

City of Los Angeles Integrated Resources Plan

Facilities Plan Volume 3: Runoff Management

July 2004

Prepared For:

City of Los Angeles
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Final Report

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Facilities Plan

Volume 3: Runoff Management

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Abbreviations

acre-ft/yr	Acre-feet per year
BOS	Bureau of Sanitation
BUREAU	Bureau of Sanitation
CAAA	Clean Air Act Amendments
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CFS	cubic feet per second
CIP	capital improvement program
CIS	Coastal Interceptor Sewer
CITY	City of Los Angeles
d/D	depth/diameter
DOF	State of California Department of Finance
DWP	Department of Water and Power
dtpd	dry tons per day
DWUR	dry weather urban runoff
ECIS	East Central Interceptor Sewer
EIR/EIS	Environmental Impact Report/Environmental Impact statement
EMS	Environmental Management System
EMWD	Eastern Municipal Water District
EPA	Environmental Protection Agency
EVWRP	East Valley Water Recycling Project
FP	Financial Plan
gpcd	gallons per capita per day
gped	gallons per employee per day
gpd	gallons per day
gpd/ft ²	gallons per day per square foot
gpm	gallons per minute
GWI	groundwater infiltration

HTP	Hyperion Treatment Plant
IPWP	Integrated Plan for the Wastewater Program
IRP	Integrated Resources Plan
LA River	Los Angeles River
LAA	Los Angeles Aqueduct System
LADPW	Los Angeles Department of Public Works
LACSD	Los Angeles County Sanitation District
LADWP	Los Angeles Department of Water and Power
LAGWRP	Los Angeles -Glendale Water Reclamation Plant
LAUSD	Los Angeles Unified School District
MF	microfiltration
MF/RO	microfiltration/reverse osmosis
MG	million gallons
mgd	million gallons per day
MW	mega watts
MWD	Metropolitan Water District
NdN	nitrification/denitrification
SCAG	Southern California Associations of Government
SCAQMD	Southern California Air Quality Management District
SFR	Single Family Residential
SUSMP	Standard Urban Stormwater Mitigation Plan
TITP	Terminal Island Treatment Plant
TWRP	Donald C. Tillman Water Reclamation Plant
UWMP	Urban Water Management Plan
WFP	Wastewater Facilities Plan

Section 1

Introduction

1.1 Background

The City of Los Angeles (City) has embarked on a unique approach of technical integration and community involvement to guide policy decisions and water resources facilities planning. The Integrated Resources Plan (IRP) incorporates a future vision of water, wastewater and runoff management in the City that explicitly recognizes the complex relationships that exist among all of the City's water resources activities and functions. Addressing and integrating the water, wastewater and runoff needs of the City in the year 2020, the IRP also takes an important step towards comprehensive basin-wide water resources planning in the Los Angeles area. This integrated process is a departure from the City's traditional single-purpose planning efforts for separate agency functions, and it will result in greater efficiency and additional opportunities for citywide benefits, including potential overall cost savings. This integrated process also highlights the benefits of establishing partnerships with other citywide and regional agencies, City departments, and other associations, both public and private.

The IRP seeks to accomplish two basic goals as part of developing an implementable facilities plan:

- Integrate water supply, water conservation, water recycling, and runoff management issues with wastewater facilities planning through a regional watershed approach, and
- Enlist the public in the entire planning and design development process at a very early stage beginning with the determination of policy recommendations to guide planning.

The IRP is a multi-phase program:

- Phase I – Integrated Plan for the Wastewater Program (IPWP) (completed in 2001): focused on defining the future vision for the City by developing a set of guiding principles to direct future, more-detailed water resources planning.
- Phase II – Integrated Resources Plan: Focuses on the more detailed planning required to develop in a facilities plan, environmental impact report and financial plan.
- Projects – Implementation (2005 and beyond): Includes future concept reports, studies, and design and construction projects to implement the capital improvement program (CIP) developed as part of Phase II.

The City is facing many challenges, including: the dynamic nature of current and projected regulations affecting the recycled water, runoff and wastewater programs; potential community concerns with siting new wastewater, runoff and recycled water facilities in neighborhoods; potential funding needs for the proposed facilities and programs, and the importance of inter-agency coordination to handle jurisdictional issues. By addressing these challenges now as part of the IRP, the City will have the structure and tools in place to adapt to changing conditions in the future.

The combination of Phases I and II constitute the documentation and overall implementation plan for the IRP, which is intended as an integration of the City's water (water reuse/recycling and water conservation), wastewater (collection, treatment and biosolids) and runoff (dry weather and wet weather) service functions. By using this integrated approach, the City will establish a framework for a sustainable future for the Los Angeles basin, one where there are sufficient wastewater services, adequate water supply, and proper and proactive protection and restoration of the environment.

1.2 Overview of Document

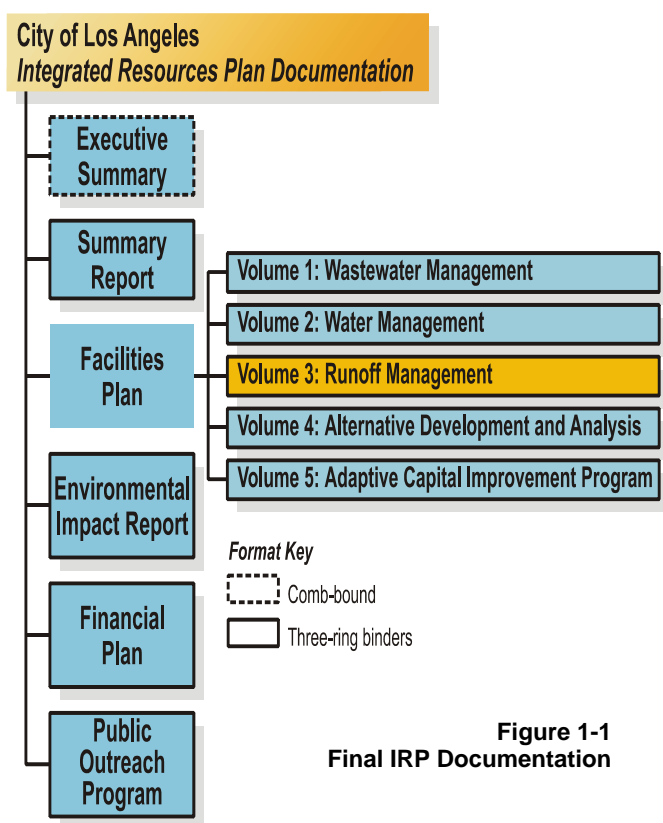


Figure 1-1
Final IRP Documentation

The IRP documentation includes a series of volumes that includes an Executive Summary; Summary Report; Facilities Plan (5 volumes); Final Environmental Impact Report/Environmental Impact Statement (EIR/EIS; Financial Plan; and Public Outreach. Each volume will include sections and subsections. Figure 1-1 illustrates the organization of these volumes.

Facilities Plan Volume 3: Runoff Management focuses on the runoff service function of the project, specifically dry and wet weather runoff management. Table 1-1 provides a description of each of the sections of this document.

Table 1-1 IRP Facilities Plan Volume 3: Runoff Management	
Section	Description
1 – Introduction	Study objectives and background
2 – Approach	Study approach
3 – Planning Parameters	Summary of planning year, runoff management watershed areas, regulatory requirements and guiding principles
4 – Runoff Characterization	Summary of runoff volume estimates for dry and wet weather runoff
5 – Existing Programs and Facilities	Description of current and planned runoff management efforts
6 – Dry Weather Options	Description of the options for managing dry weather runoff
7 – Wet Weather Options	Description of the options for managing wet weather runoff
8 – Alternatives Analysis	Description of the runoff management components included in the recommended alternatives. (See Alternatives Analysis Volume for additional discussion)
References	Summarizes the sources of data, information, and contributions of others.
Appendices	Supporting Documentation

Section 2

Approach

2.1 Introduction

The approach to runoff management must take into account several factors, including runoff quantity and quality, differences between dry and wet weather runoff, potential impacts on the wastewater collection and treatment systems, regulatory drivers (permits and Total Maximum Daily Loads (TMDLs)), and the City's beneficial use goals. Similar approaches may be used for managing both dry and wet weather flows. However, the volume of wet weather flow, which is significantly greater than dry weather flow, creates additional operational and cost impacts that must be addressed.

2.2 Overall Project Approach

The IRP is a multi-phase program:

- Phase I [Integrated Plan for the Wastewater Program (IPWP)] (completed in 2001): focused on defining the future vision for the City by developing a set of guiding principles to direct future, more-detailed water resources planning.
- Phase II (Integrated Resources Plan): Focuses on the more detailed planning required to develop a facilities plan, environmental impact report and financial plan.
- Projects (Implementation) (2005 and beyond): Will include future concept reports, studies, and design and construction projects to implement the capital improvement program (CIP) developed as part of Phase II.

Using the year 2020 as the planning horizon, the steps in the IRP approach for facilities planning include:

- Developing and confirming data (general and specific): Establish the system demands in year 2020 and intermediate years; summarize the current and potential future regulatory drivers and confirm the capacities of the existing systems and programs to meet those demands.
- Identifying shortfalls and options: Determining shortfalls (or gaps) between demands and existing systems for the water, wastewater and runoff systems and options to address the gaps.
- Developing preliminary alternatives to meet the water, wastewater and runoff program requirements.

- Perform initial screening: evaluate the appropriateness and effectiveness of the different strategies using criteria established by the IRP public stakeholders, i.e., the Steering Group; select the most preferred strategies or strategy combinations.
- Refine alternatives using detailed models.
- Screen to final alternatives using information from financial planning team.
- Prepare CIP and implementation plan for preferred alternative determined during the environmental analysis.

Figure 2-1 illustrates the facilities planning approach and the relationship with the financial and environmental planning tasks.

