July 9, 2008 require developers to give top priority to BMPs that infiltrate stormwater and lowest priority to mechanical/hydrodynamic units.

A review of City development records showed that on average, approximately 250 acres of new development or redevelopment projects have been implemented across the City each year since 2001. The Implementation Plan assumes that throughout the period of implementation, this rate of development will continue. The enhanced SUSMP guidelines adopted in 2008 will be vigorously applied to these projects and further modified as needed to comply with MS4 permit requirements.

Institutional BMPs

The City will implement a variety of institutional BMPs to reduce metals loadings in the watershed. Many of these BMPs are consistent with ongoing City efforts to implement institutional BMPs in other watersheds, e.g., Ballona Creek. In some cases, these BMPs recognize or supplement institutional BMPs already being implemented through the City's MS4 permit program. However, other BMPs are new and recommended for implementation to help address urban runoff management concerns in general, and target metals sources specifically. Specific institutional BMP activities have been categorized into four broad areas. These categories and the primary BMPs being considered for implementation include:

- Direct Source Control—BMPs that directly address metals sources are included in this category. Sources are addressed either through pollution prevention or activities that reduce the volume of urban runoff. Planned BMPs include:

  - Product Replacement – The purpose of this BMP is to reduce a significant source of metals in the environment by developing safe alternative products. To implement this BMP, the City will continue to support efforts to reduce metals in vehicle brake pads and wheel weights through pending legislation.

  - Enhanced Street Sweeping – This BMP focuses on enhancing street sweeping activities to achieve a modest 5 percent increase in material picked up by 2028. To achieve this goal, the City will evaluate opportunities to increase the efficiency of its existing street sweeping program.

  - Downspout Disconnection – This BMP can greatly reduce stormwater runoff volumes and involves encouraging property owners to disconnect their roof downspouts and redirect the stormwater runoff to pervious surfaces, rain gardens, rain barrels or cisterns. The pilot program underway in the Ballona Creek Watershed will be expanded to include the LAR Watershed.

- Program Development—This category addresses the need for ordinance, policy, and guidance development. BMPs include:

  - Source Control Incentive Programs – The City will consider developing incentive programs to control metals at their source, especially on commercial and industrial parcels.

  - Green Policy/Guidance Development – The City will continue its efforts to work collaboratively with City agencies and other jurisdictions to establish revised or new policies that facilitate the implementation of green urban runoff management BMPs.

  - Stream Protection Ordinance – The City will complete development of its Stream Protection Ordinance to provide a mechanism to protect lands adjacent to waterbodies.

  - Source Control Ordinances – The City will evaluate its existing ordinances to determine whether additional or modified city ordinances would make residents and businesses more responsive to source control measures.

- Education and Outreach—Some of the BMPs in this category are already being implemented; however, they are included in the Implementation Plan to document continued commitment to this BMP category, or recognition that some programs may need to be evaluated and revised to create better-targeted messages addressing metals sources. BMPs include:

- Urban Runoff Websites – The City will continue to manage its stormwater website (www.lastormwater.org) to provide information on urban runoff management practices, and add specific information on LAR Metals TMDL implementation.

- Regulatory and Policy Education – The City will develop and implement a process to educate and provide outreach to appropriate City departments and agencies to support implementing newly developed policies, ordinances, and incentive programs.

- Targeted Metals Education & Outreach – The City will evaluate its existing education and outreach program to determine the need to enhance this effort to improve the effectiveness of this BMP, especially as targeted to metals reduction.

- Rapid Transit Promotion – The City will evaluate the potential to partner with regional transportation agencies to promote use of rapid transit to minimize the number of vehicle miles driven in the watershed. Where partnerships are possible, the City will evaluate with these agencies opportunities to develop and implement incentives to reduce the number of vehicle miles driven.

- Education and Outreach Effectiveness Evaluation – The City will develop evaluation and monitoring methods to better understand the performance of education and outreach programs. This information can be used to better prioritize educational campaigns.

- Watershed-wide Education – This ongoing BMP focuses on improving the consistency and efficiency of urban runoff management education efforts watershed-wide.

- Education and Outreach Funding – The City will work with its watershed partners to establish a long-term stable fund for supporting watershed-wide education activities that is cost-shared among jurisdictions and organizations.

- Environmental Learning Center – The City will complete construction of the Environmental Learning Center, and establish a secure funding source so that the facility is regularly open to provide environmental education

- Planning and Coordination—Coordination will be needed both within and among agencies to successfully execute BMPs in the watershed. Such coordination can create opportunities, increase efficiency and effectiveness, and minimize the likelihood that other agencies or jurisdictions work at cross-purposes. BMPs include:

  - Interagency Task Force – Establish a task force with appropriate representation to coordinate the review and revision or adoption of new policies and ordinances in a consistent manner in the watershed. Other functions could include

facilitation of BMP implementation and coordination of similar institutional BMP programs across jurisdictions.

- Collaborative Watershed Projects – The City will continue to work collaboratively with the NGOs where opportunities exist to cost share on the implementation of BMP projects that are consistent with the goals of this Plan.

- General Plan Update – Consistent with the WQCMPUR, the City will work with its planning department to consider options for revising the City's General Plans to facilitate urban runoff management, particularly as redevelopment opportunities become available.

Green Structural BMPs

The top ranked regional and distributed BMP sites underwent final review and analysis to divide the potential sites into Priority 1 and Priority 2 projects. Priority 1 sites are proposed for implementation under this Implementation Plan according to the schedule described below[1]. Priority 2 sites are held in reserve at this time. As the TMDL implementation process moves forward, where additional regional and distributed BMP projects are needed, the Priority 2 sites serve as the pool from which new projects may be drawn. The City may also supplement these Priority 2 sites in the future where opportunities become available.

Regional BMP Projects

Four Priority 1 sites have been selected for implementation under this Plan; the remaining sites are considered Priority 2 sites. Table ES-1 summarizes the conceptual plan for each of these four Priority 1 projects.

Table ES-1 Characteristics of Four Priority 1 Regional BMP Sites with Potential BMP Options

Site Name	Owner	Subwatershed	Drainage Area (ac)	Potential BMP Type	BMP Footprint (ac)
Van Nuys Sherman Oaks Park	City of Los Angeles	LAR Reach 4	1,520	Detention Basin/Wetland	27
North Hollywood Park	City of Los Angeles	LAR Reach 4	4,360	Detention Basin/ Infiltration	14

[1] The City may substitute one or more of these priority projects with other regional and/or distributed BMP projects if it is determined that a project is not feasible, e.g., the land is unavailable, or a project opportunity becomes available that is functionally equivalent, i.e., provides necessary volume of treatment and/or accomplishes the goals of this TMDL Implementation Plan.

Distributed BMP Projects

A screening process was used to narrow the 100 candidate distributed BMP sites to 50 Priority 1 sites. Factors included areas with highest frequency of water quality impairments, subwatersheds that did not have any regional BMP sites, sufficiency of public right-of-ways for installing BMPs, and sites with educational land uses. The remaining distributed BMP sites have been retained as potential Priority 2 sites.

ES.7 Implementation Schedule

The metals TMDL includes separate compliance requirements for dry and wet weather (Table ES-2). These compliance requirements are based on the percent of the drainage within the City of Los Angeles' jurisdiction that is in compliance with the TMDL targets.

Table ES-2 Metals TMDL Compliance Targets

Flow Condition	Target Date	Compliance Target (Percent of City of Los Angeles Drainage Area)
Dry Weather	2012	50%
	2020	75%
	2024	100%
Wet Weather	2012	25%
	2024	50%
	2028	100%

CMP data collected between October 2008 and August 2009 demonstrate that more than 75 percent of the City's drainage area within the LAR Watershed is in compliance with dry weather Metals TMDL targets for copper and lead (total and dissolved). Accordingly, for dry weather, the focus of BMP implementation activities will be on compliance with the 2024 target.

In contrast to the dry weather data, CMP wet weather data collected in 2009 indicate that the City is not currently in compliance with any of the total copper and total zinc metals wet weather targets (although the City was in compliance with all lead and cadmium targets). Given these results, the focus of BMP implementation under this Plan is on the wet weather targets, in particular for total copper and total zinc. Because many of the BMPs planned for implementation will also result in dry weather load reductions, the City's focus on wet weather compliance will result in compliance with dry weather targets.

Tables ES-3 and ES-4 summarize the proposed schedule for structural and institutional BMP implementation to achieve compliance with Metals TMDL wet weather targets applicable to the City's portion of the LAR Watershed. Implementation of this schedule is dependent on adequate program funding. Quantitative analyses demonstrate that implementation of this Plan will result in the required metals load reductions within the City's jurisdiction to achieve compliance with the wet weather targets. However, even if an adequate funding source is established in the short term, the City will not be able to construct by 2012 all the necessary structural BMPs required to comply with the 2012 wet weather target date. A review of City projects shows that the length of time required to complete a BMP project (including pre-design, design, bid/award, construction, and post-construction activities) is typically 32 months for a distributed BMP and 60 months for a regional BMP. Regardless, the City is committed to expediting the planning, design, and construction phases for each structural BMP project to the maximum extent practicable. The following sections describe the general implementation approach for each BMP Implementation Category.

Table ES-3 Planned Implementation of Structural BMPs to Achieve TMDL-specific Targets

Implementation Category	BMP/Program	TMDL Target (Acres Treated)		
		2012	2024	2028
Existing & Planned Projects	Proposition O (see Table 4-1 for projects and TMDL target dates)	1,910	255	5,130
	Other Watershed Projects (see Table 4-2 for projects and TMDL target dates)	10,280	590	480
New Green Structural BMPs	Distributed BMPs (Priority 1 projects by 2012; Priority 2 plus other projects by 2028)	1,400	7,000	
	Regional BMPs (Priority 1 - North Hollywood Park)	4,360	--	--
	Regional BMPs (Priority 1 – Van Nuys Sherman Oaks)	--	1,520	--
	Regional BMP Priority 2 projects	--	--	20,000

Table ES-4 Planned Implementation of Institutional BMPs to Achieve TMDL-specific Targets

Institutional Program	BMP Type	2012 Target	2024 Target	2028 Target
Direct Source Control	Brake Pad Replacement	6.5% average copper content	5.7% average copper content	5.0% average copper content
	Enhanced Street Sweeping	5% increase in sediment removal		
	Downspout Disconnection	2,500 downspout disconnects/year		
Development/ Redevelopment Standards	Enhanced Program	250 acres/year		
Other BMP Categories Types	Education & Outreach, Program Development, Planning & Coordination	Water quality benefits not quantified. Continuous implementation through 2028; specific goals summarized in Table 4-14		

Existing and Planned BMP Projects

For Proposition O and other watershed projects, Table ES-3 summarizes the acres of runoff treated, based on the known or estimated project characteristics and the expected completion date relative to the TMDL target dates. The City will continue to monitor these projects throughout the TMDL implementation period to verify that the expected water quality benefits from each project occur.

SUSMP

Since 2001, City records indicate that an average of 250 acres of projects that meet SUSMP requirements are implemented each year in the Los Angeles River Watershed. It has been assumed that this rate of implementation will continue. The City will continue to enhance the SUSMP requirements as required by MS4 permit requirements.

Institutional BMPs

The Implementation Plan provides a general schedule for each institutional BMP planned for implementation. Where appropriate, these activities will be implemented in conjunction with other TMDL implementation activities, e.g., the Ballona Creek Bacteria and Metals TMDL Implementation Plans. This Plan adopts quantitative targets for only the few institutional BMPs for which water quality benefits can be estimated (see Table ES-4): Brake pad replacement program; enhanced street sweeping, and downspout disconnections.

Given the high uncertainty surrounding water quality benefits achievable by implementing many institutional BMPs (e.g., education and outreach), the benefits that may occur from these BMPs were not quantified for the purposes of developing this Implementation Plan. The benefits of these activities are still expected to be significant; however, by not attempting to quantify these benefits, the City has increased the margin of safety associated with its quantitative analysis.

Green Structural BMPs

Regional BMPs

Table ES-3 indicates the number of acres from which runoff is derived and targeted for treatment through the implementation of regional BMPs. These acres vary depending on the wet weather target date. The two Priority 1 projects[2] have the capacity to treat stormwater from about 5,880 acres.

The City plans to implement additional regional BMPs by 2028 that provide treatment for runoff from an additional 20,000 acres. Unless alternative opportunities become available that have not been identified to date, the City will implement selected

[2] The City may substitute one or more of these priority projects with other regional and/or distributed BMP projects if it is determined that a project is not feasible, e.g., the land is unavailable, or a project opportunity becomes available that is functionally equivalent, i.e., provides necessary volume of treatment and/or accomplishes the goals of this TMDL Implementation Plan.

projects from the list of Priority 2 regional BMP sites developed under this Plan. While the quantitative analysis demonstrates that these projects only need to be completed by 2028, the actual timing for implementation of these projects will be determined at a later date. It is likely that the City will phase the planning, design, and construction of these projects beginning prior to 2024 with completion of all work by 2028.

The City plans to achieve multiple-objectives with each of the regional BMP projects, e.g., increased open space, recreational benefits, and compliance support for other pollutants. Accordingly, it is expected that most regional BMP projects will require extensive planning, stakeholder input, and coordination with multiple agencies. All will be subject to resolution of substantive permitting and right-of-way issues. Final project flow rates and treatment levels will depend on the available area and detailed project engineering design. The treatment volumes for projects may fall below the full treatment volumes anticipated by this Plan if necessitated by the results of detailed engineering feasibility studies. Additional projects may be added to replace treatment volumes for purposes of meeting goals of TMDL Implementation Plan.

Distributed Structural BMPs

Table ES-4 indicates that achieving compliance with the 2012 wet weather TMDL target requires that the runoff from 1,400 acres receives treatment from implementation of distributed BMPs. Preliminary analyses indicate that the 50 Priority 1 distributed BMP projects may provide sufficient treatment capacity to meet the 1,400 acres treated target shown for 2012.

Between 2012 and 2028, an additional 7,000 acres of treated runoff is required to achieve the compliance goals set for 2024 and 2028. The remaining Priority 2 distributed BMP sites could be implemented following completion of the Priority 1 projects. It is estimated that these projects can provide up to an additional 1,200 acres of treatment.

The City expects to implement projects at a regular pace over the 16-year period from 2013 to 2028. Accordingly, the City will implement projects that provide an additional 300 to 350 acres of treatment each year. Based on the average project size of 35.4 acres (average of Priority 1 and Priority 2 projects combined), the City plans to implement nine to 10 distributed projects per year.

Similar to the regional BMP projects, it is expected that most distributed BMP projects will require extensive planning, stakeholder input, and coordination with multiple agencies. All will be subject to the resolution of substantive permitting and right-of-way issues. Final treatment benefits associated with each project will depend on the available area and detailed project engineering design.

ES.8 Program Costs

Implementation costs were developed based on planning level information. These program costs do not include already funded Proposition O and other watershed projects and continued implementation of the SUSMP program.

A cost estimate was prepared for each Priority 1 regional BMP project. The estimated capital cost for these two projects is about $46,800,000. Using the average cost per treated acre for these projects, it is estimated that an additional $159,200,000 in capital expenditures for regional BMP projects will be needed by 2028. The estimated cost for distributed BMP projects is based on the average cost per treated acre calculated from representative projects. Based on this approach, the capital cost for Priority 1 distributed BMP projects is estimated at $49,000,000; the capital cost of the Priority 2 distributed projects is estimated to cost an additional $245,000,000. The total capital cost for new structural regional and distributed BMPs is estimated at $500,000,000 with an additional $13,900,000 in annual operation and maintenance costs by 2028.

Many institutional BMP activities may continue at existing funding levels or with only modest increases. However, the capital cost of implementation of the downspout disconnection program at the implementation rate planned for in this Plan is estimated at $76,500,000 over the period from 2010 to 2028.

Section 4
Implementation Plan

The Implementation Plan presented in this section provides a roadmap for achieving compliance with the targets established in the Los Angeles River Metals TMDL. This section describes the phased implementation of the selected BMPs. Section 5 provides the quantitative analyses that demonstrate compliance with interim and final targets.

4.1 Overview

The Implementation Plan is consistent with the City's WQMPUR, which established a strategy for urban runoff management, and the following four guiding principles:

- *Comprehensive Program*—Incorporates a combination of institutional and green structural BMPs
- *Integrated Water Resources Approach*—Considers potential recycled water and conservation benefits of rainwater reuse
- *Green Solutions*—Enhances other public goals, such as increased acreage of parks, greenways, and open space
- *Phased Approach*—Implements BMPs in phases while evaluating associated water quality improvements; revises BMP priorities as needed

Compliance with TMDL targets can be achieved through the implementation of a BMP program that takes into account the combined water quality benefits achieved through different BMP programs. Figure 4-1 illustrates the framework used to build this Implementation Plan.

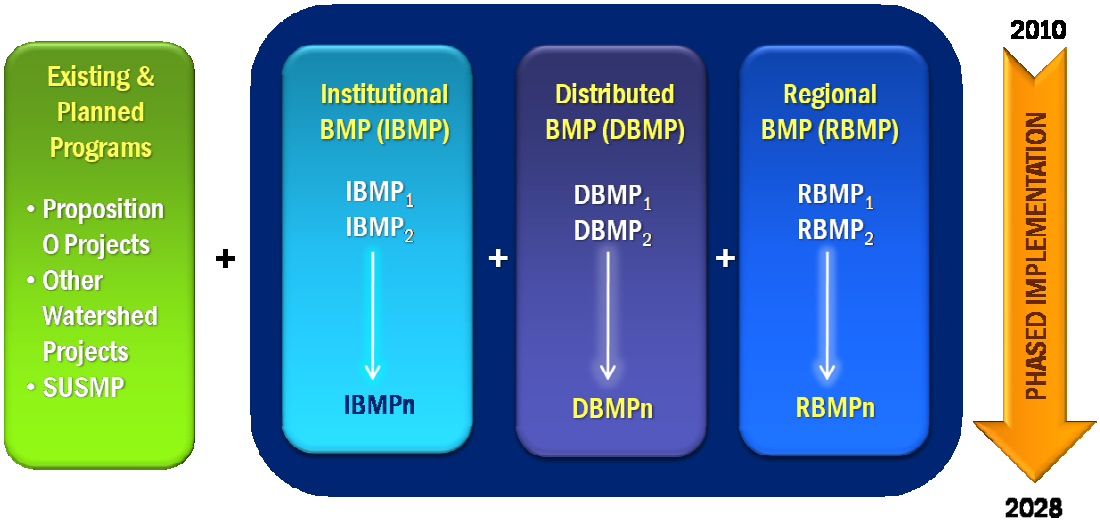

Figure 4-1
Overview of Proposed Comprehensive BMP Program for the Implementation Plan

4.2 Existing and Planned BMPs

Water quality benefits are already being achieved through implementation of MS4 permit requirements and existing and planned watershed projects. These benefits, described below, have been incorporated into this Implementation Plan.

4.2.1 Proposition O Projects

A number of major Proposition O projects will be completed prior to the metals TMDL compliance target dates (Figure 4-2). Each of these projects provides a significant water quality benefit. Additional smaller projects (e.g., Oros Green Street) also provide benefits. Table 4-1 summarizes the number of acres of tributary runoff that are expected to receive treatment as a result of the completion of each major Proposition O project.

Table 4-1 Water Quality Benefits of Major Proposition O Projects

Proposition O Project	TMDL Compliance Target Supported	Acres Tributary
Cabrito Paseo Walkway	2012	16
Cesar Chavez Recreational Complex	2012	679
Echo Park Lake Restoration	2012	356
Hansen Dam Wetlands Restoration	2012	235
LA Zoo Parking Lot	2012	33
North Atwater Park	2012	62
South Los Angeles Wetland Park	2012	525
Albion Dairy Park	2024	255
Strathern Pit Stormwater Infiltration	2028	929
Taylor Yard G2	2028	4200 (est)[1]
Total Acres Tributary to Project		**7,290**

[1] – (est.) = tributary acres estimated as a function of approximate space available for a BMP

4.2.2 Other Watershed Projects

A number of other major watershed projects are in development stages or planned for completion prior to the metals TMDL compliance target dates (Figure 4-3). Additional smaller projects (e.g., Riverdale and Elmer Green Streets) also provide benefits. Similar to the Proposition O projects, each of these major projects provides a significant water quality benefit. Table 4-2 summarizes the number of acres of tributary runoff that are expected to receive treatment as a result of the completion of each of the major watershed projects.

