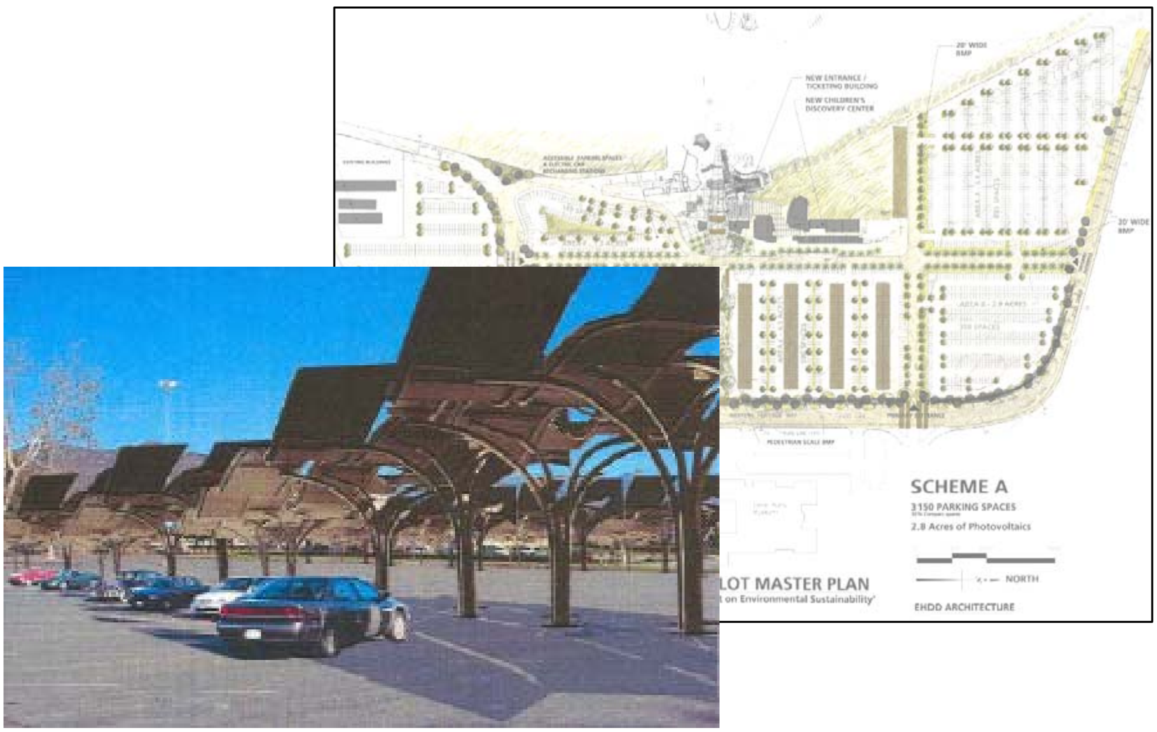
Final Concept Report

Proposition O
Los Angeles Zoo Parking Lot: Demonstration on Environmental Sustainability Project

December 12, 2006



Prepared for:

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Department of Public Works
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Appendices

Executive Summary

This report provides a conceptual overview of the proposed improvements to the Los Angeles Zoo parking area and drainage.

ES.1 Project Overview

Storm water runoff from the Los Angeles Zoo parking lot site has the potential to contribute trash, heavy metals, pathogens, total suspended solids, oil and grease, and gasoline to the storm water conveyance system within the Los Angeles River Watershed. The Los Angeles Zoo Parking Lot: Demonstration on Environmental Sustainability Project goal is to minimize, to the maximum extent practicable, the introduction of pollutants of concern that may result in significant impacts, generated from site runoff to the storm water conveyance system. Surface flow from the parking lot and Zoo Drive flows to a California Department of Transportation (Caltrans) right-of-way storm drain, which empties directly into the Los Angeles River. Pollutants of concern consist of any pollutants that exhibit one or more of the following characteristics:

- Current loadings or historic deposits of the pollutant impact the beneficial uses of receiving water bodies.
- Elevated levels of the pollutant are found in sediments of receiving water and/or have the potential to bioaccumulate in organisms therein.
- The detectable inputs of the pollutant are at concentrations or loads considered potentially toxic to humans and habitats

Targeted pollutants include the following:

- Trash
- Heavy Metals
- Total Coliform
- Fecal Coliform
- Fecal Enterococcus
- Total Suspended Solids
- Oil & Grease

The proposed network of best management practices (BMPs)/improvements for both Phase I and Phase II of the Zoo Parking Lot site include the following:

- Trash capture devices to address runoff from the neighboring Zoo Drive which still enters the storm drain system
- Porous pavement in the parking area
- Gravel and vegetated swales (bioswales) around the perimeter of the parking lot
- Potential reclaimed water usage for irrigation
- Evapotranspiration controllers and drip irrigation
- California native drought-tolerant landscaping
- Detention pond
- Sand filtration system

The 134-acre Los Angeles Zoo is located in the northeast corner of Griffith Park. The Zoo Project seeks to renovate the Zoo's existing 33-acre main parking lot[1] in two phases to provide additional infiltration, runoff reduction and pollutant loading control. As part of the Phase I implementation, improvements include managing and reusing storm water runoff through trash capture devices, porous pavement (e.g., *Ecocreto* porous concrete), and bioswales. Figure ES-1 depicts the approximate locations of the Phase 1 improvements.

During Phase I, planning and design for a range of additional BMPs and improvement alternatives (to be constructed in Phase II) will take place. These Phase II BMPs potentially include: stormwater collection (cistern) system for reuse to help meet irrigation demands at the site, detention pond, and sand filtration system to help potentially treat runoff directed from outside the Parking Lot Area. The site includes the entire existing Zoo Parking Lot, bordered on three sides by Zoo Drive[2], and by the Zoo's front entrance plaza to the west.

The existing 33-acre parking lot is impermeable and floods during storm events. The existing asphalt pavement throughout most of the parking lot is badly damaged and cracked, which creates safety issues for cars and pedestrians. The Zoo Project will provide a system of swales and grade adjustments that will be made during repaving to direct surface water to the swales for efficient filtration. Piping may also be installed in the parking lot under the porous pavement to capture water for reuse in landscape irrigation.

[1] The parking lot, at full current capacity, is used by more than 950,000 cars per year. (2,635 spaces x 364 days per year)

[2] The Zoo Drive swales are only used to treat water from Zoo Drive.

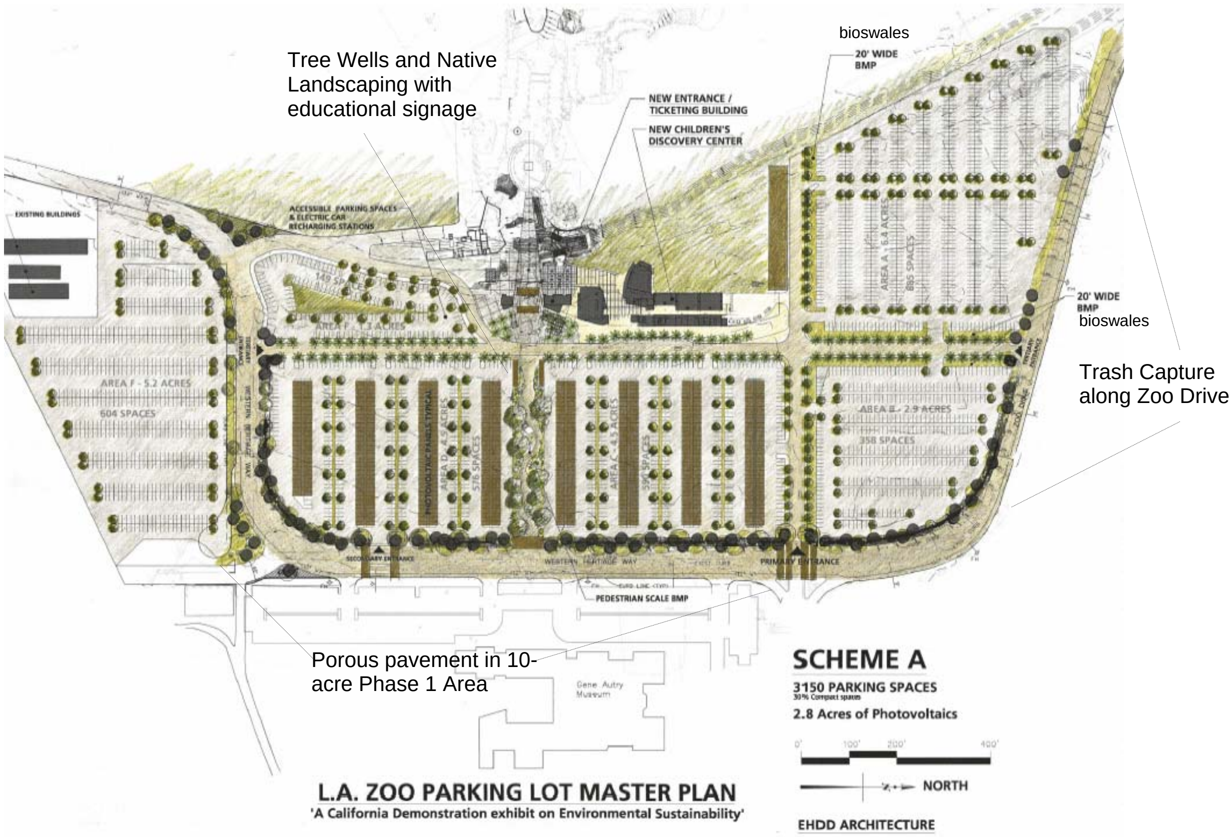


Figure ES-1
Schematic of LA Zoo and Locations of BMPs

Based on grading of the surrounding area, only runoff from the Zoo Parking Lot Area, some hillside areas and Zoo Drive contribute to flows. Total annual flow, assuming 15 inches per year, using an imperviousness of 100 percent and a runoff coefficient of 0.90, results in a sheet flow runoff volume of approximately 34 acre-feet per year.

