Appendix I
Facilities Siting Technical Memorandum

CH:CDM

Santa Monica Bay Beaches Wet Weather Bacteria TMDL Implementation Plan

Technical Memorandum Task 8: Facilities Siting

To: *Morad Sedrak, City of Los Angeles Watershed Protection Division*
Representing Jurisdiction 2 and 3 Agencies

From: *Hampik Dekermenjian, CH: CDM*
Dave Jones, CH:CDM
Tina Ponce, CH:CDM
Bob Kemmerle, E2
Stephanie Roberts, CH:CDM

Date: *August 18, 2004*

1.0 Introduction

1.1 Background

The CH:CDM team is assisting Jurisdiction Groups 2 and 3 in developing an Implementation Plan to address the requirements of the Santa Monica Bay (SMB) Beaches Wet Weather Bacteria Total Maximum Daily Load (TMDL). This TMDL sets a limit on wet weather bacteria exceedance days per year based on monitoring at the SMB beaches.

There are seven jurisdictions, organized by watersheds, which are impacted by this TMDL. Of these seven jurisdictions, the City of Los Angeles is the lead agency for Jurisdiction 2 and is a significant participant in three other Jurisdictions (1, 3 and 7). The City of Santa Monica is the lead in Jurisdiction 3 and is a participant in Jurisdiction 2. Other responsible agencies within Jurisdictions 2 and 3 include El Segundo, the County of Los Angeles, and Caltrans. This technical memorandum (TM) pertains to the joint implementation planning effort for Jurisdictions 2 and 3 (see Figure 1).

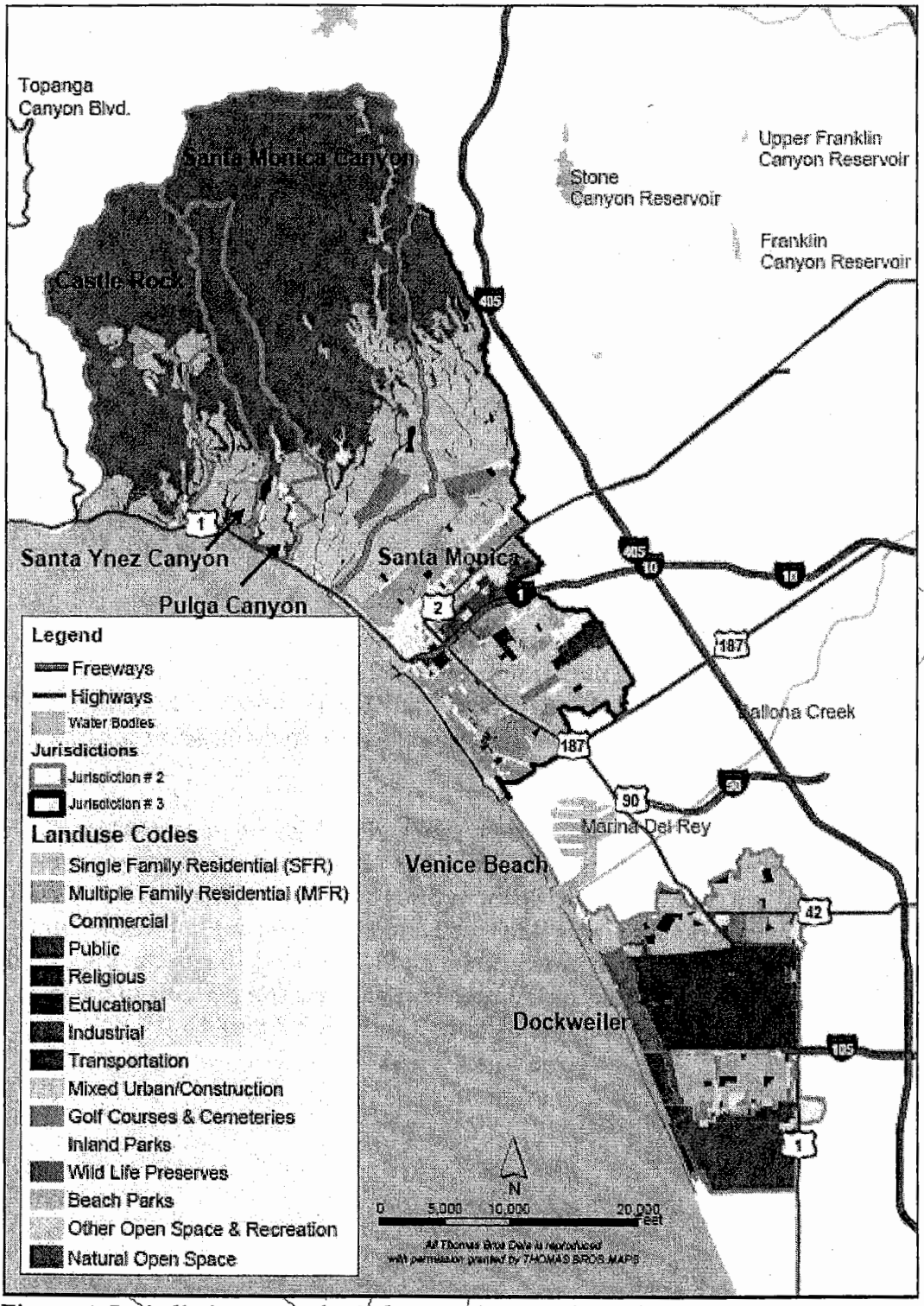

Figure 1. Jurisdictions 2 and 3 Subwatersheds and Land Use

In support of the Jurisdictions' efforts to prepare the Implementation Plan, the CH:CDM team is under contract to provide the following tasks:

Task 1: Assist with TMDL Development Planning
Task 2: Provide Staff Support for the Development of Integrated Implementation Plan
Task 3: Regulatory Requirements
Task 4: Detailed Hydrologic Study
Task 5: Beneficial Use Evaluation
Task 6: Treatment and Management Options Evaluation
Task 7: Coastal Collection System Evaluation and Conceptual Alternatives
Task 8: Research Potential Sites for Collection, Treatment and Diversion Facilities
Task 9: Analysis of Implementation Alternatives
Task 10: Prepare TMDL Implementation Plan
Task 11: Task Management

1.2 Purpose

The purpose of this technical memorandum (TM) is to evaluate potential sites for facilities that may be required to implement the TMDL implementation plan under various runoff management options. The range of options are described in TMs 5, 6, and 7. In TM 5, various beneficial use opportunities for wet weather runoff within the Jurisdiction 2 and 3 subwatersheds were evaluated. TM 6 defined on-site and regional methods of source control and treatment facilities that could be required to implement the beneficial uses defined in TM 5 and to implement other options for reducing wet weather discharges to the beaches. TM 7 determined the capacity of the existing wastewater collection and treatment systems that could be used to treat wet weather runoff.

This technical memorandum (TM 8) builds upon these tasks by identifying potential sites at which the on-site and regional runoff management options under consideration could be implemented.

2.0 Runoff Management Options

In order to categorize the types of facilities that require siting, the runoff management options were reviewed. Based on the previous TMs, a three-tier approach for implementation is recommended. This approach involves managing runoff through institutional, on-site, and regional options. These options, as they pertain to facilities to be sited, are summarized in this section.

2.1 Institutional Options

These options are intended to prevent or reduce levels of bacteria, or potential bacteria sources (e.g. garbage/trash) from initially being picked up by runoff whether on-site, in the curb/street, or in the storm drain system. They generally consist of efforts such as education and implementation of "good housekeeping" practices for individuals,

businesses, and industry. They also include industrial process changes to minimize waste production and enforcement activities to prevent illegal discharges and connections and ensure industrial discharge permit compliance. Due to their programmatic, "non-structural" nature, there are no facilities to be sited in order to implement institutional options.

2.2 On-site Options

On-site options are intended to improve water quality and to reduce the total volume and/or flow rate of runoff leaving properties and entering the storm drain system, including any bacteria that might be picked up in the runoff on-site. These options include cisterns, on-site storage/reuse, and small-scale capture and infiltration projects. By reducing the volume of runoff that enters the downstream storm drain system, these on-site options reduce the amount of runoff that needs to be managed downstream, or regionally. Reducing the volume and/or rate of runoff flow can help reduce the required capacity of other potential downstream treatment/storage facilities.