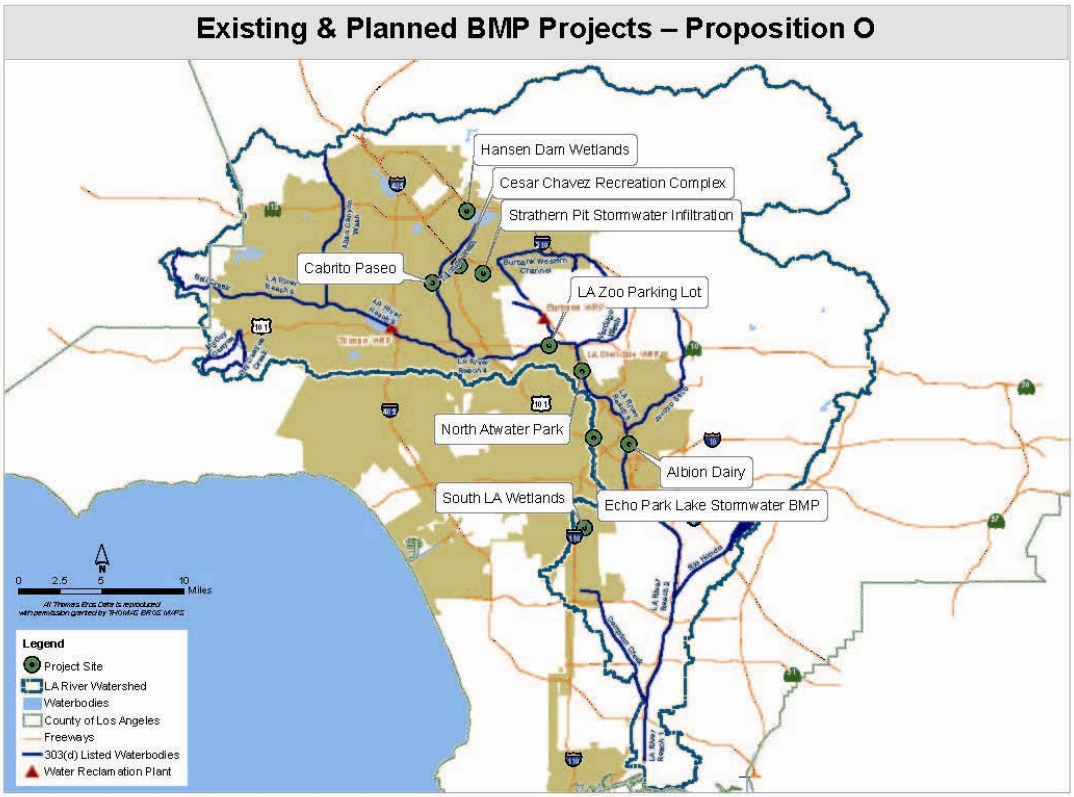

Figure 4-2
Proposition O Projects Planned for Completion by 2028

Table 4-2 Water Quality Benefits of Other Major Watershed Projects

Watershed Project	TMDL Compliance Target Supported	Acres Tributary
LADWP Whitnall Powerline Easement Stormwater Capture	2010	185
Tujunga Spreading Grounds	2012	2,840
Low Flow Diversions (7th & 8th Streets)	2012	155
Bull Creek Restoration	2012	2,800 (est.)[1]
Headworks Ecosystem Restoration	2012	4,300 (est.)[1]
LADWP Valley Generating Station Stormwater Recharge	2024	155
Cornfield-Arroyo Seco Specific Plan	2024	433
Sunnynook Park	2028	133
Aliso Creek Confluence/Reseda River Loop	2028	153 (est.)[1]
Arroyo-Seco Confluence Restoration Greenway	2028	193 (est.)[1]
Total Acres Tributary to Project		**11,347**

[1] – (est.) = tributary acres estimated as a function of approximated space available for a BMP.

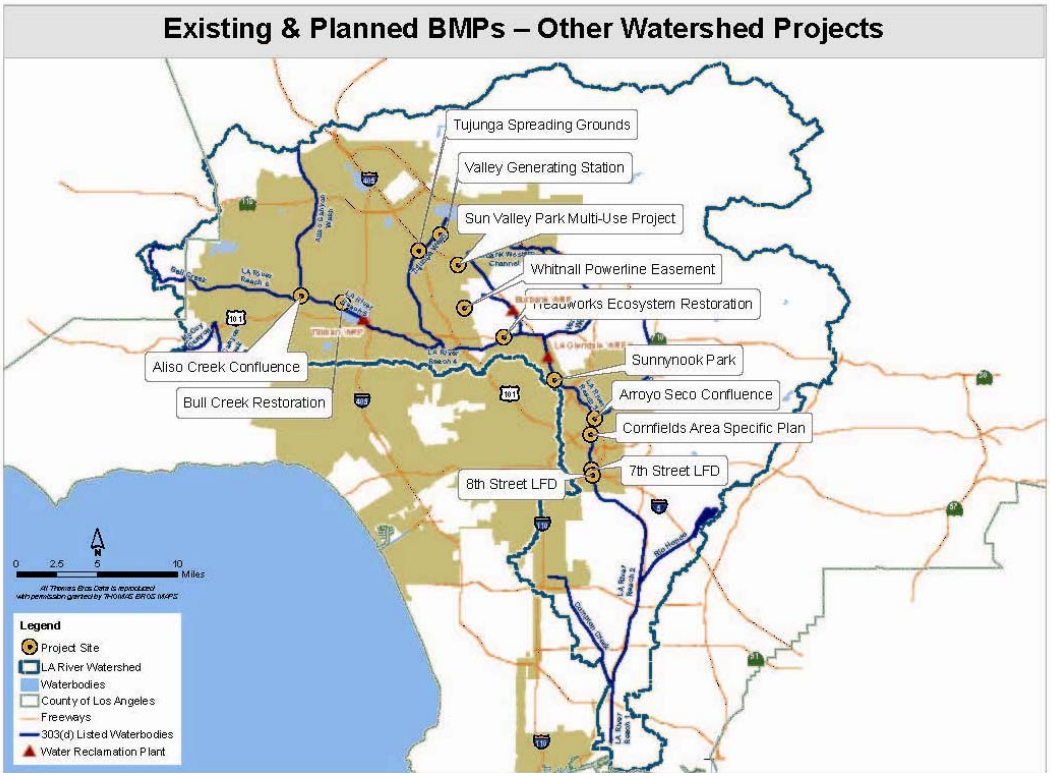

Figure 4-3
Other Watershed Projects Planned for Completion by 2028

4.3 SUSMP

Throughout the implementation of this Plan, new development and redevelopment activities will continue in the City of Los Angeles. Many of these development activities are subject to MS4 permit SUSMP requirements for managing stormwater. Where SUSMP requirements apply, the BMPs installed on-site must be able to infiltrate, capture and reuse, or treat all of the runoff from an 85th percentile storm, which is equivalent to a 3/4", 24-hour storm. New City guidelines for SUSMP approved on July 9, 2008 require developers to give top priority to BMPs that infiltrate stormwater and lowest priority to mechanical/hydrodynamic units.

A review of City development records shows that on average, approximately 250 acres of new development or redevelopment projects have been implemented across the City each year since 2001. This plan assumes that this average number of acres subject to SUSMP requirements will continue to occur in the Los Angeles River Watershed in future years.

4.4 Institutional BMPs

Institutional BMPs focus on pollution prevention and stormwater runoff volume reduction to decrease pollutant loading to the City's waters. This section describes the proposed plan for implementing watershed-wide institutional BMPs to reduce metals loadings in the LAR Watershed. While specific to this watershed, many of these BMPs are consistent with other City efforts to implement institutional BMPs in other watersheds. Because of the difficulty in implementing some BMPs related to technological, institutional, or political issues, this proposed plan recognizes that some actions can be taken immediately while others will take longer as they may require significant discussion among multiple stakeholders.

The BMPs described in this section represent the range of potential institutional BMPs being considered for implementation in the watershed. In some cases, these BMPs recognize or supplement institutional BMPs already being implemented through the City's MS4 permit program. Other BMPs are new and recommended for implementation to help address urban runoff management concerns in general, and target metals sources specifically.

To simplify the presentation of institutional BMPs planned for consideration and/or implementation, specific BMP activities have been categorized into the following four broad areas:

- *Direct Source Control*—BMPs that directly address metals sources are included in this category. Sources are addressed either through pollution prevention, such as product replacement, or activities that reduce the volume of urban runoff, e.g., downspout disconnection program.

- *Program Development*—This category addresses the need for ordinance, policy, and guidance development. Included in this area is the need to consider how to incentivize BMP implementation on properties under private ownership, especially commercial and industrial properties.

- *Education and Outreach*—Some of the BMPs in this category are already being implemented; however, they are included to document continued commitment to the BMP, or recognition that some programs may need to be evaluated and revised to create better-targeted messages addressing metals sources. This category also includes BMPs that are more programmatic in nature to help ensure that education and outreach activities receive the needed funding, are consistent across the watershed and the City, and are regularly updated to ensure that those tasked with managing urban runoff are kept updated on current policies and guidance.

- *Planning and Coordination*—Coordination will be needed both within and among agencies to successfully execute BMPs in the watershed. Such coordination can create opportunities, increase efficiency and effectiveness, and minimize the likelihood that other agencies or jurisdictions work at cross-purposes. For example, revisions or development of new education and outreach materials, development

of green policies, and downspout disconnection specifications (see other BMP categories) need not be developed separately by each jurisdiction. Moreover, opportunities may exist to work collaboratively with NGOs to implement selected elements of the institutional BMPs.

4.4.1 Direct Source Control

Implementation of the institutional BMPs associated with this category result in the direct removal of pollutant sources either through removal of a metals source or by reducing urban runoff which prevents metals from being conveyed to storm drains and into the Los Angeles River.

Product Replacement

The purpose of this BMP is to reduce a significant source of metals in the environment by developing safe alternative products. To implement this BMP, the City will continue to support efforts to reduce metals in vehicle brake pads and wheel weights through pending legislation (SB 346 and SB 757, respectively). In addition, if opportunities arise to participate in studies or legislation to reduce the metal content in other products, the City will consider its potential role participating in those efforts.

Enhanced Street Sweeping

This BMP focuses on enhancing street sweeping activities to achieve a modest 5% increase in material picked up by 2028. To achieve this goal, the City will evaluate opportunities to increase the efficiency of its existing street sweeping program. This evaluation will include a pilot study to evaluate effectiveness of street sweeping by evaluating parameters such as sweeping frequency, sweeper type, location (areas with highest potential pollutant loads), need for parking regulations, material captured (type and quality), etc. Based on the study findings, the City can develop and implement program features that improve sweeping effectiveness.

Downspout Disconnection

This institutional BMP involves encouraging property owners to disconnect their roof downspouts and redirect the stormwater runoff to pervious surfaces, rain gardens, rain barrels or cisterns. Implementation of this BMP can greatly reduce the stormwater runoff volumes and reduce pollutant loading to City waterbodies.

BMP implementation in the Los Angeles River Watershed will be coordinated with ongoing efforts to develop a downspout disconnection program in the Los Angeles River Watershed. Currently, a pilot program is underway in the Ballona Creek watershed. Based on the findings from this effort and studies of other downspout disconnect programs (e.g., in cities such as Portland, OR), the City will obtain technical information to evaluate program results (e.g., volume of urban runoff from rooftops and the water quality of rooftop runoff); develop technical specifications (e.g., methods for downspout disconnections); and evaluate programmatic issues, including estimating the numbers of homeowners willing to participate, methods for

encouraging property owner participation (e.g., incentive or city service), and analyzing program costs.

Based on the outcome of the pilot study, the City will consider establishing an incentive program to encourage residential, commercial, and industrial property owners to implement downspout disconnections on their own properties. Examples of this approach have been used successfully elsewhere (e.g., City of Portland[1] provides a one-time rebate on a portion of the costs incurred by property owners who disconnect downspouts on their own).

4.4.2 Program Development

The water quality benefits achievable through institutional BMP implementation are facilitated and enhanced through implementation of ordinances, policies, or programs that require or encourage a better approach to urban runoff management. A number of institutional BMPs are already being implemented in this BMP category. The City will either continue these activities or implement new activities in the following areas:

Source Control Incentive Programs—The City will consider developing incentive programs to control metals at their source, especially on commercial and industrial parcels. Specifically, the City will consider (1) adopting a stormwater credit program (e.g., City of Minneapolis, Minnesota[2], or city of Portland's Clean River Rewards Program[3]) that provides a reduction in stormwater fees based on the degree of BMP implementation that affects stormwater quality or quantity; or (2) adopting a business recognition program for facilities that implement selected BMPs (e.g., Clean Bay Business Program, City of Palo Alto, California[4]).

Green Policy/Guidance Development—The City will work collaboratively within and among City agencies and possibly other jurisdictions to establish revised or new policies that facilitate the implementation of urban runoff management BMPs. Policies/guidances (which include minimum technical specifications) to be addressed include: (1) beneficial reuse of stormwater; (2) green building (including LID requirements); (3) use of permeable or porous pavement; and (3) Green Street development. An effort will be made to create as much consistency as possible across the watershed and address critical policy issues. For example, a Green Street retrofit can be limited to the street within the right-of–way, or expanded to include drainage capture from adjacent private lots. Policy development would need to consider the potential for creating public/private partnerships in these types of projects.

SUSMP Enhancement—Enhance the SUSMP requirements for new development and redeveloped properties to include LID principles to reduce property stormwater runoff. At a minimum, SUSMP enhancements will be consistent with expected LID requirements in future MS4 stormwater permits (e.g., as already defined in the

1 http://www.portlandonline.com/Auditor/index.cfm?a=245002&c=28044
2 http://www.ci.minneapolis.mn.us/stormwater/fee/index.asp (last visited on July 23, 2009)
3 http://www.portlandonline.com/BES/index.cfm?c=41976
4 http://www.cityofpaloalto.org/business/news/details.asp?NewsID=526&TargetID=5

recently adopted Ventura County MS4 permit[5]) (See additional SUSMP discussion in Section 4.2.1).

Stream Protection Ordinance—The City will complete development of its Stream Protection Ordinance to provide a mechanism to protect lands adjacent to waterbodies. Implementing this ordinance over a long period of time will reduce pollutant loads from reaching City waterbodies.

Source Control Ordinances—The City will evaluate its existing ordinances to determine whether additional or modified city ordinances would make residents and businesses more responsive to source control measures. In addition, the City will continue its efforts to implement an integrated water resource approach to urban runoff management. This effort includes implementing BMPs to increase water conservation and stormwater reuse through projects that reduce water use or capture stormwater. Such efforts will reduce potential pollutant loading to downstream waters.

4.4.3 Education and Outreach

One of the primary keys to source control is implementing education and outreach programs to increase public understanding of urban runoff management issues. Accordingly, this BMP involves providing education on water quality impacts from controllable sources, and preventing polluted runoff from entering the storm drain system. Implementation activities include:

Urban Runoff Websites—The City will continue to manage its stormwater Website (www.lastormwater.org) to provide information on urban runoff management practices, and add specific information on Los Angeles River metals TMDL implementation.

Regulatory and Policy Education—The City will develop and implement a process to educate and provide outreach to appropriate City departments and agencies to support implementing newly developed policies, ordinances, and incentive programs.

Targeted Metals Education & Outreach—The City currently implements a comprehensive education program to reduce potential mobilization of metals into storm drains from car washing (both at home and charity car washes), hosing down driveways, improper disposal of used oil, and vehicle maintenance activities at home. The City will evaluate its existing education and outreach program to determine the need to enhance this effort to improve the effectiveness of this BMP.

Rapid Transit Promotion—The City will evaluate the potential to partner with Metrolink, Los Angeles County Metropolitan Transit Authority, and Los Angeles Department of Transportation to promote the use of rapid transit to minimize the number of vehicle miles driven in the watershed. Where partnerships are possible, the

5 http://www.swrcb.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/ventura_ms4/09-0057/Transmittal%20Letter%20and%20MS4%20Permit%20Order%20No%2009%200057.pdf

City will evaluate with these agencies opportunities to develop and implement incentives to reduce the number of vehicle miles driven.

Education and Outreach Effectiveness Evaluation—The City will develop evaluation and monitoring methods to better understand the performance of education and outreach programs. Based on this information, prioritize educational campaigns on the basis of their effectiveness (e.g., information dissemination through brochures, public meetings, signage, school education, etc.).

Watershed-wide Education—The purpose of this ongoing BMP is to improve the consistency and efficiency of urban runoff management education efforts watershed-wide. The City will continue to collaborate with other jurisdictions, City agencies, and NGOs to develop appropriate watershed-wide educational programs.

Education and Outreach Funding—The City will work with its watershed partners to establish a long-term stable fund for supporting watershed-wide education activities that is cost-shared among jurisdictions and organizations including, but not limited to, the cities, Los Angeles County, and NGOs. Establishing this fund would include developing an agreement on the methods for governing fund expenditures.

Environmental Learning Center—The City will complete construction of the Environmental Learning Center by the end of 2010, and establish a secure funding source so that the facility is regularly open to provide environmental education.

4.4.4 Planning and Coordination

Given the need to implement a comprehensive program to reduce metals loads in the Los Angeles River Watershed, this effort would benefit from increased coordination and collaboration among responsible jurisdictions, NGOs and stakeholders. To facilitate this need, the following institutional BMP activities will be considered for implementation:

Interagency Task Force—Establish a task force that includes appropriate representation (e.g., decision-makers associated with responsible city or agency departments and NGOs). The primary purpose of this task force would be to coordinate the review and revision or adoption of new policies and ordinances in a consistent manner in the watershed. Other functions could include facilitation of BMP implementation and coordination of similar institutional BMP programs across jurisdictions.

Collaborative Watershed Projects—The NGOs often obtain funds for watershed projects from state and federal grant funding sources. When cost-shared with other entities (e.g., cities or the County), opportunities are created to fund valuable BMP projects (e.g., as identified by other planning activities or programs). Accordingly, the City will continue to work collaboratively with the NGOs where opportunities exist to cost share on the implementation of BMP projects that are consistent with the goals of this Plan.

General Plan Update—The City will work with its planning department to consider options for revising the City's General Plans to facilitate urban runoff management, particularly as redevelopment opportunities become available. The City of Los Angeles has already begun this process through the implementation of its WQCMPUR.

4.5 Green Structural BMPs

After a review of the top ranked regional and distributed BMP sites, those sites were divided into Priority 1 and Priority 2 sites. Priority 1 sites are proposed for implementation under this Implementation Plan according to the schedule described in Section 4.6[6]. Priority 2 sites are held in reserve at this time. As the TMDL implementation process moves forward, where additional regional and distributed BMP projects are needed, these Priority 2 sites serve as the pool from which new projects may be drawn. The City may also supplement these Priority 2 sites in the future where opportunities become available.

4.5.1 Regional BMP Projects

Additional screening was conducted on the 17 candidate regional BMP sites (see Section 3) based on opportunity potential, site conditions, ownership, drainage area, and geographic distribution. The screening narrowed the 17 sites to four Priority 1 sites (Table 4-3 and Figure 4-4). As Priority 1 sites, these four are recommended for the initial phases of structural BMP implementation under the Implementation Plan.

Table 4-3 Characteristics of 4 Priority 1 Regional BMP Sites with Potential BMP Options

Site Name (Catchment ID)	Owner	Sub-watershed	Figure No.	Drainage Area (ac)	Potential BMP Type	Comments	BMP Footprint (ac)
BI9203-2	City of Los Angeles	LA River Reach 4	Figure 4-5; Figure 4-6	1,520	Detention Basin/Wetland	Van Nuys Sherman Oaks Park	27
MT30-2_7	City of Los Angeles	LA River Reach 4	Figure 4-7; Figure 4-8	4,360	Detention Basin/ Infiltration	North Hollywood Park	14

[6] The City may substitute one or more of these priority projects with other regional and/or distributed BMP projects if it is determined that a project is not feasible, e.g., the land is unavailable, or a project opportunity becomes available that is functionally equivalent, i.e., provides necessary volume of treatment and/or accomplishes the goals of this TMDL Implementation Plan.

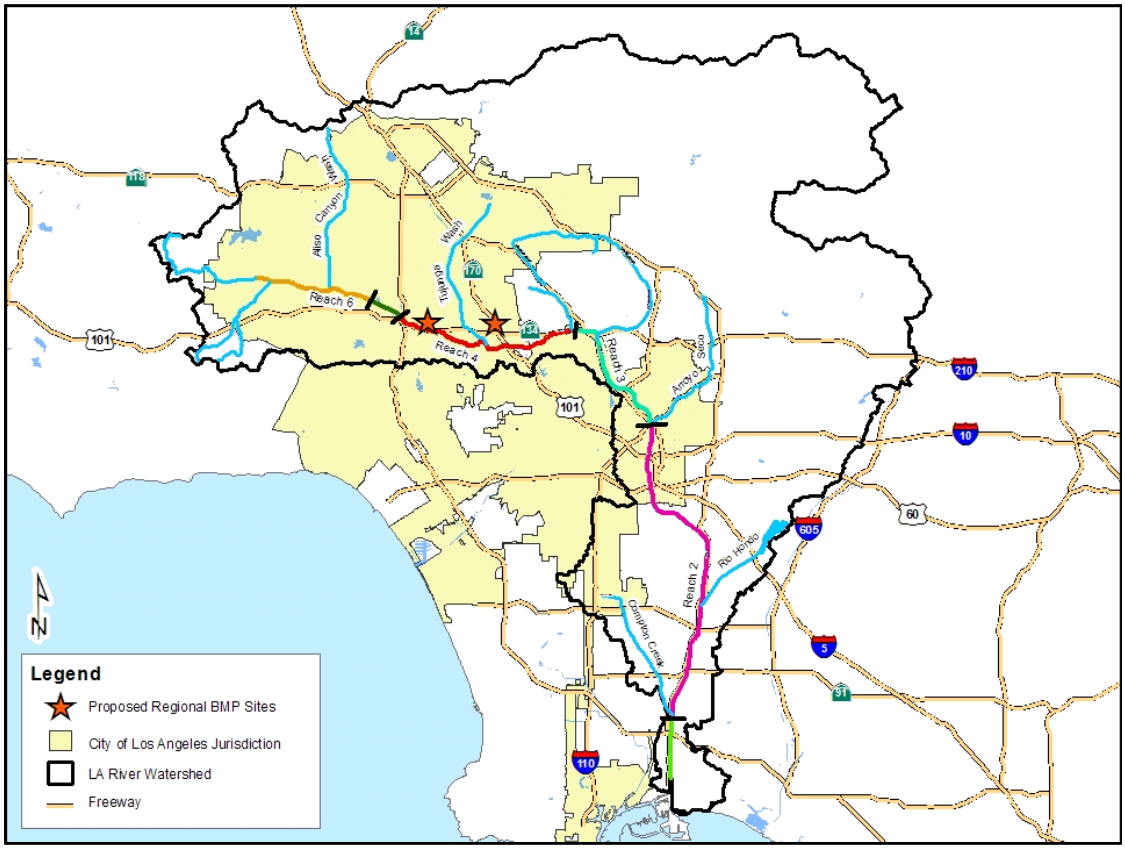

Figure 4-4
Recommended Priority 1 Regional BMP Sites

Priority 1 Regional BMP Sites

The following sections provide descriptions for each Priority 1 regional BMP site, including location, storm drain, and open space information. For each of the recommended Priority 1 BMPs, a preliminary conceptual plan was developed and basic sizing properties were estimated for use in the simulation of runoff capture and treatment. The plan includes information on the general schematics of the BMP inflows and outflows, potential flow control devices, and flow diversions (if needed) from the waterbody and/or storm drains from where inflows are drawn for treatment. For various types of BMP options suitable for these sites, different criteria are used in developing preliminary conceptual sizing for model inputs. This section discusses those criteria as well.