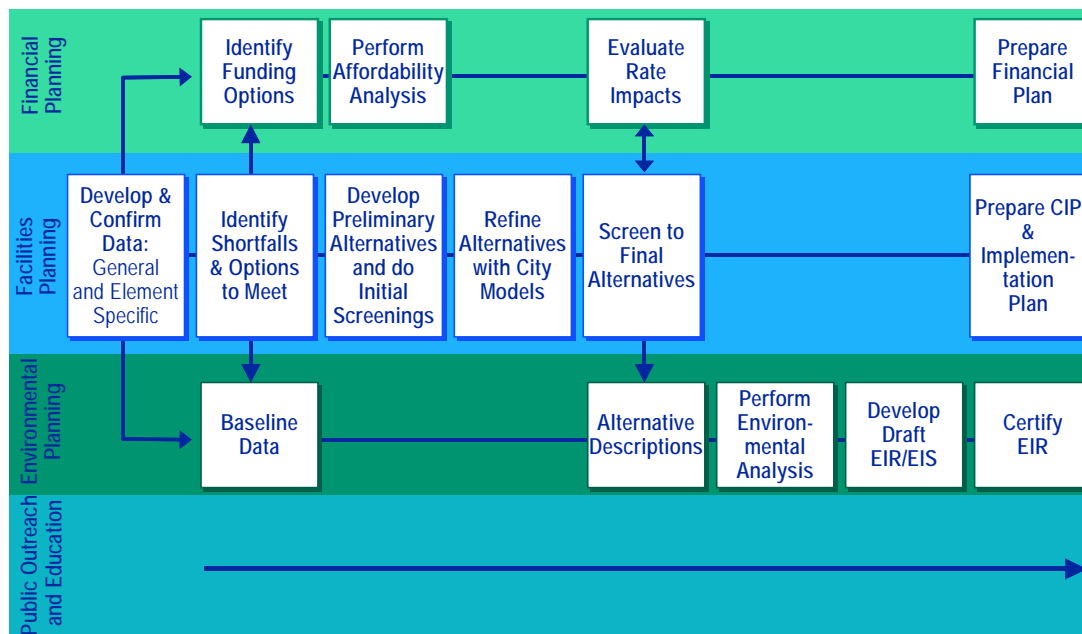


Figure 2-1
Overall IRP Approach

2.3 Runoff Management

The first step in developing runoff management options for the stormwater program is to evaluate the regulatory drivers and other planning parameters that pertain to runoff. The second step is to estimate the amount and the quality of both dry and wet weather runoff that will need to be managed to meet regulatory requirements and to meet any other environmental goals developed by the City. The third step is to identify existing City programs and runoff facilities and assess how they might impact future planning and needs. The information resulting from the analysis outlined above can then be used to develop runoff management options that can be integrated into a citywide stormwater program.

2.3.1 Regulatory Drivers and Planning Parameters

The primary regulatory drivers affecting the stormwater program are the issuance of National Pollutant Discharge Elimination System (NPDES) stormwater permits and the development of TMDLs. The Los Angeles County Stormwater permit requires implementation of a comprehensive stormwater program, Best Management Practices (BMPs), and TMDLs. TMDLs will limit pollutant loading to a number of impaired waters in the City, including the Los Angeles River, which is a major receiving water for both urban runoff and wastewater effluent, as well as Ballona Creek and Santa Monica Bay. Guiding principles developed during the first phase of the Integrated Resources Plan provide goals for the stormwater program that also must be addressed during the planning process.

The main focus of managing runoff, wherever possible, is on maximizing reuse and recycling of runoff, as recommended by the IRP guiding principles. Because the majority of the TMDLs are not published yet, the intent of the IRP is not to ensure TMDL compliance but instead it focuses on maximizing runoff management opportunities to supplement water supply needs, and in the process improve the water quality of the receiving water bodies.

The IRP process is an excellent method of obtaining stakeholder input and advice, but is only a planning tool for conceptual development. It provides a guide on a macro scale to relatively compare different scenarios to maximize runoff for reuse. It also provides a methodology of an integrated water resources approach to consider in managing runoff. Building on this IRP process once the TMDLs regulations are promulgated, a detailed implementation plan will need to be developed to address full compliance with the TMDLs regulations. This is where the various agencies and stakeholders in the watershed will need to conduct further detailed investigations of regulatory water quality standards and limits, hydrologic and water quality characteristics, and mitigation options or alternatives. Once the regulators approve the implementation plan, it will eventually lead to facilities siting and construction to meet full TMDL compliance.

2.3.2 Runoff Characteristics

2.3.2.1 Dry Weather Runoff

Dry weather runoff is any runoff that occurs in the absence of rainfall. Dry weather runoff volume is estimated using data from gauging stations on the major drainage channels in conjunction with the sizes of the areas tributary to the drainage channels. General runoff factors for the major watersheds can be calculated by dividing the channel flow by the area tributary to the channel. These runoff factors can then be used in estimating dry weather flows in other non-flow monitored channels, by applying the calculated runoff factors to the areas tributary to the channels.

2.3.2.2 Wet Weather Runoff

Wet weather runoff is any runoff that occurs as a direct result of rainfall. Wet weather runoff represents a significantly larger volume of water than dry weather runoff. For this reason, it is not reasonable to expect that all wet weather flows can be managed. The wet weather runoff volume to be managed is primarily dependant on either meeting TMDLs or maximizing beneficial uses. Based on the anticipated TMDL requirements and on historical rainfall information, an average amount of runoff per storm to be captured and treated or diverted can be determined.

2.3.3 Runoff Management Options

The overall approach to managing runoff includes the development of four separate options, all of which include source control as a method of reducing pollutant loading to receiving waters. These options can be combined to form an integrated plan for runoff management. The options to be analyzed are:

- Diversion to the sewer system
- Treatment and discharge
- Direct beneficial use
- Regional Recharge

2.3.3.1 Source Controls

Source controls are included in each of the four options. Source controls assist in meeting the permit requirements and current and future TMDLs by reducing the volume and improving the quality at the source. Source controls include efforts such as smart irrigation, on-site/neighborhood infiltration, use of cisterns, etc. and are detailed in sections 6 and 7. Several of the source controls are aligned with beneficial use goals.

Issues to consider for dry and wet weather runoff include costs, public acceptance and use, future regulations and new technologies.

2.3.3.2 Diversion to Wastewater System

The diversion to wastewater option can be used to meet current and future TMDLs, and can exclusively manage dry weather flows. This option is not directly aligned with the beneficial use goals, as the runoff is not being beneficially used. However, once the runoff enters the sewer, it becomes available for reclamation and subsequent beneficial use.

Issues to consider for dry weather runoff include the availability of locations to divert runoff, the available capacity at wastewater plants and in the collection system, and the effects that contaminants in the runoff may have on treatment processes.

Issues to consider for wet weather runoff include the amount of operational storage required, the limits on diverting flow during peak flow periods, the available capacity at wastewater plants during low flow periods, and the effects that contaminants in the runoff may have on treatment processes.

2.3.3.3 Runoff Treatment and Discharge

The runoff treatment and discharge option can be used to meet current and future TMDLs, and can be exclusively used to manage dry and potentially wet weather flows. However, this option is not aligned with beneficial use goals, as the runoff is treated and discharged back into the stormwater system where it will ultimately be conveyed to the ocean.

An issue to consider is the sizing of treatment facilities, because facilities sized for wet weather flows would be under-utilized during dry weather.

Issues to consider for wet weather include the amount of operational storage required, the cost of operations, and the possibility that treatment may be limited to certain constituents.

2.3.3.4 Runoff Treatment and Beneficial Use

Another option for managing runoff is to treat and beneficially use it. The runoff treatment and beneficial use option can be used to meet current and future TMDLs, and can exclusively manage dry weather flows. This option is aligned with beneficial use goals. Beneficial uses include irrigation, industrial use, wetlands restoration, on-site/neighborhood infiltration/recharge, and recreational impoundments.

Issues to consider for dry weather include the requirements to meet Department of Health Services Title 22 regulations for use as recycled water, and the possibility that wetlands and recreational impoundments may themselves become impaired waters listed on the 303d list.

Issues to consider for wet weather include the availability of and costs associated with seasonal storage (see Section 4 for a discussion on the volume of wet weather runoff to be managed), distribution, and Title 22 requirements.

2.3.3.5 Non-Urban Regional Recharge

The regional recharge option can be used to meet current and future TMDLs only in certain areas of the City (see section 7 for further discussion). This option is aligned with beneficial use goals as it replenishes the groundwater.

Issues to consider for dry weather include collection and transportation of runoff to the spreading grounds and water quality requirements imposed by the Watermaster and the Regional Board.

Issues to consider for wet weather include the availability of and costs associated with seasonal storage or operational storage, transportation of runoff to spreading grounds and water quality requirements imposed by the Watermaster and the Regional Board.

Section 3

Planning Parameters

3.1 Introduction

Planning parameters are the baseline considerations that will be used for developing the IRP. Planning parameters include the planning year, area of focus (or service area), regulatory requirements and guiding principles from Phase I. Other planning parameters include demographic data and land use. This section will focus on the planning parameters that will be used for the runoff management analysis of the IRP. Discussion of demographic data is summarized here, and a detailed discussion is included in Section 3 of the *Facilities Plan Volume 1: Wastewater Management*.

3.2 Planning Year

The goal of the IRP is to develop a facilities plan to meet the system needs for the future. A facilities plan for wastewater systems is required by EPA Rules and Regulations, 40 CFR, Section 35.917 to satisfy Section 201 of the Clean Water Act.

Facilities plans are typically developed with a 20-year planning window and are updated every 10 years. The City prepared a Wastewater Facilities Plan (WFP) in 1982 and prepared an update in 1991. The 1991 WFP Update planned for facilities through the year 2010.

Planning parameters include the planning year, area of focus, regulatory requirements, and guiding principles.

This IRP serves to renew the information prepared in the 1991 WFP Update, while also considering the water and runoff system needs and the integration of the three systems where appropriate. As already discussed in *Volume 1: Wastewater Management*, the IRP will use year 2020 as the planning year for evaluating the runoff needs and determining how current and upcoming regulations will guide the needs through 2020.

For the IRP, “current” or “today” will correspond to year 2002. In addition, the system will be evaluated for years 2005, 2010, and 2015 to allow the development of an adaptable capital improvement program (CIP).

3.3 Runoff Service Area

3.3.1 Introduction

The City’s runoff service area includes four major watersheds and over 2,000 sub-watersheds, or geographic drainage areas. The City’s drainage system includes over 1,200 miles of storm drains, 34,000 catch basins and 2,457 culverts, and 157 flood control basins (data source: Arc View 3.2 GIS database, updated regularly, data taken from 2002 snapshot). This system drains dry and wet weather urban runoff from city streets, routes it into an underground network of pipes and drains, and discharges it either directly to the ocean or through the various inland streams and channels.

A watershed is defined as a region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water. Hydrologic conditions in the area, both natural (e.g., rainfall, streams) and man-made (e.g., irrigation), will cause runoff to drain to a receiving body of water. In the Los Angeles area, the terrain includes both natural and urban development. The quality of the water that flows over land (referred to as overland flow) is affected by the material collected in route to its ultimate destination.

The Los Angeles Regional Water Quality Control Board (LARWQCB) approach to water quality protection is through a *comprehensive and integrated strategy towards resource protection, enhancement, and restoration, while balancing economic and environmental impacts within a hydrologically defined drainage basin or watershed* (Santa Monica Bay Restoration Project, 2000b). To implement this Watershed Management Approach, Los Angeles County has been divided into six Watershed Management Areas (WMAs) (Los Angeles River WMA, Santa Monica Bay WMA, Dominguez Channel WMA, Santa Clara River WMA, San Gabriel River WMA, Los Cerritos Channel/Los Alamitos Bay WMA) and these areas are incorporated into the Municipal Stormwater National Pollution Discharge Elimination System (NPDES) Permits. The City's service area is located in four of these WMAs (described below).