There is the potential for several water quality benefits at the Los Angeles Zoo Parking Lot site, including both dry weather and wet weather runoff management. These benefits will assist in complying with current and future TMDL regulations as the project drainage is tributary to the Los Angeles River.

Construction of the aforementioned BMP's will yield an estimated removal for nearly all of the pollutants listed in Table ES-1.

Table ES-1
Proposed BMPs and the Expected Benefits

BMP Activity	Applicability	Expected Benefit
	Phase I BMPs	
Trash Screen Inserts in storm drains (possibly Full Capture Device) *or:* Continuous Deflection Separators (CDS) Units	Captures over 90% of trash Reduces floatables by 100%, reduces TSS by 80%, reduces oil and grease by 80-90% reduces phosphorous by 15-80%, reduces heavy metals by 15-80%	Reduce trash to the Los Angeles River as well as other pollutants of concern
Porous Pavement	Reduces TSS by 65-100%; reduces pathogens by 65-100%, reduces total phosphorous by 30-65%, reduces nitrogen by 65-100%; reduces heavy metals 65-100%	Reduce polluted runoff; reduce stormwater runoff
Vegetated Swales*	Reduces TSS by 30-80%; reduces nitrogen by 15-80%; reduces total phosphorous by 15-80%; reduces heavy metals 15-80%	Reduce sediment loads and absorbed pollutants to the Los Angeles River; fix pollutants through root uptake; improve water quality
"Smart " Irrigation System	Reduces water usage; reduces runoff	Lower water demand; reduce polluted runoff
Native plantings/drought tolerant landscaping	Reduces water demand; reduces runoff	Lower water demand, reduce polluted runoff
	Phase II BMPs	
Detention pond	Reduces TSS by 75%; reduces coliform by up to 30%; reduces fecal enterococcus by up to 30%; reduces heavy metals by 30-50%	Reduce sediment loads and absorbed pollutants to the Los Angeles River; improve water quality
Sand filtration system	Reduces TSS by 75%; reduces coliform by up to 90%; reduces fecal enterococcus by up to 90%; reduces heavy metals by up to 90%	Reduce sediment loads and absorbed pollutants to the Los Angeles River; improve water quality

TSS = total suspended solids.
* Actual pollutant removal percentages vary depending on design of BMP and vegetation planted.
Sources: EPA, 1999; EPA, 1993; CWP, 2000.

As noted, some of the projected pollutant removal would be achieved through the construction of Phase II, which is not included in this Proposition O request. Refer to Appendix B and Section 3.2 for pollutant load results and discussion of water quality benefits.

This project takes a positive step towards increasing the beneficial and recreational uses of receiving water bodies, reducing potential risks to human health and safety, reducing beach closures, and preserving aquatic marine and plant habitat. Thus, the project will support the City's efforts to comply with current and future stormwater regulations to improve water quality while also benefiting the tourism industry.

ES.2 Project Costs

The total estimated project cost for Phase I and the amount requested from Prop O is $13,900,000 as summarized in the table below.

Table ES-2
(Project No. 9) The Los Angeles Zoo Parking Lot, Demonstration on Environmental Sustainability
Cost Estimate

Budget Category		Non-Proposition O Funding (if applicable) see notes below	Requested Proposition O Funding		Total
			Water Quality Benefits	Other Project Benefits	
(a)	Construction Cost	-	$8,704,941	$2,424,549	$11,129,490
(b)	Land Purchase/Right-of-Way acquisition	-	-	-	-
(c)	Pre-Design and Design (including environmental clearance, design project management)	-	$1,239,332	$504,441	$1,743,773
(d)	Construction and Post-Construction management	-	$803,637	$227,342	$1,030,979
(e)	**Grand Total [Sum (a) through (d) for each column]**	**-**	**$10,747,910**	**$3,156,332**	**$13,904,242**

Source(s) of Non-Proposition O Funds
Los Angeles Department of Water and Power – Solar Energy Component

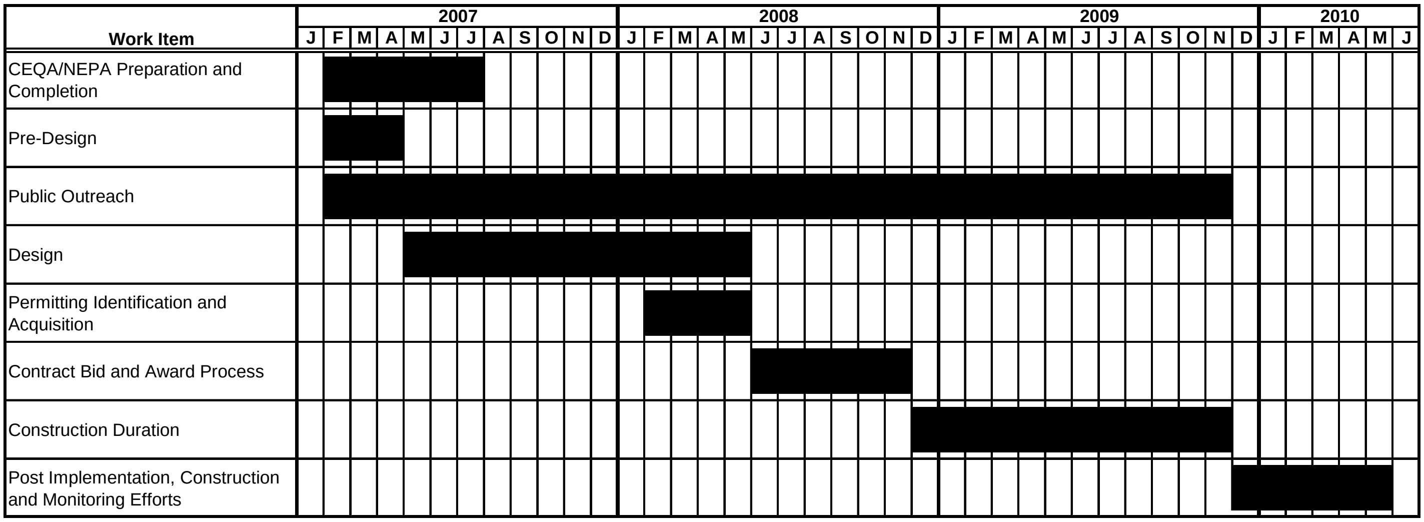
Water quality elements include trash capture devices, porous pavement, bioswales, and smart irrigation. Other project elements include parking lot striping, lighting and signage. Refer to Section 8 for a detailed breakdown of the estimated costs.

Operation and Maintenance Costs

The annual operation and maintenance cost for the project is estimated at $55,000. However, O&M costs are not being requested through Proposition O.

ES.3 Project Implementation Schedule

Based on the best information available during preparation of this Concept Report, the project design and construction will be completed by December 2009.



Section 1
Introduction

The Los Angeles Zoo and Botanical Gardens project proposes to transform the primary parking lot located east of the facility into the Zoo's first exhibit, a "Demonstration on Environmental Sustainability." The space will immediately impact the public as they enter the parking lot and make their way toward the Zoo's front entry plaza. This area will function as a high capacity parking lot, a stormwater infiltration system, an educational experience, and an example of environmental conservation. This project will create an area that will benefit the local as well as the regional community.

1.1 Project Objectives

The overall project goal is to reduce trash, heavy metals, total coliform, fecal coliform, fecal enterococcus, and total suspended solids in order to aid the City in meeting the Total Maximum Daily Load (TMDL) requirements in the watershed.

The project plans to accomplish this goal through Phase I Parking Lot Improvements including:

- Installing trash capture devices at catch basins within the site
- Installing porous pavement (*Ecocreto*) through the 10 acres included in Phase I to reduce runoff
- Installing bioswales to aid in infiltration and pollutant reduction

Stormwater runoff from the Zoo parking lot directly discharges to the Los Angeles River. The improvements to the Zoo parking lot are intended to minimize runoff to the LA River by capturing stormwater for onsite reuse and possibly infiltrating stormwater to the underlying aquifer; thus improving water quality in the Los Angeles River.

Additional Benefits

The various best management practices (BMPs) employed throughout the project site will form the educational framework of the parking lot as an exhibit space, providing the Zoo's 1.5 million annual visitors with information about environmental conservation, ecological sustainability, native planting techniques, and alternative energy sources. The parking lot will then become the Zoo's first interaction with visitors and an opportunity to provide an exhibit that is at the cutting edge of environmental technology.

Additionally, solar trees, free standing photovoltaic panels, will be installed throughout the parking lot to harness passive solar energy. The parking lot will also encourage alternative methods of transportation by providing easy access to bicycle paths and public transportation.

1.2 Overview of Project

The 134-acre Los Angeles Zoo is located in the northeast corner of Griffith Park. The site includes the entire existing Zoo Parking Lot, bordered on three sides by Zoo Drive[3], and by the Zoo's front entrance plaza to the west. The Zoo Project seeks to renovate the Zoo's existing 33-acre main parking lot[4] in two phases to provide additional infiltration, runoff reduction and pollutant loading control. As part of the Phase I implementation, improvements include managing and reusing storm water runoff through trash capture devices, porous pavement (e.g., *Ecocreto* porous concrete), and bioswales. During Phase I, planning and design for a range of additional BMPs and improvement alternatives to be constructed in Phase II will also take place. These Phase II BMPs potentially include: a stormwater collection (cistern) system for reuse to help meet irrigation demands at the site, a detention pond, and sand filtration system to help potentially treat runoff directed from outside the Parking Lot Area.

The existing 33-acre parking lot is impermeable and floods during storm events. The existing asphalt pavement throughout most of the parking lot is badly damaged and cracked, which leads to the underutilization of the swales and creates safety issues for cars and pedestrians. The Zoo Project will provide a system of swales and grade adjustments that will be made during repaving to direct surface water to the swales for efficient filtration. In addition, the parking lot will be improved with porous pavement (e.g., Ecocreto porous concrete) and potentially subsurface infrastructure to capture water for reuse in irrigating the landscaping.