The information and figures presented for the proposed Priority 1 regional BMP sites are preliminary and conceptual in nature. At this time only informal discussions with landowners have taken place and the actual availability of the land necessary to implement these regional BMP projects has not been secured. The specific infrastructure and land needs will be determined during the feasibility study and design phases of each project. Additional information that will need to be gathered includes:

- Topographic site survey of existing ground surfaces, utilities and structures;
- Analysis of as-built drawings for all existing utilities and structures;
- Geotechnical subsurface soil investigation;
- Hydraulic conductivity testing (soil permeability);
- Detailed water quality testing for process design; and
- Environmental review

If the necessary land for project implementation cannot be secured, then alternative Priority 1 projects will be considered for implementation. In addition, impacts to existing recreational uses, surrounding areas, aesthetics, wildlife and other factors will also be examined in more detail in the CEQA and/or NEPA environmental process.

Van Nuys Sherman Oaks Park (BI9203-2)
The Van Nuys Sherman Oaks Park site is located within the area that drains to Los Angeles River Reach 4 (Figure 4-5, Table 4-4). The site includes about 30 acres of ball fields located at the Van Nuys Sherman Oaks Park. The site is located within the City of Los Angeles jurisdiction, owned by the City of Los Angeles, and maintained by the Parks and Recreation Department.

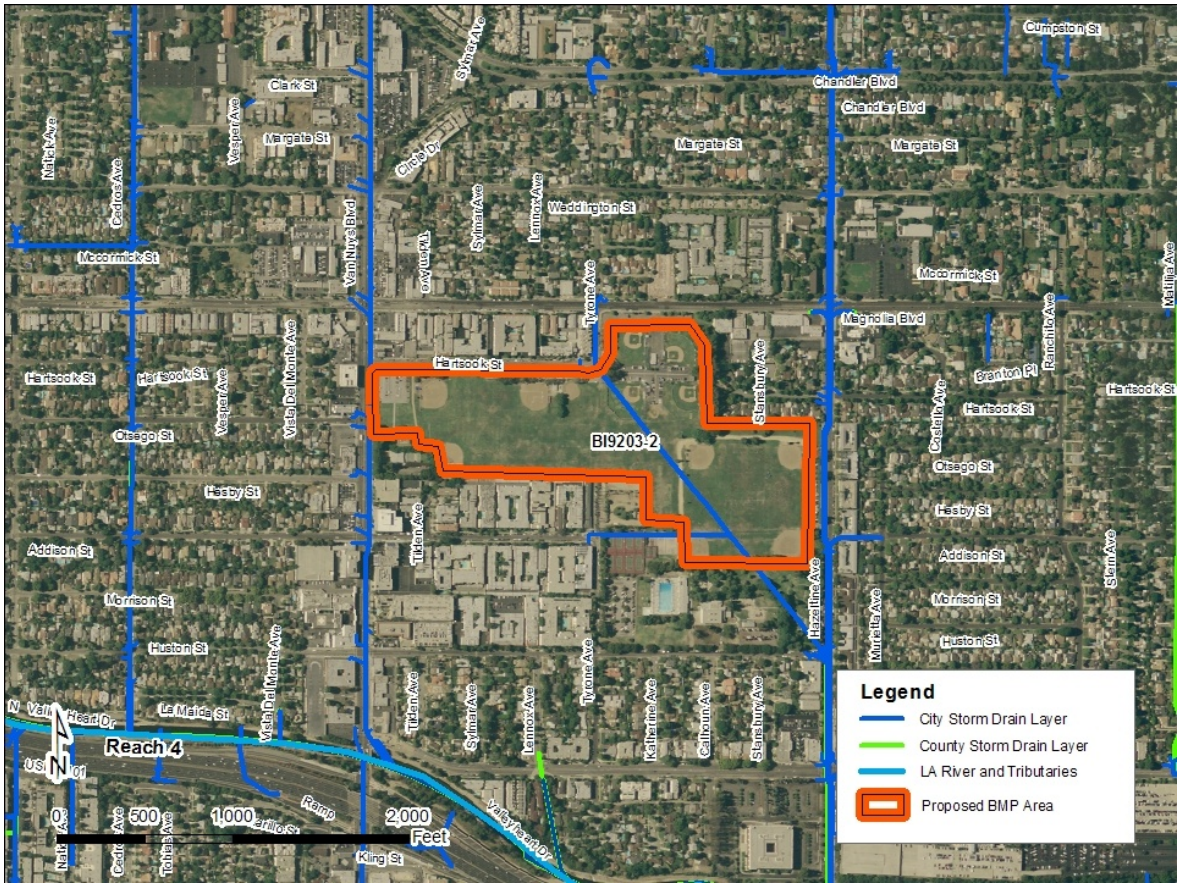

Figure 4-5
Priority 1 Regional BMP – Van Nuys Sherman Oaks Park (BI9203-2)

TABLE 4-4VAN NUYS SHERMAN OAKS PARK (BI9203-2) SUMMARY

Owner	Land Use	Property Area (ac)	Catchment Area (ac)	Distance from major Storm Drain (ft)	Approx Open Space (ac)	Current Use of open space	BMP Options	Comments
City of Los Angeles	Open Space	65.5	1,520	0	27	Ball fields	Detention Basin/ Wetland	Limited unused open space

The site has a tributary area of approximately 1,520 acres, and is located within three parcels, APN's 2248008901, 2248009901 and 22488023901. Storm drains that run through the park, and along the east and west sides of the potential BMP area (Figure 4-6), could be routed to the proposed detention basin. The detention basin could be constructed as an open basin with the ball fields at the basin invert so that they would be available for park use during dry weather. Another option is to design the basin as an underground detention basin, which would also maintain existing recreational use; however, for the purposes of preparing a cost estimate for this project, it was assumed that the detention basin would be above ground (see Section 6).

North Hollywood Park (MT30-2_7)

The North Hollywood Park site is located within the area that drains to Reach 4 of the Los Angeles River (Figure 4-7, Table 4-5). This portion of North Hollywood Park consists of 20 acres of walking trails, trees and grassy areas. The site is located within the City of Los Angeles jurisdiction, owned by the City of Los Angeles, and maintained by the Parks and Recreation Department.

The site has a tributary area of approximately 4,360 acres, and is comprised of a single parcel, APN 2353001903. The potential BMP type is proposed as an infiltration basin. Flow from the open channel along the west side of the potential BMP area (Figure 4-8) could be diverted near the northwest corner of the site for infiltration. This will require pumping because the invert of the channel is about 10 to 15 feet below the invert of the potential infiltration basin. Storage volume for an infiltration basin at North Hollywood Park is dependent upon the infiltration rate of the underlying soils.

The proposed project area is on the southern portion of North Hollywood Park. Most of the recreational use at the park occurs at the northern portion of the park (north of Magnolia Blvd), which is not considered for the siting of the infiltration basin. The primary recreational use in the southern portion is the use of dirt walking paths around and through the park. In order to maintain the existing use of the site, the walking paths can be left in place or reconstructed within the infiltration basin. The proposed infiltration basin will require that some existing landscaping (including trees) be replaced after construction. The walking paths would be usable during the dry season and between storm events.

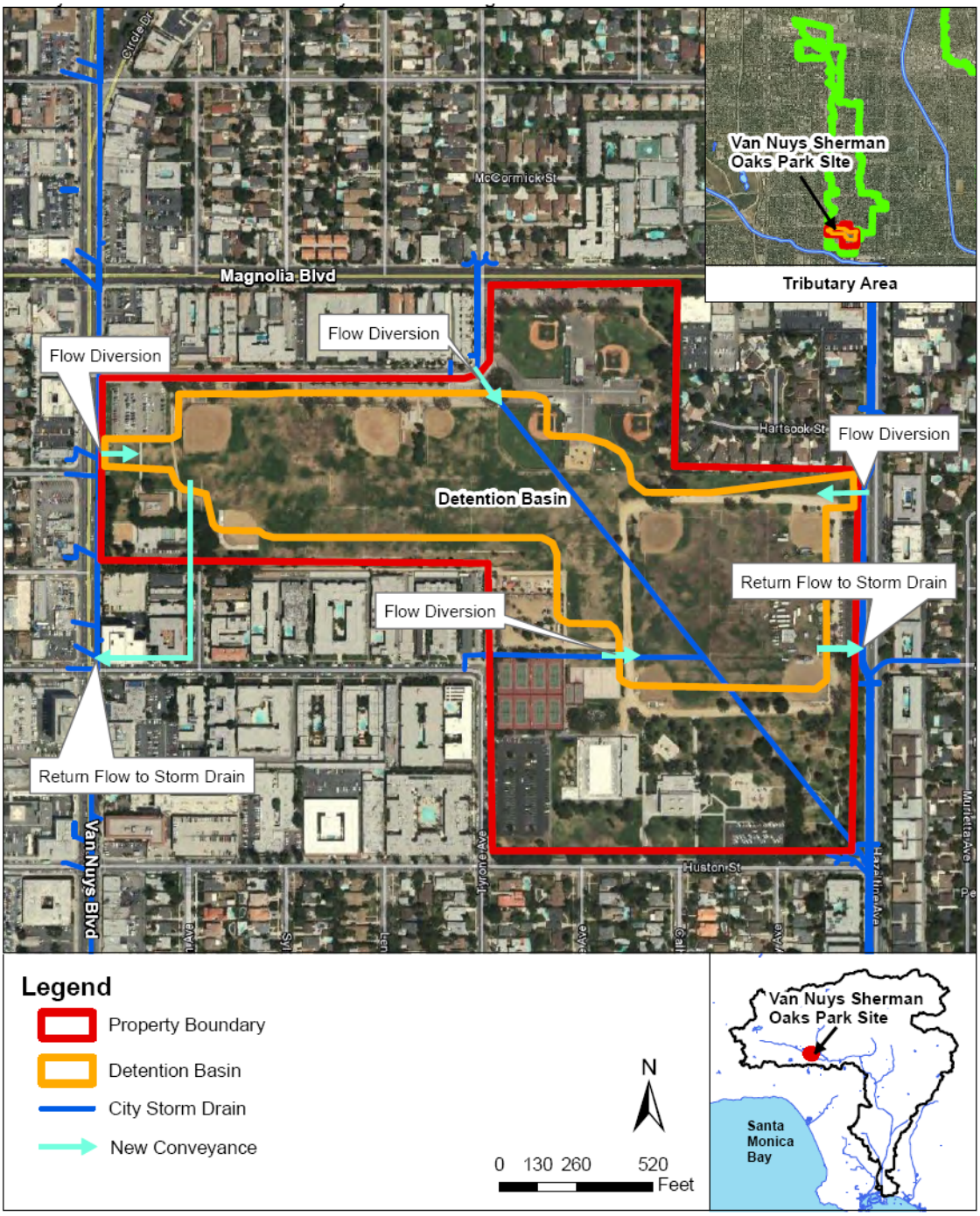

Figure 4-6
Regional BMP Footprint - Van Nuys Sherman Oaks Park (BI9203-1)

TABLE 4-5 NORTH HOLLYWOOD PARK (MT30-2_7) SUMMARY

Owner	Land Use	Property Area (ac)	Catchment Area (ac)	Distance from major Storm Drain (ft)	Approx Open Space (ac)	Current Use of open space	Potential BMP Option	Comments
City of Los Angeles	Open Space	20.5	4,360	0	14	Park	Detention Basin/ Infiltration	Grassy areas, walking trails and mature trees.

Figure 4-7
Priority 1 Regional BMP – North Hollywood Park (MT30-2_7)

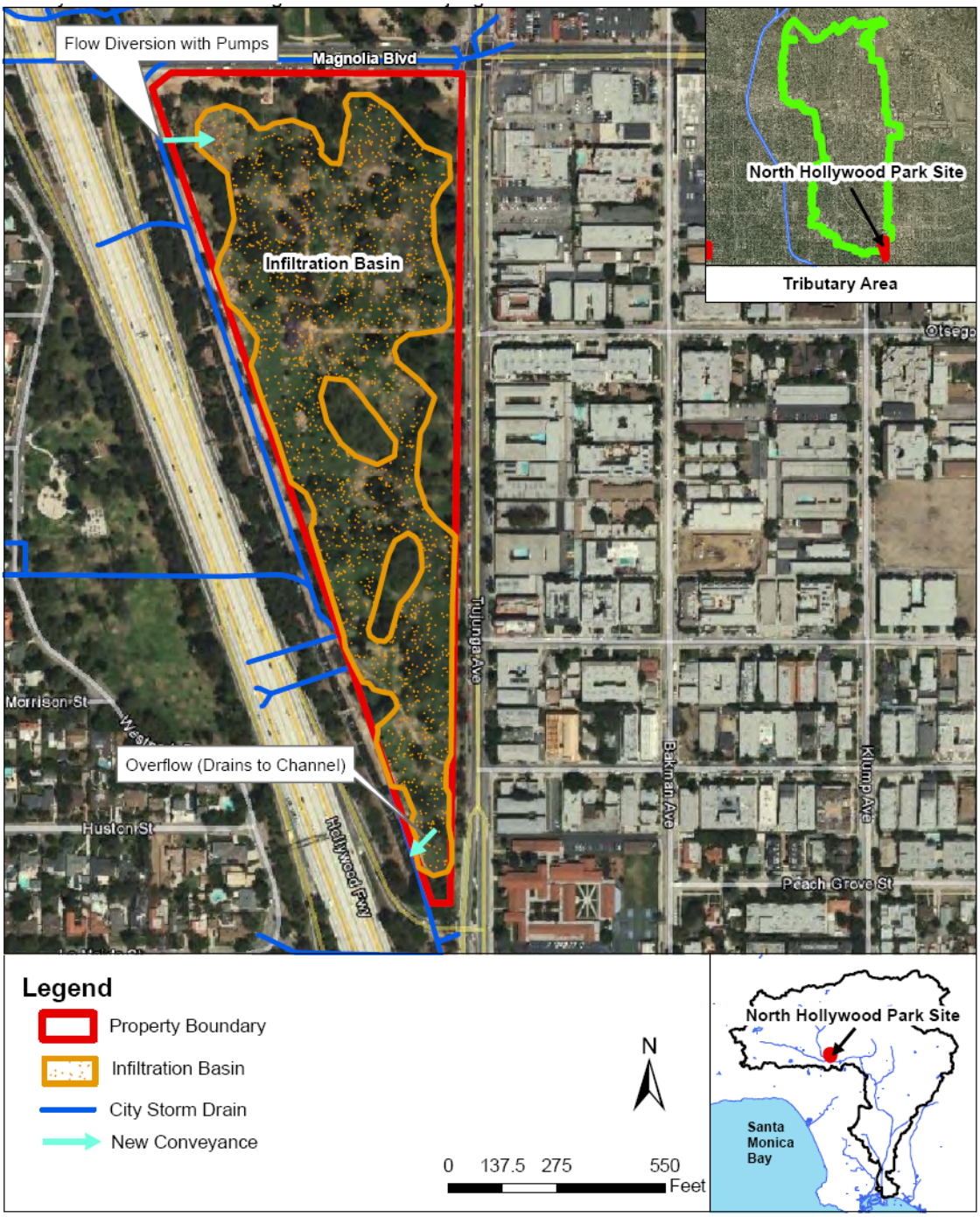

Figure 4-8
Regional BMP Footprint – North Hollywood Park (MT30-2_7)

Priority 2 Regional BMP Sites

The Priority 1 BMPs presented above are proposed for implementation under this Metals TMDL Implementation Plan. As needed, additional regional BMP projects may be implemented comply with the TMDL targets. These Priority 2 projects will likely be drawn from other field-investigated sites (see Tables 3-6 and 3-7). However,

if opportunity for a collaborative project with watershed stakeholders becomes available, the City will consider participation to meet the goals of the TMDL.

4.5.2 Distributed BMPs Sites

Priority 1 Distributed BMP Sites

Although 100 distributed BMP opportunity sites were field investigated, the specific sites and the number of sites needed for implementation was determined based on the phased compliance analysis and discussions among City staff. A screening process was used to narrow the 100 distributed BMP sites to 50 Priority 1 sites (Figure 4-9)

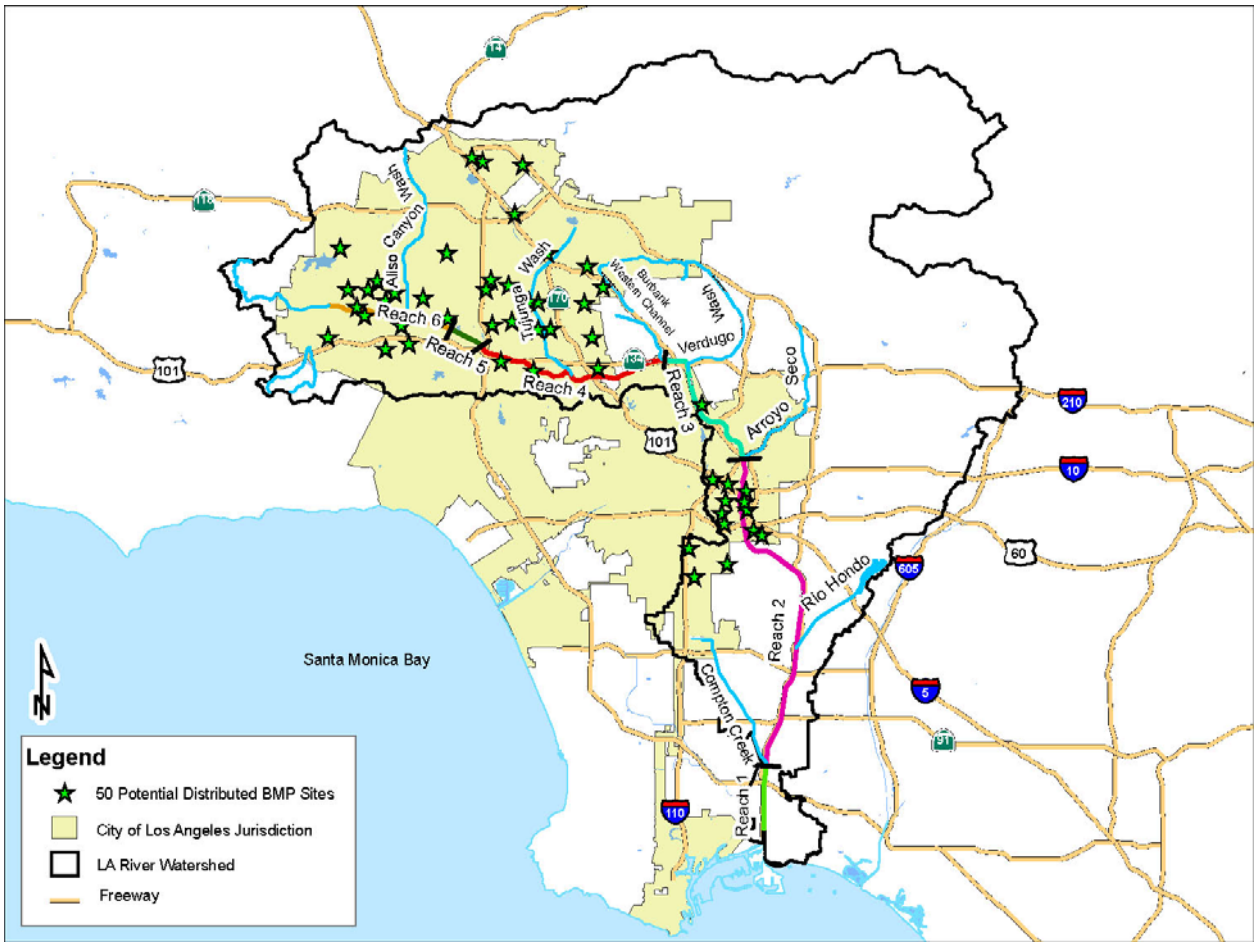

Figure 4-9
50 Potential Distributed BMP Priority 1 Sites

BMP sites within subwatersheds that have water quality impairments (estimated by previous water quality exceedances shown by water quality data) were ranked the highest in the Priority 1 list. Water quality exceedances were determined by comparing the dry weather data for metals with the water quality targets.

- Subwatersheds that did not have any regional BMP sites were considered as priority sites for the distributed BMPs. This was particularly the case for the industrial and commercial areas.

- Sites must have sufficient public right-of-way for implementing distributed BMPs. Sites with minimal or no public land available for implementation of distributed BMPs were ranked lower.