As shown in Figure 3-1, portions, but not all, of the WMAs are within the City of Los Angeles' boundary. For the purposes of the IRP, facility planning will be focused on runoff derived from the watershed service areas within the City of Los Angeles. However, it may be the case that many stormwater runoff management solutions would be most appropriate to implement on a watershed-wide basis, and may involve coordination with the WMAs. The City's runoff service area is comprised of portions of the following four major WMAs:

- LA River (including Reaches 1, 2, 3, 4, 5, and 6)
- Ballona Creek
- Dominguez Channel
- Santa Monica Bay (the portion within the City of LA)

3.3.2 Los Angeles River Watershed Management Area

The Los Angeles River WMA is one of the largest in the region. The Los Angeles River is 51 miles long and drains 834 square miles (533,760 acres) of watershed of which approximately 30 miles of river and 289 square miles (185,000 acres) of watershed lie within the City. It is also one of the most diverse in terms of land-use patterns. Approximately 324 square miles (207,000 acres) of the watershed are covered by forest or open space land, including the area near the headwaters, which originate in the Santa Monica, Santa Susana, and San Gabriel Mountains. The remaining 510 square miles (326,500 acres) of the watershed, and approximately 231 square miles (148,000 acres) of the City portion, is highly developed. Table 3-1 summarizes these values.

The Los Angeles WMA has several dams that control flows in some areas of the watershed, including the Pacoima Dam, the Rio Hondo, and the area above Big Tujunga Wash. These dams hold back water in portions of the watershed such that during parts of the year runoff does not reach the Los Angeles River. The related flow data is discussed at length in Section 4 of this document, but the tributary areas that are controlled by dams are also presented in Table 3-1.

Table 3-1 Los Angeles River Watershed Management Area Summary							
Item	Watershed Area			City of Los Angeles Portion of Watershed			
	Area (mi ²) ¹	Area (acres)	Percent of Total Area	Area (mi ²)	Area (acres)	Percent of Total Area	Percent of Watershed
Undeveloped Area (Forest or Open Space)	324	207,260	39%	58	37,000	20%	18%
Developed Area	510	326,500	61%	231	148,000	80%	45%
Total Area	834	533,760	100%	289	185,000	100%	35%
Area Controlled by Dams	540	346,000	--	190	122,000	--	--
Note: 1. Source: Integrated Plan for the Wastewater Program, Stormwater Quality Management Technical Memorandum, April 2001.							

The river flows through the San Fernando Valley past heavily developed residential and commercial areas. From the Arroyo Seco (north of downtown Los Angeles), to the confluence with the Rio Hondo, the river flows through industrial and commercial areas and is bordered by rail yards, freeways, and major commercial and government buildings. From the Rio Hondo to the Pacific Ocean, the river flows through industrial, residential, and commercial areas, including major refineries and petroleum products storage facilities, major freeways, rail lines, and rail yards serving the Ports of Los Angeles and Long Beach. The land uses in the City can be seen in Table 3-2, and a map of the watershed (which identifies the portion within the City of Los Angeles) is shown in Figure 3-1.

Major tributaries to the river in the San Fernando Valley are the Pacoima Wash and the Tujunga Wash (both drain portions of the Angeles National Forest in the San Gabriel Mountains), and the Burbank Western Channel and the Verdugo Wash (both drain from the Verdugo Mountains). South of the Glendale Narrows, the river is contained within a concrete-lined channel down to Willow Street in Long Beach. The main tributaries to the river in this stretch are the Arroyo Seco (which drains areas of Pasadena and portions of the Angeles National Forest in the San Gabriel Mountains), the Rio Hondo, and Compton Creek. The Los Angeles River has been studied in further detail as a part of the IRP project and two reports, *Los Angeles River Harvesting Concept Study* (CH:CDM, 2003) and *Los Angeles River Flow Optimization Study* (CH:CDM, 2004) include maps and more detailed discussion on the river.

Table 3-2 Land Use Summaries Within the City of Los Angeles				
Land Use Type	Watershed Areas (acres)			Total
	Los Angeles River	Ballona Creek (with Santa Monica Bay)	Dominguez Channel	
Commercial	18,500	11,200	2,200	31,900
Industrial	12,500	2,500	3,300	18,300
Multi Family	13,750	12,500	1,950	28,200
Open Space/Agriculture	41,500	28,500	1,100	71,100
Single Family High Density	79,500	32,400	4,500	116,400
Single Family Low Density	4,000	2,900	40	6,940
Single Family Mid Density	30	50	-	80
Transportation/Utilities/Mixed	14,800	4,500	1,800	21,100
Water	400	350	90	840
Other	20	100	20	140
Total (in acres)	185,000	95,000	15,000	295,000
Source: Watershed Protection Division GIS, based on SCAG data				

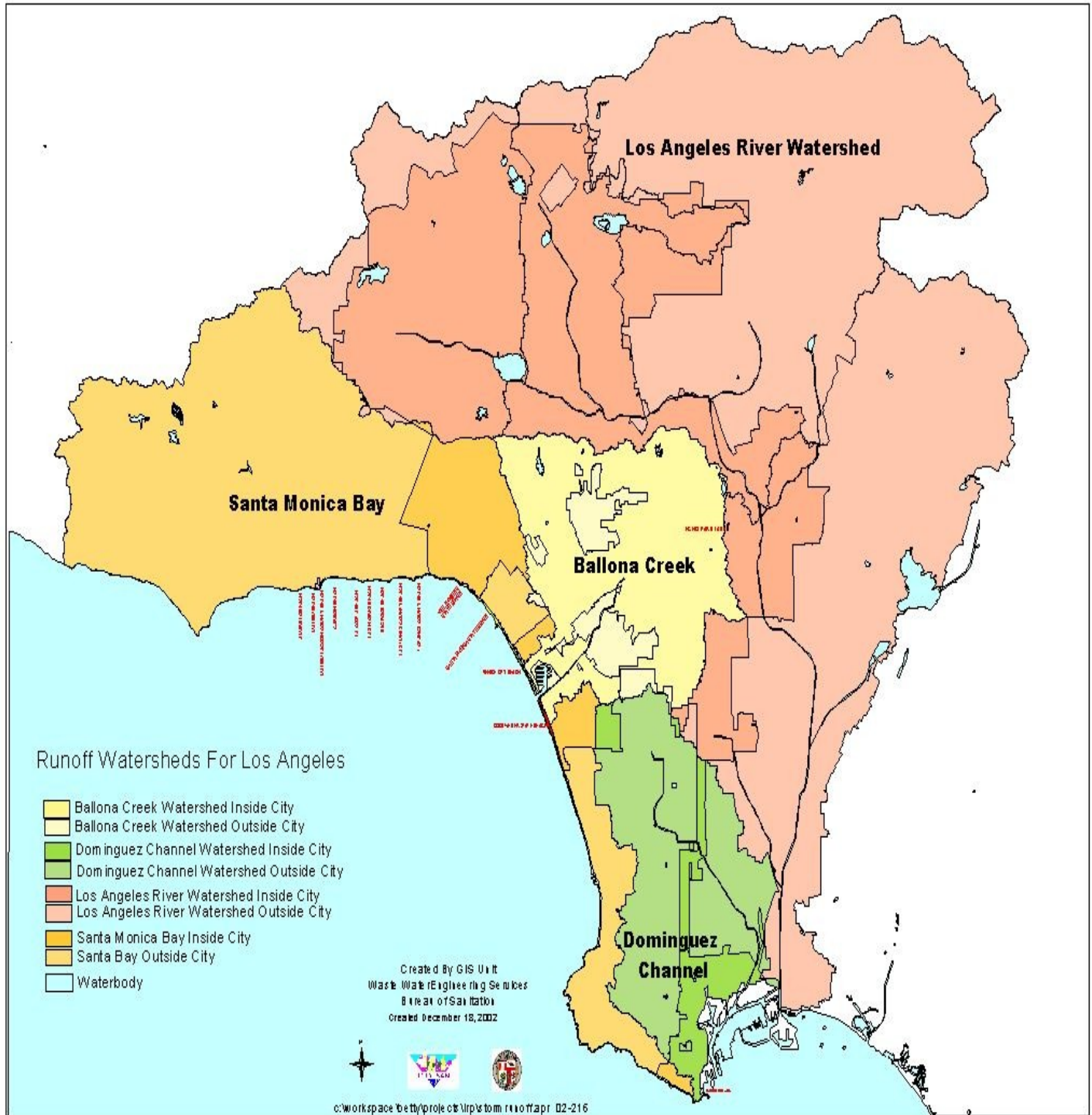


Figure 3-1
Runoff Watersheds for Los Angeles

3.3.3 Ballona Creek/Urban Santa Monica Bay WMA

The entire Santa Monica Bay watershed, which encompasses an area of 414 square miles, is quite diverse. Its borders extend from the crest of the Santa Monica Mountains on the north to the Ventura-Los Angeles County line on the west to downtown Los Angeles on the southeast. From there, it extends south and west across the Los Angeles plain to include the area east of Ballona Creek and north of the Baldwin Hills. South of Ballona Creek, the natural drainage area is a narrow strip of wetlands between Playa del Rey and Palos Verdes. The WMA includes a number of watersheds; the two largest are Malibu Creek (to the north) and Ballona Creek (to the south). The remaining are smaller watersheds, some of which discharge to the bay entirely through local storm drain systems. Only 149 square miles combined of the Ballona Creek WMA and Santa Monica Bay WMA fall within the City. The Santa Monica Bay Watershed includes the portions just north and south of the Los Angeles International Airport. Land uses are shown in Table 3-2 and a map of the watershed (which identifies the portion within the City of Los Angeles) is shown in Figure 3-1.

3.3.4 Dominguez Channel/Los Angeles Harbor WMA

The Dominguez Channel/Los Angeles Harbor WMA drains 110 square miles of watershed (LACDPW and URS Greiner Woodward Clyde, 2000), of which approximately 23 square miles of the watershed lie within the City. Land uses are shown in Table 3-2 and a map of the watershed (which identifies the portion within the City of Los Angeles) is shown in Figure 3-1.

3.3.5 Storm Drain System

With the cooperation of City, County, State and Federal agencies, Los Angeles has an extensive drainage system to protect its citizens and property from flood hazards. The system includes open channels, flood control basins, storm drains, catch basins, culverts, low-flow diversions to direct runoff to the sanitary sewer system, pumping plants, debris basins, detention basins, and spreading grounds.