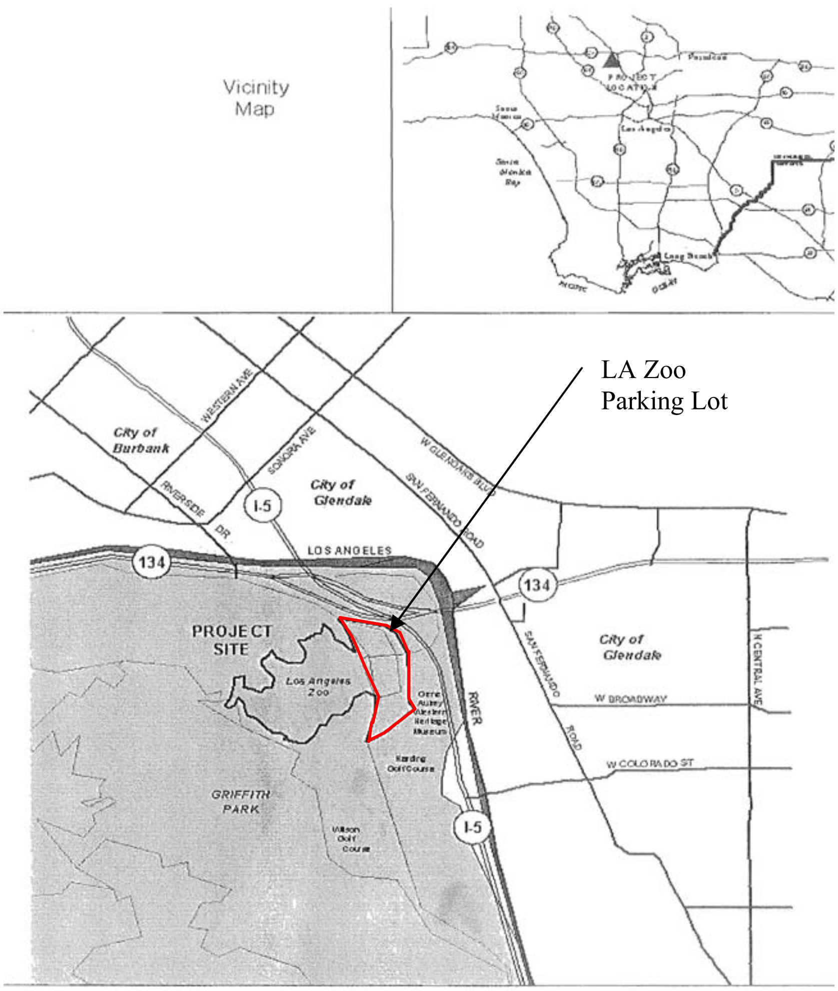
This project takes a positive step towards increasing the beneficial and recreational uses of receiving water bodies, reducing potential risks to human health and safety, reducing beach closures, and preserving aquatic marine and plant habitat. The project will support the City's efforts to comply with current and future stormwater regulations to improve water quality and will also benefit tourism in the region.

[3] The Zoo Drive swales are only used to treat water from Zoo Drive.
[4] The parking lot, at full current capacity, is used by more than 950,000 cars per year. (2,635 spaces x 364 days per year)

Section 2
Existing Project Site Characteristics

2.1 Land Use and Jurisdictional Boundaries

The Los Angeles Zoo is located in the eastern portion of Griffith Park near the intersection of the Golden State Freeway (Interstate 5) and the Ventura Freeway (State Highway 134). Figure 2-1 presents the site location map. In general the 134-acre zoo is bordered by hilly terrain. Of the 134 acres, about 33 acres are used for parking, roughly 11 acres are undeveloped hillside, and the remaining acreage is dedicated to exhibits, infrastructure and circulation. The Zoo parking lot, the subject of this concept report, is bordered by Zoo Drive on three sides and the Zoo front entry plaza on the fourth side. At full capacity the parking lot accommodates more than 950,000 cars, annually.



Source: Parsons Engineering Science, Inc.

Figure 2-1
Site location map of the Los Angeles Zoo

The Zoo was opened in 1966 and is owned by the City of Los Angeles. Originally the Zoo was operated by the Los Angeles Department of Recreation and Parks (RAP). However in June 1997, the Department of the Zoo was created to operate, manage, and maintain the zoo.

2.1.1 Master Plan and Zoning

As mentioned, the Zoo is located in the City of Los Angeles, and more specifically within Griffith Park. The Hollywood Community Plan, which is part of the City of Los Angeles General Plan, designates the Zoo as "Open Space". Griffith Park is also designated as "Open Space". The proposed improvements to the Zoo parking lot, which are discussed in this Concept Report, will occur only on Zoo property, are within the Department of the Zoo's jurisdictional boundary, and will not conflict with the General Plan designation. Additionally the Zoo will minimize the impact to visitors by phasing the renovations and scheduling construction only during the off-peak visitor months.

Griffith Park, a City of Los Angeles RAP municipal park, has adopted its own Master Plan. The vision of the Griffith Park Master Plan indicates that "The environmentally sensitive and responsible practices incorporated throughout the Park will demonstrate to Park visitors the many ways we can operate in harmony with the natural world". The proposed improvements to the Zoo parking lot are consistent with the goals of the Plan; these goals include:

- Minimize the impact of intensive uses on resource, operation and maintenance, and maximize operational efficiency
- Improve physical relationships between interrelated activity centers, and uses
- Enhance and add user amenities and activity generators to retain and attract Park users while minimizing new impacts on the Park
- Implement environmentally sound and sustainable programs and policies with the Park
- Implement a watershed management system that maximizes the use of natural drainage systems, retention of stormwater, filtering and recharging of the water table, and provision of suitable storage, overflows, and connections to the Los Angeles River
- Increase and restore prime habitat and native vegetation

2.2 Current Environmental Setting

The existing 33-acre parking lot is impermeable and floods during storm events. Currently, surface flows from Zoo Drive and the parking lot are controlled by perimeter swales along Zoo Drive. However, the existing asphalt pavement throughout most of the parking lot is badly damaged and cracked, which leads to the underutilization of the swales and creates safety issues for cars and pedestrians.

2.2.1 Hydrology

Watershed Description

Located in the north central portion of the Los Angeles River Watershed, Griffith Park includes more than 3 miles of Los Angeles riverfront. While the 134 Freeway separates the Los Angeles Zoo Parking Lot from Reach 4 of the Los Angeles River (Glendale Narrows), storm drains in the project area do drain directly into the Los Angeles River.

Zoo Drainage Systems

The Zoo has three drainage systems, which collect runoff as described below:

- Storm Drain System – this system collects runoff from the Zoo Proper and from 11 acres of surrounding hillside. The Zoo Proper is comprised of animal pens, exhibits, displays, walkways, and excludes drainage from animal ponds.
- Pond Drain System – this system collects drainages from habitat ponds for animals.
- Parking Lot Storm Drain System – Surface flow from the parking lot and Zoo Drive flows to a Caltrans right-of-way storm drain, which empties directly into the Los Angeles River. The Zoo parking lot and surrounding areas are graded such that the parking lot does not receive runoff from the surrounding area with the exception of the surrounding hillside.

2.2.2 Geology and Hydrogeology

Based on the following soil characterization, it is likely that the proposed BMPs are feasible at the project site. However, a soil study/geotechnical investigation should be conducted to confirm this. The Griffith Park Master Plan states that the area is characterized by two distinct types of soil: the Tujunga-Soboba association in the extreme northern portion of the Park along the Los Angeles River floodplain (near the Headworks and the Los Angeles Zoo), and the San Andreas-San Benito association in the remainder of the Park. The Tujunga-Soboba association is a very well drained, coarse, sandy loam on alluvial fans reaching depths of five feet, resulting in low runoff and erosion potential due to its quick absorption properties. This soil is of low natural fertility and typically supports grasses, forbs (herbaceous plants), and areas of brush.

The San Andreas-San Benito association is characterized by relatively deep (to 48 inches) well-drained, sandy, clay loam. These deposits overlay sandstone or shale that is relatively fine-grained, but often excludes plant roots except in joints. This association has a moderate runoff and erosion potential because of the slope, though these soils are of moderate natural fertility and typically support wildlife and vegetation.

2.2.3 Biology

Griffith Park is home to a variety of amphibians, reptiles (native and non-native), over 166 bird species, and mammals. Additionally, Griffith Park includes areas of landscaped vegetation as well as natural plant communities. Landscaped areas include lawns and greens decorated with horticultural shrubs. Nine natural plant communities have been identified in the park and with each there is vegetation that is both native and non-native to southern California. The nine plant communities are as follows: Mixed Chaparral (most widespread), Mixed Scrub (second most widespread), Oak-Sycamore Riparian, Oak-Walnut Woodland, Oak Woodland, Pine (forest), Ornaments and Non-native Landscape, Ruderal (weedy), and Disturbed Habitat. Native plants found within the park include: chamise and toyon, costal sagebrush, California buckwheat, California encelia, white sage, coast live oak, western sycamore, Mexican elderberry, willows, mule fat, and poison oak, and non-native species include pine, silk oak short-pod mustard, wild oats, tree tobacco, castor bean, giant reed, and California fan palm.

2.2.4 Recreation and Open Space

Parks

With over 4,210 acres, Griffith Park is the largest municipal urban park in the United States and continues to be a refuge and recreational amenity for the people of Los Angeles and the surrounding region. The Park includes areas of natural chapparal-covered terrain as well as landscaped parkland and picnic areas. Recreational attractions have been developed throughout the Park, and include: numerous family attractions, an assortment of educational and cultural institutions, bicycle lanes, and miles of hiking and horseback riding trails.

Set within Griffith Park, the Zoo provides a unique recreational and educational experience for children and adults alike. Over 1.5 million people visit the Zoo each year and it is the Zoo's hope that visitors begin to develop an appreciation for our planet's wild creatures and become lifelong stewards for wildlife. Various exhibits showcase California native plants and animals as well as species from around the world. The Zoo is dedicated to the community with programs for youth, families, people with special needs, and volunteers; it also sponsors summer camps, and provides teachers' resources.