- Sites with educational land use were considered as priority sites since at least one type of distributed BMP was suitable in those areas.

The Priority 1 distributed sites with proposed BMPs are presented in Table 4-6. Specific distributed BMPs at the Priority 1 sites were determined based on availability of public right-of-way such as parkways, alleys, and public facilities for potential BMP installation, land use, field investigations, desktop analysis, ownership, and site conditions. Table 4-7 summarizes the general treatment capabilities that may be provided by the distributed BMPs described in Table 4-6BMP footprint maps were drawn for all the Priority 1 distributed BMP sites and are provided in Appendix E. An example distributed footprint map is presented in Figure 4-10. Each BMP footprint map includes the following information:

- Catchment boundary. In most cases, the catchment boundary (typically about 40 acres in size) is the same as the project boundary. However, in some cases, the catchment boundary was adjusted to remove the private land areas where distributed BMPs are not considered for implementation at this time.

- Waterbody

- Site name and neighborhood

- BMP footprint

- Storm drain network

- Publicly owned parcels

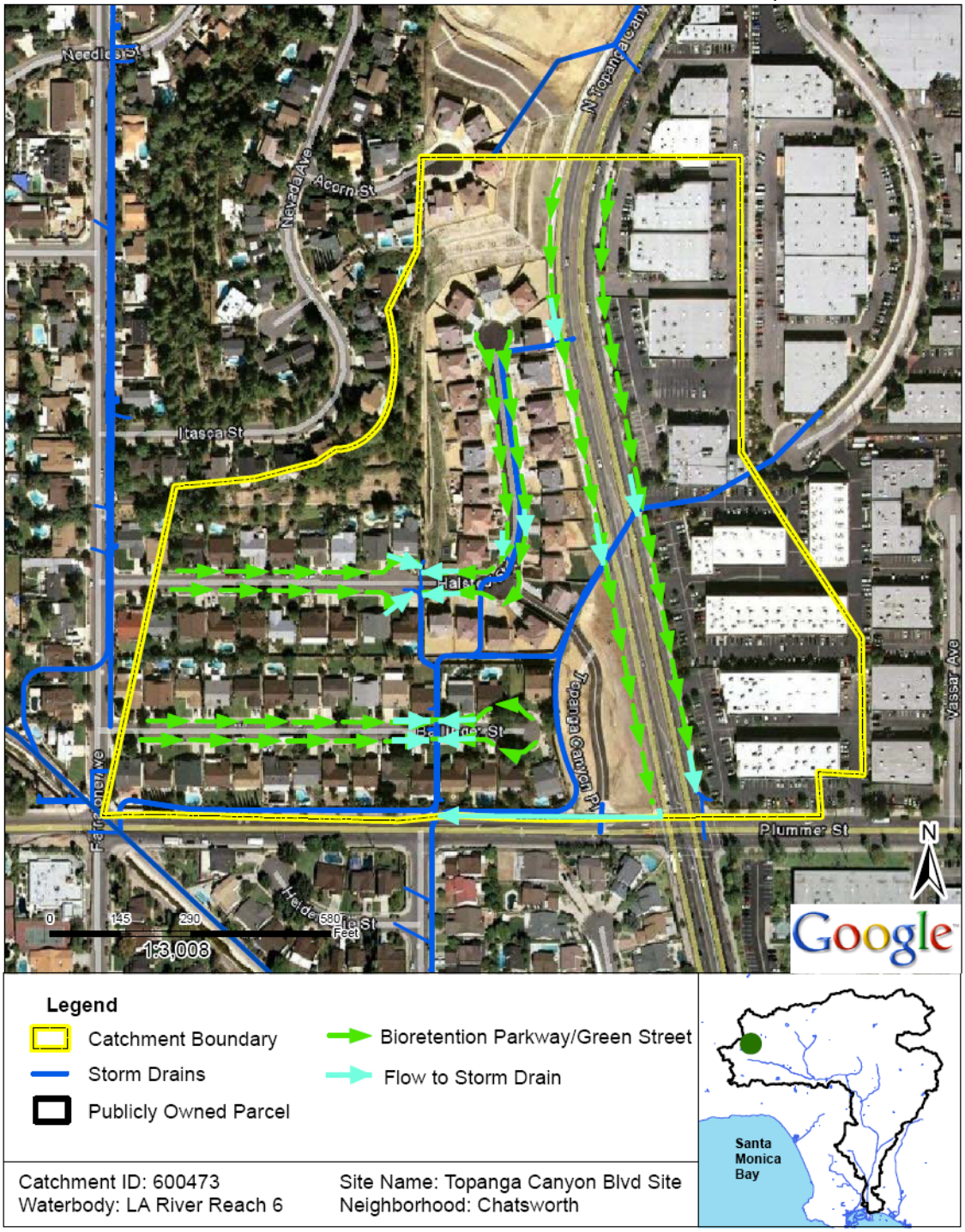

Figure 4-10
Example Distributed BMP Footprint Map for a Priority 1 Site

Table 4-6 Summary of Priority 1 Distributed BMP locations

Sub-catchment	Catchment ID	Waterbody	Site Name	Neighborhood	Bioretention Parkway/ Green Street	Permeable pavement	Cisterns
600473	STSUS3	LA River Reach 6	Topanga Canyon	Chatsworth	X	-	-
600954	BROWN7	LA River Reach 6	Sunnybrae Ave	Canoga Park	X	X	X
603373	CALAB4	LA River Reach 6	Capistrano Ave	Winnetka/ Canoga Park	X	X	X
603679	LAR2	LA River Reach 6	Hart St.	Canoga Park	X	X	X
603932	BI3857	LA River Reach 6	Archwood St	Winnetka	X	-	-
604000	BI477	LA River Reach 6	Cantara St	Winnetka	X	-	-
605031	BI652	LA River Reach 6	Collier St	Tarzana/ Woodland Hills	X	X	X
605134	BI9202	LA River Reach 6	Cantlay St	Winnetka	X	X	-
605283	BI476	LA River Reach 6	Lull St	Reseda	X	X	-
605314	LAR12	LA River Reach 6	Vanalden Ave	Reseda	X	X	X
606966	BI474B	LA River Reach 6	Valerio St	Reseda	X	X	X
607512	BI472	LA River Reach 6	Holmes Middle School	Northridge	X	X	X
603646	BI478B	LA River Reach 6	Alabama Ave	Canoga Park	X	-	-
607618	LA2327	LA River Reach 6	Haynes St.	Lake Balboa	X	X	X
608851	BI106	LA River Reach 5	Stagg st.	Van Nuys	X	-	-
610302	BI108	LA River Reach 4	Colombus Ave	Van Nuys	X	X	-
610314	LA7335	LA River Reach 4	Willis Ave	Sherman Oaks	X	-	-
611527	BI9203-2	LA River Reach 4	Tyrone Ave	Van Nuys	X	X	X
611694	LAR54	LA River Reach 4	Dixie Canyon Ave	Sherman Oaks	X	X	X
614782	BI39-2	LA River Reach 4	Sun Valley Middle School	Sun Valley/North Hollywood	X	X	X
614816	BI39-3	LA River Reach 4	Burbank Blvd	North Hollywood	X	X	X
614854	BI39-4	LA River Reach 4	Cahuenga Blvd.	Toluca Lake	X	X	-
615410	BI60A	LA River Reach 3	Dover St.	Atwater Village	X	X	X
800837	LAR138	LA River Reach 2	Hill St.	Chinatown	X	X	X
800901	B166-3	LA River Reach 2	Cesar Chavez St.	Boyle Heights	X	-	-
801011	BI59-2	LA River Reach 2	Beaudry Ave.	Downtown	X	X	-
801038	LAR140	LA River Reach 2	Utah St.	Boyle Heights	X	X	X
801118	BI5203	LA River Reach 2	Wall St.	Downtown	X	X	-
801131	BI67A	LA River Reach 2	Clarence St.	Boyle Heights	X	-	X
801255	LA4958	LA River Reach 2	Stanford Ave	Downtown	X	X	X
801306	BI58	LA River Reach 2	12th St.	Downtown	X	X	-
801412	BI5206-2	LA River Reach 2	Soto St.	Boyle Heights	X	X	X

Table 4-6 Summary of Priority 1 Distributed BMP locations

Sub-catchment	Catchment ID	Waterbody	Site Name	Neighborhood	Bioretention Parkway/ Green Street	Permeable pavement	Cisterns
801426	BI90	LA River Reach 2	Olympic Blvd	Boyle Heights	X	X	X
606886	BI475	LA River Reach 6	Crebs Ave	Tarzana	X	X	-
610855	WILSN3	Tujunga Wash	Sayre St	Sylmar	X	-	-
610981	PACDV9	Tujunga Wash	San Fernando High School	Pacoima	X	X	X
611116	SYLMR1	Tujunga Wash	Barry J. Midorf Juevenile Hall	Sylmar	X	X	X
611118	SYLMR2	Tujunga Wash	Ralston Ave	Sylmar	X	-	-
611486	BI9203-1	Tujunga Wash	Lanark St Site	Panorama City	X	-	-
613731	BI107B	Tujunga Wash	Laurel Canyon Blvd	Pacoima	X	X	-
614047	BI85-1	Tujunga Wash	Blythe St.	Panorama City	X	-	-
614067	BI9245	Tujunga Wash	Atoll Ave	Valley Glen	X	X	-
614088	TJNGA3	Tujunga Wash	Sherman Way	Van Nuys/Valley Glen	X	-	-
614161	TJNGA4	Tujunga Wash	Oxnard St.	Van Nuys	X	-	-
614200	BI91	Tujunga Wash	Bessemer St.	Valley Glen	X	X	X
790701	CNTRA	Burbank Western Channel	Tuxford St.	Sun Valley	X	X	-
790772	BI609B	Burbank Western Channel	San Fernardo Rd	Sun Valley	X	X	X
850062	BI73B-1	Compton Creek	Martin Luther King Jr Blvd	Historic South Central	X	-	-
850150	BI73A-3	Compton Creek	Slauson Ave.	South Los Angeles	X	X	-
851060	HOOP-1	Compton Creek	Holmes Ave	Central-Alameda	X	X	X

Table 4-7 Tributary Area and Runoff Treatment Capacity for Distributed BMPs in the 50 Priority 1 Catchments

Catchment ID	Permeable Pavement Tributary (acres) [1]	Cistern Tributary (acres) [1]	Bioretention				
			Average K_{sat} (in/hr)	Underdrain Needed	Parkway Length (miles) [2]	Bioretention Tributary (acres)	Runoff Treatment Capacity (in) [3]
600473	0.0	0.0	0.83	No	1.3	18.7	0.42
600954	0.9	0.2	0.57	No	1.3	27.2	0.81
603373	0.8	0.0	0.27	No	1.7	24.7	0.41
603646	0.0	0.0	0.69	No	1.4	43.8	0.44
603679	1.0	0.2	0.35	No	1.1	20.2	0.38
603932	0.0	0.0	0.39	No	1.7	28.2	0.61
604000	0.0	0.0	0.54	No	1.3	29.4	0.49
605031	0.3	0.2	0.25	Yes	0.6	19.2	0.75
605134	1.0	0.0	0.36	No	1.7	30.1	0.38
605283	0.8	0.0	0.36	No	1.6	32.3	0.45
605314	0.9	1.0	0.82	No	1.3	20.0	1.42
606886	1.1	0.0	0.33	No	2.3	36.0	0.74
606966	0.8	0.4	0.36	No	1.2	31.5	0.30
607512	0.0	0.0	0.28	Yes	0.4	6.3	0.75
607618	6.2	3.7	2.51	No	0.3	6.5	2.25
608851	0.0	0.0	0.36	No	0.7	16.6	0.24
610302	1.6	0.0	0.36	Yes	1.4	27.3	0.75
610314	0.0	0.0	0.45	No	1.3	23.0	0.55
610855	0.0	0.0	0.45	No	1.4	38.7	0.33
610981	3.3	2.7	0.56	No	0.8	16.1	1.00
611116	0.7	3.0	0.30	No	0.2	4.5	0.68
611118	0.0	0.0	0.45	No	0.9	34.9	0.45
611486	0.0	0.0	0.36	Yes	1.6	24.0	0.75
611527	0.2	0.3	0.45	No	1.2	21.0	0.38
611694	0.7	1.0	0.23	No	0.3	12.5	0.08
613731	1.4	0.0	0.67	No	1.3	29.2	0.73
614047	0.0	0.0	0.45	Yes	0.8	33.0	0.75
614067	2.0	0.0	0.72	No	0.8	27.9	0.44
614088	0.0	0.0	0.48	No	1.6	43.1	0.38
614161	0.0	0.0	0.45	No	1.5	28.0	0.45
614200	0.6	1.2	0.72	No	1.2	20.1	0.74
614782	10.3	9.4	0.72	No	0.6	15.2	0.44
614816	0.6	1.3	0.72	No	1.4	24.5	0.62
614854	1.3	0.0	0.72	No	1.5	32.5	0.89
615410	0.4	0.6	0.39	No	1.5	29.7	0.76
790701	8.4	0.0	0.72	No	0.9	30.4	0.41
790772	3.3	2.5	0.72	No	1.1	35.1	0.33

Table 4-7 Tributary Area and Runoff Treatment Capacity for Distributed BMPs in the 50 Priority 1 Catchments

Catchment ID	Permeable Pavement Tributary (acres) [1]	Cistern Tributary (acres) [1]	Bioretention				
			Average K_{sat} (in/hr)	Underdrain Needed	Parkway Length (miles) [2]	Bioretention Tributary (acres)	Runoff Treatment Capacity (in) [3]
800837	0.4	0.4	0.40	No	1.6	23.5	0.51
800901	0.0	0.0	0.45	No	1.4	22.9	0.59
801011	0.6	0.0	0.11	Yes	0.8	18.2	0.75
801038	9.4	10.1	0.35	No	1.9	15.1	0.62
801118	0.5	0.0	0.33	Yes	2.0	38.1	0.75
801131	0.0	1.4	0.43	No	0.8	12.6	0.56
801255	0.2	0.0	0.33	No	2.4	42.0	0.39
801306	4.7	0.0	0.33	No	2.1	35.0	0.40
801412	1.3	0.3	0.45	Yes	0.8	15.3	0.75
801426	0.9	2.4	0.45	No	0.7	12.1	0.38
850062	0.0	0.0	0.33	Yes	1.6	33.2	0.75
850150	3.8	0.0	0.33	No	1.2	33.2	0.21
851060	3.4	2.5	0.33	Yes	0.2	34.7	0.75
Total	**74**	**45**			**61**	**1277**	

1) Effective capture of runoff form 0.75 inch design storm is assumed
2) Parkway length is the length of bioretention area along each curb of a Green Street retrofit
3) Treatment capacity, as runoff depth, is a function of tributary area, available space in ROW for bioretention, and soil permeability.

Figure 4-10 also shows the approximate location where stormwater will enter the existing storm drain system from green street BMPs (shown with light blue arrows). The need for under drains will be determined based on the site-specific conditions. If a collector under drain pipe system is used, stormwater will enter bioretention parkways through newly constructed curb-opening inlets, percolate through the bioretention parkway soil/media, then drain into a collector pipe. The collector pipe will tie into the existing storm drain system. If the system does not need a collector pipe, stormwater that enters bioretention parkways through new curb opening inlets is retained for infiltration and evapotranspiration. For larger storms, flows that exceed the capacity of bioretention parkways may flow in the gutter, bypassing bioretention curb-opening inlets, and enter the existing storm drain system at existing inlets. The specific infrastructure needs for each project site will be determined during the design phase of each BMP project.

4.6 Other Implementation Activities

Throughout the implementation of the TMDL, the City will continue to participate, as needed, in watershed-wide monitoring activities and special studies to support compliance analyses. The following sections describe these activities.

4.6.1 Water Quality Monitoring

As noted in Sections 1 and 2, the City is participating with other jurisdictions in the LAR Watershed in the implementation of the CMP. Under this Implementation Plan the City will continue to participate in this monitoring program. However, as needed to demonstrate that the City's jurisdiction is in compliance with its requirements under the TMDL, the City will conduct additional monitoring activities. These additional monitoring activities are described in Appendix F.

4.6.2 Special Studies

The TMDL includes a provision for reconsidering the TMDL wasteload allocations and implementation schedule within five years after the TMDL effective date (i.e., by January 11, 2011). At this time, the results of any special studies that provide the basis for reconsideration of any of the TMDL's provisions are to be submitted to the LARWQCB. Under this Plan, the City will participate in studies where appropriate, e.g., atmospheric deposition, water effect ratio analyses or other potential special studies as described in the Metals TMDL (LARWQCB 2005). In addition, the City recommends that the LARWQCB reconsider the 2012 wet weather target date. As noted in Section 4.7, even with adequate funding, implementation of all structural BMPs identified as necessary to achieve compliance with this target date is infeasible in this short time frame. Table 4-8 summarizes the typical length of key project phases for regional and distributed BMPs.

Table 4-8 Typical length of time associated with implementation of key phases of City BMP projects.

Project Phase	Number of Months for Completion	
	Regional BMP	**Distributed BMP**
Pre-Design	18	6
Design	12	8
Bid & Award	6	6
Construction	18	6
Post-Construction	6	6
Total Months	**60**	**32**

4.7 Implementation Plan Schedule

The Implementation Plan schedule phases structural and institutional BMP implementation to meet the interim and final TMDL targets. Implementation of the BMPs presented in this Plan is dependent on adequate funding over the duration of the implementation period. The City is currently evaluating options for establishing a funding source for implementation of this and other TMDLs. However, even if an adequate funding source is established in the short term, the City will not be able to construct by 2012 all necessary BMPs required to comply with the 2012 wet weather target date (see Section 4.6.2 and Table 4-8 for additional information). Regardless, the City is committed to expediting the planning, design, and construction phases for each structural BMP project to the maximum extent practicable.

The metals TMDL includes separate compliance requirements for dry and wet weather (Table 4-9).

Table 4-9 Metals TMDL Compliance Targets

Flow Condition	Target Date	Compliance Target (Watershed Drainage Area)
Dry Weather	2012	50%
	2020	75%
	2024	100%
Wet Weather	2012	25%
	2024	50%
	2028	100%

Results from CMP data collected since October 2008[7] demonstrate that more than 75 percent of the City of Los Angeles drainage area within the Los Angeles River Watershed is in compliance with dry weather metals TMDL targets for copper and lead (total and dissolved) (see Section 5 for detailed analysis). Accordingly, for dry weather, the focus of BMP implementation activities will be on compliance with the 2024 target.

In contrast, CMP wet weather collected in 2009 (see footnote 7) indicate that the City is not currently in compliance with any of the total copper and total zinc metals wet weather targets (although the City was in compliance with all lead and cadmium targets). Given these results, the focus of BMP implementation under this Plan is on

[7] Los Angeles River TMDL CMP Ambient Monitoring 2008-2009 submittal to the LARWQCB. September 14, 2009

the wet weather targets, in particular for total copper and total zinc. Because many of the BMPs planned for implementation will also result in dry weather load reductions, the City's focus on wet weather compliance will result in compliance with dry weather targets.

Tables 4-10 and 4-11 summarize the proposed schedule for structural and institutional BMP implementation to achieve compliance with metals TMDL wet weather targets applicable to City's portion of the Los Angeles River Watershed. The table identifies activities applicable to interim and final target dates. Quantitative analyses demonstrate that implementation of this Plan will result in the required metals load reductions within the City's jurisdiction to achieve compliance with the wet weather targets (see Section 5 for detailed analyses). The following sections describe the general implementation approach, expected water quality benefits, and relationship between implementation and TMDL target for the implementation categories summarized in Tables 4-10 and 4-11.

Table 4-10 Planned Implementation of Structural BMPs to Achieve TMDL-specific Targets

Implementation Category	BMP/Program	TMDL Target (Acres Treated)		
		2012	2024	2028
Existing & Planned Projects	Proposition O (see Table 4-1 for projects and TMDL target dates)	1,910	255	5,130
	Other Watershed Projects (see Table 4-2 for projects and TMDL target dates)	10,280	590	480
New Green Structural BMPs	Distributed BMPs (Priority 1 projects by 2012; Priority 2 plus other projects by 2028)	1,400	7,000	
	Regional BMPs (Priority 1 - North Hollywood Park)	4,360	--	--
	Regional BMPs (Priority 1 –Van Nuys Sherman Oaks)	--	1,520	--
	Regional BMP Priority 2 projects	--	--	20,000

Table 4-11 Planned Implementation of Institutional BMPs to Achieve TMDL-specific Targets

Institutional Program	BMP Type	2012 Target	2024 Target	2028 Target
Direct Source Control	Brake Pad Replacement	6.4% average copper content	5.7% average copper content	5.0% average copper content
	Enhanced Street Sweeping	5% increase in sediment removal		
	Downspout Disconnection	2,500 downspout disconnects/year		
Development/ Redevelopment Standards	Enhanced Program	250 acres/year		
Other BMP Categories Types	Education & Outreach, Program Development, Planning & Coordination	Water quality benefits not quantified. Continuous implementation through 2028; specific goals summarized in Table 4-14		

4.7.1 Existing and Planned BMP Projects

Sections 4.2.2 and 4.2.3 identified the major Proposition O and other major watershed projects which will provide water quality benefits regarding urban runoff. The acres of runoff treated, based on the known or estimated project characteristics, and the expected completion date relative to the TMDL target dates are summarized in Table 4-10. The City will continue to monitor these projects throughout the TMDL implementation period to verify that the expected water quality benefits from each project occur.