At this time, the City has GIS infrastructure maps of the storm drain system, but the information does not include pipe sizes or condition. A separate database has the pipe sizes available, but there is no information on the conditions of the pipelines. There are approximately 1,200 miles of mainline storm drains and 400 miles of laterals that need to be assessed. The City is currently undertaking a condition assessment program of the storm drain system, and the City has awarded a multi-year contract to do the condition assessment. The City currently has a database list of the size and location of the storm drain outlets to the major waterways. Listed in the database are approximately 2,000 outlets to the Los Angeles River and 315 outlets for Ballona Creek. Table 3-3 provides an inventory of runoff conveyance facilities within the City.

Table 3-3 Summary of Runoff Conveyance Facilities in Los Angeles			
Flood Control Facility Feature	Total Quantity within the City of Los Angeles	Description	Owned by the City of Los Angeles
Open Channel	220 miles	Larger visible concrete-lined drainage system.	31 miles
Storm Drain Pipe	1,900 miles	Underground pipe or box varying in size from 12 inches in diameter to greater than 10 feet in diameter.	1,200 miles
Debris Basin	150	Basin that collects debris (sand, mud, rock, vegetation) at the point where natural areas connect with development. Size varies.	86
Catch Basin	62,660	Curb inlet structure for directing runoff into the storm drain system.	33,800
Pump Plant	11	Collects runoff in low-lying areas and pumps it to an acceptable discharge location.	11
Culvert	3,270	Open channel crossing at bridge or other locations where a short pipe or box structure conveys runoff.	2,350
Corrugated Metal Pipe (City of Los Angeles only)	**	Storm drains constructed of corrugated metal pipe. Typically, less desirable and prone to require excessive maintenance.	30 miles
Low-Flow Drain	1,315	Conveys low or nuisance runoff short distances to alleviate minor problem areas.	1,250
** Data not yet available			
Source: Integrated Plan for the Wastewater Program (IPWP) Stormwater Quality Management Technical Memo and City of Los Angeles Stormwater Condition Assessment Project Data; data taken from the City's Bureau of Engineering GIS database			

3.4 Runoff Planning Sheds

As part of the IRP, the major watersheds (Los Angeles River, Ballona, Santa Monica Bay, and Dominguez Channel) were divided into smaller runoff planning sheds, resulting in 21 areas that drain to major channels or that are tributary to major receiving water bodies. These locations were considered logical points of collection as they already drain larger tributary areas and the flows can be captured at a point prior to discharge to the Los Angeles River, or other water body.

In addition, the Los Angeles River, Ballona Creek, Dominguez Channel, and many of the tributary channels and creeks are on the 303(d) list of water bodies. Section 303(d) of the Clean Water Act (CWA) requires states to develop a list of waters not meeting water quality standards or that have impaired uses. Waterbodies that are listed must be prioritized, and a management strategy or total maximum daily load (TMDL) must subsequently be developed for all listed waters. Though many TMDLs have not yet been implemented, they may indicate that runoff must be treated prior to entering these bodies of water.

A map of these runoff planning sheds is included in Figure 3-2. Table 3-4 presents a summary of the acreage of these sheds. These runoff planning sheds will be used throughout this document, specifically in the runoff characterization section (Section 4), the options sections (Sections 6 and 7) and the alternatives analysis section (Section 8).

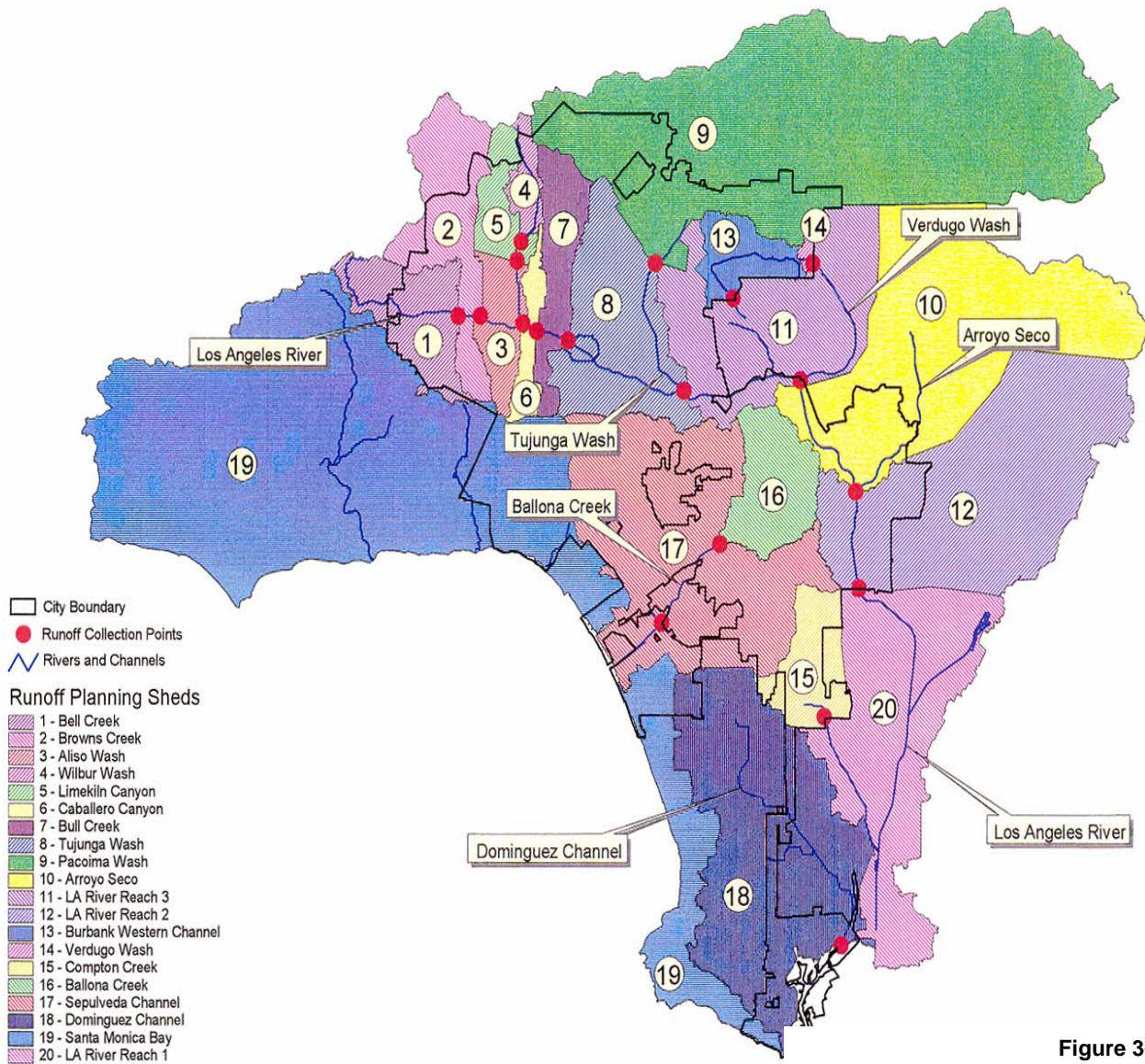


Figure 3-2
Runoff Planning Sheds

Table 3-4 Summary of Runoff Planning Shed Areas				
Watershed Management Area	Runoff Planning Shed	Total Area (acres)	Portion within City of Los Angeles	
			(acres)	(Percent)
Los Angeles River	Bell Creek	17,000	11,500	68%
	Browns Creek	23,000	12,000	52%
	Aliso Wash	9,500	9,500	100%
	Wilbur Wash	5,000	4,000	80%
	Limekiln Canyon	8,000	6,000	75%
	Caballero Canyon	5,500	5,500	100%
	Bull Creek	13,500	13,500	100%
	Tujunga Wash	32,500	32,500	100%
	Pacoima Wash	143,200	28,000	20%
	Arroyo Seco	78,500	13,500	17%
	Los Angeles River Reach 3	45,000	13,900	31%
	Los Angeles River Reach 2	73,000	15,000	21%
	Burbank Western Channel	9,300	9,000	97%
	Verdugo Wash	1,000	1,000	100%
	Compton Creek	14,000	10,100	72%
	Subtotal	478,000	185,000	39%
Ballona Creek	Ballona Creek	17,000	17,000	100%
	Sepulveda Channel	67,000	50,000	75%
Santa Monica Bay	Santa Monica Bay 1	21,100	21,100	100%
	Santa Monica Bay 2	5,900	5,900	100%
	Santa Monica Bay 3	1,000	1,000	100%
Dominguez Channel	Dominguez Channel	70,000	15,000	21%
Area not Tributary to City (not in planning shed)		209,000	NA	NA
Total		869,000	295,000	
Source: City's GIS database.				

3.5 Population and Employment Projections

Demographic data is described in detail in *Volume 1: Wastewater Management* and summarized here. For a more extensive discussion, refer to the *Volume 1: Wastewater Management*.

3.5.1 Recommended Population Projections

For the IRP, future population was estimated using the Southern California Association of Government's (SCAG) 2001 Regional Transportation Plan. This data source has population projections through year 2020 for the City.

The use of SCAG data is also consistent with the City's planning process and is in compliance with the requirements of the EPA. Table 3-5 shows the population projections for the years 2000, 2005, 2010, 2015 and 2020.

Table 3-5 Summary of Population Projections and Percent Increase Compared to 2000		
Year	Population Projection Projections for IRP ¹	% Increase in Population compared to Year 2000
2000	4,278,156	0%
2005	4,478,676	5%
2010	4,639,281	8%
2015	4,802,072	12%
2020	5,024,987	17%
Notes: ¹ Based upon SCAG-01 projections		

3.5.2 Recommended Employment Projections

Estimating employment is also a component of IRP planning. Employment is a factor used to estimate the wastewater, water and runoff from commercial businesses.

For the IRP, the SCAG 2001 *Regional Transportation Plan* will be the source of employment data.

The projected employment for the years 2000, 2005, 2010, 2015 and 2020 are presented in Table 3-6.

Table 3-6 Summary of Employment Projections and Percent Increase Compared to 2000		
Year	Population Projection Projections for IRP ¹	% Increase in Population compared to Year 2000
2000	2,329,509	0%
2005	2,429,691	4%
2010	2,525,179	8%
2015	2,589,443	11%
2020	2,626,498	13%
Notes: ¹ Based upon SCAG-01 projections		

3.6 Regulatory Requirements/Forecast

Understanding the regulatory forecast and developing appropriate environmental quality goals are essential steps in the facilities planning process. For the IRP, a technical memorandum was generated to document the anticipated regulatory forecast for pretreatment, wastewater collection and treatment, water recycling, air quality, biosolids management, and stormwater/runoff management. This document titled *Regulatory Forecast Technical Memorandum* (CH:CDM, May 2003) is included in Appendix A of this volume. The priority regulations and key policy issues were summarized using four categories:

- ***Current policies and regulations:*** those which are in place and are part of a permit, order or enforceable tool.
- ***Emerging policies and regulations:*** those which are adopted, but not yet included in a permit, order, or other enforceable tool.
- ***Proposed policies and regulations:*** those, which are in various developmental stages, but not yet adopted.
- ***"Crystal Ball" policies and regulations:*** issues that have the potential of becoming proposed, emerging or current in the future.