The Zoo parking lot area is not just used by Zoo patrons, but is an integrated element of Griffith Park. People from the larger community regularly use the area for biking, jogging and other recreational activities in the park. Additionally, the Zoo is integrated into the greater Griffith Park trail system. The "Skyline Trail" passes through the northwest corner of the parking lot, while the "Main Trail" crosses the main entrance to the parking lot. Per the Griffith Park Master Plan, with the completion of the Taylor Yard Path, the Park's trail system will extend south and connect to Elysian Park.

Accessibility & Other Resources

The Zoo is located approximately nine miles north of downtown Los Angeles and is accessible by major regional transit and accessibility lines. From Union Station, downtown LA's transit hub, the Los Angeles Zoo is a short walk from the station to Chinatown followed by a 20-minute ride by bus. Union Station is served by public railways including the Red line, the Gold line and Metrolink. Additionally, a Griffith Park shuttle bus drives the perimeter of the Park with two stops near the Zoo parking lot.

In addition to bus and rail, bike lanes service the Zoo. A dedicated bike path (Class I) parallels the west side of Los Angeles River, extending south from Victory Boulevard. The trail is being extended through Burbank. Class II and class III bike lanes co-exist with vehicular traffic on Zoo Drive, Crystal Springs, Griffith Park Drive, and Griffith Park Boulevard.

Although the Zoo advocates public transportation, proximity to the Golden State Freeway and the Ventura Freeway provide easy vehicular access to the Zoo.

2.2.5 Environmental Studies

The LA Zoo is the subject of one item in a City of Los Angeles settlement agreement concerning pollution control for the Los Angeles River.

Settlement Agreement

In October 1987, the California Attorney General, on behalf of the Regional Board, filed a complaint with the Los Angeles Superior Court (Case No. C 665238) for civil penalties regarding unpermitted discharges to Discharge Serial No. 001 and raw sewage overflows to surface waters from the Hyperion collection system. A settlement agreement was entered into on January 29, 1990. In lieu of civil penalties, the City was required to implement 23 projects to improve and enhance its collection system and benefit the waters in the Greater Los Angeles Area. Twenty two of the 23 Settlement Agreement projects have been completed.

The remaining project deals with the Los Angeles Zoo Wastewater Treatment Facility. Originally, this project had three components: (1) construction of the retention basin and pump station for collection of the Zoo's wastewater, (2) diversion to the North Outfall Sewer force main, and (3) the installation of a peripheral drainage system. The first two components were completed in 1995. In 1997, the City proposed to substitute BMPs that more precisely meet the goals of the City's Stormwater Management Program, for the storm water peripheral drainage system. The LA Zoo retained the services of Parsons Engineering Science (Parsons) to complete a storm water BMP study. The study was finalized in July 2000.

After reviewing the study, the Regional Board rejected the City's proposal because the proposed BMPs cannot achieve the objectives of the original Settlement Agreement. Currently, the City is in the process of reviewing this project as an option for the Regional Board's consideration.

Storm Water BMP Study

The purpose of the Parsons BMP study was to identify cost effective BMPs that could be implemented at the Los Angeles Zoo to reduce the quantity and/or improve the quality of the storm water from the Zoo. The study identified the sub-watersheds which drain to the Zoo, exclusive of the parking lot area, and the quality and quantity of runoff in each sub-watershed. Parsons evaluated (1) the BMPs which were being evaluated at the time of the study for effectiveness in improving storm water quality; and (2) BMPs that could be implemented throughout the Zoo (including the parking lot). Parsons concluded that the parking lot is the most suitable location to implement BMPs.

Section 3
Description of Proposed Project

3.1 Overview of Proposed Project

The Los Angeles Zoo parking lot project includes water quality elements that will be funded by Proposition O, as well as supporting elements that will be funded by other sources.

Renovations to the Zoo parking lot will occur in two phases in order to retain onsite parking during construction, thereby minimizing the impact to visitors. Phase I of the project will include design and engineering of the entire 33-acre Zoo parking lot and construction of the 10-acre main parking lot in front of the main entry gate. Phase II will include construction of the remaining 23 acres of parking lot. Phase I of the project is expected to be completed in 2009, with California Environmental Quality Act (CEQA) documentation filed by the end of 2006. Figure 3-1 shows the Phase I and Phase II portions of the parking lot.

Figure 3-1
Phase I and Phase II of the LA Zoo Parking Lot Project

3.1.1 Proposition O Funded Elements

The first phase of the Zoo Project is being presented here for Proposition O funding which includes design and engineering of the BMPs throughout the entire parking area (33 acres) and construction of the BMPs in the 10-acre main parking area. A schematic of the Zoo Project is presented in Figure 3-2. The following Phase I elements of the Zoo project to be funded by Proposition O are those that are directly related to the improvement of water quality:

- **Trash capture devices** - Runoff from the neighboring Zoo Drive will still enter the storm drain system in addition to runoff from the Zoo Parking Lot during large storm events. A combination of sturdy brush material installed over the opening of the catch basin and a 5-milimeter aluminum mesh screen inside the catch basin will provide a trash capture device capable of meeting the City's trash TMDL.

- **Porous pavement in the parking area** - the company *Ecocreto* has patented a resin that when mixed with a concrete aggregate produces a permeable pavement that is able to withstand the stress of heavy equipment and high volumes of traffic, and is therefore the preferred vendor. The average permeability is 4 inches per hour and the strength of the material is over 3,000 pounds per square inch (psi) after 24 hours and over 5,000 psi after 28 days. A schematic of a typical *Ecocreto* paving situation is presented in Figure 3-3 below.

- **Gravel and vegetated swales** - The Zoo parking lot design will employ the use of vegetated swale BMPs around the perimeter of the parking lot. Vegetated swales promote infiltration and reduce flow velocities, while trapping pollutants, including sediment. The use of vegetated swales around the Zoo parking lot is especially important because they will aid in filtering out sediment and preventing the conveyance of runoff onto the permeable parking lot (except during major storms).

- **California native drought tolerant landscaping**

- **Evapotranspiration controllers and drip irrigation**

Additional Planning and Design of Additional BMPs and BMP Alternatives for Phase II Implementation

- **Reclaimed water usage for irrigation** - In the redesign of the LA Zoo parking lot the opportunity for reclaimed water for onsite irrigation has been considered. One potential alternative includes installing a liner beneath the subgrade of the porous pavement system, so that water can be captured and directed to a cistern for subsequent use. Water can then be pumped as needed from the cistern to meet a portion of the Zoo's irrigation needs. The technological feasibility of this alternative will be considered as part of the design and planning tasks for the entire 30-acre area.

- **Detention pond and Sand filtration system –** As part of the Phase II improvements, a detention pond and sand filtration system is being considered for additional pollution control. While the construction of these elements are not part of Phase I constructed elements being considered in this application, the design of these elements along with the construction of the Phase I elements will help insure an overall appropriate suite of BMPs for the Zoo Parking Lot area. Therefore, the planning and design tasks associated with the Phase II elements are being included in this application.

These measures are described briefly below.

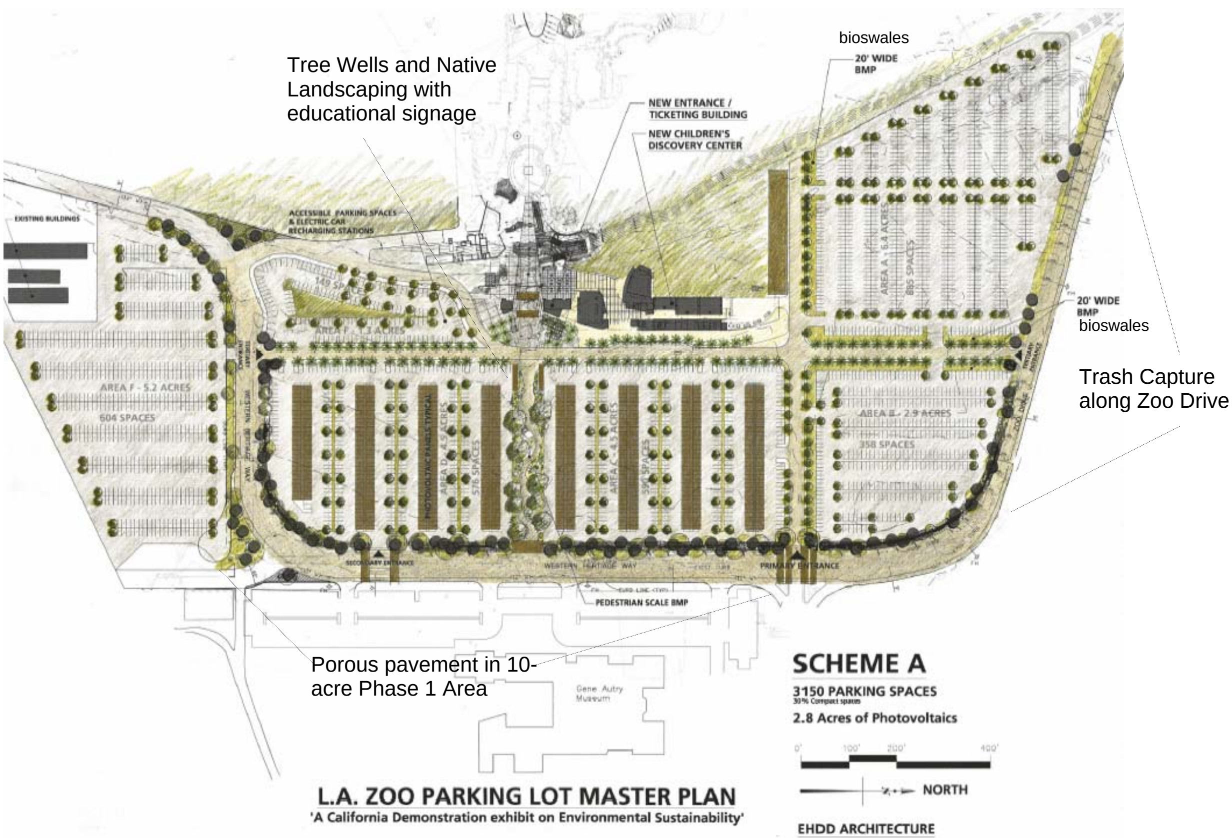


Figure 3-2
Schematic of LA Zoo and Locations of BMPs

Phase I BMPs

Trash Capture Devices

While the installation of porous pavement will help reduce runoff, runoff from the neighboring Zoo Drive will still enter the storm drain system in addition to runoff from the Zoo Parking Lot during large storm events. As mentioned in Section 2, the storm water on Zoo Drive is directed to the Caltrans storm drain and is conveyed directly to the Los Angeles River. To aid in meeting the existing trash TMDL for the LA River, trash capture devices will be installed on the two storm drains along Zoo Drive.