Cisterns collect diverted runoff from impervious roof areas into on-site storage reservoirs ranging from 60 to 10,000 gallons in volume. This stored runoff could provide a source of chemically untreated 'soft water' for gardens and compost, free of most sediment and dissolved salts. Cisterns of this size are likely most appropriate for installation at single-family and multi-family residences. They can be sited wherever a property has sufficient landscaping to utilize the collected runoff. TM 5 quantified single and multi-family residential land uses by subwatershed. Thus, no additional specific siting recommendations for this option will be discussed in this memorandum.

"On-site storage/reuse" involves capturing runoff from rooftops and other hardscaped areas, performing limited treatment, and storing it for subsequent reuse on-site in a much larger (on the order of 100,000 gallons) underground-type of storage. The Open Charter School Demonstration Project in the Ballona Creek watershed is an example of this option. Potential sites for this type of system would be public parks, urban vacant lots, government facilities, or schools at which the runoff could be reused for irrigation under specific, controlled conditions without needing to meet full Title 22 treatment standards (requiring filtration and disinfection). Potential sites for on-site storage/reuse projects are discussed in Section 3.1 of this memorandum.

Small-scale capture and infiltration involves capturing runoff from hardscaped areas and infiltrating into the soil. Various methods for on-site infiltration include porous pavement, retention grading, dry wells, and bioretention. As described in TM 5, due to the nature of surface soils in Jurisdictions 2 and 3, very limited opportunities exist for on-site infiltration projects that will lead to quantifiable reductions in runoff volumes. There may be some opportunities, however, along the beach areas of the Venice Beach and Dockweiler subwatersheds. In the Venice beach area, a small-scale infiltration project could be implemented. (Larger, regional infiltration projects in the Dockweiler area will be discussed under Regional Options). As described in TM 6, runoff from

boardwalk and street areas near the beach could be routed to a treatment system to remove grit and oil, and then routed to an infiltration system located in the sandy area. The infiltration system would consist of a perforated culvert that could store the runoff until it is infiltrated. A 48" perforated culvert, located parallel to the coast, would have a storage capacity of 94 gallons per foot of culvert. In some cases, this volume may be infiltrated in a 24-hour period. A small-scale infiltration project consisting of 1,000 feet of culvert could be implemented, for example, in the southern area of Venice beach where the historical bacteria exceedances are more of a concern than in the northern section of Venice beach.

2.3 Regional Options

Regional options involve capturing runoff from the storm drain system after it has left individual properties and before it enters the receiving waters. The options for handling the runoff after it is collected include diversion to wastewater treatment, treatment and discharge, treatment and beneficial use, treatment and groundwater injection, and ocean disposal. Summaries of these options and of the required facilities follow.

All of the regional options involve diverting some or all of the runoff from the major storm drains before it is discharged to the ocean. Thus, implementation of the regional options requires installing diversion structures and transport pipelines. Since the instantaneous runoff flowrate during a typical rain event varies from zero to a relatively high flowrate and then decreases to zero, the regional options would also require short-term operational storage to balance the rainfall hydrograph inflow over much more limited outflow rates to treatment or reuse facilities so that the required facility design flowrate is more economical than at the peak runoff rate. Thus, siting of operational storage near major storm drain outlets will be discussed in Section 4.

- Divert to wastewater treatment – As described in TM 7, there is some additional capacity within the wastewater collection system to handle diverted runoff. These quantities, per subwatershed, are discussed in TM 7. From the operational storage facilities, runoff may be directly diverted to the wastewater collection system. For this reason, separate sites for diversion opportunities will not be discussed here, rather, it is assumed that the diversions will be co-located with the operational storage facilities.

- Treatment and discharge – In this option, runoff would be temporarily captured and stored in operational storage facilities. It would then be treated using newly constructed runoff treatment plants designed to meet the AB411 beach standards and discharged to the ocean (typically through the storm drain outfalls). Based on the design criteria presented in TM 6, treatment may consist of storage, influent pumping, bar screens to remove trash, sedimentation basins to remove settleable solids such as grit and organic material, and disinfection. As an alternative to traditional treatment, it is possible that a wetland treatment system could be constructed where a large amount of land is available. There are potential benefits to wetlands. They support

vegetation and multiple recreational uses; are generally a more aesthetically pleasing, "softer" solution than traditional plants or stormwater detention basins; and have relatively low operations and maintenance costs. The main constraint for wetlands is that they require a large amount of land, which may mean high acquisition costs and may preclude their use in highly developed areas. Per TM 6, wetlands require 3 acres/mgd. In addition, the use of wetlands to remove bacteria from wet weather flow has not been a proven treatment technology. Siting of new treatment facilities or wetlands will be discussed in Section 4. If the treatment facilities or wetlands are not located near the operational storage facilities, transmission pipelines will be needed to convey the runoff from storage to treatment.

- Treatment and beneficial reuse – This option involves capturing, storing (operational storage facilities), diverting runoff to treatment facilities designed to Title 22 Standards (filtration and disinfection to meet a less than 2.2 MPN coliform standard), and then distributing to reuse sites. For this analysis, it is assumed that a plant to treat runoff to these standards would be similar to the Santa Monica Urban Runoff Recycle Facility (SMURRF), which is currently used to treat dry weather runoff. As presented in the TM 6, the SMURRF has an average capacity of 500,000 gallons per day (gpd) and a peak capacity 750,000 gpd. It employs a rotating drum screen and cyclone-type grit chamber to remove grit, small particles and debris, a dissolved air floatation (DAF) system to remove oil and grease, microfiltration and ultraviolet (UV) disinfection. The footprint area for this plant is about 19,000 SF with the usable portion at 12,000 SF because of setback requirements (Salgaonkar, 2004). For the purposes of this study, it will be assumed that a new plant would require 12,000 square feet for each 0.5 mgd plus a 10 percent factor for setbacks. This corresponds to a footprint area of 0.6 acres per mgd. Potential reuse sites and the need for seasonal storage will be discussed in Section 4.

- Large-scale infiltration projects – As discussed above, due to the favorable infiltration characteristics of the surface soils in the coastal area of the Dockweiler subwatershed, there may be opportunities for treatment through infiltration projects on a larger scale than those discussed above for the Venice beach area. In the vacant land areas just inland from the beach sands, runoff could be captured and treated by infiltration into the soil.

- Treatment and groundwater injection – With this option, runoff would be treated and then used as a source of regional groundwater injection. As discussed in TM 5, this option does not appear to be feasible for Jurisdictions 2 and 3, unless the water could be considered as a supplemental source of supply with Hyperion effluent to the existing West Basin Municipal Water District's recycled water distribution system.

- Discharge to ocean through extended outfall – This option involves discharging the runoff using an outfall to extend the discharge point of runoff without treatment for bacteria/pathogens to beyond the surf/swim zone, thereby avoiding bacterial

contamination of waters used for recreational purposes. As presented in TM 6, it was assumed that the only potential for this option is to consider routing runoff from the Dockweiler area to the existing Hyperion Treatment Plant (HTP) 1-mile outfall. Although this option does not improve water quality, it does reduce health risk along the beaches by relocating the point of discharge.

Based on the above summary of runoff management options, several categories of facilities will require siting. These are:

1. Potential on-site storage and reuse projects
2. Operational storage near major storm drain outlets
3. Transmission pipelines to treatment facilities
4. Treatment or wetland facilities for discharge or beneficial reuse
5. Beneficial reuse sites

Possible locations for these types of facilities, siting requirements, and criteria are discussed in the next section.

3.0 Potential Sites for On-Site Storage and Reuse

As mentioned previously, "on-site storage and reuse" involves capturing runoff from rooftops and other hardscaped areas, performing limited treatment, and storing it for subsequent reuse on-site in a larger (on the order of 100,000 gallons) underground-type of storage. Potential sites for this type of system would be public parks, urban vacant lots, government facilities, or schools. If the runoff can be reused under closely managed, controlled irrigation systems with no public contact, Title 22 treatment standards (requiring filtration and disinfection) are not required and only limited treatment prior to reuse is necessary. Potential sites for on-site storage/reuse projects are discussed in this section.