The Regulatory Forecast memo updated information generated in 2001 in IPWP regarding the status of regulations affecting pretreatment, collection system management, wastewater treatment and operations, water recycling, air quality, biosolids management, and construction. The regulations and policies that are affecting or may affect stormwater/runoff management are summarized in Table 3-7.

As noted in Section 2, the runoff volume of the IRP is not intended to serve as a plan for meeting emerging or future regulations. Once the regulations are promulgated, a detailed implementation plan will need to be developed to address full compliance with the regulations. Further detailed investigations of regulatory water quality standards and limits, hydrologic and water quality characteristics, and mitigation options or alternatives will need to be conducted. Once the regulators approve this implementation plan, it will eventually lead to facilities siting and construction to meet full TMDL compliance.

Table 3-7
Regulatory Forecast - Stormwater/Runoff Management

Item	Regulations and Policies	Agency	Phase
1	Clean Water Act, Section 402(p) and Phase I regulations for MS4	EPA, LARWQCB	Current
2	National Pollutant Discharge Elimination System – Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles (Permit No. CAS004001)	LARWQCB	Current
3	Beneficial Use Designations per Clean Water Act (CWA) and State Resolutions (except for MUN)	LARWQCB and SWRCB	Current
4	New development specific design criteria for mitigating storm water impacts for the California Coastal Zone	California Coastal Commission	Current
5	Standard Urban Stormwater Mitigation Plan (Part of Item 2)	LARWQCB and City of Los Angeles	Current
6	Policy Statement on the Environment	City of Los Angeles Adopted 1/26/99	Current
7	Storm water Ordinance No. 172172, Effective 10-01-98, Ordinance No. 172673, Effective 6-24-99, Ordinance No. 173494, Effective 9-12-00	City of Los Angeles Department of Public Works Bureau of Sanitation	Current
8	Section 303(d) of the Clean Water Act – Impaired Water Bodies	EPA, SWRCB and LARWQCB	Current, Emerging and Proposed (new list June 2003)
9	Total Maximum Daily Loads (TMDLs) including Consent Decree Schedule for Completion of TMDLs in Los Angeles Region	LARWQCB, SWRCB and EPA	Current and Emerging
10	Region 1X Draft Guidance for Issuing Permits for Discharges into Impaired Waters in the Absence of a TMDL	EPA, LARWQCB	Current
11	Trash TMDL for the Los Angeles River, Ballona Creek and Santa Monica Bay and Beaches	LARWQCB, EPA	Current
12	Santa Monica Bay Dry Weather Bacteria TMDL	LARWQCB	Current
13	Santa Monica Bay Wet Weather Bacteria TMDL	LARWQCB	Current
14	Water Quality Enforcement Policy – LA Region	LARWQCB, SWRCB	Emerging
15	Application of Numerical WQS in stormwater permits as a result of the TMDL	LARWQCB	Current, Emerging and Crystal Ball
16	Application of Numerical WQS in stormwater NPDES permits for all priority pollutants and CTR pollutants	EPA, SWRCB and LARWQCB	Crystal Ball
17	Redirection, Beneficial Use, or Treatment of Stormwater - see water recycling issues	LARWQCB/DOHS	Current/ Emerging, Proposed and Crystal Ball

Note: For additional discussion, refer to the "Regulatory Forecast Technical Memorandum" (CH:CDM, May 2003) in Appendix A.

3.6.1 Standard Urban Storm Water Mitigation Plans (SUSMP)

The SUSMP is a model guidance document for use by builders, land developers, and public agencies (including City department capital projects and others) to select post construction BMPs and to obtain municipal approval for projects that fall into specific categories (single-family hillside residences, certain commercial and residential developments, automotive repair shops, parking lots with 5,000 square feet or more or with 25 or more parking spaces, etc.) (RWQCB, 2000b).

SUSMPs are intended to address storm water pollution from new development and redevelopment by the private sector as well as equivalent public works projects. As adopted by the RWQCB, the countywide SUSMP requires that BMPs be implemented to meet specific design standards to achieve the following goals (RWQCB, 2000b):

- Mitigation (i.e., infiltration or treatment) of storm water runoff is determined from either
 1. The 85th percentile 24-hour runoff event determined as the maximized capture stormwater volume for the area from the formula recommended in *Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87, (1998)*, or
 2. The volume of annual runoff based on unit basin storage water quality volume to achieve 80 percent or more volume treatment by the method recommended in *California Stormwater Best Management Practices Handbook – Industrial/Commercial. (1993)*, or
 3. The volume of runoff produced from a 0.75-inch storm event prior to its discharge to a storm water conveyance system, or
 4. The volume of runoff produced from a historical record-based reference 24-hour rainfall criterion for “treatment” (0.75-inch average for the Los Angeles County area) that achieves approximately the same reduction in pollutant loads achieved by the 85th percentile 24-hour runoff event.
- Control of peak-flow discharge to provide stream channel and over-bank flood protection, based on flow design criteria selected by the local agency.

The County’s SUSMP includes a limitation on the use of infiltration BMPs where there is potential for storm water to contaminate groundwater. This concern has been expressed by the Upper Los Angeles River Area Watermaster. A limitation on the location of infiltration BMPs has been included in the City’s Prescriptive Methods for SUSMP compliance to prohibit the implementation of infiltration BMPs in the San Fernando Valley watershed. The San Fernando Groundwater Basin provides approximately 15 percent of the City’s water supply and is an unconfined aquifer, which increases the likelihood of potential contamination.

The City has adopted an ordinance of the Los Angeles Municipal Code to provide the necessary legal authority to enforce the requirements for the implementation of SUSMPs. Implementation of these new regulations requires the Watershed Protection Division (WPD) to review and approve certain categories of private and public development projects to comply with SUSMP requirements, determine pollution control system adequacy and appropriateness, and provide technical assistance to the public.

Monitoring each BMP system is essential to evaluate the performance of each system based on removal efficiency, effectiveness, maintenance, and cost. This information will be obtained through analysis of water quality, flow, precipitation data for monitored storm events, frequency of maintenance to prevent clogging, and cost of disposal.

3.7 Environmental Quality Goals

A critical component in determining the approach to managing runoff quality is identifying the regulatory drivers and environmental goals for the affected bodies of water. Currently, the regulatory drivers that affect runoff management are the discharge permits that define practices but do not list numerical limits for constituents. In addition, the City's beneficial use goals will also establish limits for each beneficial use option. However, the long-term regulatory drivers are the TMDLs. There are four current TMDLs that have numerical limits or other quantifiable targets such as days of exceedence:

- Los Angeles River Trash TMDL
- Los Angeles River Nitrogen TMDL
- Santa Monica Bay Dry Weather Bacteria TMDL
- Santa Monica Bay Wet Weather Bacteria TMDL

All IRP alternatives will be created to meet these existing TMDLS. Also there are additional TMDLs that are currently being developed for different constituents in the LA River WMA, Ballona Creek WMA, Santa Monica Bay WMA and Dominguez Channel WMA. These constituents are listed on the 303d list that identifies these impaired water bodies and their constituents of concern. For the most recent list, refer to the regional board website at: <http://www.swrcb.ca.gov/tmdl/>. These will result in new TMDLs in the future, and the regional board is developing TMDLs according to the consent decree schedule and a new strategy the uses a watershed approach. The challenge in IRP planning is that the actual constituent limits and targets associated with the future TMDLs are still undetermined.

Managing the quality of runoff includes meeting the following goals:

- Address all existing TMDLs (listed above) and regulations in all alternatives

(considered minimum requirements);

- Provide leadership by including additional runoff management projects with multiple benefits (e.g., on-site storage/use, or infiltration trenches), which will provide beneficial use as well as some water quality benefits;
- Developing a range of management options to meet future regulations;
- Developing an IRP Implementation Plan that will include a schedule with potential regulatory triggers to allow the City to check whether the IRP projects will satisfy compliance with new TMDLs as they are issued. Whether and how to modify/expand the IRP plan will be detailed as part of each TMDL's Implementation Plan.

Managing runoff and meeting these goals can be accomplished through a broad range of both structural and non-structural options.

- Several options reduce certain constituents in runoff that will still be discharged through the storm drain system to the receiving waters. These options include source controls, in-line treatment, wetlands treatment and management of open space. For these options the relative comparison directly relates to the "removal effectiveness" of the measure and the ability to meet a TMDL target.
- Other options result in complete diversion of runoff away from the receiving waters; these options include diversion to sewer, regional recharge, treatment for direct beneficial use and several source controls. For these options, the relative comparison is how much of the total volume of runoff can be diverted to each option.
- From the point of view of impact on the listed receiving waters, these options all provide a high degree of pollutant removal and may fully satisfy a TMDL target.

While these options provide a high level of pollutant "removal", other concerns and regulatory drivers may impact the relative level of treatment and/or removal effectiveness required based on the end use. For example, treatment and beneficial use for irrigation would require a high level of removal of solids and bacteria, but nutrient reduction would not be required; in another example groundwater recharge for infiltration will require varying degrees of pollutant removal consideration (relative to the "natural" groundwater). All of the runoff management options will be discussed in detail in Sections 6 and 7 of this document.

3.8 Guiding Principles Affecting Runoff Management

In Phase I of the IRP (the Integrated Plan for the Wastewater Program), the Steering Group created six primary objectives for the program (Figure 3-3).

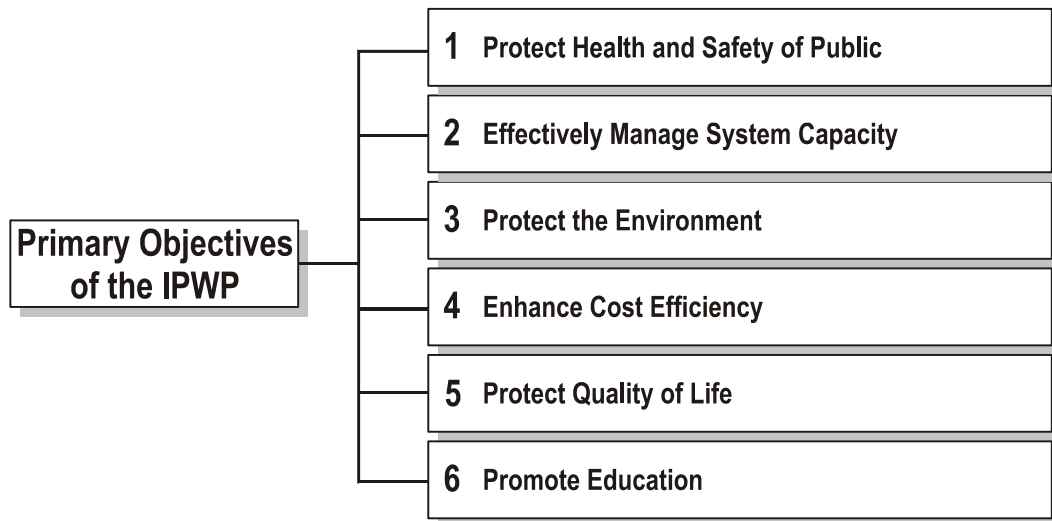


Figure 3-3
IRP Objectives

The IRP objectives are the goals that define the essential purposes of the IRP in broad, overarching terms. The objectives can be seen as a set of goals that answer the question: Why do we want to have an IRP?