The Cities of Burbank, Glendale, La Canada Flintridge and Pasadena (Four-cities) submitted a request to the Regional Water Quality Control Board, Los Angeles Region for certification for an innovative trash capture method. The system proposed by the Four-cities is a two part system that includes (1) a brush material, similar to a mud flap used on large truck, installed over the catch basin opening, and (2) a metal mesh with slot size just smaller than 5-milimeters installed slightly above the opening of the outlet pipe. On May 4, 2005 the Four-cities received approval from the regional board. A similar system to that of the Four-cities is proposed for the catch basins in the vicinity of the Zoo parking lot.

USEPA lists the percent removal rates for Continuous Deflection Separators (CDS) as follows (EPA, 1999):

- Floatables: 100 percent removal
- Metals: 15 to 80 percent removal
- Suspended Solids: 80 percent removal
- Oil and Grease: 80 to 90 percent removal
- Phosphorous: 15 to 80 percent removal

Porous Pavement

Porous pavement is an infiltration system where storm water runoff is infiltrated into the ground through a permeable layer of pavement or other stabilized permeable surface. These systems can include porous asphalt, porous concrete, modular perforated concrete block, cobble pavers with porous joints or gaps or reinforced/stabilized turf. Permeable pavement can be used in parking lots, roads and other paved areas and can greatly reduce the amount of runoff and associated pollutants leaving the area. In the past porous pavement was not suitable for use in areas that are exposed to high volumes of traffic or heavy equipment. However, the company Ecocreto™ has patented a resin, that when mixed with a concrete aggregate produces a permeable pavement that is able to withstand the stress of heavy equipment and high volumes of traffic.

The *Ecocreto* specifications indicate that the pavement system must be protected from landscape clogging by either grading to prevent run-on to the pavement, or by adding a filtering area between any mulch or dirt surface and the pavement. The filter area may be any well-vegetated surface, including turf. Porous pavements, including *Ecocreto*, require maintenance including periodic vacuuming or jet-washing to remove sediment from the pores. When properly designed and maintained, porous pavement systems can be an effective means of managing urban storm water runoff.

A variety of tests were performed on two different mixtures of *Ecocreto* at the University of Texas. The void structure of the mixes is approximately 15 percent to 25 percent and has a permeability ranging from 2.24 to 5.72 inches per minute. According to the study, even if permeability were reduced by a factor of 60, the average permeability would still be 4 inches per hour. Exceeding the strength of standard concrete, the strength of both mixes were over 3,000 pounds per square inch (psi) after 24 hours and over 5,000 psi after 28 days.

Provided that there is a minimum of 18 inches of soil beneath the subgrade material, *Ecocreto* porous pavement is effective in the treatment of BOD, TSS, nitrogen, phosphorus, pathogens, metals, sulfates, organics and other toxic substances. Water quality regulations must be considered in the design and permitting of these systems as well as the establishment of a maintenance program.

Phase I of the Zoo parking lot project will include construction of the 10-acre main parking lot using *Ecocreto* porous paving materials. For heavy traffic areas 6 inches of compacted *Ecocreto* are recommended. A schematic and a typical cross-section of the porous pavement is shown in Figure 3-3 and Figure 3-4, respectively. Per the suggestion of an *Ecocreto* representative, it may be possible to recycle the existing asphalt parking lot by breaking it into 8-inch to 10-inch pieces and then using the pieces in the subgrade material. If the recycled asphalt is not technologically feasible for this application, graded sand may be the more appropriate choice.

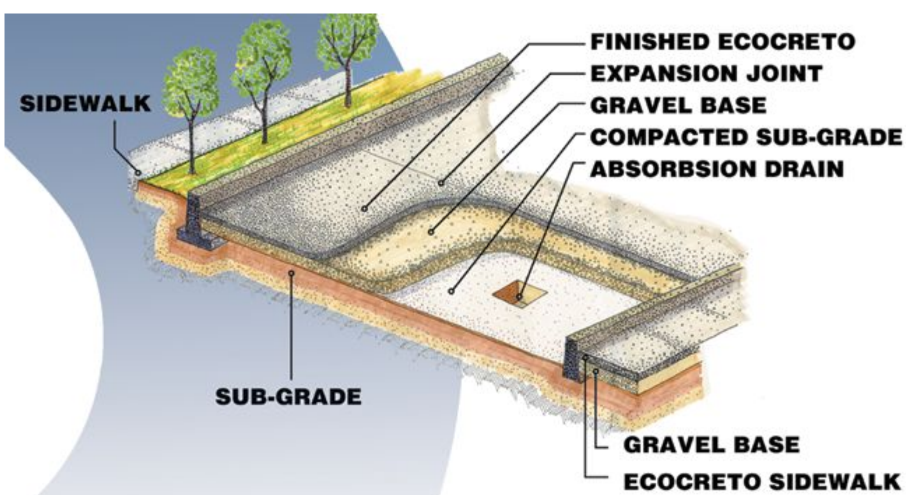


Figure 3-3
Schematic of a Typical *Ecocreto* Paving Situation

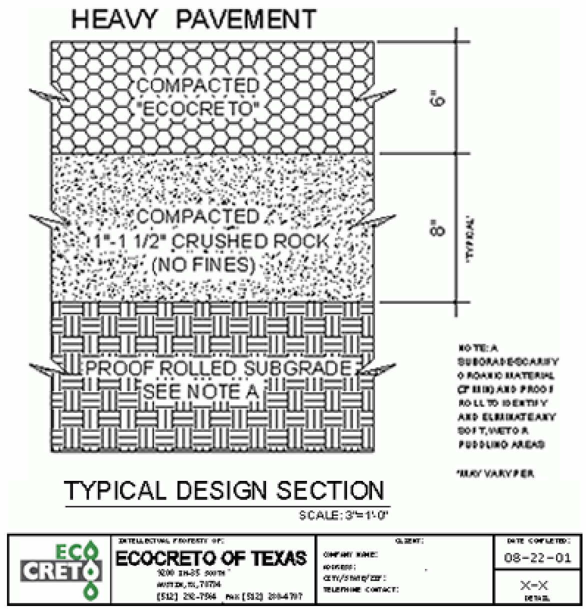


Figure 3-4
Typical Design Detail of *Ecocreto* Used for Heavy Pavement

Another feature of *Ecocreto* is versatility in artistic design. It is possible to color the resin which bonds to the aggregate, and then pour the concrete in separate colored sections. An example of the artistic design is shown in Figure 3-5.

Figure 3-5
Example of *Ecocreto* Installation in Soyalo, Chipas, Mexico

The following pollutants are expected to be removed by this BMP (EPA, 1999):

- Metals: 65 to 100 percent removal
- Pathogens: 65 to 100 percent removal

- Suspended Solids: 65 to 100 percent removal
- Nitrogen: 65 to 100 percent removal
- Phosphorous: 30 to 65 percent removal

Vegetated Swales and Grading

Bioswales, also known as vegetated filter strips or biofilters, are engineered swales utilized to convey runoff and naturally pre-treat stormwater. Stormwater is conveyed through broad, shallow channels with dense vegetation covering the sides and bottom of the channel. These open channel systems are alternatives to impervious curb and gutter stormwater conveyance systems. These systems slow stormwater runoff, capture pollutants, and promote infiltration. Swales tend to be most effective when slopes are between two and six percent to increase the time for treatment, and when water depths do not exceed the vegetation height. Bioswales can either be dry, collecting runoff as it occurs, or wet, where the swale holds standing water and a wetland is established.

The Zoo parking lot design will utilize dry vegetated swale BMPs around the perimeter of the parking lot. The use of vegetated swales around the Zoo parking lot is especially important because they will aid in filtering out sediment and reducing pollutant loadings (except during major storms).

The pedestrian path which bisects the 10-acre main parking lot and leads to the front gate will also be designed with vegetated swales on either side of the walking path.

The following pollutants are expected to be removed by this BMP (EPA, 1999):

- Metals: 15 to 80 percent removal
- Total Suspended Solids: 30 to 80 percent removal
- Nitrogen: 15 to 80 percent removal
- Phosphorous: 15 to 80 percent removal

Habitat

The vegetated swales and pedestrian path will be planted with native southern California vegetation. As a result of introducing native vegetation into the parking lot, the Zoo anticipates a revitalization of the native bird and insect population. This effective habitat restoration will provide an additional educational opportunity to promote ecological awareness and preservation. Table 3-1 lists the vegetation that will be used to vegetate the swales and create habitat.

Planning for Phase II Implementation

Reclaimed Water for Irrigation

In the redesign of the Zoo parking lot the opportunity for use of reclaimed water for onsite irrigation has been considered. In addition, if a liner is installed beneath the subgrade of the porous pavement system, runoff can be captured and directed to a cistern for subsequent reuse. A storage cistern will allow the water to be reused at the site for irrigation purposes offsetting potable water demands for irrigation.

An underground cistern can be placed in the southeastern end of the parking area allowing for gravity flow following the existing elevation contours (thereby reducing the amount of grading needed). The technical feasibility collecting runoff via the porous pavement and the location of the cistern will be determined during the planning and design tasks in Phase I.