3.1 Parks and Recreational Centers

Public parks within Jurisdictions 2 and 3 and their approximate areas were identified from land use data. Parks and recreational land are good sites for underground cisterns and other BMPs including vegetated swales since improvements will not interfere with the natural surroundings and public enjoyment of the park, the site will maintain its recreational use, and acquisition costs are not involved.

Inland parks are shown in light green on Figure 1. They are also listed in Table 1. The larger the park, the greater the capacity to capture and retain runoff. The largest ten parks listed (and shown in **bold**) in Table 1 include: Will Rogers Park, Rustic Canyon Recreation Center, Palisades Park, Memorial Park, Clover Park, Penmar Recreational Park and Playground, South Beach Park, Westchester Golf and Recreation Center, Recreation Park, and The Lakes at El Segundo. A photo of Rustic Canyon Recreation Center is shown in Figure 2.

Table 1 Public Parks		
Site	**Area (Acres)**	**Subwatershed**
Santa Ynez Canyon Park	9.6	Castle Rock
Barrington Recreation Center	1.5	Santa Monica
Will Rogers State Historic Park	**36.5**	**Pulga, Santa Monica Canyon, and Castle Rock**
Temescal Canyon Park	9.0	Pulga Canyon
Rustic Canyon Recreation Center	**13.0**	**Pulga Canyon**
Palisades Park	4.7	Pulga Canyon
Douglas Park	5.4	Santa Monica
Schader and/or Park Dr. Park	4.8	Santa Monica
Stewart Street Park	1.1	Santa Monica
Palisades Park	**22.5**	**Santa Monica**
Lincoln Park	7.0	Santa Monica
Virginia Avenue Park	6.2	Santa Monica
Memorial Park	**11.3**	**Santa Monica**
Clover Park	**13.5**	**Santa Monica**
Palisades Park	8.3	Santa Monica
Joslyn Park	2.9	Santa Monica
Penmar Recreational Park	**14.4**	**Santa Monica**
Los Amigos Park	6.9	Santa Monica
Marine Park	7.1	Santa Monica
Mary Hotchkiss Park	2.9	Santa Monica
Crescent Bay Park	4.4	Santa Monica
Beach Park	4.6	Santa Monica
Ocean View Park	0.8	Santa Monica
Oakwood Recreation Center	5.1	Santa Monica
Westminster Park	3.2	Santa Monica
South Beach Park	**16.9**	**Santa Monica**
Del Rey Lagoon Park	8.5	Dockweiler
Westchester Golf and Recreation Center	**22.3**	**Dockweiler**
Vista del Mar	1.6	Dockweiler
Constitution Park	7.0	Dockweiler
Library Park	3.1	Dockweiler
Recreation Park	**20.5**	**Dockweiler**
Hilltop Park	3.0	Dockweiler
The Lakes at El Segundo Golf Course	**14.7**	**Dockweiler**
Total Park Area	**304.3**	

Figure 2. Rustic Canyon Recreation Center

3.2 Government Facilities

Government buildings and public facilities include city halls, chambers of commerce, fire and police stations, libraries and some hospitals. If these facilities have significant irrigation demand relative to the amount of on-site runoff that could be captured, they would make good potential sites for on-site storage and reuse projects because land acquisition would not be required, and these public facilities will set examples for future on-site management of runoff for private commercial sites. On-site storage and reuse projects implemented at these sites could be combined with other on-site BMPs, such as porous pavement in parking lots, or vegetative or bioretention swales.

Underground storage options could be accommodated at these sites either in the parking areas or in the green space. Government facilities identified within Jurisdictions 2 and 3 are listed in Table 2. They are shown in Figure 1 as public land areas (purple).

Table 2 Government Facilities		
Site	**Area (Acres)**	**Subwatershed**
Post Office	2.1	Pulga Canyon
DMV	3.3	Santa Monica
School District Offices	5.8	Santa Monica
County Courthouse	9.0	Santa Monica
Post Office	2.1	Santa Monica
El Segundo City Hall	2.0	Dockweiler
Fire Station	0.9	Santa Monica
J.Paul Getty Museum	11.6	Castle Rock
Fire Station #69	0.9	Santa Monica Canyon
Fire Station #23	1.3	Castle Rock
St. John's Hospital and Health Center	10.9	Santa Monica
Fire Station #3 and #4	0.9	Santa Monica
Santa Monica-UCLA Hospital	5.8	Santa Monica
Main Library	1.7	Santa Monica
Fire Headquarters Station #1	0.9	Santa Monica
Fire Station #5	1.6	Santa Monica
Santa Monica City Hall	2.1	Santa Monica
Santa Monica Civic Auditorium	4.7	Santa Monica
Fire Station	0.8	Santa Monica
Fire Station #63	2.2	Santa Monica
Fire Station #63	0.8	Santa Monica
Fire Station #5	0.8	Dockweiler
Loyola Village Branch Library	6.7	Dockweiler
Airport police	3.1	Dockweiler
Fire Station #80	1.5	Dockweiler
Post Office	3.5	Dockweiler
Fire Station	1.2	Dockweiler
Post Office	1.9	Dockweiler
Total Area	**90.1**	

3.3 Schools

On-site storage and reuse projects have been successfully implemented at several schools within Southern California. As mentioned previously, the Open Charter Elementary School project involved construction of an underground cistern and limited treatment system to enable reuse of the stored runoff for on-site irrigation. A school does not have to be large in order to be a potential site for an underground cistern. A cistern facility can be installed, for example, underneath playing fields that are 0.25 to 0.50 of an acre. Within Jurisdictions 2 and 3, there are approximately 40 or more public school facilities. Any of these facilities could make good potential sites for underground

cisterns. During implementation planning, the Los Angeles Unified School District should be contacted to help identify and prioritize candidates sites.

3.4 Urban Vacant Lots

Urban vacant lots could potentially make good sites for on-site storage and reuse projects. If there were plans to develop new parks or other uses on the lots that had sufficient irrigation demand, and reuse could be conducted in a controlled manner, underground cisterns could be implemented in conjunction with the above-ground improvements. A particular consideration is that urban vacant lots are privately owned and implementing projects at these sites would first include the cost and negotiations necessary to acquire the land. Urban vacant lots identified within Jurisdictions 2 and 3 are identified in Table 3.

Table 3
Urban Vacant Lots

Site	Area (Acres)	Subwatershed
Next to Getty Museum	3.9	Castle Rock
Wilshire Blvd & 14th St	1.9	Santa Monica
Between Clover Park and Santa Monica Airport	6.4	Santa Monica
Lincoln Blvd & La Tijera Blvd (next to Westchester Rec Center)	2.4	Dockweiler
Lincoln Blvd (next to Westchester Golf Course)	2.1	Dockweiler
W Manchester Blvd & Vista Del Mar	4.5	Dockweiler
Westchester Pkwy & Pershing Dr	27.4	Dockweiler
E Imperial Hwy & California St	2.6	Dockweiler
E. Grand Ave & Illinois St	4.3	Dockweiler
E Grand Ave & Continental Blvd	5.7	Dockweiler
Sepulveda Blvd and E Grand Ave	0.7	Dockweiler
Total Area	**61.9**	

4.0 Siting for Regional Options

Based on the proposed regional options presented in Section 2.3, the following facilities may be required:

- Operational Storage
- Treatment Facilities and Wetlands
- Transmission pipelines
- Reuse Locations for treated runoff

Potential sites for these facilities are discussed in this section.

4.1 Operational Storage Siting

In Task 4, Hydrologic Analysis, TMDL target runoff volumes for each subwatershed within Jurisdiction 2 and 3 were calculated. These TMDL target capture volumes equate to the amount of wet weather runoff that needs to be managed in order to prevent water quality exceedances at the outfall points at the beach to 17 days or less each year, 90 percent of the time (refer to TM 4 for details). The modeling conducted to determine this volume assumed that the storage would be drawn down in 24 hours in order to be able to handle closely spaced rain events. A summary of the target volumes calculated for each subwatershed is presented in Table 4. As mentioned previously, implementation of some of the on-site options discussed in Section 3 may have the potential to reduce downstream runoff volumes.