There are many different means to meet these objectives. The goal of Phase I of the IRP was to develop a set of guiding principles that provide the instructions or guidelines for building alternatives to meet the objectives. These guiding principles were recommended by the Steering Group and staff for consideration by the City Council in planning for the future of the City.

On December 14, 2001, the City Council concurred with the guiding principles of the Integrated Plan for the Wastewater Program developed by the IPWP Steering Group and City staff. The City Council also directed the Bureau of Sanitation (BOS) staff to continue working with the community stakeholders and proceed with the development of an Integrated Resources Plan (IRP), which includes a Wastewater Facilities Plan, an Environmental Impact Report, a Financial Plan (FP), and an associated public outreach program to address the facility needs of the City's wastewater program through the Year 2020 in accordance with the guiding principles of the Integrated Plan for the Wastewater Program.

The guiding principles form the foundation in this more detailed facilities planning phase of the IRP. The complete set of guiding principles is included in a separate document titled *Summary of the Steering Group Process and Their Recommendations for*

Integrated Resources Planning Development (Summary Statement) and is found in Appendix B of this volume.

Several of the guiding principles are specific to runoff management. These guiding principles include:

- *Increasing the amount of dry weather urban runoff that is diverted and treated or captured and beneficially used*

The primary benefit of increased dry weather diversion will result from reduced pollution throughout the City's waterways; this, in turn, will have a major impact on the region's quality of life.

In addition, dry weather urban runoff could potentially provide additional beneficial water use opportunities. To protect all beneficial uses, the City recommends an extensive dry weather urban runoff capture and beneficial use program. The IPWP assumed that the one of the requirements of any project would be that dry weather diversions would not impair the beneficial uses of other receiving waters in the Los Angeles basin.

- *Increasing the amount of wet weather urban runoff that can be captured and beneficially used*

By capturing and beneficially using wet weather urban runoff, the City has the opportunity to make some significant restrictions in its dependence on imported water. For this reason, both the Steering Group and the City support capturing and beneficially using wet weather urban runoff.

- *Focusing on lower-cost solutions within the framework of the policy elements noted above*

Providing for improvements in, and maintenance of, wastewater, recycled water, stormwater and water services that are adequate for meeting future treatment and quality needs may require increased investments in these programs, and paying for these improvements will result in some level of increased user costs. A wide range of possible costs for future actions was indicated by the alternatives studied in the Phase I process. In fact, individual economic preferences were considered in selecting alternatives. While alternatives will require significant investments, they will also offer the added value of achieving both the level-of-service and the environmental goals that are important for the City and its residents, and they may result in economic savings over time. Nonetheless, it is possible, within the scope of the desired options and policies outlined above, to strive for the lowest cost solutions that meet performance requirements. For these reasons, the Steering Group supported the use of lower cost solutions where they are available within the framework of the other policy elements.

Section 4

Runoff Characterization

4.1 Introduction

A fundamental element of managing runoff is estimating the volume of runoff that occurs or will occur and identifying its quality. Runoff is associated with dry and wet weather conditions. Dry weather runoff is generally associated with activities such as landscape irrigation and street washing. Wet weather runoff is directly associated with rainfall that is collected and transmitted to receiving waters by the storm drain system.

This section presents information on the total amount of runoff that is expected to occur. However, not all of the runoff needs to be managed in order to meet permit, TMDLs or IRP goals. Therefore, the section also discusses quantity targets to meet the various goals.

4.2 Dry Weather Runoff

4.2.1 Introduction

Discharges from the storm drainage system occur during dry weather periods at most locations throughout the watersheds where the City is located. These discharges, or “low flows,” are the result of a combination of factors including landscape irrigation runoff, street washing, car washing, ground water seepage, illegal connections, hydrant flushing, construction runoff, and other commercial activities. Limited permitted discharges to storm drain channels may also contribute to dry weather discharges. Estimates of the volume and composition of the dry weather runoff into the Los Angeles River, Santa Monica Bay and other water bodies within the City are described in the following subsections.

Average monthly flow data from several locations throughout the Watershed Management Areas (WMAs) during the dry months from October 1996 to September 2001 was used in preparing estimates of the dry weather urban runoff volumes. This is the most recent data released by the County of Los Angeles Department of Public Works (Los Angeles County, 2002).

For the IRP, a “dry month” was defined as a month in which less than 0.25 inches of rain fell. The rainfall measured at the Los Angeles International Airport (LAX) rain gauge was used to determine which months during the study period were dry. A summary of the reported monthly rainfall as well as those months defined as dry is presented in Table 4-1.

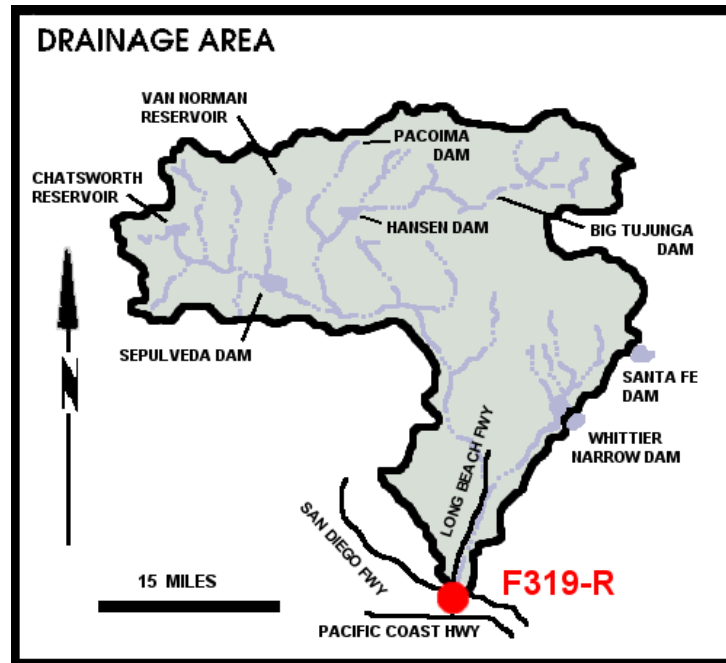
Table 4-1 Integrated Resources Plan Summary of Total Rainfall at LAX and Corresponding Dry Weather Months						
Total inches of rainfall						
Month	1996	1997	1998	1999	2000	2001
January	1.94	5.12	3.71	1.19	0.84	4.68
February	4.19	0.05	13.56	0.5	4.71	7.30
March	1.36	0.00	3.33	2.12	2.39	1.25
April	0.42	0.00	1.00	2.23	1.88	1.10
May	0.05	0.00	2.46	0.00	0.00	0.01
June	0.00	0.00	0.09	0.59	0.00	0.00
July	0.00	0.00	0.00	0.00	0.00	0.00
August	0.00	0.00	0.00	0.00	0.03	0.00
September	0.00	0.27	0.01	0.00	0.03	0.00
October	1.44	0.00	0.00	0.00	1.12	0.04
November	1.88	2.66	1.79	0.28	0.00	1.34
December	4.54	3.97	0.67	0.00	0.00	1.05
Total Rainfall	15.82	12.07	26.62	6.91	11.00	16.77
The following months marked as “dry” are those months where the rainfall was less than 0.25 inches.						
Month	1996	1997	1998	1999	2000	2001
January						
February		dry				
March		dry				
April		dry				
May	dry	dry		dry	dry	dry
June	dry	dry	dry		dry	dry
July	dry	dry	dry	dry	dry	dry
August	dry	dry	dry	dry	dry	dry
September	dry		dry	dry	dry	dry
October		dry	dry	dry		dry
November					dry	
December				dry	dry	
Total Dry Months	5	8	5	6	7	6
Note: National Weather Service Data. Measured at LAX rain gauge.						

4.2.2 Dry Weather Runoff Flows

4.2.2.1 Dry Weather Runoff Volume – Los Angeles River WMA

A water balance approach was used to estimate the dry weather urban runoff into the Los Angeles River. The water balance approach assumes that the dry weather runoff in the river equals the total measured flow, minus the water reclamation plant flows, and minus the rising groundwater flow, as these are the only flows in the river. A description of this approach and the estimated runoff from the entire watershed, as

well as from within the City boundary, into the Los Angeles River are presented in the following sections. A drawing of the watershed used for this analysis is presented in Figure 4-1.



Source: County of Los Angeles, Annual Hydrologic Report

Figure 4-1
Drainage Area for Los Angeles River Runoff Analysis

The water balance approach used for the Los Angeles River WMA consisted of accounting for three elements: treated effluent flows from water reclamation plants, groundwater entering the river, and dry weather urban runoff. Data from the City of Los Angeles was used to characterize the water reclamation plants effluent flows (2001). Data from the Upper Los Angeles River Area Watermaster was used to characterize the rising groundwater (2002). Data from the Los Angeles County Department of Public Works metering stations was used to characterize the flows in the river and tributaries throughout the WMA. Dry weather urban runoff was estimated as the difference between measured flows in the river and tributaries and the effluent and rising groundwaters. In other words, the water balance approach can be looked at as an equation where:

$$\text{Dry Weather Runoff} = \text{Total Measured Flow} - \text{Water Reclamation Flows} - \text{Groundwater Flows}$$

Water Reclamation Plant Flows

The first element of the water balance approach to estimating dry weather runoff is summarizing the water reclamation plant contributions to the Los Angeles River. Three water reclamation plants currently discharge tertiary treated effluent to the Los Angeles River including the Donald C. Tillman Water Reclamation Plant (TWRP), the

Los Angeles-Glendale Water Reclamation Plant (LAGWRP), and the Burbank Water Reclamation Plant (BWRP). The location of these facilities is shown in Figure 4-2.