4.7.2 Institutional BMPs

Table 4-12 provides a summary matrix and general schedule for institutional BMP implementation. Where appropriate, these activities will be implemented in conjunction with other TMDL implementation activities, e.g., the Ballona Creek Bacteria and Metals TMDL Implementation Plans. This Plan adopts quantitative targets for only the few institutional BMPs for which water quality benefits can be estimated (see Table 4-12):

- *Brake Pad Replacement*—Table 4-11 indicates the expected average copper percentage (by weight) in brake pads over the period of implementation. Existing vehicles have, on average, 6.5 percent copper in their brake pads. By 2012, it is expected that this average percentage will remain unchanged. Assuming SB 346 becomes law in 2010, it is assumed that the average copper percentage will decline to 5.7 percent by 2024, and 5 percent by 2028. These modest reductions in average copper content of brake pads takes into account the lag time expected for new brake pad products to be common on vehicles in California.

- *Enhanced Street Sweeping*—During the period of implementation, the City plans to enhance street sweeping to achieve an additional 5 percent removal of sediment. This modest increase takes into account the fact that the City already has an active street sweeping program. Thus, opportunities to increase effectiveness are limited.

- *Downspout Disconnect*—Downspout disconnection is a key element of the City's proposed Implementation Plan. This program, which is already being piloted in the Ballona Creek Watershed, will be expanded to the Los Angeles River Watershed. Throughout the period of implementation until 2028, the City plans to implement 2,500 downspout disconnections per year.

- *Enhanced SUSMP Implementation*—Since 2001, City records indicate that an average of 250 acres of projects that meet SUSMP requirements are implemented each year in the Los Angeles River Watershed. It has been assumed that this rate of implementation will continue. The City will continue to enhance the SUSMP requirements as required by MS4 permit requirements.

Table 4-12 Schedule for Implementation of Institutional BMP Program Elements

Category	Institutional BMP	Implementation Process/Schedule	Expected Benefits
Direct Source Control	Product Replacement	■ Continue to provide technical, financial and political support to adopt SB 346 and SB 757 in 2010. ■ Support implementation efforts after legislation passed, including participating pilot/monitoring studies ■ Conduct or participate in local, regional or state studies to identify product replacement opportunities to reduce metals pollutant loads to City waters.	Metals are contained in a number of consumer products the use of which increased metal loadings to the waterbodies. Replacement of metals in these products with a safer alternative will result in significant reductions of metals loadings.
	Street Sweeping Enhancement	■ By 2012, complete street sweeping effectiveness study. ■ By 2013, use findings of study to revise street program ■ By 2014, fully implement revised program (e.g., if it is determined that new equipment is needed).	Increasing the effectiveness of this program will further reduce pollutant loading during wet weather. Conducting an effectiveness study provides opportunity to evaluate new types of equipment and revised strategies.
	Downspout Disconnection	■ By 2011, implement/evaluate pilot program, develop targeted program for full implementation, and begin program implementation ■ By 2013, complete at least 2,500 downspout disconnects in the Los Angeles River Watershed ■ 2013 - 2028, implement at least 2,500 downspout disconnects/year in the Los Angeles River Watershed.	The cornerstone to compliance with wet weather targets is the implementation of a progressive, targeted downspout disconnection program. Implementation is phased so that time is allowed for developing an effective program that targets the most important areas of the watershed.
Program Development	Source Control Incentives	■ By 2013, establish and implement incentive program that encourage implementation of BMPs that reduce wet weather runoff from commercial and industrial properties.	Establishing incentives for commercial and industrial properties increases likelihood of implementation of distributed structural BMPs on these privately owned properties. This will result in reduced pollutant loads in wet weather runoff.
Program Development	SUSMP Enhancement	■ By 2012 (or sooner if required by MS4 permit), establish and implement enhanced SUSMP requirements that incorporate LID principles	Implementation of LID principles on new developments or redeveloped properties subject to SUSMP will reduce pollutant loads in wet weather runoff.
	Stream Protection Ordinance	■ By 2011, establish stream protection ordinance in the City of Los Angeles	Over the long term, this BMP provides opportunities for implementation of BMPs along waterbodies to mitigate urban runoff. Ordinance development is underway in the City of Los Angeles
	Source Control Ordinances	■ By 2011, evaluate need for additional authority in ordinances to reduce metals loads in urban runoff. ■ By 2013, adopt new or revised ordinance provisions as needed.	BMP provides opportunity to identify additional authority needed to reduce metals pollutant loads in dry and wet weather runoff.

Table 4-12 Schedule for Implementation of Institutional BMP Program Elements

Category	Institutional BMP	Implementation Process/Schedule	Expected Benefits
Program Development	Green Policy/Guidance Development	■ By 2011, establish (or revise as needed) policies and guidance for green street retrofits and green building activities (including LID requirements) ■ By 2012, establish stormwater beneficial reuse policies and guidance ■ By 2012, establish permeable pavement policies and guidance	The establishment of formal policies and guidance (including technical specifications) provides an important mechanism for ensuring implementation of appropriate BMPs to manage urban runoff throughout the area.
Education and Outreach	Urban Runoff Website	■ Continuous implementation	Provides quick, easy way to broadcast information throughout the watershed
	Regulatory and Policy Education	■ Continuous – as products from program development are developed, information and training provided, as needed.	Training of staff within each jurisdiction of new programs, procedures and policies ensures more effective implementation
Education and Outreach	Targeted Metals-Education & Public Outreach	■ By 2011, review and revise public education and public outreach activities related to activities which can reduce metals loading to storm drains, e.g., used oil disposal, car washing, vehicle maintenance	Provides mechanism for continual improvement of materials and message delivered to homeowners and organizations that promote activities such as charity car washes.
	Rapid Transit Promotion	■ By 2011, identify opportunities to establish partnerships with regional transportation agencies to implement programs to promote rapid transit as a means to improve water quality. ■ By 2012, evaluate opportunities with identified partners to create incentives to promote use of rapid transit. If appropriate, conduct pilot program prior to implementation of program throughout the watershed.	Given that vehicle tires are an important metals source in the environment, implementation of BMPs that result in reduced driving reduces the build-up of metals on roadways and metals loadings in waterbodies.
	Effectiveness Evaluation	■ By 2011, conduct evaluation of existing education and outreach materials that target metals sources to determine their effectiveness. ■ By 2012, select most effective materials and programs, update as needed and implement.	Establishing a common education and outreach message across the watershed helps ensure that a consistent message is broadcast. The effectiveness evaluations and development of watershed-wide materials should be closely coordinated
	Watershed-wide Education	■ By 2012, consolidate education and outreach programs to the extent possible to provide consistent message across the watershed.	
	Program Funding	■ By 2012, establish long-term, stable funding source for education and outreach activities.	Establishment of long-term, stable funding source for education supports efforts to provide consistent and, as needed, regularly updated message. A portion of the established funds would be dedicated to the annual operation of the ELC.
	Environmental Learning Center	■ By 2011, complete ELC construction and initiate learning activities at the Center. ■ By 2012, establish long-term, stable funding source for operation of ELC.	

Table 4-12 Schedule for Implementation of Institutional BMP Program Elements

Category	Institutional BMP	Implementation Process/Schedule	Expected Benefits
Planning & Coordination	Interagency Task Force	■ By 2011, establish Task Force and begin meeting at least quarterly	Establishment of this Task Force increases the opportunity for consistent collaborative implementation of urban runoff management strategies and site-specific BMP projects throughout the watershed.
	Watershed Collaboration	■ Continuous implementation	Occasionally state and federal grant opportunities become available for funding NGO projects which have urban runoff management benefits. By working collaboratively with the NGOs, jurisdictions have opportunities to cost-share projects.
	General Plan Update	■ By 2011, all jurisdictions evaluate opportunities to update their General Plans to incorporate urban runoff management goals. ■ By 2015, complete General Plan updates to the extent possible (as defined by the public process)	Updating General Plans provides a mechanism to establish common development goals that recognize the importance of managing urban runoff. The extent of implementation of this BMP depends on concurrence of Plan changes by many stakeholders.

Given the high uncertainty surrounding water quality benefits achievable by implementing many institutional BMPs (e.g., education and outreach), the benefits that may occur from these BMPs were not quantified for the purposes of developing this Implementation Plan. The benefits of these activities are still expected to be significant; however, by not attempting to quantify these benefits, the City has increased the margin of safety associated with its quantitative analysis.

In many cases, the City is already implementing at least a baseline program for a number of the institutional BMPs identified in this Plan. Under this Plan, these existing programs will be reviewed and, where appropriate, update or enhanced (e.g., updated education and outreach materials to target metals sources).

Implementation of some of the new institutional BMPs, e.g., downspout disconnection program, will generally follow a typical project cycle including planning, preparation of a detailed and specific BMP action plan, and development of a pilot program leading into subsequent implementation phases. Where appropriate, this development cycle will be coordinated with similar programs planned for implementation in other watersheds (e.g., Ballona Creek).

Where feasible, the pilot programs will be prioritized to target the higher priority catchments. A detailed institutional BMP action plan will be developed for each program and will focus on what each specific agency is currently doing, how resources could be shifted to target high priority catchments initially, and what can be done to enhance activities that will be ultimately implemented by the City.

As the institutional BMPs become better defined through the iterative, adaptive approach, specific, quantifiable performance measures will be identified and included in the respective program implementation plans. In addition, as water quality monitoring results are obtained from the CMP, institutional BMPs can be honed to target specific locations where high metals concentrations are found, and the implementation plan for the affected programs modified accordingly.

4.7.3 Regional Structural BMPs

Table 4-10 indicates the number of acres from which runoff is derived and targeted for treatment through the implementation of regional BMPs. These acres vary depending on the wet weather target date. Section 4.4.1 identified two priority regional BMP projects for implementation to achieve compliance with the wet weather TMDL targets. These two projects[8] have the capacity to treat stormwater from about 5,900 acres (see Table 4-3). The City plans to implement the North Hollywood Park priority regional BMP project by 2012 and the Van Nuys Sherman Oaks Park priority regional BMP by 2024.

[8] The City may substitute one or more of these priority projects with other regional and/or distributed BMP projects if it is determined that a project is not feasible, e.g., the land is unavailable, or a project opportunity becomes available that is functionally equivalent, i.e., provides necessary volume of treatment and/or accomplishes the goals of this TMDL Implementation Plan.

Table 4-10 indicates that the City plans to implement additional regional BMPs by 2028 that provide treatment for runoff from an additional 20,000 acres. Unless alternative opportunities become available that have not been identified to date, the City will implement selected projects from the list of potential regional BMP sites developed under this Plan (see Tables 3-6 and 3-7). While the quantitative analysis demonstrates that these projects only need to be completed by 2028, the actual timing for implementation of these projects will be determined at a later date. It is likely that the City will phase the planning, design, and construction of these projects beginning prior to 2024 with completion of all work by 2028.

The City plans to achieve multiple-objectives with each of the regional BMP projects, e.g., increased open space, recreational benefits, and compliance support for other pollutants. Accordingly, it is expected that most regional BMP projects will require extensive planning, stakeholder input, and coordination with multiple agencies. All will be subject to resolution of substantive permitting and right-of-way issues. Final project flow rates and treatment levels will depend on the available area and detailed project engineering design. The treatment volumes for projects may fall below the full treatment volumes anticipated by this Plan if necessitated by the results of detailed engineering feasibility studies.

4.7.4 Distributed Structural BMPs

Table 4-10 indicates that achieving compliance with the 2012 wet weather TMDL target requires that the runoff from 1,400 acres receives treatment from implementation of distributed BMPs. Tables 4-6 and 4-7 describe 50 Priority 1 distributed BMP opportunities[9] planned for implementation in the Los Angeles River Watershed. The treatment catchment area for these projects is variable; however, according to preliminary analyses these 50 projects have the potential to provide sufficient treatment capacity to meet the 1,400 acres treated target shown for 2012 (Table 4-10).

Between 2012 and 2028, an additional 7,000 acres of treated runoff is required to achieve the compliance goals set for 2024 and 2028. The remaining distributed BMP sites not included as Priority 1 sites could be implemented following completion of the Priority 1 projects (see Tables 3-8 and 4-6). These projects likely can provide up to an additional 25% of the treatment needs from distributed BMP projects between 2012 and 2028. Additional projects will need to be developed during future years of implementation.

The City expects to implement projects at a regular pace over the 16-year period from 2013 to 2028. Accordingly, the City will implement projects that provide an additional 450 to 500 acres of treatment each year. Based on the typical project size of distributed

[9] The City may substitute one or more of these priority projects with other regional and/or distributed BMP projects if a project opportunity becomes available that is functionally equivalent, i.e., provides necessary volume of treatment and/or accomplishes the goals of this TMDL Implementation Plan.

BMP projects, the City will need to implement approximately 15 distributed BMP projects per year.

Similar to the regional BMP projects, it is expected that most distributed BMP projects will require extensive planning, stakeholder input, and coordination with multiple agencies. All will be subject to the resolution of substantive permitting and right-of-way issues. Final treatment benefits associated with each project will depend on the available area and detailed project engineering design.

Section 5
Implementation Plan Compliance Analysis

The Los Angeles River Metals TMDL includes pollutant mass load allocations for MS4 Permittees in the watershed. The TMDL sets load allocations to require reduction of metals concentrations in impaired waterbodies to below California Toxics Rule (CTR) water quality standards. Load allocations differ for dry and wet weather runoff conditions, with the definition of wet-weather being any day with greater than 500 cfs at the Wardlow gauge (LARWQCB 2005). Compliance schedules also different between dry and wet weather conditions (See Section 1).

5.1 Dry Weather Compliance Analysis

5.1.1 Dry Weather Wasteload Allocation

Table 5-1 shows the allowable wasteload allocation in waterbodies downstream of City of Los Angeles MS4 drainage areas. Per the TMDL, allocations for dry weather are the product of numeric concentration targets, based on chronic CTR standards for copper and lead, and median dry weather flow for each waterbody. For ungaged waterbodies or river segments, the dry weather flow is estimated by taking the difference between median dry weather flows at Wardlow (145 cfs) and combined median discharge from three wastewater treatment plants (WWTP) in the watershed (111 cfs). The remaining flow is apportioned to waterbodies based solely on the size of upstream drainage areas.

Table 5-1 Copper and Lead Dry weather wasteload allocations for stormwater in City of Los Angeles MS4 drainage areas (modified from Table 6-6 of TMDL Staff Report, LARWQCB 2005)

Waterbody	Critical Flow (cfs)	Combined MS4 Permittees		City of Los Angeles[1]	
		Copper (kg/day)	Lead (kg/day)	Copper (kg/day)	Lead (kg/day)
LAR Reach 6	7.2	0.53	0.33	0.39	0.24
LAR Reach 5	0.75	0.05	0.03	0.05	0.03
LAR Reach 4	5.13	0.32	0.12	0.29	0.11
LAR Reach 3	4.84	0.06	0.03	0.03	0.02
LAR Reach 2	3.86	0.13	0.07	0.04	0.02
LAR Reach 1	2.58	0.14	0.07	0.0003	0.0001
Bell Creek	0.79	0.06	0.04	0.03	0.02
Tujunga Wash	0.03	0.001	0.0002	0.0002	0.00005
Verdugo Wash	3.3	0.15	0.07	0.01	0.00
Burbank Western Channel	3.3	0.18	0.1	0.09	0.05
Arroyo Seco	0.25	0.01	0.01	0.001	0.001
Rio Hondo Reach 1	0.5	0.01	0.006	0.00	0.00
Compton Creek	0.9	0.04	0.02	0.02	0.01
Total	**34**	**1.7**	**0.89**	**0.96**	**0.51**

[1] City of Los Angeles wasteload allocation is determined by multiplying the total waterbody-specific stormwater wasteload allocation by the fraction of drainage area within the City

The City of Los Angeles MS4 drainage area also includes the portion of the watershed draining to Aliso Canyon Creek and Reach 6 of the Los Angeles River, where there is a concentration based TMDL for selenium of 5 µg/L during dry weather. The TMDL states that the source of this pollutant is likely natural. Accordingly, this compliance analysis only focuses on cadmium, copper, lead, and zinc.

5.1.2 Dry Weather Compliance

For dry weather conditions, water quality samples collected at ten locations by the coordinated monitoring program (CMP) are available to estimate the portion of the MS4 drainage area in compliance for each sampling event (Figure 5-1). Assuming that each monitoring location represents water quality conditions within its immediate upstream drainage area, the portion of the MS4 drainage area in compliance with numeric targets in the TMDL is evaluated for each sampling event. Table 5-2 summarizes the portion of the MS4 drainage area associated with each CMP sample location. Table 5-3 shows the area in compliance for each dry weather sample event since October 2008. These results show that dry weather compliance is achieved for greater than 75 percent of the City of Los Angeles MS4 drainage area over the past year of CMP sampling. Therefore, the metals TMDL Implementation Plan for dry weather will focus on achieving 100 percent compliance for the 2024 target. Significant structural and institutional BMPs necessary for wet weather compliance will provide more than the necessary load reductions needed during dry weather conditions to achieve this milestone.

Table 5-2 Percent of City of LA MS4 Drainage Area Represented at each CMP Location

CMP Dry Weather Sample Location [1]	% of City of Los Angeles MS4 Area	Dry Weather Numeric Targets (µg/L)			
		Total Copper	Dissolved Copper	Total Lead	Dissolved Lead
LAR at White Oak Ave.	28.60%	30	29	19	11
LAR at Sepulveda Blvd.	16.45%	26	29	19	11
LAR at Tujunga Ave.	8.22%	26	19	10	6.6
LAR at Zoo Dr.	8.74%	23	22	12	7.6
LAR at Figueroa St.	6.70%	26	21	12	7.5
LAR at Washington Blvd.	9.55%	22	21	11	7.3
LAR at 710 Freeway [2]	1.89%	22	21	11	7.3
Tujunga Wash at Moorpark St. [3]	8.22%	20	19	10	6.6
Burbank Western Channel at Riverside [4]	5.26%	19	18	9.1	6.1
Compton Creek at Del Amo [5]	6.38%	19	18	8.9	6.0

1 Only Tier 1 CMP stations shown. Data from additional monitoring plan (AMP) locations, collected as necessary, will replace downstream CMP site data for the portion of the subwatershed represented
2 Additional Monitoring Program (AMP) site LAR-R2 includes 0.50% of City of LA MS4 Area (see Appendix F)
3 AMP site LAR-R4 includes 0.92% of City of LA MS4 Area
4 AMP site LAR-R3 includes 4.80% of City of LA MS4 Area
5 AMP site LAR-R1 includes 0.67% of City of LA MS4 Area

Table 5-3 Compliance with Dry Weather Numeric Targets in Metals TMDL

Sample Month	Total Copper	Dissolved Copper	Total Lead	Dissolved Lead
10/2008	87%	92%	100%	100%
11/2008	92%	92%	100%	100%
12/2008	92%	92%	100%	100%
1/2009	100%	100%	100%	100%
4/2009	92%	92%	83%	92%
5/2009	100%	100%	100%	100%
6/2009	94%	100%	100%	100%
7/2009	92%	92%	100%	100%
8/2009	100%	100%	100%	100%

5.2 Wet Weather Compliance Analyses

5.2.1 Wet Weather Wasteload Allocation

Wet weather wasteload allocations for MS4 Permittees are set for cadmium, copper, lead, and zinc in all waterbodies of the LAR Watershed. These allocations are a function of storm runoff volume, represented as load duration curves for the entire LAR Watershed (Figure 5-2). The allocation for MS4 permittees, developed watershed-wide, is the majority of the acceptable loading capacity, as shown for a 500 cfs flow condition at the Wardlow gauge (Table 5-4). These curves show the allowable pollutant load from a given storm runoff volume for cadmium, copper, lead, and zinc. The wasteload allocations shown incorporates allowable load from the minimum flow to distinguish a wet-weather condition (500 cfs at Wardlow), equivalent to the values shown in Table 5-4.

Table 5-4 Wet weather wasteload allocations for stormwater based on a daily flow of 500 cfs (from Table 6-13 of TMDL Staff Report, LARWQCB 2005)

Pollutant	General Industrial permittees (kg/day)	General Construction permittees (kg/day)	Caltrans (kg/day)	MS4 Permittees (kg/day)	Combined storm water permittees (kg/day)
Cadmium	0.089	0.036	0.036	1.6	1.8
Copper	0.50	0.20	0.20	9.1	10
Lead	3.6	1.4	1.4	65	71
Zinc	5.08	2.03	2.03	93	102

The City of Los Angeles MS4 drainage area represents approximately 50 percent of the total MS4 permittee drainage area in the LAR Watershed. According to the TMDL, the City's allocation is equal to this fraction of the combined MS4 permittee load allocation.