Table 4
Results of Task 4 Hydrologic Analysis

Subwatershed	Area (Acres)	Estimated Target Runoff Volume (MG)
Castle Rock	4,982	16
Santa Ynez	1,226	6
Pulga Canyon	1,984	7
SM Canyon	10,125	33
Santa Monica	9,152	63
Venice Beach	109	0.3
Dockweiler	6,879	49
Totals	**34,457**	**174**

Facilities will be needed to capture and temporarily store the target volume. Logical sites for these operational storage facilities are as close as possible to each major storm drain outfall. Figure 3 shows the approximate locations of the major storm drains as well as the tributary area to each major drain.

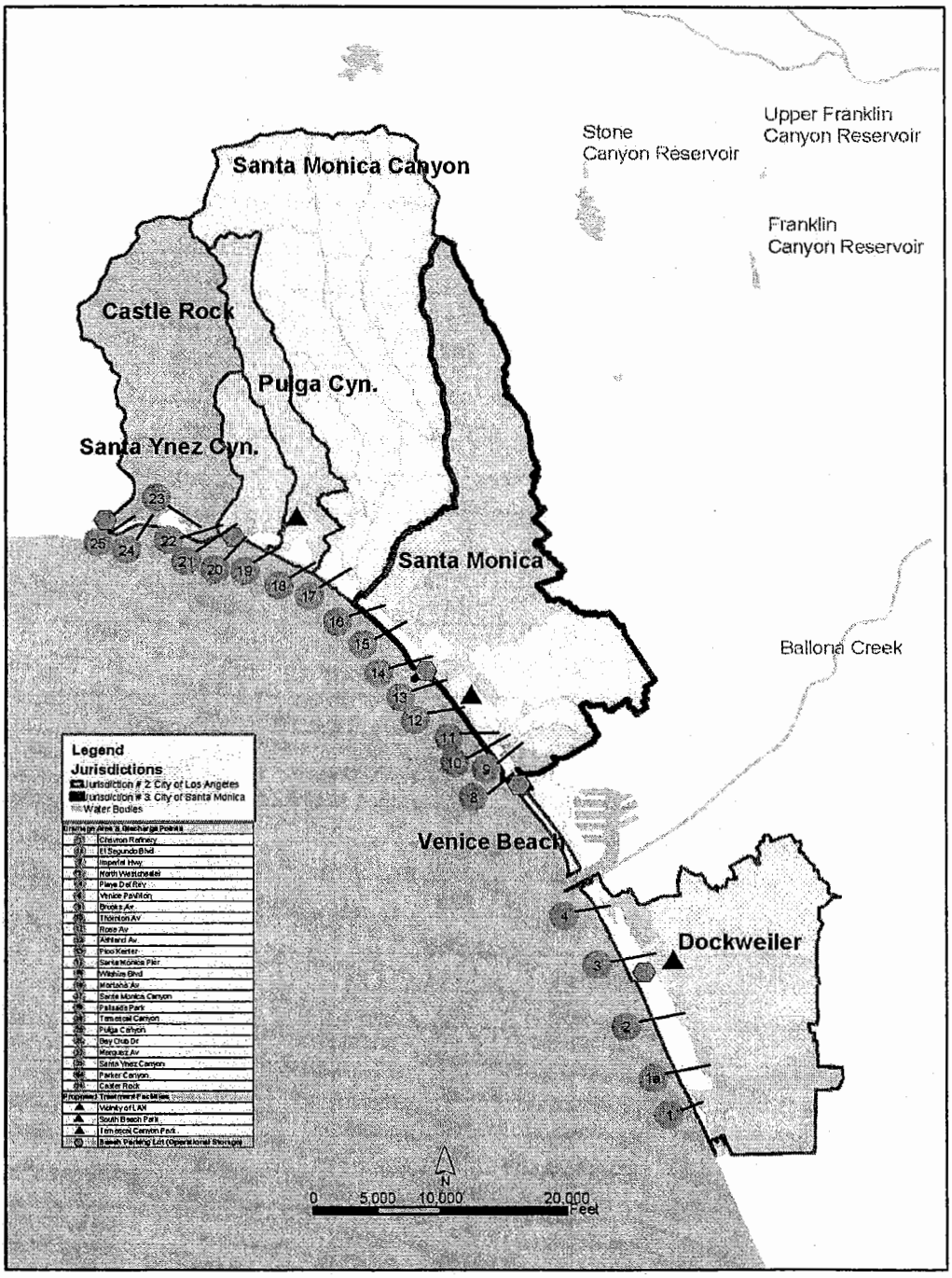

Figure 3. Major Storm Drain Drainage Areas and Proposed Facilities

The target volume to be captured and stored from each major storm drain was generally estimated by distributing the total watershed volumes shown in Table 4 by the subdrainage areas for each major storm drain as shown in Table 5.

Table 5
Target Runoff Volumes per Storm Drain

Storm Drain [1] (N to S)	Drainage Area[1] (Acres)	Portion of Subtotal (%)	Estimated Target Wet Weather Runoff Volume[2] (MG)
Castlerock			
Castlerock	74	2%	.2
Parker Canyon	282	6%	1.0
Santa Ynez Canyon	4,387	92%	14.8
Subtotal	**4,743**	**100%**	**16**
Santa Ynez Canyon			
Marquez Avenue	47	3%	0.2
Bay Club Drive	148	10%	0.6
Pulga Canyon	1,220	86%	5.2
Subtotal	**1,415**	**100%**	**6**
Pulga Canyon			
Temescal Canyon	1,660	80%	5.6
Palisades Park	405	20%	1.4
Subtotal	**2,065**	**100%**	**7**
Santa Monica Canyon	**10,147**	**100%**	**33**
Santa Monica			
Montana Avenue	825	9%	5.7
Wilshire Blvd	926	10.4%	6.5
Santa Monica Pier	94	1%	0.7
Pico-Kenter	4,147	45.5%	28.7
Ashland Avenue	264	2.9%	1.8
Rose Avenue	2,117	23.3%	14.6
Thornton Avenue	267	3.0%	1.8
Brooks Avenue	304	3.3%	2.1
Venice Pavilion	161	1.8%	1.1
Subtotal	**9,105**	**100%**	**63**
Dockweiler			
Playa Del Rey	403	6.3%	3.0
North Westchester	2,416	37.5%	18.4
Imperial Highway	1,958	30.4%	14.9
El Segundo Blvd.	539	8.4%	4.1
Chevron Refinery	1,129	17.5%	8.6

Table 5
Target Runoff Volumes per Storm Drain

Storm Drain [1] (N to S)	Drainage Area[1] (Acres)	Portion of Subtotal (%)	Estimated Target Wet Weather Runoff Volume[2] (MG)
Subtotal	**6,445**	**100%**	**49**
Total	**33,920**		**174**

Notes:

1. Drainage areas, storm drains, and approximate storm drain locations were obtained from the Santa Monica Bay Storm Drain Low-Flow Diversion Master Plan, Final Report, September 1996 as prepared by the City of Los Angeles, Department of Public Works, Bureau of Engineering.
2. The estimated runoff is based on the portion of the drain watershed in the J2/3 subwatershed times the estimated target runoff for the subwatershed presented in Table 4.

Several criteria were used in identifying potential sites at which to construct facilities to store these volumes. These criteria include the following:

- To minimize the lengths of the piping from the diversion points to the operational storage facilities, sites should be located as near as possible to the coast
- A site must allow construction with a minimal traffic disruption
- A site must already have street access and necessary traffic control (e.g. lights, turning lanes) from local streets and highways so that additional access permits and infrastructure are not required
- Publicly owned land is desirable since it will not require land acquisition
- Sites should be as remote as possible from existing residential properties
- Flat terrain is more desirable

The beach parking areas along the coast were found to meet all of these criteria. Operational storage can be constructed so that it is underground, which will not preclude the use of these areas as parking lots. Based on the ability to meet all the criteria, data was collected about the size and locations of the beach parking in J2/3. A summary of this analysis is presented in Table 6.