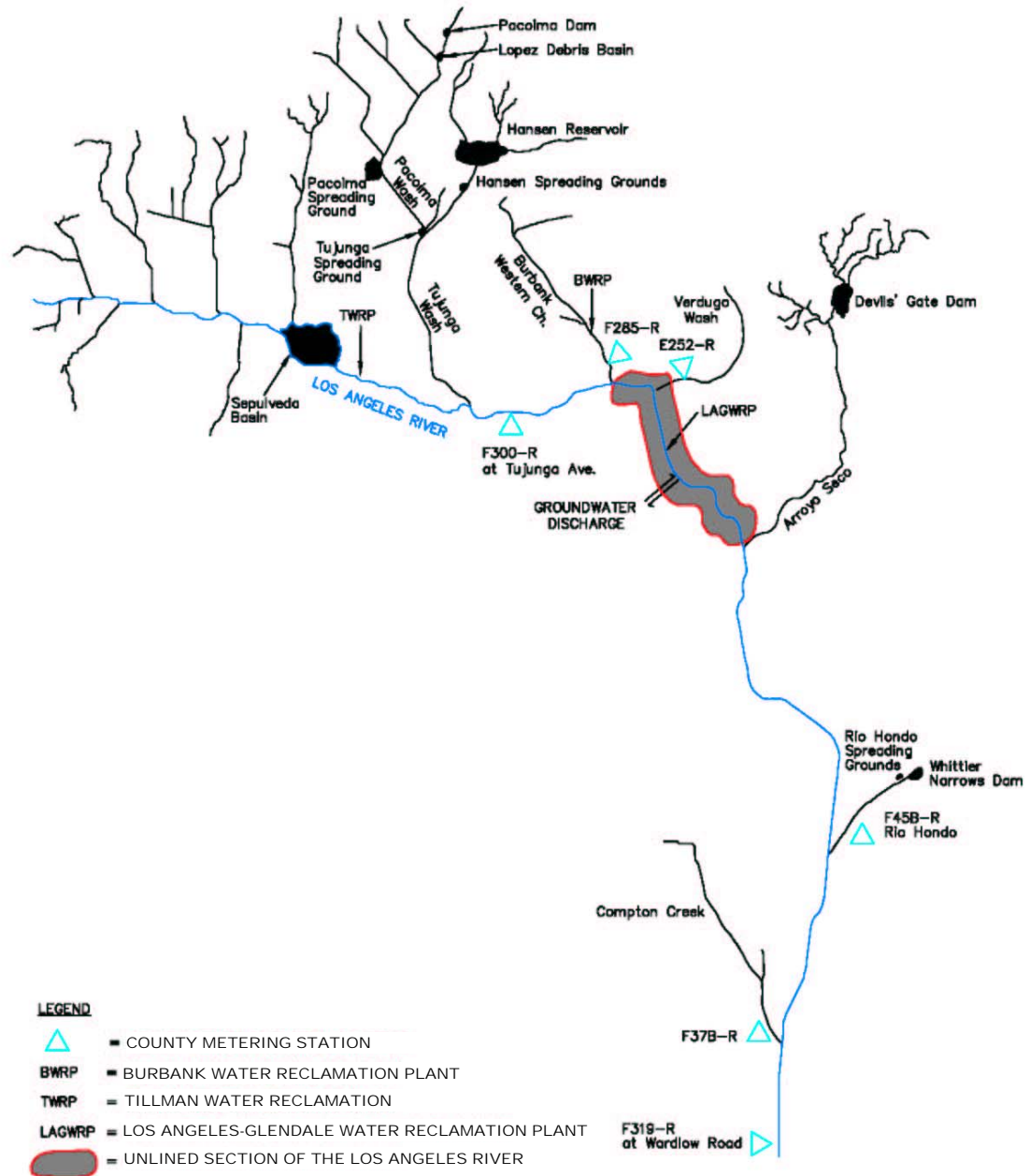


Figure 4-2
Reclamation Plant Discharge Locations

The TWRP discharges to the Los Angeles River at four locations in the Sepulveda Basin area; into the Bull Creek, Hayvenhurst Channel, and Haskell Creek and at a direct discharge below Sepulveda Dam. The BWRP discharges both directly to the Burbank Western Channel and indirectly after use as cooling water for the Burbank Steam Power Plant; both discharges reach the Los Angeles River via the Burbank Western Channel. The LAGWRP discharges directly to the Los Angeles River between where the Verdugo Wash and the Arroyo Seco enter the river. The effluent from these water reclamation plants are metered and reported to the RWQCB as part of their permit requirements. To summarize the “current” discharges from these plants to the Los Angeles River, the IRP averaged the daily dry weather flow data from 1996 to 2001. The average current discharges are summarized in Table 4-2. See Appendix C for supporting calculations and raw data.

Table 4-2 Summary of the Average Dry Weather Flows from Water Reclamation Plants to the Los Angeles River	
Water Reclamation Plant	Average Discharges to the Los Angeles River (mgd)
Tillman WRP ¹	50.4
Burbank WRP ¹	5.5
Los Angeles/Glendale WRP ²	16.2
Total	72.1
Notes: ¹ City of Los Angeles Monthly Performance Reports for TWRP, 1996-2001. ² Source: City of Los Angeles, Bureau of Sanitation Standard Reports See Appendix C for supporting calculations and raw data	

Groundwater

The second element of the water balance approach to estimating dry weather runoff is summarizing the groundwater contribution to the Los Angeles River. The Upper Los Angeles River Area Watermaster is responsible for accounting for all of the water entering and leaving the Upper Los Angeles River Area as part of adjudicating water rights for the groundwater within the San Fernando Groundwater Basin. When the Los Angeles River was lined/channelized in the 1930s, the portion of the river through the Glendale Narrows/Elysian Park area (6 miles long) was not lined because the groundwater table was too high in the area. Therefore, in this area, groundwater flows into the Los Angeles River. The estimated rising groundwater during the study period is 2.9 mgd (as presented in Table 4-3). The Watermaster also publishes the estimated groundwater levels in the basin. This data indicates that the groundwater levels tend to remain fairly constant throughout the year. Based on this observation, it was assumed that the rising groundwater rate is constant throughout the year.

Table 4-3 Estimated Groundwater Flow into the Los Angeles River in Unlined Portions (Glendale Narrows/Elysian Park)		
Year	acre-feet/year	mgd
2000	3,000	2.7
1999	1,980	1.8
1998	4,400	3.9
1997	4,000	3.6
1996	3,000	2.7
Averages	3,276	2.9
Data Source: Upper Los Angeles River Area Water Master Report for the Water Year 2000 to 2001.		

Metered Flow in Los Angeles River

The third element of the water balance approach to estimating dry weather runoff is summarizing the metered flows of the Los Angeles River. The IRP team selected the County of Los Angeles (County) Flow Meter F319-R for this analysis. This meter is located at Wardlow Road, as shown on Figure 4-2, and is the most downstream point on the Los Angeles River that has available flow data. At this point along the river, the tributary area is 521,600 acres, which is 12,160 acres less than the total area of the Los Angeles River Watershed (533,760 acres). The remaining 12,160 acres is downstream of the metering point.

Data from 1996 to 2001 at the Wardlow Road Meter was used in the analysis. Of the 2,556 daily flow values analyzed, 1,131 occurred during dry months. Of these, there was no data available at the Wardlow Road flow meter during 461 days. Of the remaining days, the calculated runoff (see below for calculated runoff from metered flow) was slightly negative (averaging -3 mgd) indicating that slight irregularities in the data existed or the actual rising groundwater was less than the assumed amount. Of the remaining days, 8 had a difference greater than 100 mgd, which was assumed to be too large to accurately reflect dry weather urban runoff. Thus, the data from 537 days were found to be reasonable estimates of the actual runoff reaching the Los Angeles River during dry weather periods.

Based on the analysis of the metered raw flow data, the average flow at Wardlow Road was calculated to be 101.6 mgd. This flow includes the water reclamation plant flows as well as the groundwater flows. Subtracting these flows from the total flow at Wardlow Road results in the total flow from dry weather runoff. This equals 26.6 mgd. A summary of the estimated flow sources is presented in Table 4-4. A summary of the raw data used for this analysis is presented in Appendix C.

Table 4-4 Estimated Dry Weather Flow Sources in the Los Angeles River at Wardlow Road (1996-2001)	
Source of Flow	Flow (mgd)
Total Measured Flow At Wardlow Road ¹	101.6
Reclamation Plant Flows (see Table 4-2)	72.1
Groundwater (see Table 4-3)	2.9
Remaining Flow = Dry Weather Urban Runoff	26.6
Notes:	
¹ Meter data from County of Los Angeles flow meter F319-R.	

Adjustment to Tributary Area

As was discussed in Section 3, the Los Angeles WMA has several dams that control flows in some areas of the watershed. Therefore, only a portion of the watershed contributes to the flow that is measured at Wardlow Road, a value that is less than the total tributary area of the watershed. Only the area that contributes to the metered runoff can be used in calculating the runoff rate.

Based on the information presented by the County for flow meters throughout the WMA, portions of the flow in the Los Angeles River WMA are retained by operating dams, reservoirs and spreading basins to capture flow throughout much of the year. To determine the impact of the dams, reservoirs and spreading basins in the Los Angeles River WMA, at the following locations the tributary areas and the measured flows were analyzed and the apparent runoff rate for portions of the watershed was estimated. A summary of the results of this analysis is presented in Table 4-5.

Table 4-5 Estimated Runoff Rates for Portions of the Los Angeles River WMA (1996-2001)				
Source	County Meter¹	Estimated Runoff (mgd)	Watershed Area (acres)	Runoff Rate (gpd/ac)
Area Above Tujunga Avenue	F300-R	0.6	256,640	2
Western Burbank Channel	F285-R	1.4	16,000	88
Verdugo Wash	F252-R	4.0	17,152	233
Rio Hondo	F45B-R	0.4	89,600	4
Compton Creek	F37B-R	0.7	14,464	48
Remainder of Watershed	-	19.5	127,744	146
Subtotal		26.6	521,600	50
Note: County of Los Angeles Flow Meters				

As shown in Table 4-5, the apparent runoff rate for the area above Tujunga Avenue and for the Rio Hondo watershed are very low when compared to the rest of the watershed. These inconsistent values indicate that the dry weather runoff from these areas is retained and does not generally reach the Los Angeles River. Thus, the dams, reservoirs, and spreading basins in the watershed that drains to the Los Angeles River (at Tujunga Avenue and to the Rio Hondo immediately upstream of where it enters the Los Angeles River) appear to effectively eliminate some dry weather urban runoff from reaching the lower portion of the Los Angeles River.

Additionally, as an example, the Pacoima dam has a reported watershed area of 18,000 acres that would discharge to tributaries upstream of where the Tillman WRP discharges to the river. The dam is used to retain flows in the reservoir throughout most of the year. Of the 49 days on which flow was released from the reservoir, only 21 occurred during dry months. Thus, the measured flows in the Los Angeles River at Wardlow Road do not reflect dry weather urban runoff that is conveyed to the storm water collection system and then to the river from the area upstream of the Pacoima Dam.