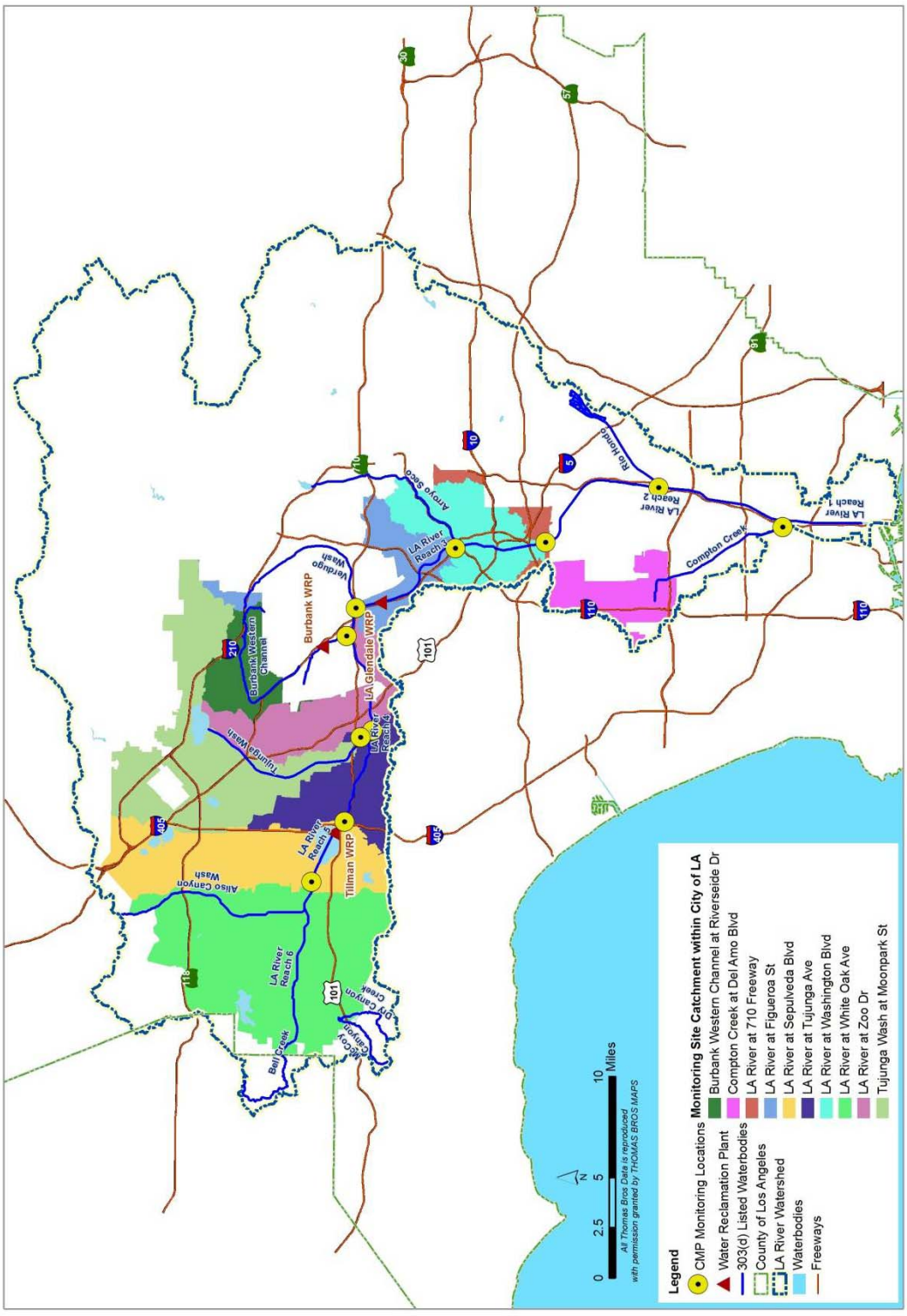

Figure 5-1
Drainage Areas to CMP Locations within the City of LA Jurisdiction

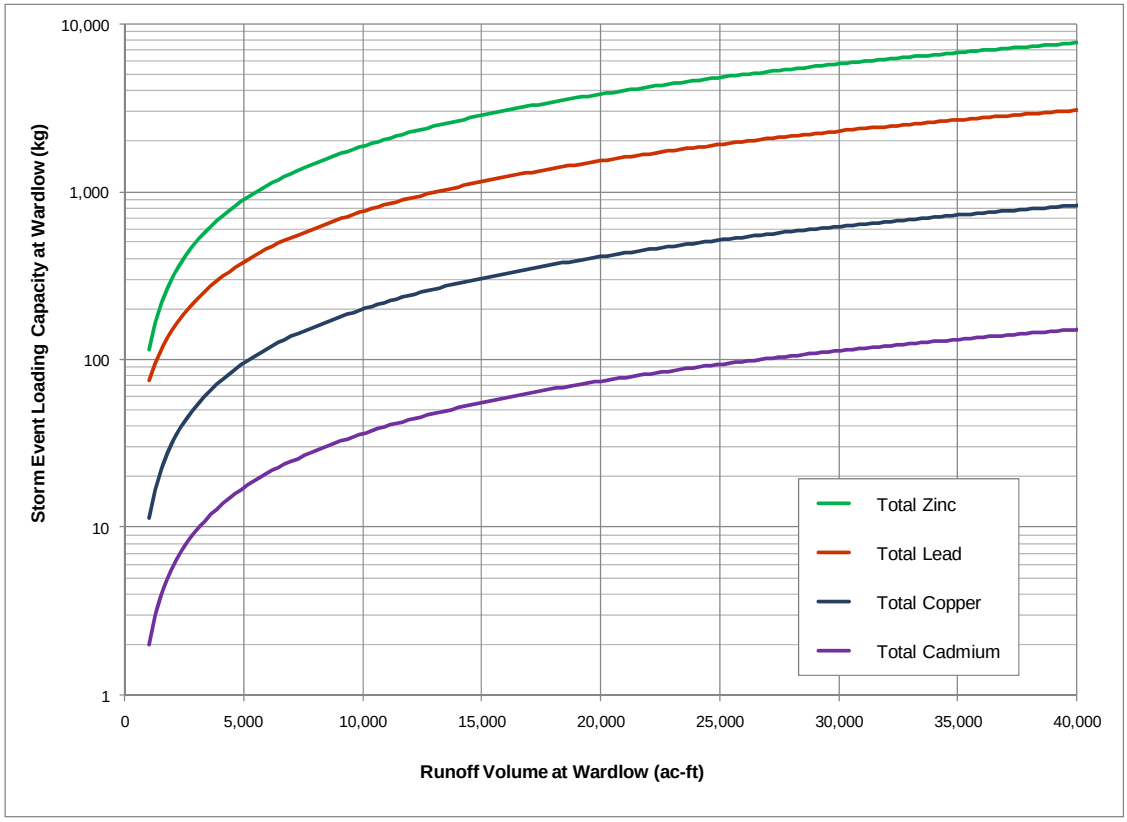

Figure 5-2
Wasteload Allocation for the City of LA MS4 Drainage Areas

5.2.2 Wet Weather Compliance

An evaluation of existing water quality conditions is necessary to determine the daily load reductions needed to achieve targets in the TMDL. Wasteload allocations are the allowable watershed loads for compliance at the final wet weather milestone in 2028. Interim compliance is measured differently; as the fraction of the MS4 drainage area where metals concentrations are below numeric concentration targets in the TMDL.

The availability of water quality data during dry weather conditions allowed for an assessment of current conditions in different parts of the watershed. Conversely, flow weighted wet weather composite samples within the LAR Watershed are limited to routine monitoring at the stormwater mass emission station within Reach 1 at Wardlow Street, except for three events where tributary mass emissions were monitored during the 2003-2004 wet season. Given the limited dataset to characterize metals loads during wet weather from different portions of the LAR Watershed, this daily compliance analysis is based upon monitoring at the Wardlow Street station. Flow weighted composite samples collected in the CMP will facilitate assessment of compliance in subwatersheds in a similar manner as dry weather compliance is evaluated in the previous section. This TMDLIP is responsive to the potential that exceedences of numeric targets are widespread, by incorporating BMP

recommendations in a variety of drainage areas. An iterative adaptive approach will be applied, so that as more data is available, prioritization of BMP implementation can be focused in areas of greatest concern.

Historical data for LAR at Wardlow showed non-compliance with several TMDL targets, most notably, total copper. Using the mass emission data for metals included in the TMDL, a trend line was fit for the loading versus runoff volume data to characterize baseline water quality throughout the LAR Watershed (Figure 5-3).Comparing this curve with the wasteload allocation for MS4 permittees approximates the load reduction needed to meet the TMDL for a given runoff event volume.

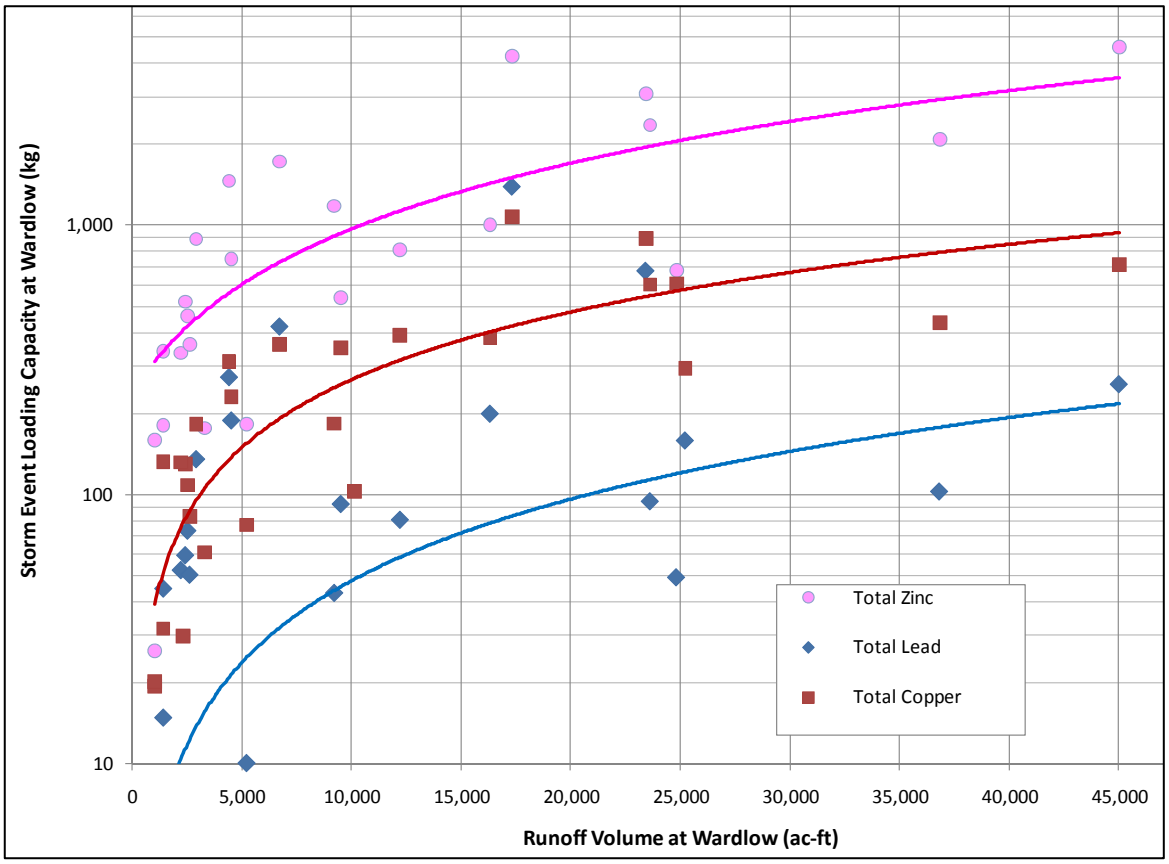

Figure 5-3
Trends to Approximate Baseline Metals Loading for the LAR Watershed

Since the relationship between runoff and load for each metal is not statistically significant, uncertainty analyses considered the full distribution of baseline metals loading in developing probabilistic results. Figure 5-4 shows comparisons of baseline water quality data and wasteload allocations for each metal in the TMDL. Total copper is the only metal where baseline water quality exceeds the loading capacity of the watershed.

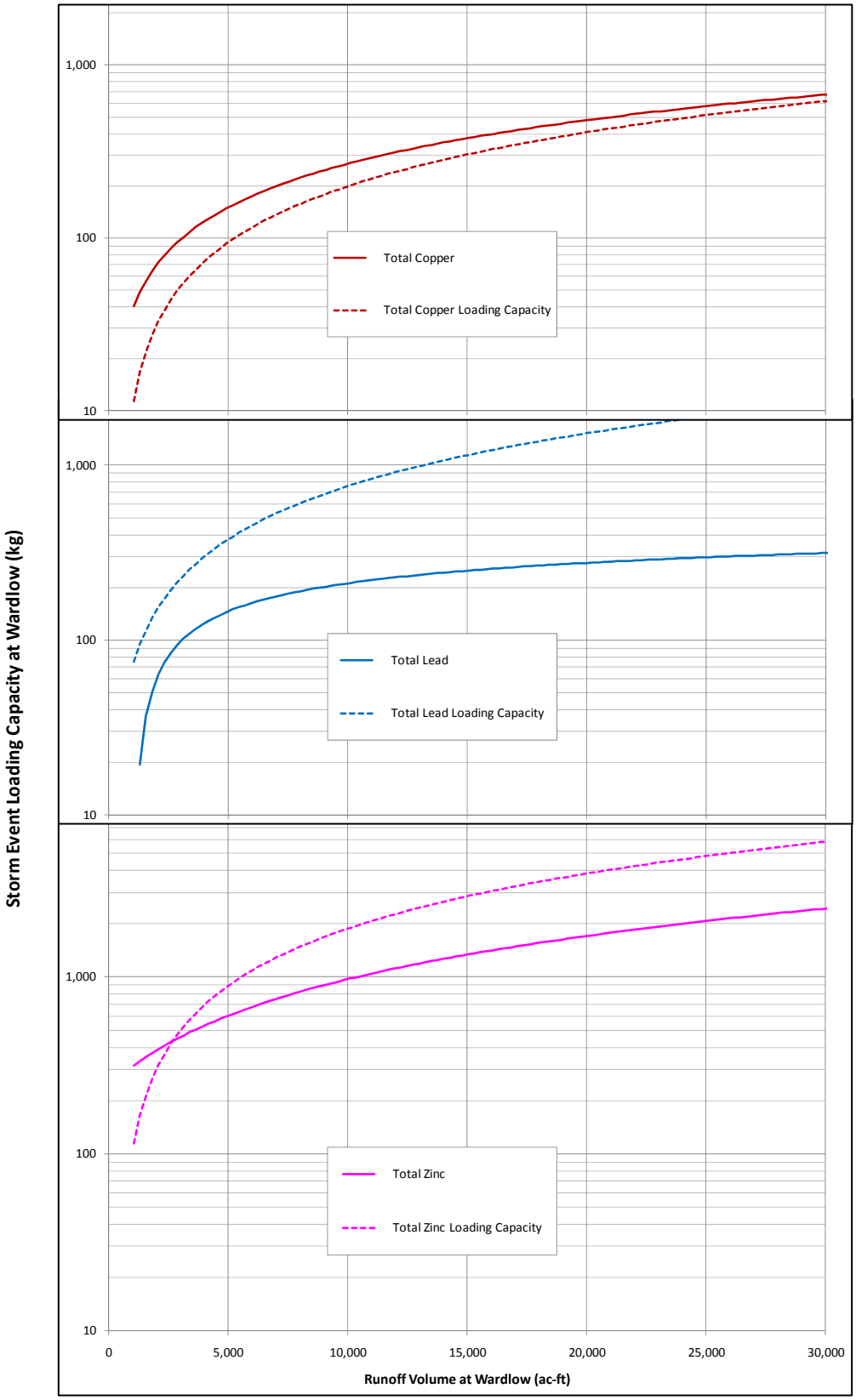

Figure 5-4
Comparison of Baseline Metals Loading Trend to Wasteload Allocation for MS4 Permittees in the LAR Watershed

Four sampling events within the Wardlow Street mass emission station period of record were excluded from the assessment of baseline water quality, because of significantly higher flow-weighted mean concentrations. Further review of these data shows that they are not outliers, but rather associated with major sediment mobilization from the watershed, due extended dry periods (i.e., first storm of wet season).

Compliance with the TMDL is driven by total copper, which has significantly greater frequency and magnitude of exceedance than total lead or total zinc. The largest deviations of baseline total copper from the wasteload allocation occur during smaller storm events, indicating that smaller storms may have higher concentrations of total copper than larger storms. During large runoff events, dilution of water quality may occur after the initial wash-off of accumulated metals in the beginning of the storm. Following a similar pattern, the trend of baseline loading for total zinc exceeded the wasteload allocation in only small to medium size storm events. The baseline trend for total lead indicates that this metal is not a significant concern.

Assuming that load reduction is proportional to MS4 drainage area compliance, compliance with interim milestones can be computed without more extensive upstream mass emission monitoring. For instance, to achieve the first milestone of 25 percent of MS4 drainage area in compliance, 25 percent of the necessary load reduction must be demonstrated. Therefore, the recommended BMP projects in the Metals TMDL Implementation Plan (see Section 4) provide sufficient treatment of urban runoff to achieve interim milestones based on the fraction of necessary load reduction achieved.

Existing stormwater management programs will be supplemented with recommendations for new or enhanced source control programs and implementation of new regional and distributed structural BMPs. The quantification of daily metals load reduction from implementation of BMPs in the watershed involves different approaches for wet versus dry weather, consideration of the type of BMP implemented, and the compliance milestone under consideration. Load reductions are estimated for the following categories of projects:

- Institutional BMPs
- Distributed Structural BMPs
- Regional Structural BMPs
- Existing / Planned BMPs
- SUSMP projects

The quantification methodology applied for all of these TMDLIP elements employed a continuous simulation, therefore it was possible to compare projected event loads with numeric targets. This approach is responsive to the requirements set in the recent Supreme Court ruling that TMDLs must be expressed as 'daily' loads (i.e. simple averaging over longer time periods is not sufficient).

The above quantitative analysis approach for wet weather assumes no in-stream processes exist that can provide some load reduction for metals (e.g., as might be the case for bacteria due to in-stream decay). Metals are typically conservative, i.e., minimal concentration change from in-stream processes is expected; however, some reductions may occur through processes such as sediment particle settling.

5.2.2.1 Load Reduction from Institutional BMPs

Quantifying the sources of metals in urban watersheds is difficult, because sources and activities that mobilize different metals are numerous and diverse. Nationwide, watershed management plans identify vehicle brake pads, tire tread, roadway sediment, used motor oil, building materials, algaecides and pesticides as significant sources of metals in urbanized watersheds. Reductions of cadmium, copper, lead, and zinc from these pollutant sources can be achieved by implementing institutional BMPs.

Institutional BMPs reduce pollutant loads by either reducing the source of a pollutant or capturing built-up pollutants before they can be washed off by stormwater into local waterbodies. Estimating the pollutant load reduction achieved through the implementation of these BMPs involves two distinct computations:

- Pollutant Buildup – Determining the relative contribution of the pollutant from a targeted source to the watershed land surface
- Pollutant Wash-off – the transport of pollutants from the watershed surface to downstream waterbodies

Quantification Methodology

Historical rainfall records were used to estimate the buildup of metals from controllable sources prior to a storm event (P_t), as a function of preceding dry days (DD). Rational method hydrologic simulations for distinct storm events in the historical rainfall record were used to estimate the wash-off of pollutant from the watershed surface (W), as a function of runoff depth (R). Numerous studies have found that pollutant buildup and wash-off are most appropriately estimated using non-linear relationships. Pollutant buildup occurs at the fastest rate in the initial days following a wash-off event, but decline as buildup approaches the maximum carrying capacity (P_{max}) for the watershed over longer dry periods (Sartor and Boyd, 1972; EPA NURP Study, 1983). These studies also show that the greatest amount of pollutant wash-off occurs with the first ½ inch of runoff, with lower wash-off rates associated with each increment of additional runoff. Therefore, exponential functions were used to estimate pollutant buildup and wash-off associated with specific sources of metals in the watershed;

$$W_t = P_t * \left[1 - e^{(k_W * R)}\right]$$

$$P_t = P_{max} * \left[1 - e^{(-k_b * DD)}\right] + \left[P_{t-1} - W_{t-1}\right] * e^{-k_b * DD}$$

The variables used in these exponential functions for buildup (k_b) and wash-off (k_w) were derived so that ultimate loading to receiving waterbodies is approximately 20 percent of metals accumulated on the watershed, consistent with what has been recorded from urban catchments by Pitt et al., (2004). In addition, the values used in this analysis (k_b = .23; k_w = 1.3) are within the range used in technical modeling for the development of the Los Angeles River Metals TMDL (TetraTech 2004) as well as recent models of highly urbanized subwatersheds in the Great Lakes region (Chen and Adams 2006).

Pollutant buildup and wash-off analyses were completed for specific sources of metals; including copper in brake pad wear debris, and all 303(d) listed metals in street sediment and atmospheric deposition to quantify water quality benefits associated with brake pad product replacement, enhanced street sweeping, and roof downspout disconnection, respectively. These institutional BMPs were identified as BMPs for which water quality benefits can be most reliably quantified. Figure 5-5 shows reductions in total copper buildup over the watershed that may be achievable with implementation of the recommended direct source control institutional BMPs.