Table 6
Estimated Parking Lot Area at Santa Monica Beaches

Beach	Location	Number of Parking Spaces[1]	Estimated Area (square feet)
Topanga	Pacific Coast Highway at Topanga Canyon	**187**	**57,970**
Will Rogers 1, 3, 5	Pacific Coast Highway, Pacific Palisades	**1,794**	**556,140**
Santa Monica State Beach			
Lot 1	North	1,173	363,630
Lot 3	North	460	142,600
Lot 4	North	1,060	328,600
Lot 5	North	1,030	319,300
Lot 6	North	950	294,500
Lot 7	North	930	288,300
Lot 8	North	214	66,340
Lot 9	North	79	24,490
Lot 10	North	162	50,220
Lot 1	Beach Central/Pier	66	20,460
Lot 2	Beach Central/Pier	63	19,530
Lot 3	Beach Central/Pier	120	37,200
Lot 4	South	1,496	463,760
Lot 5	South	871	270,010
SMB Total		**8,674**	**2,688,940**
Venice Beach			
Venice City Beach	Rose Avenue, Venice	288	89,280
Venice City Beach	Venice Avenue, Venice	303	93,930
Venice Total		**591**	**183,210**
Dockweiler Beach			
Dockweiler State Beach	Vista del Mar and Grand Ave, Los Angeles	113	35,030
Dockweiler State Beach	62nd Avenue, Playa del Rey	50	15,500
Dockweiler Total		**163**	**50,530**
Marina del Rey			
Marina del Rey #13	4601 Via Marina	138	42,780
Marina del Rey #12	4151 Marquesas	206	63,860
Marina del Rey #11	14101 Panay Way	263	81,530
Marina del Rey #10	4101 Admiralty Way	209	64,790
Marina del Rey #9	14110 Palawan Way	187	57,970
Marina del Rey #8	4220 Admiralty Way	183	56,730
Marina del Rey #7	4350 Admiralty Way	120	37,200
Marina del Rey #5	Mindanao Way	222	68,820
Marina del Rey #4	Bali Way	152	47,120
Marina del Rey Boat Launch	Fiji Way	234	72,540

Table 6
Estimated Parking Lot Area at Santa Monica Beaches

Beach	Location	Number of Parking Spaces[1]	Estimated Area (square feet)
Marina del Rey Total		**1,914**	**593,340**

Notes:

1. Data obtained from Los Angeles County and City of Santa Monica (http://watchthewater.co.la.ca.us/beach.cfm?bid=18 and http://parking.santa-monica.org/det_beachcentral.html)
2. Data obtained from Planning Commissioners Journal (http://www.plannersweb.com/articles/trans14.html), assumed space size: 10' by 20'

Assumed space for roadway: 12 feet wide by 10 feet / 2
Assumed area for each space: 200 + 60 = 260 SF
Assumed other area = 20%, Total Area = 310 SF/parking space.

Based on this data, an analysis was done to determine the feasibility of storing the target runoff volumes underneath beach parking lots. When siting operational storage, it is desirable to locate the storage as close as possible to the storm drain outlet. This is because due to runoff peak flow rates, conveyance pipelines to storage may be too large. Parking lots in Marina del Rey (MDR) were not initially considered in this analysis since MDR is outside of the Jurisdiction 2/3 boundaries, but data is included in Table 6 to illustrate that there is additional area in Marina del Rey if needed. The analysis presented here is an example of a possible storage scenario, but can be adjusted based on revised target volumes, or different desired depths. The locations of the beach parking lots relative to the major storm drain outlets are shown in Figure 3.

The runoff from the Castlerock and Parker Canyon drains could be stored in a facility at Topanga State Beach. If the target volume of 1.2 MG was stored underneath the parking lot (57,970 square feet), a storage depth of 3 feet would be sufficient. If greater depth was used, less of the parking lot would be required for construction.

The runoff from the Santa Ynez Canyon, Marquez Avenue, Bay Club Drive, Pulga Canyon, Temescal Canyon, Palisades Park, and Santa Monica Canyon drains could be stored in a facility located at the Will Rogers State Beach. The total target runoff from these drains is 60.8 MG. This beach has three parking areas with a total estimated surface area of about 556,000 square feet. If the entire volume were to be stored, a storage depth of about 15 feet would be required.

There are three parking lots at the Will Rogers State Beach. The two northern lots are on a narrow plot starting at the drain at the Bay Club at the North end extending to 3,000 feet south of Temescal Canyon Road and Pacific Coast Highway (PCH), directly across PCH from the Palisades Park. A photo of the area in the vicinity of the Bay Club is presented in Figure 4. For this study, it will be assumed that the operational storage

facility could be constructed in this vicinity. The pump station to empty the storage basin could be in the parking area and the pump station wet well would extend into the sand area of the beach.

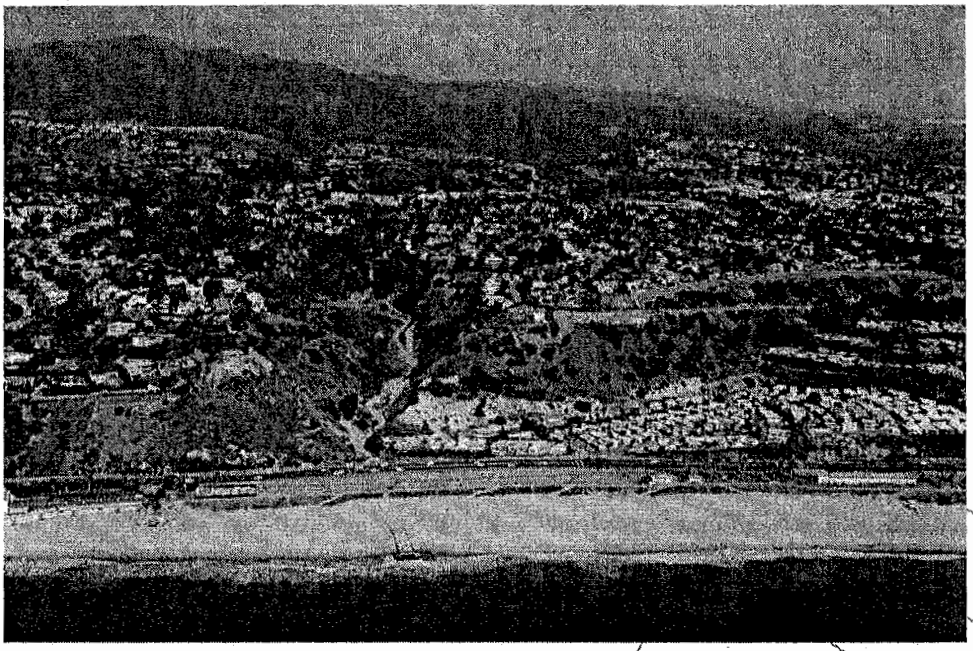

Figure 4. Parking in the Vicinity of Will Rogers State Beach

The runoff from the Montana Avenue, Wilshire Blvd, Santa Monica Pier, Pico-Kenter, Ashland Avenue, Rose Avenue, Thornton Avenue, and Brooks Avenue drains could be stored in a facility located at the Santa Monica State Beach. The total target runoff from these drains is 61.9 MG. The beach has 14 parking areas with a total estimated surface area of about 2.7 million square feet. If a portion of the lot, for example, an area of about 840,000 square feet is used to construct storage facilities, a storage depth of about 10 feet would be required. A photo of this area is presented in Figure 5.