A "Smart Irrigation" system is recommended to meet the site's irrigation needs. The term "Smart Irrigation" refers to the use of irrigation controllers to monitor irrigation, based on actual weather data and soil moisture content. In addition to reducing the amount of water used by limiting irrigation (i.e. no irrigating after a storm event when the soil is already saturated), the units would also reduce or eliminate over-watering, a significant contributor to dry weather runoff. The Smart Irrigation device reduces the amount of over irrigation by anywhere from 20 to 80 percent and reduces the amount of runoff from over irrigation by 60 percent.

Smart irrigation reduces pollutant loading to the receiving water by reducing the amount of dry weather runoff. Dry weather runoff carries with it multiple pollutants, and by reducing the amount of runoff, there is in turn a direct reduction in pollutant loading.

Detention Pond

Detention ponds intercept storm water, thereby reducing the peak flow rate of a storm. The ponds are typically designed to release the impounded water within 24 hours and remain dry between storm events. Pollutant removal is limited to gravity settling of suspended solids. A detention pond is being considered as part of the Phase II implementation to potentially assist with treatment of runoff from the Zoo itself. Flows from the Zoo would be directed/conveyed to a detention pond located in the Zoo Parking Lot Area. The feasibility and need for a detention pond will be designed during Phase I for implementation in Phase II.

Table 3-1
Vegetated Swale Plant Palette

Common Name	Botanical Name
Trees	
White Alder	Alnus rhombifolia
Toyon	Heteromeles arbutifolia
Coulter Pine	Pinus coulteri
California Sycamore	Platanus racemosa
Freemont cotton wood	Populus fremontii
Coastal Live Oak	Quercus agrifolia
Black Willow	Salix gooddingii
Shrubs	
Bush Anemone	Carpenteria californica
Westren Redbud	Cercis occidentalis
California Poppy	Eschscholzia californica
Coral bells	Heuchera maxima
Pacific Coast Iris	Iris douglasiana
Coastal Statice	Limonium californicum
Matileja Poppy	Romneya coulteri
Cleveand Sage	Salvia clevelandii
Autumn Sage	" greggii
Grasses	
California Meadow sedge	Carex pansa
Berkeley Sedge	Carex tumuicola
Deer Grass	Mulenbergia rigens

Source: Patricia Araiza, Los Angeles Department of Public Works, Street Services
PW/Street Services/Engineering Division

USEPA lists the percent removal rates for Detention Ponds as follows (EPA, 1999):

- Metals: 15 to 80 percent removal
- Coliform: 30 percent removal
- Fecal Enterococcus: 30 percent reduction
- Total Suspended Solids: 75 percent removal

Sand Filter

A sand filter is a filtration system designed to remove a fraction of the constituents found in storm water. Filters are primarily a water quality control device designed to remove particulate pollutants. Typical uses of filters include small sites such as parking lots and small developments. Constructing filters in series with a forebay, such as a detention pond, will assist in removing heavier solids prior to filtration and will prevent clogging while extending the life of the filter system. A sand filter will be designed during Phase I for implementation in Phase II.

USEPA lists the percent removal rates for Sand Filtration Systems as follows (EPA, 1999):

- Metals: 90 percent removal
- Coliform: 90 percent removal
- Fecal Enterococcus: 90 percent reduction
- Total Suspended Solids: 75 percent removal

3.1.2 Project Elements Funded by Other Sources

Supporting elements of the project that will not be funded by Proposition O include: solar trees and educational signage throughout the parking lot.

Solar Trees

The Zoo has formed a partnership with the Los Angeles Department of Water and Power for the installation of solar trees throughout the parking lot. Solar trees are vertical structures consisting of photovoltaic cells suspended from metal posts; Figure 3-6 shows their innovative design. Although the solar trees will not be funded through Proposition O, these devices are an integral element of the parking lot project's concept of being an exhibit on environmental sustainability. The solar trees will generate power that will be recycled into the City's energy grid and will provide a unique opportunity to educate the public on alternative forms of energy.

The solar trees will be interspersed throughout the rows of cars providing shade while capturing passive solar energy. The system will generate one megawatt of power per hour of operation, enough for over 500 homes.

Educational Signage

This complete project provides an educational opportunity to showcase a variety of new technologies to help water quality and the environment in general. Educational kiosks and signs will be used to call attention to and explain the various features being implemented throughout the parking lot.

3.2 Water Quality Benefits

Proposed Project BMPs

There are several water quality benefits at the Zoo parking lot, including capture and infiltration of all water from small rain events. In retaining the runoff and rainwater on site, this project will contribute to the regional objective of reducing pollutant discharges to the Los Angeles River. Trash screens will also be installed at strategic locations to aid in meeting the trash TMDL, such as the storm drains located along Zoo Drive in the northeast and northwest corners of the project site.

Figure 3-6
Examples of the Solar Tree Design

The following Table 3-2 identifies the BMPs included in the program and their effectiveness in reducing pollutants, as determined by the United States Environmental Protection Agency (EPA):

The City of Los Angeles, Bureau of Sanitation has determined the influent pollutant load to the Zoo parking lot BMPs and then calculated the resulting effluent load. The targeted pollutants are: trash, heavy metals (copper, lead, zinc), total coliform, fecal coliform, fecal enterococcus, oil & grease, and total suspended solids (TSS). The hand calculations were performed according to the phasing of the project. For Phase I, 10 acres of porous pavement and vegetated swales were considered, while Phase II considered 20 acres of runoff being treated by a detention pond and sand filter. In both cases, the calculations assume 15 inches of annual rainfall. The equation used to estimate total annual loading, L (kg/yr), for each targeted pollutant is as follows:

Table 3-2
Proposed BMPs and the Expected Benefits

BMP Activity	Applicability	Expected Benefit
Phase I BMPs		
Trash Screen Inserts in storm drains (possibly Full Capture Device) *or:* Continuous Deflection Separators (CDS) Units	Captures over 90% of trash Reduces floatables by 100%, reduces TSS by 80%, reduces oil and grease by 80-90% reduces phosphorous by 15-80%, reduces heavy metals by 15-80%	Reduce trash to the Los Angeles River as well as other pollutants of concern
Porous Pavement	Reduces TSS by 65-100%; reduces pathogens by 65-100%, reduces total phosphorous by 30-65%, reduces nitrogen by 65-100%; reduces heavy metals 65-100%	Reduce polluted runoff; reduce stormwater runoff
Vegetated Swales*	Reduces TSS by 30-80%; reduces nitrogen by 15-80%; reduces total phosphorous by 15-80%; reduces heavy metals 15-80%	Reduce sediment loads and absorbed pollutants to the Los Angeles River; fix pollutants through root uptake; improve water quality
“Smart “ Irrigation System	Reduces water usage; reduces runoff	Lower water demand; reduce polluted runoff
Native plantings/drought tolerant landscaping	Reduces water demand; reduces runoff	Lower water demand, reduce polluted runoff
Phase II BMPs		
Detention pond	Reduces TSS by 75%; reduces coliform by up to 30%; reduces fecal enterococcus by up to 30%; reduces heavy metals by 30-50%	Reduce sediment loads and absorbed pollutants to the Los Angeles River; improve water quality
Sand filtration system	Reduces TSS by 75%; reduces coliform by up to 90%; reduces fecal enterococcus by up to 90%; reduces heavy metals by up to 90%	Reduce sediment loads and absorbed pollutants to the Los Angeles River; improve water quality

TSS = total suspended solids.
* Actual pollutant removal percentages vary depending on design of BMP and vegetation planted.
Sources: EPA, 1999; EPA, 1993; CWP, 2000.

$$L = \sum_{i}^{n} RC_i AASV_i * C_i * G$$

Where L = annual loading (kg/yr)

RC_i = runoff/rainfall ratio for given land use (imperviousness ≈ 1.00)

C_i = anticipated concentration for given land use (mg/l)

G = unit conversion factor (10^{-6} kg/mg*28.3 l/cf)

$AASV_i$ = average annual storm volume for given drainage area (cf/yr)

= $P*A_i$ *F and where;

P = annual rain fall = 15 in /yr

Ai= Drainage area

F = unit conversion factor (43,560sf/ac-1ft/12in)

The pollutant loadings were calculated with the inputted BMPs (except for Trash Screen Insert/CDS BMP). Effluent loading of the targeted pollutants is presented in Table 3-3 and Table 3-4 for Phase I and Phase II, respectively. Please note that different sources, such as EPA and Caltrans, quote different percent removal for various BMPs. Also note that while Phase II estimates are provided below, this application does not include the construction of the Phase II BMPs.

Table 3-3 (Phase I)
Estimated Annual Pollutant Loads Within the Project Area*

Pollutant	Pollutant Conc. (mg/l)[1]	Total Annual Pollutant Load (kg/yr)	BMP Removal (%)			Effluent Loading (kg/yr)**
			Trash Screen Insert/ CDS ***	Swale	Porous Pavement	
Trash	--	--	90%	--	--	--
Copper (Cu)	0.035	0.719	--	60%	99%	0.003
Lead (Pb)	0.012	0.126	--	60%	99%	0.001
Zinc (Zn)	0.239	3.876	--	60%	99%	0.016
Total Suspended Solids (TSS)	67.40	1,045.0	--	83%	95%	8.9
Oil & Grease	--	--	80%	--	--	--

* Pollutant loading for the project area is only an estimate and is based on a number of assumptions such as, anticipated pollutant loads for various land uses, average rainfall, and runoff coefficients.

** The "Effluent Loading" is the expected pollutant load in the effluent after the runoff has gone through the BMPs. As such, the percent of the pollutant removed is as shown in the "BMP Removal" column. For example, for TSS, the effluent load is calculated as follows:

1,045 kg/yr * (1-0.83) * (1-0.95) = 8.9 kg/yr

*** BMP Removal % for trash and oil & grease pollutants is based on EPA (1999) sources.

Source: Caltrans BMP Report April 2002, ASCE's Urban Runoff Research Council

In addition to the results shown in Table 3-3, based on the 1999 EPA study, the Phase I BMP porous pavement achieves a 65 to 100 percent removal efficiency of bacteria, as referenced in Table 3-2. Furthermore, bacteria are reduced by the following Phase II BMPs: detention pond which achieves a 30 percent reduction, and sand filtration system which receives a 90 percent reduction.