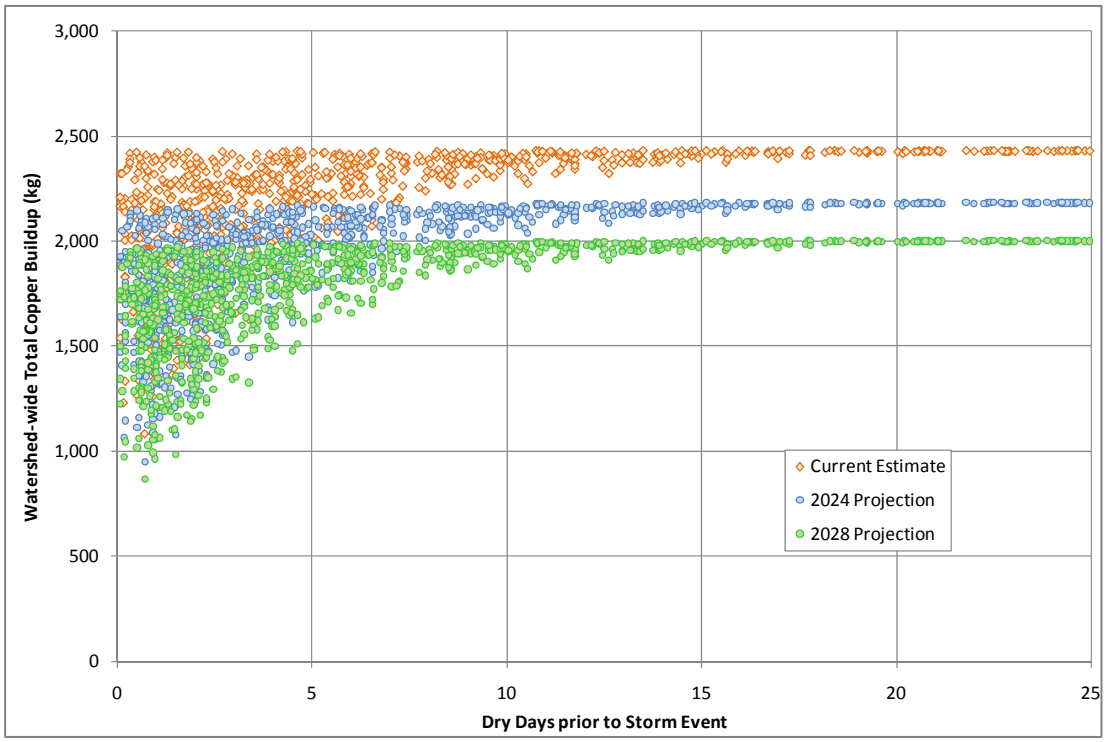

Figure 5-5
Buildup Rates of Total Copper within LAR Watershed for Current Conditions and at Long-Term Wet Weather Compliance Milestones with Implementation of Institutional BMPs

The concentration of metals in accumulated sediment is reduced by implementing institutional BMPs, therefore wash-off of accumulated sediment in the future will have a reduced associated metals loading. These institutional BMPs have a similar

effect on buildup rates of cadmium, lead, and zinc. Table 5-5 summarizes the estimated metals load reduction from the implementation of brake pad replacement, enhanced street sweeping, and downspout disconnection BMPs. The following sections describe the approach used to quantify metals buildup and washoff from brake pad wear debris, street sediment, and atmospheric deposition on rooftops.

Additional institutional BMPs included in this TMDL Implementation Plan were not quantified, yet may provide additional pollutant removal. Water quality monitoring will determine if the non-quantified BMPs provide an additional benefit, resulting in potential reduction in the need for structural BMPs to comply with later compliance milestones.

Table 5-5 Summary of Pollutant Load Reductions Achieved by Recommended Institutional BMPs for different Categories of Storm Event Runoff by 2028

Runoff (inches)	Brake Pad Replacement, Enhanced Street Sweeping, and Downspout Disconnection (kg removal/event)		
	Total Copper	Total Lead	Total Zinc
< 0.10	0.3	0.0	0.1
0.11 - 0.25	5.9	1.0	2.8
0.26 - 0.50	16.8	2.8	8.2
0.51 - 0.75	28.3	5.3	15.1
0.76 - 1.00	40.0	6.3	18.2
1.01 - 1.50	52.0	10.0	28.6

Brake Pad Replacement

Copper from vehicle brake pad wear debris accounts for a significant portion of total copper loads in urban watersheds. In subwatersheds of the San Francisco Bay, brake pad wear debris accounted for 15-50 percent of total copper loads, depending upon the land use in each subwatershed (AquaTerra 2007). The Santa Clara Valley Urban Runoff Program estimated that brake pads are responsible for 42 percent of copper loading to the San Francisco Bay (SCVURP 1997). To develop this Implementation Plan, a similar analysis for the LAR Watershed estimated the fraction of total copper loading manageable through direct source control activities related to copper content in brake pads. The mass of copper released to the watershed per vehicular kilometers traveled (VKmT) provides a basis to quantify baseline loads of total copper from brake pad wear debris.

Copper loading rates per VKmT were estimated in several targeted studies conducted by the Brake Pad Partnership (Rosselot 2006). Rosselot (2006) identified a brake pad copper wear rate of 1.08 mg per VKmT. Rosselot (2006) also evaluated the copper content in different types of vehicles within the San Francisco Bay area, and found an average copper content for vehicles of 6.4 percent. At this copper content level, an approximate rate for total brake pad wear is 17 mg/VKmT (1.08 mg Cu per VKmT / 0.064 Cu content = 17 mg brake pad debris per VKmT).

Daily VKmT was estimated by taking the population in the watershed (~3 million) with an assumed average annual driving of 12,300 kilometers (SCAG, 2009). This equates to an approximate daily driving in the LAR watershed of 101 million VKmT.

Studies have shown equilibrium of pollutant carrying capacity occurs after approximately 20 dry days within an urban watershed (Pitt and Shawley 1982). Therefore, the maximum buildup of copper on impervious areas is estimated as the buildup over 20 dry days. In the LAR Watershed, this is approximately 1,250 kg of copper (17 mg/VKmT * 1E-6 kg/mg * 0.064 Cu * 20 days * 101 million VKmT/day * 57% imperviousness). The mass of accumulated sediment on a given day is an exponential function of this maximum carrying capacity, residual pollutant not washed off during the preceding runoff event, and dry days prior to the event.

If implemented, State Bill 346 would require new brake pads in the State of California to contain less than 5 percent copper by 2021 and 0.5 percent copper by 2032. Given these changes in copper content in brake pad wear debris, the mass of copper built up on the watershed, and available for wash-off, will be reduced. To account for the gradual introduction of new brake pads into the market, this compliance analysis assumed average copper content could be reduced to 5 percent by the 2028 compliance milestone (allowing for seven years – a typical length of time for consumers to purchase a new car). For the 2024 compliance milestone, an interim average copper content of 5.7 percent provides the basis for direct source control reduction.

Enhanced Street Sweeping

Removal of accumulated sediments and associated pollutants from streets is another institutional BMP that can reduce pollutant loads in runoff entering receiving waterbodies. The City's Bureau of Street Services (BSS) currently operates a street sweeping program that includes over 130 mechanical broom sweepers with a staff of over 100 operators. Citywide, BSS conducts routine street sweeping for 7,600 curb-km of posted streets on a weekly basis, and an additional 15,500 curb-km of non-posted or arterial streets on a monthly basis.

Several alternatives exist for BSS to enhance its program by capturing more sediment for roads within the City, including increased frequency of sweeping on non-posted roadways or replacement of aging mechanical broom sweepers within the current fleet with new more efficient types of street sweepers. The City of Dana Point doubled sediment removal by increasing street sweeping from biweekly to weekly (Dana Point 2005). Several studies comparing mechanical broom sweepers to newer high efficiency alternative equipment have shown increases in sediment removal of 35 percent (Pitt 2002), 15 to 60 percent (Minton 1998), and up to 140 percent (Schwarze Industries 2004). This TMDL Implementation Plan uses a conservative target of increasing current sediment removal by 5 percent with enhancements to street sweeping. Additional studies and potential pilot programs, working closely with BSS, will be necessary to evaluate the most effective and suitable approach to achieve this target.

Findings of local studies of accumulation rate and metals composition in street sediment provide necessary information to quantify the metals loading associated with approximately 16,000 curb-km of roads in the City's portion of the LAR Watershed. Sartor and Gaboury (1984) estimated sediment accumulation for impervious surfaces to range from 12 to 21 kg/curb-km/day. In a more recent study to support the Brake Pad Partnership in California, Rosselot (2007) measured a street sediment accumulation rate of 14 kg/curb-km/day. Using this rate of accumulation for 20 days following a washoff event, a maximum carrying capacity of sediment on streets within the City is approximately 6.7 million kg. The mass of accumulated sediment on a given day is an exponential function of this maximum carrying capacity, residual pollutant not washed off during the preceding runoff event, and dry days prior to the event.

Accumulated street sediments contain a high concentration of metals of concern in the LAR Watershed, based on finding of Lau and Stenstrom (2005) from several roadways in the neighboring Ballona Creek Watershed (Table 5-6). These values facilitate quantification of reductions in pollutant buildup for specific metals associated with additional sediment removal from current BSS street cleaning operations.

Table 5-6 Metals of Concern in Street Sediments of the LAR Watershed

Metal	Concentration in Street Sediments (mg/kg) [1]	Maximum Buildup within City of Los Angeles portion of the Watershed (kg)
Cadmium	1.7	7.7
Copper	99	446
Lead	133	599
Zinc	371	1670

[1].Average of values reported by Lau and Stenstrom (2005)

Downspout Disconnection

Rooftop runoff is another source of metals loading in the watershed, due to atmospheric deposition and leaching of building materials. Disconnection of rooftop drainage downspouts involves redirection of rooftop runoff from impervious surface runoff or gutter flow to pervious land where bioretention and infiltration can occur. Reduction in runoff from a property provides a reduction in metals loads, estimated as a function of the accumulation of metals on the roof prior to the runoff event. Due to limited information on types of roofing materials used throughout the watershed, load reductions are quantified based on atmospheric deposition alone. Therefore, estimated reductions are conservative.

Monitoring of metals deposition from the atmosphere onto the LAR Watershed during dry weather occurred during 2002-2003 at three locations spanning the lower and upper portions of the watershed (Lim et. al. 2006). Averages of measured depositional fluxes for metals addressed by this Plan, including copper, lead, and zinc were 21, 19, and 120 $\mu g/m^2/day$, respectively. Applying these fluxes to rooftop area provides an estimate of metals accumulation on roofs as a function of dry days prior

to a storm event, applying the same exponential function used for brake pad wear and street sediment accumulation. Using this rate of accumulation for 20 days following a wash-off event, a maximum carrying capacity of metals on an estimated 17,000 acres[1] of residential rooftops within the City is approximately 0.7 kg Cd, 43 kg Cu, 39 kg Pb, and 248 kg Zn. The mass of accumulated sediment on a given day is an exponential function of this maximum carrying capacity, residual pollutant not washed off during the preceding runoff event, and dry days prior to the event.

5.2.2.2 Load Reduction from Distributed BMPs

This Plan evaluated pollutant removal from distributed BMPs selected for implementation. Bioretention along public rights of way also referred to as a Green Street retrofit, is the most widespread distributed BMP selected for implementation. Siting of these BMPs within the public ROW limits potential land acquisition constraints. In addition to capturing overland flow from surrounding properties, bioretention parkways can provide pollutant removal for larger drainage areas by incorporating curb cuts to reroute gutter flow into the BMP. This Plan also includes recommendations for permeable pavement and cisterns to capture runoff from impervious surfaces on select publicly owned properties. Priority 1 distributed BMPs are recommended in 50 catchments as described in Section 4.

Quantification Methodology

Performance of the Priority 1 distributed BMPs used a long-term simulation of runoff from the upstream drainage area and estimated treatment capacity of different types of BMPs located within the catchment. Several key assumptions were necessary to simulate these different BMPs. Permeable pavement projects have sufficient capacity to capture and retain runoff from storms up to 0.75 inch of rainfall over an area twice as large as the permeable pavement footprint. Cisterns to capture rooftop runoff will be sized to capture runoff from up to 0.75 inches of rainfall for use in landscape irrigation after the storm. The tributary area to cisterns and permeable pavement is relatively small, therefore capture and treatment of the runoff from a 0.75 inch storm (equivalent to SUSMP requirements for certain new development and redevelopment projects) is achievable without significantly disrupting existing developments.

Estimation of the treatment capacity of bioretention within public ROWs required analysis of several factors, including the tributary area (A_{trib}) to the BMP, area available for siting a bioretention area (Abioretention), and permeability of underlying soil ($P_{in/hr}$). Using a drawdown time (t) of 72 hours within the bioretention areas, depth of bioretention media (d) and allowable ponding (l); the treatment capacity, measured by the maximum depth of runoff (R_{in}) captured at a given site is:

$$R_{in} = \frac{[A_{bioretention} * t * P * (d + l)]}{A_{trib} * l}$$

[1] Estimate of rooftop area from analysis of building footprint data included in the LA County Parcel database

This equation is equivalent to the method documented in the Los Angeles County BMP Design Manual. Tributary area to bioretention in public ROWs is a function of local topography and roadway drainage. Typically, Green Street bioretention drainage areas are larger than other distributed BMP types, because of the use of curbcuts to route gutter flow to the bioretention area. The available space for bioretention approximated from field observation at opportunity sites accounted for limitations due to other uses of the public ROW, such as for mature trees, driveways, and utilities.

The permeability of underlying soil is highly variable depending upon the location of the BMP in the LAR Watershed. For each of the 50 Priority 1 catchments, the permeability of the underlying soil was extracted by intersecting catchment and soil GIS layers to provide a better estimate of catchment specific infiltration rate for bioretention BMPs. Given all of these factors, if the estimated treatment capacity is less than 0.25 inches of runoff over the BMP tributary area, then it was assumed that underdrains would be used to route BMP effluent to the stormwater system. Table 5-7 summarizes parameters used to represent permeable pavement, cistern, and bioretention BMPs averaged across 50 Priority 1 catchments.

Table 5-7 Summary of Recommended Distributed BMPs within 50 Priority Catchments

Sizing Criteria	Permeable Pavement	Cisterns	Green Streets / Bioretention
Projects	91	247	61 curb miles
BMP Footprint (ac)	42	n/a	16.2
Tributary Area (ac)	74	45	1,277
Runoff Capture (in)	0.75	0.75	0.53 [1]

[1] Tributary weighted average of estimated runoff capture from bioretention BMPs recommended in each of the 50 priority catchments; Runoff capture at individual sites will vary

SBPAT uses the Stormwater Management Model (SWMM) for hydrologic simulations of runoff and BMP performance. Effluent from distributed BMPs has reduced concentrations of metals for effectively captured and treated runoff. The volume of runoff capture is equal to all runoff up to the design capacity of potential facilities; which is assumed at 0.75 inches for permeable pavement and cisterns, and 0.53 inches for Green Street bioretention. The different design capacity for Green Street bioretention comes from BMP siting limitations based on field investigations of typical street ROWs in the LAR watershed. The International BMP Database provides values of effluent concentration from different BMP types, which are used to approximate performance of the recommended BMPs in this Implementation Plan (www.bmpdatabase.org).

Variability of influent and effluent water quality is characterized using SBPAT to perform Monte Carlo analyses for each recommended BMP (Geosyntec 2008a). This simulation involves numerous iterations of the tool, with each using a unique set of influent and effluent metals concentrations selected from statistical distributions of potential values. To develop sampling distributions for the Monte Carlo analysis,

SBPAT uses variability measured in the LADPW 1995-2000 land use monitoring data (http://ladpw.org/wmd/NPDES/IntTC.cfm) for influent EMCs, and ranges of values found in the International BMP database for effluent concentrations (WERF 2008). The pollutant load reduction computed at numerous model iterations provides a range of potential results. To quantify the water quality benefit from distributed BMP implementation in 50 catchments, the average load reduction of all model iterations at a given runoff depth is subtracted from the baseline watershed-wide loading at the same runoff depth. Using runoff depth as opposed to runoff volume aligns BMP load reductions for relatively small tributary areas with the corresponding load over the entire watershed. Table 5-8 shows the incremental metals load reduction from the 50 Priority 1 distributed BMP catchments for different runoff depth intervals.

Table 5-8 Summary of Pollutant Load Reductions Achieved by Recommended Distributed BMPs for different Categories of Storm Event Runoff by 2028

Runoff (inches)	Permeable Pavement, Cisterns, and Bioretention (kg removal/event)		
	Total Copper	Total Lead	Total Zinc
< 0.10	0.2	0.1	2.7
0.11 - 0.25	0.5	0.2	6.2
0.26 - 0.50	1.1	0.5	12.4
0.51 - 0.75	1.5	0.7	16.9
0.76 - 1.00	1.8	0.8	20.1
1.01 - 1.50	1.9	0.8	20.5

The results from these 50 Priority 1 distributed BMP catchments are normalized by tributary acres and runoff inches to extrapolate the total tributary acreage within the City of Los Angeles MS4 in the LAR Watershed requiring a downstream distributed BMP to meet the 2024 and 2028 compliance milestones.

5.2.2.3 Load Reduction from Regional BMPs

This Plan evaluated pollutant removal from two regional BMPs selected for implementation; including detention at Van Nuys Sherman Oaks Park and infiltration at North Hollywood Park (see Section 4 for description of these opportunities). Additional regional BMP opportunity sites identified through the desktop and field evaluations may be necessary to meet long-term compliance milestones, but the regional BMP quantitative analysis was limited to the two projects recommended in this Plan (however, as noted in Section 4.5.1, these recommended projects are only preliminary and conceptual in nature).

Quantification Methodology

Performance of the four regional BMPs involved the development of a long-term simulation of runoff from the upstream watershed and capture in a storage unit (infiltration or detention) or series of storage and flow through treatment (SSF wetland with equalization). SBPAT uses the Stormwater Management Model (SWMM) for hydrologic simulations of runoff and BMP performance. Effluent from regional BMPs has reduced concentrations of metals for effectively captured and

treated runoff. The International BMP Database provides values of effluent concentration from different BMP types, which are used to approximate performance of the recommended BMPs in this Implementation Plan (www.bmpdatabase.org).

Variability of influent and effluent water quality is characterized using SBPAT to perform Monte Carlo analyses for each recommended BMP (SBPAT Citation). This simulation involves numerous iterations of the tool, with each using a unique set of influent and effluent metals concentrations inputs selected from a statistical distributions of potential values. To develop sampling distributions for the Monte Carlo analysis, SBPAT uses variability measured in the LADPW 1995-2000 land use monitoring (http://ladpw.org/wmd/NPDES/IntTC.cfm) for influent EMCs, and ranges of values found in the International BMP database for effluent concentrations (WERF, 2008). The pollutant load reduction computed at numerous model iterations provides a range of potential results. To quantify the water quality benefit of each recommended regional BMP, the average load reduction of all model iterations at a given runoff depth is subtracted from the baseline watershed-wide loading at the same runoff depth. Using runoff depth as opposed to runoff volume aligns BMP load reductions for relatively small tributary areas with the corresponding load over the entire watershed.

Regional BMP Load Reduction

For each of the recommended BMPs, a conceptual plan was developed and basic sizing properties were estimated for use in the simulation of runoff capture and treatment. Table 5-9 summarizes sizing variables used in the modeling of each regional BMP. For different BMP types, there are different criteria used in developing conceptual sizing for model inputs:

- Storage volume for an infiltration basin at North Hollywood Park is dependent upon the infiltration rate of the underlying soils, which determines the depth of water that can be stored, while allowing for a 48-hour drawdown time. The runoff capture is then a function of this storage depth and usable open space.

- Storage volume of an extended detention basin at Van Nuys Sherman Oaks Park is a function of the depth of storage and available open space. The depth of storage is assumed to be four feet on average to reduce structural challenges and allow for continued use of the properties for baseball fields. The basin outlet structure is then designed to provide a 48-hour drawdown of captured runoff.

Table 5-9 Summary of Sizing Criteria for Recommended Regional BMPs

Sizing Criteria	Hollywood Park Infiltration Basin	Van Nuys Sherman Oaks Park Detention Basin
Drainage Area (ac)	4,360	1,520
Available Open Space (ac)	14	27
Average Basin Depth (ft)	4	6
Treatment Volume (ac-ft)	56	162
Equalization Volume (ac-ft)	n/a	n/a
Equalization Footprint (acres)	n/a	n/a

Table 5-10 shows the incremental metals load reduction from the recommended regional BMPs for different runoff depth intervals. For the North Hollywood Park infiltration basin, the load reduction achieved does not differ significantly by runoff event size, indicating that this opportunity is limited by storage and infiltration capacity to treat runoff from a large watershed relative to the BMP footprint. One advantage of this opportunity is that during smaller runoff events the capacity of the BMP for load reduction is maximized.

Table 5-10 Summary of Pollutant Load Reductions Achieved by Recommended Regional BMPs for Different Categories of Storm Event Runoff

Runoff (inches)	North Hollywood Park Infiltration (kg removal/event)			Van Nuys Sherman Oaks Park Detention (kg removal/event)		
	TCu	TPb	TZn	TCu	TPb	TZn
< 0.10	0.8	0.3	5.8	0.1	0.0	1.4
0.11 - 0.25	1.5	0.5	10.3	0.4	0.1	3.5
0.26 - 0.50	1.5	0.5	10.2	0.7	0.2	6.5
0.51 - 0.75	1.3	0.4	9.0	1.2	0.3	11.7
0.76 - 1.00	1.6	0.6	11.6	1.5	0.4	15.3
1.01 - 1.50	1.6	0.5	10.4	2.3	0.5	21.9

Load reductions for the Van Nuys Sherman Oaks Park detention basin is greater for larger storm events, indicating that this site has the ability to capture and treat runoff from larger storm events in the upstream watershed. This is due to the less restrictive sizing criteria for detention basins and smaller tributary area to the site. The results from these two projects are normalized by tributary acres and runoff inches to extrapolate the total tributary acreage within the City's MS4 in the LAR Watershed requiring a downstream regional BMP to meet the 2024 and 2028 compliance milestones.