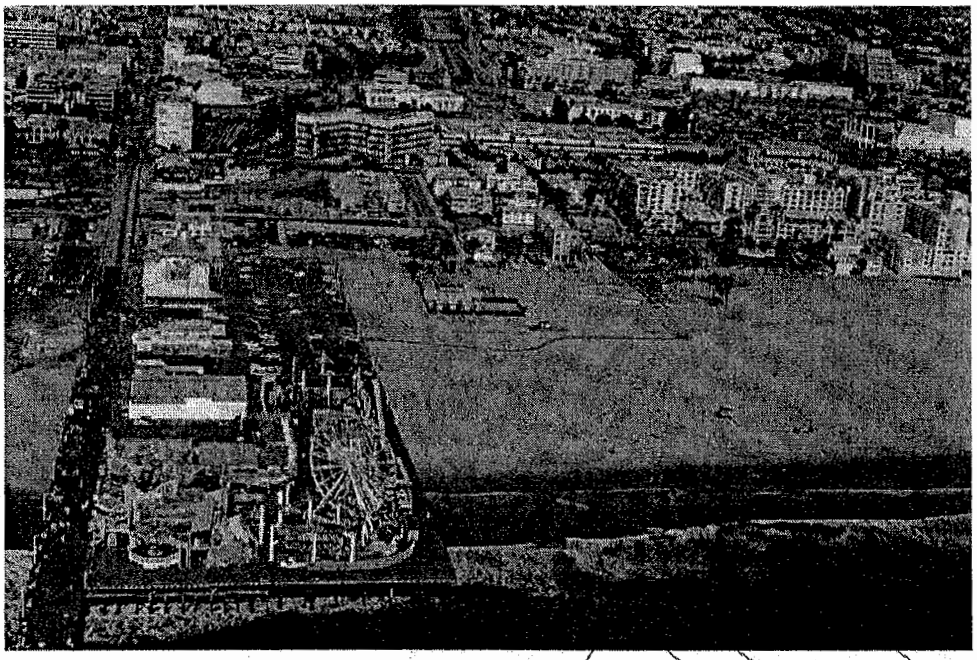

Figure 5. Parking in the Vicinity of Santa Monica State Beach

The runoff from the Venice Pavilion drain could be stored in the vicinity of the Venice City Beach parking area. The target runoff from this drain is 1.1 MG. At a depth of 10 feet, the storage facility would cover about 14,700 square feet. Since the available parking lot area is 183,210 square feet, storage could easily be accommodated. A photo of this area is presented in Figure 6.

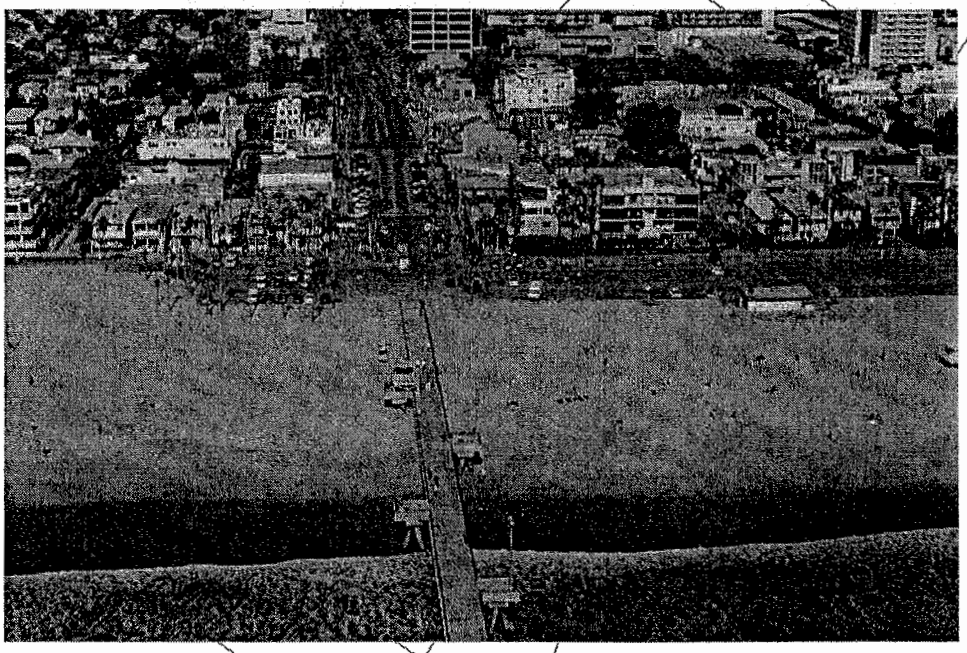

Figure 6. Parking in the Vicinity of Venice Beach

The runoff from the Playa Del Rey, North Westchester, Imperial Highway, El Segundo Blvd, and Chevron Refinery drains could be stored in a facility located at the Dockweiler State Beach. The total target runoff from these drains is 49 MG. This beach has two parking areas with a total estimated surface area of about 50,000 square feet. Based on an assumed storage depth of 30 feet, an area of about 220,000 square feet would be required for the operational storage facilities.

Since the parking areas can only accommodate a small fraction of the required storage facility area, an additional area in the vicinity of LAX, northeast of the intersection of Pershing Drive and Westchester Parkway, was selected because it meets the storage siting criteria presented above. Not only does this area have large acres of vacant land, but it is also outside of the coastal zone and outside of the airfield area. A photo of this area is presented in Figure 7. This area is discussed in Section 4.2 and presented in Table 8 as "Vacant Land above LAX". It is assumed that sufficient space in this area could be appropriate for the remainder of the Dockweiler subwatershed storage volumes.

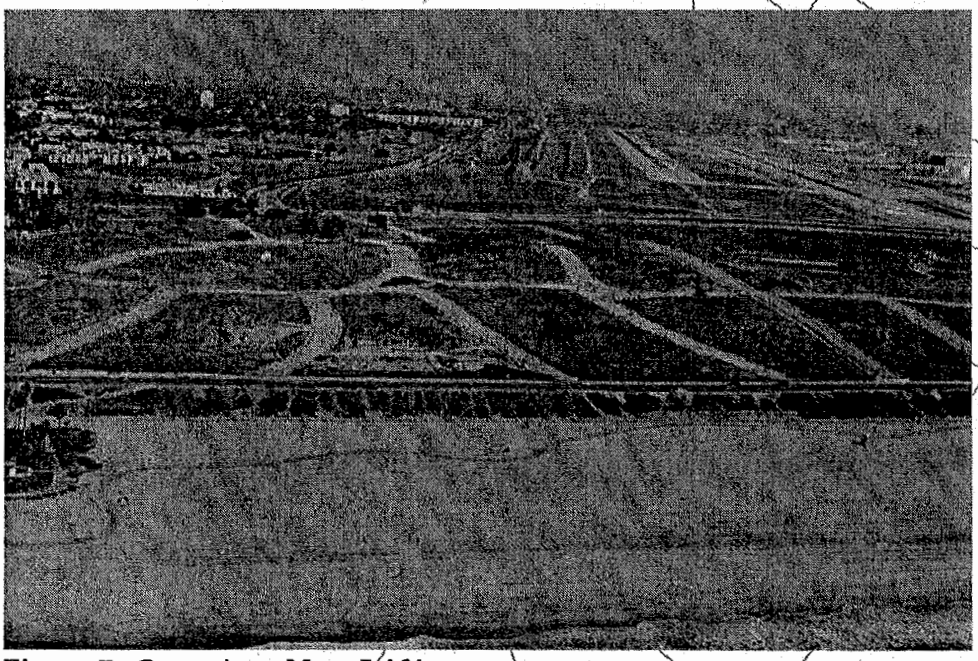

Figure 7. Open Area Near LAX

4.2 Treatment Facilities and Wetlands

Treatment facilities are required to implement several of the proposed regional options. The following criteria were developed to assist in selecting potential sites for these facilities. Different options may require different types of treatment facilities with different footprint area requirements.

- To minimize the lengths of the piping from the operational storage facilities, treatment facilities should be located as near to the coast as possible

- A site must allow construction with a minimal traffic disruption
- Public land is more desirable since acquisition is not required
- Sites should be as remote as possible from existing residential properties
- Flat terrain is more desirable

Public parks with sufficient open land near the coast were found to meet the above criteria. In order to focus in on some potential sites, parks larger than approximately 5 acres are listed in Table 7. As stated above, the required footprint size for treatment facilities will vary depending on the type of facility and capacity. For example, a treatment plant designed to treat runoff and discharge it to the ocean may not require filtration, so it is feasible that a site with much less than five available acres would be appropriate. On the other hand, if runoff will be treated to meet Title 22 standards for reuse (similar to the SMURRF facility), a larger footprint area will be needed, perhaps more than 5 acres depending on the plant capacity. Constructed wetlands, as discussed previously, will require a large area. For this reason, parks several acres and larger in size are presented as possible sites.

Although this evaluation focuses on public parks as potential sites because of the limited amount of open land and the fact that park land does not require acquisition, there may be other constraints associated with siting treatment facilities at parks. For example, conservancy groups have expended considerable effort in securing Topanga State Park to restore the local watershed. Although it is listed as a park with a large area, it may not be an appropriate site for a treatment facility due to political, institutional, and other non-technical factors.