It is intended that the combination of the two phases of the project be considered as one whole project. The Phase I BMPs are the first step toward reducing the targeted pollutants at the site, while the Phase II BMPs complete the project goals.

Table 3-4 (Phase II)
Estimated Annual Pollutant Loads Within the Project Area*

Pollutant	Pollutant Concentration		Total Annual Pollutant Load **	BMP Removal %		Effluent Loading***
	mg/l	(MPN/ml)		Detention Pond	Sand Filter	
Copper (Cu)	0.035		1.438	90%	80%	0.029
Lead (Pb)	0.012		0.252	90%	80%	0.005
Zinc (Zn)	0.239		7.751	90%	80%	0.155
Total Coliform		806,940	2.24E+16	90%	37%	1.41E+15
Fecal Coliform		1,340,167	3.72E+16	90%	37%	2.34E+15
Fecal Enterococcus		34,661	9.61E+14	90%	37%	6.05E+13
Total Suspended Solids (TSS)	67.40		2,090.0	75%	86%	73.1

* Pollutant loading for the project area is only an estimate and is based on a number of assumptions such as, anticipated pollutant loads for various land uses, average rainfall, and runoff coefficients.

** Units are in kg/yr for Copper, Lead, Zinc, and TSS and in MPN/yr for Total Coliform, Fecal Coliform, and Fecal Enterococcus.

*** The "Effluent Loading" is the expected pollutant load in the effluent after the runoff has gone through the BMPs. As such, the percent of the pollutant removed is as shown in the "BMP Removal" column. For example, for TSS, the effluent load is calculated as follows: 2,090 kg/yr * (1-0.75) * (1-0.86) = 73.1 kg/yr. Units are in kg/yr for Copper, Lead, Zinc, and TSS and in MPN/yr for Total Coliform, Fecal Coliform, and Fecal Enterococcus.

3.3 Additional Project Benefits

In addition to the water quality benefits noted above, the Zoo Project would include additional environmental benefits that indirectly improve water quality and improve the quality of life, including:

- Promotion of alternative transportation methods through convenient public transportation access and bicycle paths to the Zoo and throughout the Griffith Park area.
- Improved trails, walking locations, and bike paths to the Griffith Park trails network.
- Educational displays showing the Zoo's conservation efforts including, but not limited to, stormwater BMPs and promoting individual conservation measures.

- Promotion of BMP Parking Lots using the latest porous paving (e.g., *Ecocreto*)[5].
- Generation of energy through the use of photovoltaic solar trees in the parking lot.

[5] *Ecocreto* porous pavement has been recently installed at the Taylor Park parking lot. It is also being considered at bus stops in the City of Los Angeles. Source: Personal communication, David Fowler, *Ecocreto*, June 2006. www.Ecocreto.com

Section 4
Proposed Project Siting

4.1 Siting Location and Construction Constraints

Design Criteria

In order to design the proposed project, the existing site conditions need to be analyzed. During the design and planning phase, if the collection and reuse of runoff alternative is selected, any portion of the parking lot that may be underlain by a liner will need to be graded to convey infiltrated runoff to the cistern. Additionally, site-specific conditions need to be discussed with *Ecocreto* to confirm that it is possible to break apart and reuse the existing parking lot in the subbase of the new parking lot.

Per *Ecocreto* design specifications, the largest clogging threats to the system occur during construction and from landscape. During initial or reing construction, contractors may use pavement areas to store materials such as sand, gravel with fines, soil or landscape materials containing fines. The owner or supervising contractor must require all contractors to protect the pavement using heavy Visqeen or plywood under such piles and to cover all piles to prevent blowing and or washing away of such materials.

Additionally, *Ecocreto* recommends:

- No piling of dirt, sand, gravel or landscape material without covering the pavement first with a durable cover to protect the integrity of the pervious surface.

- All landscape cover must be graded to prevent washing and or floating of such materials onto or through the pervious surface.

The vegetative bioswales should also be designed to maximize retention time in order to increase the pollution removal potential. Vegetation selection must consider vegetation that can withstand periodic inundation with significantly drier conditions much of the time, particularly during the dry summers experienced in this region. The vegetation will act as a physical barrier to trash that Zoo visitors may improperly dispose of, and therefore periodic removal of trash from the bioswales will be required.

Considerations for Phase II Implementation

Cistern selection is dependent upon the underlying soil types. An infiltration cistern is only feasible if the soil has suitable porosity, and therefore soil sampling will be required if a storage cistern is determined to be infeasible. If a storage cistern is selected, a pump will be required to convey water for irrigation purposes. Sizing of either type of cistern must take into account expected flows and infiltration rates. Capacity of the pump will be determined based on desired pressure and application rates. A connection to the unlined portion of the parking lot would be required to discharge flows that exceed the capacity of the cistern.

The use of porous pavement at the Zoo parking lot will reduce runoff from the parking lot to other BMPs, such as potential implementation of a detention pond and associated sand filters. Therefore, these BMPs, should be located and sized to receive runoff from the Zoo proper. If it is determined that runoff from the Zoo proper does not reach the parking lot area, then inclusion of these BMPs in the parking lot design should be reconsidered.

Construction Constraints

Several construction constraints need to be taken into consideration during scheduling/phasing of the project. The LA Zoo parking lot accommodates LA Zoo visitors as well as providing overflow parking for the Glendale Galleria and the Hollywood Bowl; therefore, construction scheduling needs to be done such that the visitors to the LA Zoo are not drastically impacted by the construction activities, and loss of valuable parking spaces.

Additionally, the sequencing of construction needs to be phased such that the construction of the vegetated swales will not immediately clog the porous pavement system. Requirements for the installation of the solar trees should be discussed with DWP.

4.2 Environmental Feasibility

As described in previous sections, the runoff from the Zoo parking lot and Zoo Drive areas will flow either through the porous pavement for infiltration or captured by a cistern for later irrigation reuse, be treated through one of the bioswales located in the parking lot area, or flow through the existing storm drain system on Zoo Drive, enhanced with trash capture devices.

As the site currently has no existing recreational program elements, construction of the proposed facilities will not have any impacts on recreational aspects of the site.

Section 5
Operations and Maintenance

The proposed water quality improvements will not change the overall use or size of the Zoo parking lot. Operations and maintenance is the responsibility of the Zoo. Existing operations and maintenance activities include the upkeep of the existing parking lot area including daily sweeping and periodic restriping, landscaping, trash pickup and periodic maintenance of the existing irrigation system.

The Zoo parking lot improvements may potentially require some additional upkeep to maintain the treatment and runoff reduction elements. The "Smart" Irrigation System will require periodic maintenance to insure that the sensors and infrastructure are in working condition. It is essential that the vegetation in the vegetated swales be maintained as needed and periodically cleared of trash and plant debris to prevent clogging of the vegetated channels.

The *Ecocreto* specifications include a section regarding "maintenance, clogging, special recommendations". *Ecocreto* recommends that the surface be vacuumed at least 2 times per year, on six-month intervals, to lift any silt or debris from the surface. This process will prevent clogging of the pervious system. Frequency may be increased due to over hanging vegetation and or excessive dirt & pollutants, which may wash into or over & foul the surface of the pervious system.

Power washing is also recommended on an annual basis, but not limited to annually, in order to flush silt or other contaminants, which is essential to maintaining the permeability of the system. It has been determined that these fines cause little to no threat to the system when washed into the lower and larger aggregate.

Section 6
Regulatory Requirements

This section describes the environmental review process and appropriate regulatory requirements for the project.

6.1 California Environmental Quality Act (CEQA)

The City of Los Angeles anticipates commencing with CEQA documentation in February 2007, following Proposition O funding approvals. For purposes of this Concept Report, a Mitigated Negative Declaration is assumed to be the appropriate level of CEQA documentation for the proposed project.

6.2 Permit Requirements

During construction, there are several state and local permits that will be required to be obtained by the contractor. The following is a preliminary list of these permits:

- Construction General Permit issued by State Water Resources Control Board (SWRCB) which includes the Storm Water Pollution Prevention Plan (SWPPP).
- Traffic Control Plan
- Erosion Control Plan
- Access Plan
- Floodplain

Section 7
Public Outreach Program

The Bureau of Sanitation will be responsible for the planning phase of the proposed project. The Bureau of Engineering will be responsible for the design and implementation phases of the proposed project. The Zoo Department will be responsible for the operations and maintenance of the proposed project. Interested stakeholders include: Greater Los Angeles Zoo Association, Gene Autry National Center, Department of Water and Power, Tree People, and Councilman Tom LaBonge's Office.

Section 8
Preliminary Cost Estimate

The total project cost is estimated at $13,900,000. The amount requested from Prop O is $13,900,000. Detailed cost breakdowns are shown in Tables 8-1, 8-2, and 8-3 below. Costs are broken down into two categories: Water Quality Benefits and Other Project Benefits.