5.2.2.4 Load Reduction from SUSMP Projects

New development and redevelopment projects required to prepare a SUSMP including BMPs to capture and treat runoff will remove metals loads from a portion

of the watershed. Most of these projects will place a large emphasis on the use of LID practices, with the basic principle of keeping runoff on-site. Distributed BMPs recommended in this Plan will be integral components of LID planning. Therefore, the load reduction from a given runoff event per unit acre of tributary area, estimated from the 50 Priority 1 distributed BMP catchments, was extrapolated to quantify metals load reduction from approximately 250 acres of SUSMP projects annually. Over time, the load reduction from new SUSMP projects increases, providing a larger benefit at the later compliance milestones (Table 5-11)

Table 5-11 Summary of Pollutant Load Reductions Estimated from Future SUSMP Projects

Runoff (inches)	2012 (kg removal/event)			2024 (kg removal/event)			2028 (kg removal/event)		
	TCu	TPb	TZn	TCu	TPb	TZn	TCu	TPb	TZn
< 0.10	0.06	0.04	1.01	0.36	0.16	4.03	0.45	0.20	5.04
0.11 - 0.25	0.6	0.08	2.01	0.60	0.31	8.03	0.77	0.38	10.4
0.26 - 0.50	0.08	0.16	4.03	1.15	0.64	16.10	1.51	0.80	20.13
0.51 - 0.75	0.08	0.24	5.51	1.54	0.96	22.05	2.03	1.20	27.57

5.2.2.5 Load Reduction from Existing and Planned BMPs

Recently completed and planned regional BMPs provide a significant extent of treated drainage area within the City's MS4 portion of the watershed, as described in Sections 3 and 4. The metals load reduction that may be associated with these projects is estimated by extrapolating the modeled load reductions, normalized from the four regional BMP simulations by tributary acres and runoff inches, recommended for implementation in this Plan. Many projects occur within the first compliance milestone of 2012, as is the case for many of the Proposition O projects, however additional projects increase the cumulative load reduction as the later compliance milestones are reached (Table 5-12).

Table 5-12 Summary of Pollutant Load Reductions Estimated from Existing and Planned Regional BMPs

Runoff (inches)	2012 (kg removal/event)			2024 (kg removal/event)			2028 (kg removal/event)		
	TCu	TPb	TZn	TCu	TPb	TZn	TCu	TPb	TZn
< 0.10	1.00	0.11	5.45	2.12	1.13	14.75	2.15	1.14	15.08
0.11 - 0.25	1.61	0.12	6.57	2.89	1.33	17.64	2.92	1.34	18.02
0.26 - 0.50	2.83	0.17	8.58	4.68	1.93	23.33	4.72	1.95	23.90
0.51 - 0.75	4.17	0.25	10.59	5.83	1.86	25.59	5.87	1.88	26.33
0.76 - 1.00	5.55	0.27	12.14	7.71	2.41	30.02	7.75	2.43	30.90
1.01 - 1.50	7.23	0.31	16.00	9.90	2.95	40.59	9.94	2.99	41.71

5.3 Compliance Analysis Results

Metals load reductions from each of the elements of the Implementation Plan scheduled for implementation prior to a compliance milestone were summed and removed from the baseline loading to demonstrate compliance with the TMDL for total copper, total lead, and total zinc, as shown in Figures 5-6 through 5-8,

respectively. Total copper proved to be the driving constituent, requiring the greatest implementation of BMPs within the City to meet the TMDL compliance milestones. The findings of this analysis were used to develop the phased implementation schedule previously presented in Section 4.

5.4 Uncertainty Analysis

There are many factors considered in the wet weather compliance analysis, thus a quantitative assessment of uncertainty is an important element of this TMDL Implementation Plan. The uncertainty analysis involved a Monte Carlo simulation to evaluate the variation of the many different variables considered in computing baseline load and load reduction achieved from implementation of the various BMPs contained in the Plan. This approach evaluates the full range of possible results by comparing distributions of data rather than means. Consistent with other elements of the quantitative analysis, uncertainty was estimated only for the primary constituent of concern, total copper.

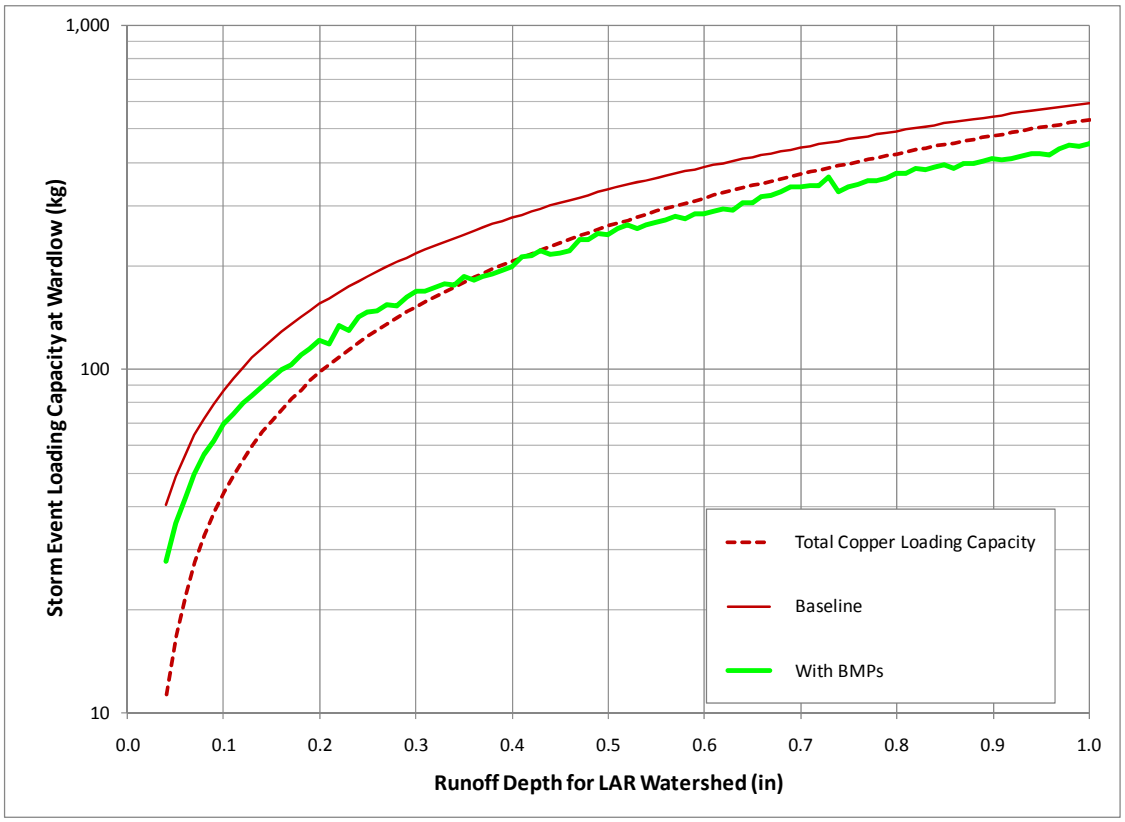

Figure 5-6
Metals Load Reduction from Quantitative Analysis Based on 2028 Compliance Target for Total Copper

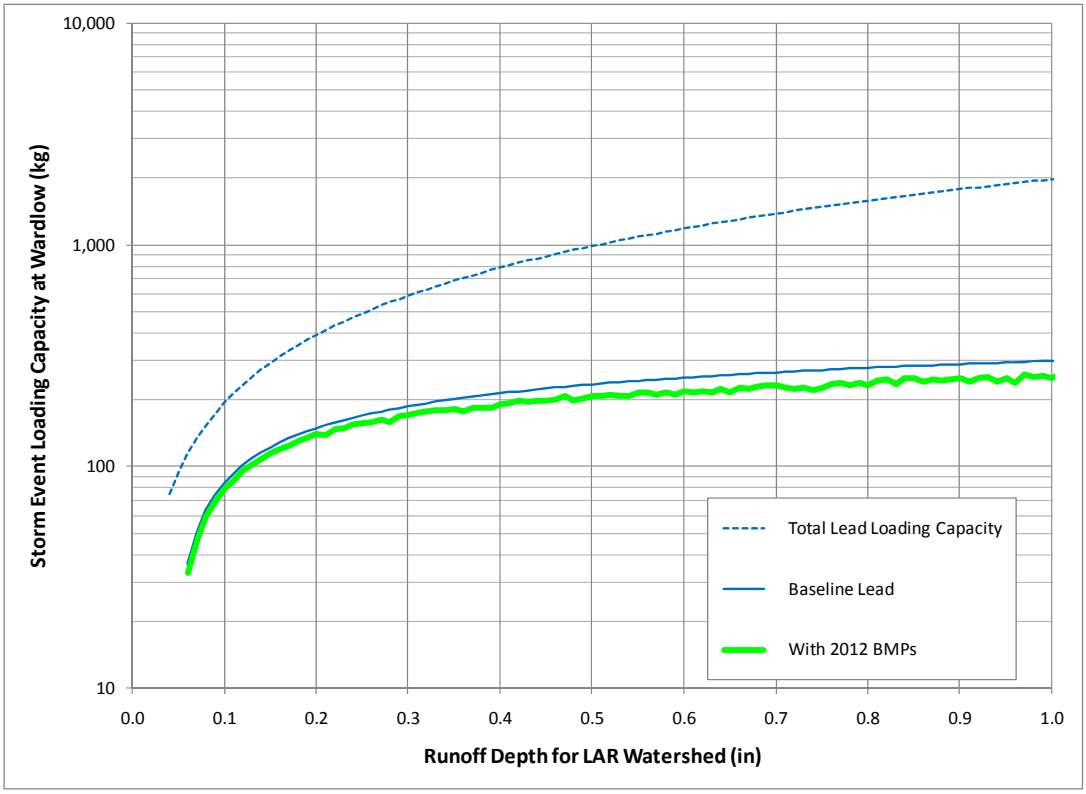

Figure 5-7
Metals Load Reduction from Quantitative Analysis Based on 2028 Compliance Target for Total Lead

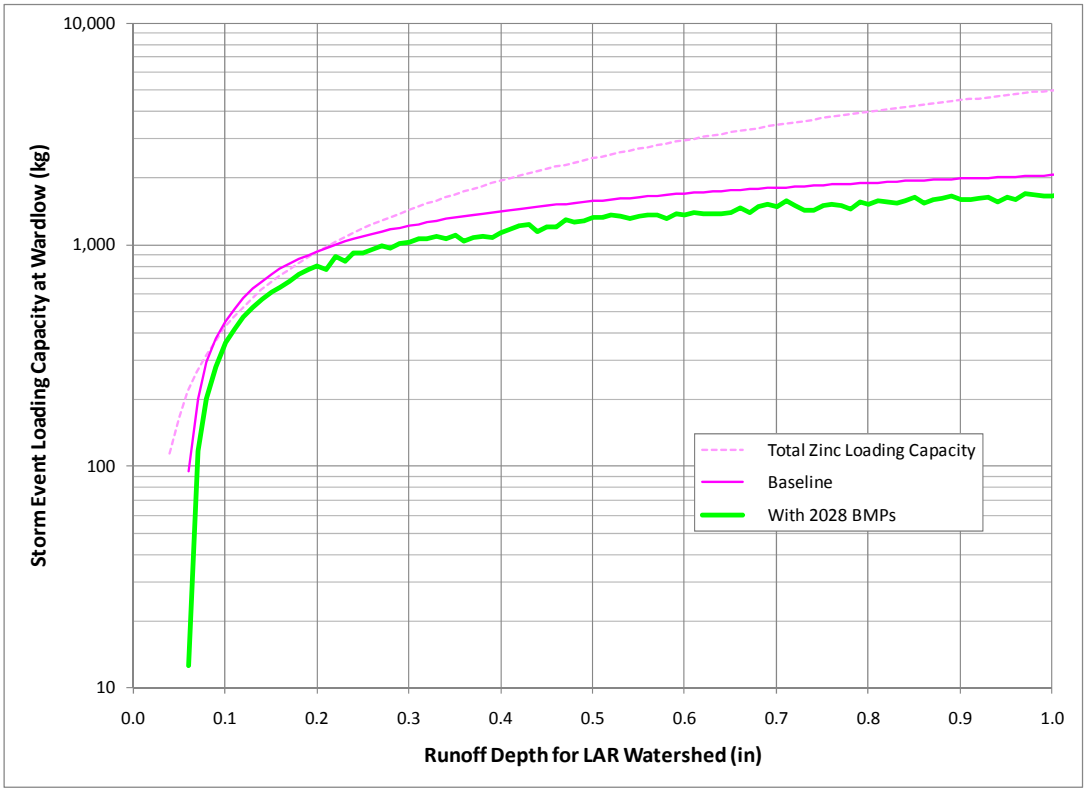

Figure 5-8
Metals Load Reduction from Quantitative Analysis Based on 2028 Compliance Target for Total Zinc

Results provide the projected range of compliance (α=0.05) for the LAR Watershed at the 2012, 2024, and 2028 milestones (Table 5-13). Based on the uncertainty analysis, the mean percent drainage area values all exceed the desired TMDL target, indicating a high expectation that implementation of this Plan will achieve the goals of the TMDL.

Table 5-13 Results of Uncertainty Analysis for Compliance with Los Angeles River Wet Weather TMDL for Total Copper

Compliance Milestone	TMDL Target (% of City of Los Angeles MS4 in Compliance)	Percent of Required Load Reduction Achieved		
		Mean[1]	Worst Case[2]	Best Case[3]
2012	25%	27%	8%	58%
2024	50%	76%	23%	143%
2028	100%	111%	32%	216%

1) Mean is the average of all Monte Carlo iterations
2) Worst case is the 5th percentile of all Monte Carlo simulated load removal
3) Best case is the 95th percentile of all Monte Carlo simulated load removal

Section 6
Program Costs

6.1 Introduction

Planning-level (order-of-magnitude) capital and operations and management (O&M) cost estimates were developed based on the preliminary project and program concepts presented in Section 4. These estimates are intended to provide decision-makers with an order-of-magnitude sense of what expenditures and staff resources may be anticipated over the period of implementation (through 2028). Given the iterative and adaptive nature of this Implementation Plan and the potential for modifications of selected priority BMP projects the cost estimate should be considered planning level only and for later years should be revisited as the implementation period moves forward.

6.2 Structural BMPs

The Water Environment Research Federation (WERF) Whole Life Cycle cost spreadsheets provide the basis for developing the cost estimates for structural BMPs (www.werf.org/bmpcost). The Whole Life Cycle costing approach was applied to the four Priority 1 regional BMP sites and five representative Priority 1 distributed BMP projects. The distributed BMP cost estimates were then extrapolated to other Priority 1 distributed BMP projects based on the estimated cost per acre of runoff treated in the five cost estimated projects.

Cost estimates for construction of these facilities were prepared using construction cost data prepared for other City of Los Angeles Proposition O projects, revised as necessary from other sources (such as bid tabulations and contacts with vendors and contractors to incorporate features not previously included in Proposition O construction cost estimates). Whole life costs (regular operations and maintenance costs prorated over the expected useful life of the project) were calculated using the spreadsheet model included in the WERF report, *Performance and Whole Life Costs of Best Management Practices and Sustainable Urban Drainage Systems* (WERF 2005).

Appendix G provides the detailed results of the structural BMP cost estimates for each of the two Priority 1 regional BMPs and five representative Priority 1 distributed BMPs. The detailed cost estimates include the present value estimated for the whole life-cycle costs for a 50-year service period.

6.2.1 Structural BMP Capital Costs

Table 6-1 provides a summary of the cost estimate for each of the Priority 1 regional BMPs. Similarly, Table 6-2 summarizes the cost estimate for the representative distributed BMP projects. Total facility capital costs and annual O&M costs are provided. Both tables provide the upstream drainage area "treated" by each BMP project. The total capital and O&M costs are divided by the treated areas to provide "per acre" costs that can be extrapolated to the remainder of the watershed.

Table 6-1 Cost Estimate Summary for Priority 1 Regional BMPs

Regional BMP Site	Total Facility Capital Cost	Total Annual O&M Costs	Acres Treated
North Hollywood Park	$13,600,000	$155,000	4,360
Van Nuys Sherman Oaks Park	$33,150,000	$133,000	1,520
Totals	**$46,800,000**	**$288,000**	**5,880**
Average Cost per Treated Acre	**$7,960**	**$50**	

Table 6-2 Cost Estimate Summary for Selected Priority 1 Distributed BMPs

Site #[1]	Total Facility Capital Cost	Total Annual O&M Costs	Acres Treated	Capital Cost per Treated Acre	Maintenance Cost per Treated Acre
Sunnybrae Avenue (LAR Reach 6)	$1,136,000	$44,000	29	$38,890	$1,508
Tyrone Avenue (Reach 4)	$448,000	$39,000	26	$17,549	$1,525
Laurel Canyon Blvd (Tujunga Wash)	$1,052,000	$42,000	32	$32,469	$1,295
Cesar Chavez St. (LAR Reach 2)	$501,000	$32,000	24	$20,875	$1,342
Slauson Avenue (Compton Creek)	$2,800,000	$72,000	43	$65,116	$1,663
		Total Acres	154		
		Average Cost per Treated Acre		$35,000	$1,500

[1] These five sites are intended to be representative of the 50 Priority 1 distributed BMPs. The average cost per treated acre was used to extrapolate costs to other distributed BMP projects.

The facility costs were determined through two steps. First, an assumed unit cost was applied to each estimated conceptual BMP identified for each distributed catchment or regional site in order to calculate the facility base costs. Second, the facility base costs were scaled up to account for the following additional capital costs:

- Project Management, which includes Engineering: Preliminary and Final Design, Topographic Survey, Geotechnical, and Landscape Design
- Utility Relocation
- Legal Services
- Permitting and Construction Inspection
- Contingency

Land acquisition costs (site, easements, etc.) were not included in the cost estimates because the facility sites were selected to be on public property or will be implemented as part of a public/private partnership.

Tables 6-1 and 6-2 present the average per acre capital cost for Priority 1 regional BMPs and representative distributed BMPs of $8,000/acre and $35,000/acre, respectively. These average costs were applied across the watershed to estimate overall structural BMP costs for the Implementation Plan based on the number of acres required needed for treatment by regional and distributed BMPs (see Section 4.6).

6.2.2 Structural BMP Operation and Maintenance Costs

Costs for routine maintenance activities include:

- Inspections
- Reporting and information management
- Vegetation management with trash and minor debris removal
- Vector control

Corrective and infrequent maintenance activities (e.g., unplanned and/or every 3 years or more) include:

- Intermittent facility maintenance
- Sediment removal

The routine and corrective/infrequent O&M costs were summed to calculate an average cost per treated acre. Similar to the capital costs, the average O&M costs were applied across the watershed to estimate overall structural BMP O&M cost for the Implementation Plan based on the number of acres needed for treatment by regional and distributed BMPs (see Section 4.6). Tables 6-1 and 6-2 present the average per acre capital cost for Priority 1 regional BMPs and representative distributed BMPs of $50/acre and $1,500/acre, respectively.

6.3 Institutional BMPs

New program costs were estimated only for the downspout disconnect program. All other institutional program costs are expected to be part of the regular urban runoff management program.

The Implementation Plan includes costs associated with the downspout retrofit program. Compliance is based on the implementation of 2,500 downspout disconnects each year from 2010 until 2028, i.e., for 18 years. Assuming at least 2,500 disconnects are completed each year, a total of 45,000 properties will be retrofitted by 2028. The majority of the retrofits will be on residential properties. The average roof area was estimated to be 2,100 square feet, or 0.05 acres.

Based on the cost estimate for the City WPD downspout retrofit pilot program (City of Los Angeles 2008), which involved downspout disconnection at 600 properties and

had a total cost of $1 million, a unit cost per downspout disconnection is estimated to be $1,700 per property.

Based on 45,000 homes being retrofit, the total capital cost is estimated to be $76.5 million. It is assumed that there will be no operation and maintenance cost for the responsible agencies as the retrofit downspouts will be the responsibility of the property owners.

6.4 Implementation Plan Costs

Estimated Implementation costs do not include already funded Proposition O and watershed projects as described in Section 4.2. In addition it is assumed that the SUSMP program will continue at its current level of program funding. Table 6-3 provides an estimate of the new costs associated with the implementation of this Plan. As shown, the total capital cost for structural and institutional BMPs is estimated to be $576,500,000 with $13,900,000 in annual O&M costs.

Table 6-3 Draft Metals TMDL Implementation Plan Costs for Los Angeles River Watershed

Watershed BMPs	Treated Acres	Estimated Capital Cost per Treated Acre	Total Capital Cost	Estimated O&M Costs per acre	Annual O&M
Structural BMPs					
Regional BMPs					
Priority 1 Projects[a]	5,880	$7,960	$46,800,000	$50	$294,000
Priority 2 Projects[b]	20,000		$159,200,000		$1,000,000
Distributed BMPs					
Priority 1 Projects[c]	1,400	$35,000	$49,000,000	$1,500	$2,100,000
Priority 2 Projects[d]	7,000		$245,000,000		$10,500,000
Institutional BMPs					
Downspout Disconnection			$76,500,000		$0
Total Cost			**$576,500,000**		**$13,900,000**

[a] Treated acres and estimated costs of Priority 1 regional projects based on BMPs as conceptualized (see Section 4.5.1).
[b] Treated acres estimate based on compliance analysis (see Table 4-12); costs extrapolated from average cost per treated acre developed from Priority 1 regional BMP cost estimates.
[c] Treated acres estimate based on compliance analysis (see Table 4-12). Table 6-2 provides the basis of cost per treated acre from representative project site cost estimates.
[d] Treated acres estimate based on compliance analysis (see Table 4-12); costs extrapolated from per treated acre costs developed from Priority 1 distributed BMP cost estimates.