It would be beneficial to site a minimum of one or two facilities for the areas north of Marina Del Rey, and one for areas south of Marina Del Rey. For example, Temescal Canyon Park, located in the Pulga Canyon subwatershed, could be a good potential site for a northern plant. In addition, South Beach Park in Santa Monica could be a good potential site that would serve the area closer to Santa Monica. In the southern subwatershed areas, the vicinity of LAX (where the operational storage would be located) was selected as a potential site for a southern facility. Due to their large acreages, the areas in the vicinity of LAX (Figure 7) could be suitable for either traditional treatment facilities or subsurface constructed wetlands, if desired. A subsurface constructed wetland, for example, could be implemented in the northern portion of the LAX area, north of the Blue Butterfly Preserve without altering the site's current use. A photo of the subject area is presented in Figure 8. Locations of these three potential treatment sites relative to operational storage sites are shown in Figure 3.

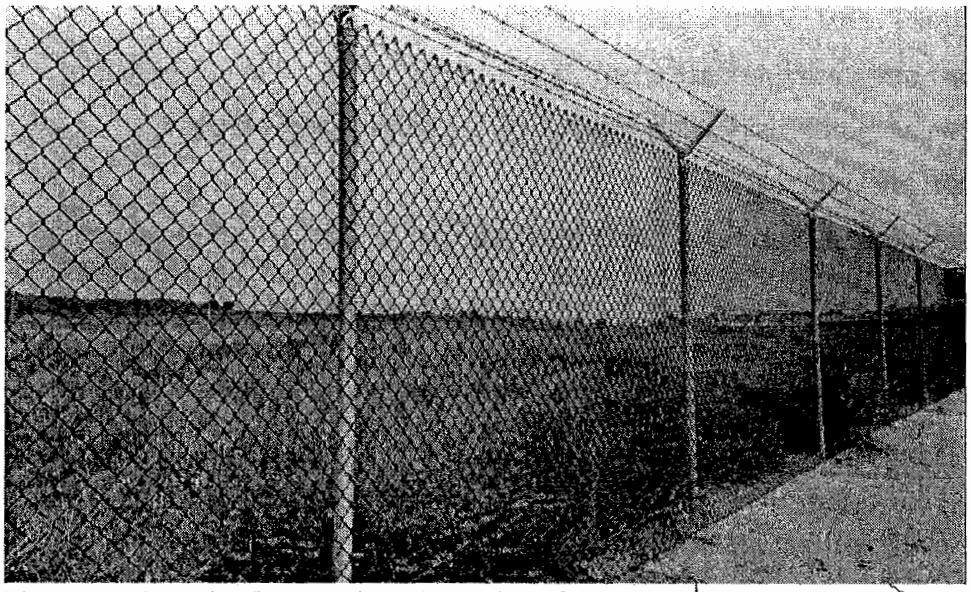

Figure 8. Area in the Northern Vicinity of LAX

Table 7
Potential Treatment Plant Sites

Site	Acreage[1]	Subwatershed	Notes
Topanga State Park	12,280	Castle Rock	Potential Site
Temescal Canyon Park	9.0	Pulga Canyon	Narrow Site
Palisades Park	48.4	Pulga Canyon and Santa Monica	Narrow, hilly site
Will Rogers State Historic Park	36.5	Pulga, Santa Monica Canyon, and Castle Rock	> 1 mile from coast
Los Amigos Park	6.9	Santa Monica	Small site in urban area
South Beach Park	16.9	Santa Monica	
Marine Park	7.1	Santa Monica	Small site in urban area
Del Rey Lagoon Park	8.5	Dockweiler	Small site in urban area
Open acres (adjacent to LAX)	25.5	Dockweiler	Potential Site
Vacant area above LAX	19.5	Dockweiler	Potential Site
Vacant area above LAX	138.0	Dockweiler	Potential Site
Vacant area above LAX	102.7	Dockweiler	Potential Site
Vacant area at Westchester Pkwy & Pershing Dr	27.4	Dockweiler	Potential Site

Notes:
1. Site acreages are based on land use data.

4.3 Transmission Pipelines

Pipelines will be required to convey diverted runoff from the storm drains to the operational storage facilities and from the storage facilities to the treatment facilities. An evaluation of these pipelines is presented here. It is assumed that these pipelines would either be in the right-of-way of the Coastal Interceptor Sewer, in the Pacific Coast Highway right-of-way, or would be located along the beaches since all of the regional storage/treatment facilities would be located near the coast.

Diversion pipelines from the storm drain channel to operational storage must be sized to convey the peak flow rate of the target storm hydrograph. Since these flowrates may be high, these pipelines could be large in diameter. For this reason, it is desirable to site operational storage as near to storm drain outlets as possible, which may result in numerous smaller operational storage facilities. On the other hand, it would be more desirable from an operations standpoint to manage fewer, larger operational storage facilities, which may in turn result in longer pipelines. A preliminary estimate of diversion pipeline lengths to storage facilities is presented in Table 8. It was assumed that the diversion pipelines would accumulate flows from several drains while transporting the runoff to the operational storage facilities.

Table 8
Preliminary Diversion Pipeline Lengths to Operational Storage Facilities

Storm Drain (N to S)	Location of Operational Storage	Estimated Pipe Length[1] (ft)	Notes
Castlerock	Topanga State Beach	2,500	From Castlerock to storage
Parker Canyon	Topanga State Beach	1,000	From Parker Canyon to Castlerock
Santa Ynez Canyon	Will Rogers State Beach	1,400	Santa Ynez Cyn to Marquez Ave
Marquez Avenue	Will Rogers State Beach	1,800	Marquez Ave to Bay Club
Bay Club Drive	Will Rogers State Beach	600	Bay Club to storage
Pulga Canyon	Will Rogers State Beach	1,400	Pulga Canyon to storage
Temescal Canyon	Will Rogers State Beach	1,200	Temescal Cyn to Pulga
Palisades Park	Will Rogers State Beach	3,600	Palisades Park to Temescal Cyn
Santa Monica Canyon	Will Rogers State Beach	3,000	SMC to Palisades Park
Montana Avenue	Santa Monica State Beach	2,500	Montana to Wilshire
Wilshire Blvd	Santa Monica State Beach	3,000	Wilshire to SM Pier
Santa Monica Pier	Santa Monica State Beach	500	SM Pier to storage
Pico-Kenter	Santa Monica State Beach	800	Pico-Kenter to storage
Ashland Avenue	Santa Monica State Beach	4,800	Ashland to Pico-Kenter
Rose Avenue	Santa Monica State Beach	1,500	Rose to Ashland
Thornton Avenue	Santa Monica State Beach	1,200	Thornton to Rose
Brooks Avenue	Santa Monica State Beach	1,800	Brooks to Thornton

Table 8 Preliminary Diversion Pipeline Lengths to Operational Storage Facilities			
Storm Drain (N to S)	**Location of Operational Storage**	**Estimated Pipe Length[1] (ft)**	**Notes**
Venice Pavilion	Venice City Beach	100	Venice Pavilion to storage
Playa Del Rey	Dockweiler State Beach	3,000	Playa Del Rey to N Westchester
North Westchester	Dockweiler State Beach	500	N Westchester to Storage
Imperial Highway	Dockweiler State Beach	7,200	Imp. Hwy to N Westchester
El Segundo Blvd	Dockweiler State Beach	5,000	El Segundo to Imp. Hwy
Chevron Refinery	Dockweiler State Beach	2,000	Chevron Refinery to El Segundo
Notes: 1. The estimated pipe length was scaled from Thomas Guide Maps and is approximate. Lot # 1 at the intersection of Chataqua Blvd and Pacific Coat Highway was used for the Will Rogers State Beach.			

Transmission pipelines to convey runoff from temporary storage to treatment facilities will also be needed. For these pipelines, if the target runoff volume is to be drawn down within a 24-hour period, pipeline diameters can be sized accordingly. Diameters are not presented here because it will depend on how much of the stored volumes will be sent to regional facilities versus other regional options. This will be discussed in the Alternatives TM (TM 9). A preliminary estimate of pipeline lengths from storage to treatment facilities is presented in Table 9.