Table 8-1
Water Quality Benefits Construction Cost Estimate

Description	Unit	Quantity	Unit Price	Item Total
Trash Capture Device	EA	2	$8,000	$16,000
Porous Pavement Installation	SF	435,600	$9	$3,920,400
Bioswales	EA	5	$40,000	$200,000
Tree Wells/Landscaping	LS	1	$100,000	$100,000
Smart Irrigation System	LS	1	$72,000	$72,000
Subtotal (1)				**$4,308,400**
Mobilization - 0% to 7% of Subtotal (1)			7%	$301,588
Permits Allowances - 1% to 3% of Subtotal (1)			3%	$129,252
Other Allowances - 5% of Subtotal (1)			5%	$215,420
Subtotal (2)				**$4,954,660**
Estimating Contingency - 10% to 25% of Subtotal (2)			20%	$990,932
Subtotal (3)				**$5,945,592**
Escalation - 10% per year of Subtotal (3)			10% (per year, 3 years)	$1,967,991
Subtotal (4)				**$7,913,583**
Construction Contingency - 10% to 20% of Subtotal (4)			10%	$791,358
Total Estimated Project Construction Cost				**$8,704,941**
Project Right of Way Estimated Cost				**$0**

Table 8-2
Other Project Benefits Construction Cost Estimate

Description	Unit	Quantity	Unit Price	Item Total
Parking lot striping, lighting, and signage	LS	1	$1,200,000	$1,200,000
Solar Trees	TBD	TBD	TBD	TBD
Subtotal (1)				**$1,200,000**
Mobilization - 0% to 7% of Subtotal (1)			7%	$84,000
Permits Allowances - 1% to 3% of Subtotal (1)			3%	$36,000
Other Allowances - 5% of Subtotal (1)			5%	$60,000
Subtotal (2)				**$1,380,000**
Estimating Contingency - 10% to 25% of Subtotal (2)			20%	$276,000
Subtotal (3)				**$1,656,000**
Escalation - 10% per year of Subtotal (3)			10% (per year, 3 years)	$548,136
Subtotal (4)				**$2,204,136**
Construction Contingency - 10% to 20% of Subtotal (4)			10%	$220,413
Total Estimated Project Construction Cost				**$2,424,549**
Project Right of Way Estimated Cost				**$0**

While total costs for the "Solar Trees" are still being determined, the City of Los Angeles, Department of Water and Power has committed to provide funding for the solar tree component of this Demonstration Project.

Table 8-3
(Project No. 9) The Los Angeles Zoo Parking Lot, Demonstration on Environmental Sustainability
Cost Estimate

Budget Category		Non-Proposition O Funding (if applicable) see notes below	Requested Proposition O Funding		Total
			Water Quality Benefits	Other Project Benefits	
(a)	Construction Cost	-	$8,704,941	$2,424,549	$11,129,490
(b)	Land Purchase/Right-of-Way acquisition	-	-	-	-
(c)	Pre-Design and Design (including environmental clearance, design project management)	-	$1,239,332	$504,441	$1,743,773
(d)	Construction and Post-Construction management	-	$803,637	$227,342	$1,030,979
(e)	**Grand Total [Sum (a) through (d) for each column]**	**-**	**$10,747,910**	**$3,156,332**	**$13,904,242**

Source(s) of Non-Proposition O Funds
Los Angeles Department of Water and Power – Solar Energy Component

Operation and Maintenance Costs

The annual operation and maintenance cost for the project is estimated at $55,000. However, O&M costs are not being requested through Proposition O.

Other Funding Sources

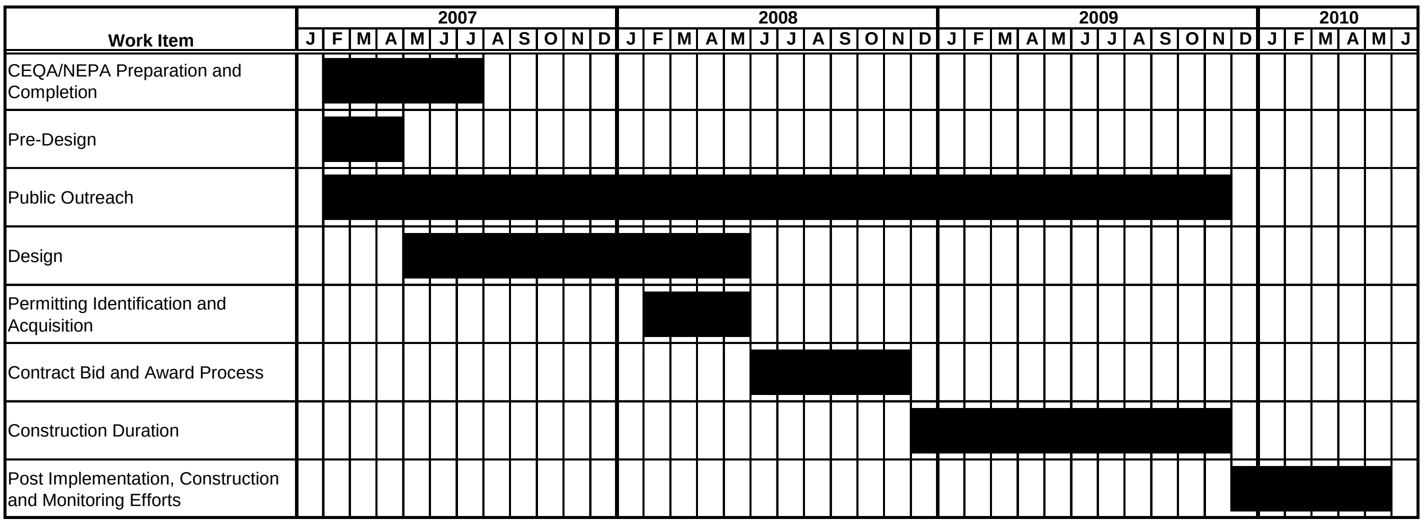
The Los Angeles Zoo has secured funds from the Los Angeles Department of Water and Power for the solar energy component of the project.

Potential Sources of Revenue

While there is no potential for additional revenues as a result of this project, however this project would result in improved facilities for both the Los Angeles Zoo and the entire Griffith Park Area, encouraging visitors to the facilities.

Section 9
Implementation Schedule

The final version of this Concept Report, which will provide a conceptual overview of the creation of the Zoo Parking Lot project, will be completed in December 2006. Based on the best information available during preparation of this Concept Report, the project design and construction will be completed by December 2009. No buildings exist at the site that will require demolition. A staging area for construction vehicles will be onsite and traffic control measures, according to the approved traffic control plan, will be implemented along affected streets, if necessary.



Section 10
Project Recommendations

In summary, the following project recommendations should be considered:

- Verify Solar Trees costs with City of Los Angeles, Department of Water and Power.

- Conduct soils and geotechnical investigation to assess local site conditions and BMP suitability.

Appendix A
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Appendix B
Pollutant Loading Estimation

Given

- Project Drainage Area: 10 acres (Phase I)
- Proposed BMP: Vegetated Swale & Porous Pavement (Phase I)
- Project Drainage Area: 20 acres (Phase II)
- Proposed BMP: Detention Pond & Sand Filter (Phase II)
- Average Annual Rainfall: 15 inches
- Targeted Pollutants:
  - Total Coliform
  - Fecal Coliform
  - Fecal Enterococcus
  - Oil & Grease
  - Total Suspended Solids (TSS)
  - Heavy Metals (Copper, Lead, Zinc)

The estimated total annual loading, L (kg/yr), for each targeted pollutant can be calculated as follows:

$$L = \sum_{i}^{n} RC_i AASV_i * C_i * G$$

Where L = annual loading (kg/yr)

RC_i = runoff/rainfall ratio for given land use (imperviousness ≈ 1.00)

C_i = anticipated concentration for given land use (mg/l)

G = unit conversion factor (10^{-6} kg/mg*28.3 l/cf)

$AASV_i$ = average annual storm volume for given drainage area (cf/yr)

= $P*A_i*F$ and where;

P = annual rain fall = 15 in /yr

A_i= Drainage area

F = unit conversion factor (43,560sf/ac-1ft/12in)

Table B-1
(Phase I) – Estimated Annual Pollutant Loads Within the Project Area*

Pollutant	Pollutant Conc (MPN/ml)[1]	Pollutant Conc (mg/l)[1]	Total Annual Pollutant Load**	BMP Removal % (Swale/PP)[2]	Effluent Loading**
Total Coliform	806939.80		1.12E+16	0/0	1.12E+16
Fecal Coliform	1340166.71		1.86E+16	0/0	1.86E+16
Fecal Enterococcus	34660.95		4.81E+14	0/0	4.81E+14
Oil & Grease		3.65	44.2	0/0	44.2
Total Suspended Solids (TSS)		67.40	1045.0	83/95	8.9
Copper (Cu)		0.035	0.719	60/99	0.003
Lead (Pb)		0.012	0.126	60/99	0.001
Zinc (Zn)		0.239	3.876	60/99	0.016

* Pollutant loading for the project area is only an estimate and is based on a number of assumptions such as, anticipated pollutant loads for various land uses, average rainfall, and runoff coefficients.
** Units are in MPN/yr for Total Coliform, Fecal Coliform, Fecal Enterococcus and kg/yr for Oil & Grease, TSS, Copper, Lead, and Zinc
PP: Porous Pavement DP: Detention Pond SF: Sand Filter

Table B-2
(Phase II) – Estimated Annual Pollutant Loads Within the Project Area*

Pollutant	Pollutant Conc (MPN/ml)[1]	Pollutant Conc (mg/l)[1]	Total Annual Pollutant Load**	BMP Removal % (DP /SF)[2]	Effluent Loading**
Total Coliform	806939.80		2.24E+16	90/37	1.41E+15
Fecal Coliform	1340166.71		3.72E+16	90/37	2.34E+15
Fecal Enterococcus	34660.95		9.61E+14	90/37	6.05E+13
Oil & Grease		3.65	88.5	0/0	88.5
Total Suspended Solids (TSS)		67.40	2090.0	75/86	73.1
Copper (Cu)		0.035	1.438	90/80	0.029
Lead (Pb)		0.012	0.252	90/80	0.005
Zinc (Zn)		0.239	7.751	90/80	0.155

* Pollutant loading for the project area is only an estimate and is based on a number of assumptions such as, anticipated pollutant loads for various land uses, average rainfall, and runoff coefficients.
** Units are in MPN/yr for Total Coliform, Fecal Coliform, Fecal Enterococcus and kg/yr for Oil & Grease, TSS, Copper, Lead, and Zinc
PP: Porous Pavement DP: Detention Pond SF: Sand Filter

[1] Los Angeles County Department of Public Works, Watershed Management Division – Stormwater Quality Data, Table 4-9 Cumulative Event Mean Concentrations 1994 – 2000 Storm Season (Commercial Land Use) (http://www.ladpw.org/WMD/npdes/wq_data.cfm)
[2] Caltrans BMP Report April 2002, ASCE's Urban Runoff Research Council