Table 9 Preliminary Pipeline Lengths from Storage to Treatment Facilities			
Storage Location (N to S)	**Treatment Facility Location**	**Estimated Pipe Length[1] (ft)**	**Notes**
Topanga State Beach	Temescal Canyon Park	10,000	Topanga to Will Rogers
Will Rogers State Beach	Temescal Canyon Park	4,000	Will Rogers to treatment
Santa Monica State Beach	South Beach Park	3,000	Santa Monica to treatment
Venice State Beach	South Beach Park	8,000	Venice to treatment
Dockweiler State Beach	Vicinity of LAX	3,000	Dockweiler to treatment
Notes: 1. The estimated pipe length was scaled from Thomas Guide Maps and is approximate. Lot # 1 at the intersection of Chataqua Blvd and Pacific Coat Highway was used for the Will Rogers State Beach.			

4.4 Sites for Beneficial Reuse as Irrigation Supply

After runoff has been treated in a regional facility, it can be distributed to individual sites to be reused as irrigation supply. This section describes siting possibilities for these beneficial use projects. Many of the potential sites for reuse of treated wet weather runoff are often the same as the potential sites for on-site storage and reuse of wet weather runoff, since the potential users, in both cases, have a demand for irrigation that could be supplied by runoff. The difference between these two approaches is the demand quantity and the treatment requirements for the end use. In general, the smaller irrigation users (i.e., smaller sites and smaller irrigation demand) may be good candidates for on-site storage and reuse (an underground cistern with limited treatment) if the runoff reuse can be closely managed and does not require Title 22 treatment. Furthermore, with on-site storage and reuse, no regional distribution pipelines would be needed. Larger irrigation users, however, may be good candidates for regionally distributed treated runoff for two reasons. First, larger sites have higher irrigation water demand, which could be more than the wet weather runoff generated on-site. Second, larger sites are more likely to have automated sprinkler systems for irrigation use, which could require treatment of wet weather runoff to Title 22 standards to meet public health requirements for unrestricted irrigation. The on-site storage and reuse option is likely to apply minimum treatment, but would not treat the wet weather runoff to Title 22 standards with filtration and disinfection. Therefore, the regional treatment and reuse option, which produces larger quantities of treated wet weather runoff meeting Title 22 standards, may be more suitable for the larger reuse sites.

As part of the regional runoff management option to capture, store, treat, and beneficially reuse wet weather runoff for irrigation or similar non-potable uses, TM 5 identified potential recycled water users for irrigation use (i.e., potential sites for reuse of treated wet weather runoff) within Jurisdictions 2 and 3. The potential recycled water users were identified based on the water use and irrigation demand data provided by the City of Los Angeles Department of Water and Power (DWP) and the City of Santa Monica Water Resources-Utility Department, which are the two water service providers within Jurisdiction 2 and 3, and the Water Recycling Master Plan, which is being developed as part of the Los Angeles Integrated Resource Plan (IRP).

TM 5 identified approximately 150 irrigation demand points within Jurisdictions 2 and 3 with an estimated total irrigation demand of 3,800 AF/year, as presented in Table 10. Refer to the TM 5 for a description and selection criteria of potential recycled water users.

Table 10

Jurisdictions 2 and 3 Irrigation Demand (AF/YR)

	Castle Rock	Santa Ynez Canyon	Pulga Canyon	Santa Monica Canyon	Santa Monica	Venice Beach	Dockweiler	Total
Airport	--	--	--	--	3	--	992	**995**
Commercial/Private	27	24	18	--	676	--	30	**775**
Country Clubs/ Cemeteries	--	--	--	256	116	--	--	**372**
Government/Public	14	--	--	--	95	1	74	**184**
Hyperion WWTP	--	--	--	--	--	--	713	**713**
Parks & Recreation	--	--	51	35	404	--	77	**567**
Schools	--	--	40	17	36	--	96	**189**
Total (AF/YR)	**41**	**24**	**109**	**308**	**1,330**	**1**	**1,982**	**3,795**

Demands within the Dockweiler subwatershed are not going to be considered further for runoff use, because as suggested in TM 5, the DWP has current plans to meet the recycled water demand in the Dockweiler region with new recycled water pipelines from the HTP serving the Playa Vista and Westchester areas. However, the areas of Santa Monica and north may be considered for using treated wet weather runoff for irrigation use, since the DWP does not have current plans to supply this area with additional recycled water. Therefore, the estimated total irrigation demand for regionally distributed treated wet weather runoff within Jurisdiction 2 and 3 is approximately 1,800 AF/year.

Appendix C in TM 5 lists further details about the individual sites with irrigation demand. Although the total demand is listed for informational purposes, further discussions with each potential customer would need to take place to determine the suitability of treated runoff to meet all or a portion of this demand.

4.4.1 Seasonal Storage

At any site that receives the treated runoff, seasonal storage (or post-treatment storage) will likely be required prior to reuse. This is because wet weather runoff would be captured, treated, and distributed for reuse during the wet months, but peak irrigation demand occurs during the dry months. Customers would need to be willing to have individual seasonal storage tanks on their sites, and then systems to pump from the tanks to irrigate when needed. Siting storage facilities, appropriately sizing them, and making the complex system user-friendly are potential constraints to achieving reuse.

Another approach to regional reuse of runoff as irrigation supply is to supply users with a 'baseline' supply during the winter months, when there is a low amount of irrigation

demand. During the peak summer periods, users will have to supplement the supply with recycled or potable water. Using this approach, the potential to reuse large quantities of runoff decreases; but it may be possible to minimize seasonal storage facilities. Even with limited seasonal storage facilities, concerns remain regarding how to preserve the quality of the runoff if it is treated and then stored for several months.

Without seasonal storage, the operations of operational storage and treatment facilities can still meet some levels of irrigation demand; however, this would be very limited and would significantly reduce the beneficial reuse potential of the runoff.

5.0 Conclusions

This technical memorandum evaluated potential sites for facilities proposed by the runoff management options. Potential sites and evaluative criteria were discussed for the following facilities:

- Potential on-site storage and reuse projects
- Operational storage near major storm drain outlets
- Transmission pipelines to treatment
- Treatment facilities
- Beneficial reuse sites

Numerous public parks, government facilities, schools, and urban vacant lots were identified as possible sites at which to implement on-site storage and reuse projects to manage runoff before it enters the storm drain system. Although there are many possible sites, each project will only manage a small portion of the target runoff and will not eliminate the need for runoff to be managed through regional facilities.

Once runoff is to be managed regionally, it must be diverted from major storm drains and temporarily stored (facilities were sized to store the target volume for a 24-hour period). Beach parking areas along the coast were found to be a feasible place for operational storage facilities.

From the operational storage facilities, runoff would be diverted either to the wastewater collection system or to treatment facilities. Possible sites for new treatment facilities were reviewed. Temescal Canyon Park in Pulga Canyon and South Beach Park in Santa Monica are suggested as potential sites for two new northern plants, and the vicinity of LAX is presented as a potential site for a southern plant. In particular, the areas in the vicinity of LAX could be suitable for either traditional treatment facilities or subsurface constructed wetlands, if desired.

After the runoff is treated, it may be discharged or distributed to potential irrigation customers. At any site that receives the regionally treated runoff, seasonal storage (or post-treatment storage) will likely be required prior to reuse.

In summary, although available open space for new facilities that will be able to handle the large runoff target volumes is quite limited within Jurisdictions 2 and 3, possible solutions are presented here. However, all of the implementation plan alternatives will need to include regional options, and all of the regional options will require adequately sized operational storage facilities. From this TM 8, it is clear that these may be difficult to site. Siting operational storage near major storm drains means that the ultimate amount of space is limited. Operational storage can be sited away from major storm drains, but new pipelines and infrastructure will be required in areas that already have limited space.

6.0 References

Santa Monica Bay Beaches Wet Weather Bacteria TMDL Implementation Plan Project, Draft Technical Memoranda:

Task 4: Hydrologic Analysis, CH:CDM and Psomas, March 4, 2004.
Task 5: Beneficial Use Evaluation, CH:CDM, April 8, 2004
Task 6: Treatment Options, CH:CDM and Psomas, May 6, 2004
Task 7: Coastal Collection System Assessment, CH:CDM, June 11, 2004

Salgaonkar, Jag, 2004. E-mail message from Jag Salgaonkar of CH2MHILL, project manager for design of the SMURRF, on June 5, 2004 regarding SMURRF dimensions.