Therefore, only the remaining portion of the watershed, the uncontrolled area (the area not controlled by dams, reservoirs, and spreading basins) was used as the tributary area draining dry weather runoff flow to the Wardlow Road Meter. This area is combined with the metered flow at Wardlow Road (minus the WRP flow and the groundwater flow) to determine the runoff rate.

Dry Weather Runoff Generation Rate for the Los Angeles River WMA

To determine the average dry weather runoff generation rate (in gpd/ac), the IRP team started by estimating the uncontrolled area. To estimate the uncontrolled area, the IRP team took the total watershed area and subtracted out the areas controlled by dams. Next, the developed portion of the uncontrolled area was estimated. The IRP team divided the estimated runoff (see Table Nos. 4-2, 4-3 and 4-4) by the uncontrolled area to obtain the dry weather runoff generation rate. Table 4-6 presents a summary of this process. The total developed areas within the watershed and the City are listed for use in calculating the total dry weather urban runoff generated, described below.

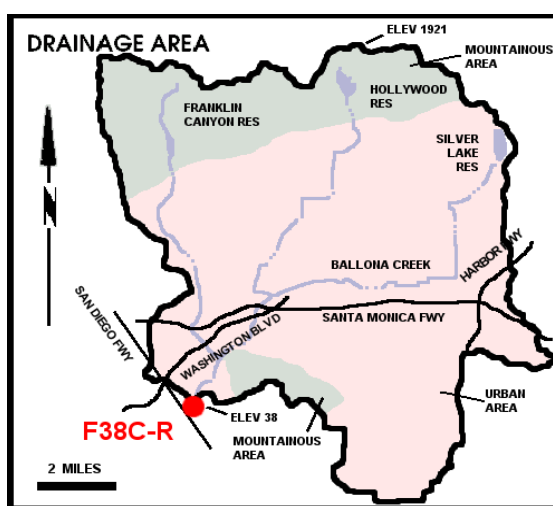
Table 4-6 Development of Dry Weather Runoff Generation Rate for the Los Angeles River Watershed Management Area				
Item		Amount	Unit	Notes
Total Watershed Areas				
1	Total Watershed Area (Upstream of Wardlow Road Metering Station)	521,600	acres	Reported at LA County DPW Website - Meter F319-R
2	Developed Watershed Area (upstream of Wardlow Rd)	310,900	acres	Based on 59.6% development as reported in the LA County 2001 - 2002 Stormwater Quality Monitoring Report
3	City Area in Watershed	185,000	acres	Analysis of City Land Use GIS Database
4	Developed City Area in Watershed	148,000	acres	Analysis of City Land Use GIS Database
5	Controlled Watershed (flow controlled by dams)	346,200	acres	Metered (LA County DPW website - meters F300-R and F45B-R)
Uncontrolled Watershed (area not controlled by dams, etc.)				
6	Total uncontrolled area	175,400	acres	Calculated (item 1 minus item 5)
7	Developed portion of uncontrolled area	140,300	acres	Analysis of City Land Use GIS Database, 80% developed
Metered Data (at Wardlow Road, only flow from uncontrolled area reaching metering station)				
8	Estimated runoff reaching the Los Angeles River	26.6	mgd	From Table 4-4 (calcs in Appendix C)
Estimated Dry Weather Runoff Generation Rate				
9	Calculated runoff rate	190	gpd/dev acres	Calculated (Item 8 / Item 7 * 1 million)

The runoff rate was calculated as a function of developed area to account for the differences between the areas that have controlled urban runoff and the areas that have uncontrolled urban runoff. The runoff rate for the developed areas was estimated by taking the estimated urban runoff reaching the river (26.6 mgd) divided by the developed area (140,300 acres) multiplied by 1 million to arrive at 190 gpd/developed acre. This rate is similar to the observed range of 150 to 200 gpd/ac derived from monitoring data in the North Orange County area (CDM, 2002).

Based on the runoff generation rate of 190 gpd/developed acre, the runoff in the watershed and the City can be estimated. By multiplying the developed area in the watershed and the developed area in the City by this runoff generation rate, the estimated dry weather urban runoff for the entire watershed and the City portion is 59 mgd and 28 mgd respectively.

4.2.2.2 Dry Weather Runoff Volume - Ballona Creek WMA

A similar approach as was used for the Los Angeles River WMA was used to estimate the dry weather urban runoff into the Ballona Creek WMA. The measured Ballona Creek flow at Sawtelle Boulevard (Los Angeles County Meter 38C) was used for this analysis. This is the only flow metering station within the Ballona Creek WMA. It is located above Sawtelle Boulevard; about 1.5 miles southeast of Culver City and about 2.5 miles upstream from where Ballona Creek enters the Santa Monica bay. The watershed area that drains to this meter is approximately 57,000 acres in size, compared to the entire Ballona Creek WMA of 86,000 acres. However, the drainage area and Ballona Creek WMA have very similar land uses, and therefore that data is considered representative of the entire area. A drawing of the drainage area used for this analysis is presented in Figure 4-3.



Source: County of Los Angeles, Annual Hydrologic Report

Figure 4-3
Drainage Area for the Ballona Creek Runoff Analysis

The dry weather urban runoff was determined by analyzing the measured flow for the dry months for the period from October 1996 - September 2001 (dry months defined as a month in which less than 0.25 inches of rain fell at LAX) at Sawtelle Boulevard. Of the 1,825 days for which data was available, 948 occurred during dry months. Of these, 875 had flows less than 35 mgd. This represents 92 percent of the flows analyzed and was considered representative of the normal flow condition. The measured flows above 35 mgd ranged as high as 253 mgd, and were eliminated from the analysis as being abnormal. A summary of this analysis is presented in Appendix D. The estimated average runoff was 13 mgd.

Based on a drainage area of 57,000 acres to the meter, a runoff rate was estimated by taking the 13 mgd of estimated runoff and dividing it by the 57,000 acres and multiplying it by 1 million, which results in 230 gpd/ac. As the area is 90 percent developed, and since the development appears to be evenly distributed throughout the watershed, this runoff rate per gross acre was used for this analysis.

The entire Ballona Creek Watershed covers 86,000 acres, of which 67,000 acres lie within the City. Thus, the estimated runoff for the entire watershed is 20 mgd and from the City is 16 mgd.

4.2.2.3 Dry Weather Runoff Volume - Urban Santa Monica Bay WMA

The method of determining the dry weather urban runoff within the Urban Santa Monica Bay WMA is different from the method used in estimating runoff for the Los Angeles River WMA and Ballona Creek WMA. For the Santa Monica Bay WMA, data from the current and planned diversions, as provided by the City's Watershed Protection Division, were used (diversions are discussed further in Section 5).

A summary of the estimated runoff flows for each of the diversions into the Santa Monica Bay is presented in Table 4-7. Based on these runoff flows, the estimated average runoff in the Urban Santa Monica Bay WMA is 10 mgd. Based on a total drainage area of 31,969 acres (which includes City and non-City tributary area), this corresponds to a runoff rate of 320 gpd/ac. The estimated average runoff rate ranged from 10 gpd/ac for the Pico-Kenter diversion to 4,189 gpd/ac for the Castlerock diversion.

Table 4-7 Estimated Dry Weather Runoff in the Urban Santa Monica Bay Watershed Management Area					
Storm Drain (N to S)	Drainage Area (Acres)	Design Flow (mgd)	Average Flow¹ (mgd)	Average Runoff gpd/ac	Design Runoff gpd/ac
Castlerock	74	0.42	0.31	4,189	5,676
Santa Ynez Canyon	4,387	2.6	2.4	547	593
Marquez Avenue	47	0.03	0.03	638	638
Bay Club Drive	148	0.08	0.05	338	541
Pulga Canyon	1,220	1	1.3	1,066	820
Temescal Canyon	1,660	2	1.4	843	1,205
Palisades Park	405	0.8	0.17	420	1,975
Santa Monica Canyon	10,147	6.5	3.6	355	641
Montana Avenue	824	0.06	N/D	N/D	73
Wilshire Blvd	926	0.11	N/D	N/D	119
Santa Monica Pier ²	94	0.05	0.04	426	532
Pico-Kenter ²	4,147	0.45	0.04	10	109
Ashland Avenue	264	0.07	0.08	303	265
Rose Avenue	2,117	N/A	0.04	19	0
Thornton Avenue	267	0.05	0.0	0	187
Brooks Avenue	304	0.11	0.08	263	362
Venice Pavilion	160	0.1	0	0	621
Playa Del Rey	403	0.26	0.1	248	645
North Westchester	2,416	0.52	0.46	190	215
Imperial Highway	1,958	0.05	0.06	31	26
Total	31,969	15	10	320	480
Notes: 1. The average runoff flow data presented here is based on more continuous data collected by the City. 2. The Santa Monica Urban Runoff Recycling Facility (SMURRF) will primarily handle flows from these drains during dry months. But, since the SMURRF does not include standby facilities, when the SMURRF is offline for maintenance, flows will continue to be diverted to Hyperion Treatment Plant. 3. Source: Watershed Protection Division Low Flow Diversion Schedule N/D=No Data N/A=Not Applicable					

The runoff in the drainage area to the Castlerock diversion appears to be very high. It is consistent, however, with the historic data collected as spot checks from 1995 to 1999 and thus appears to not be an anomaly. The reason that the runoff for this area is so high should be investigated further. Excluding Castlerock data, the estimated runoff factor for this WMA would be 309 gpd/ac.

Since the IRP considers flows for year 2020, the maximum quantity that could be diverted to the wastewater collection system via the Coastal Interceptor Sewer (CIS) was estimated. The IRP considers only the locations where permanent diversions into the CIS or other collectors are being considered. For each of these locations, the design diversion flow rate was selected to estimate the maximum flows. The total design flow from the diversions is 15.3 mgd.

Development is minimal in the rest of the watershed, in the areas where diversion of runoff to the CIS is not being considered. Therefore it was assumed that the average dry weather urban runoff for the entire watershed will also be 15 mgd.

4.2.2.4 Dry Weather Runoff Volume – Dominguez Channel/Los Angeles Harbor WMA

The County does not measure flows in the Dominguez Channel WMA. It was assumed that this area is similar to the Ballona Creek WMA with regard to dry weather urban runoff, and therefore the runoff rate is assumed to be 230 gpd/ac. The total watershed area is 69,000 acres so the estimated runoff for this WMA is 16 mgd. The City area is 15,000 acres so the estimated runoff from the City is 4 mgd.

4.2.3 Summary of Estimated Dry Weather Runoff Flows

When runoff factors that are calculated above are applied to the area in each watershed, the following dry weather runoff is calculated as shown in Table 4-8:

Table 4-8 Runoff throughout City Based on Estimated Runoff Rates					
Watershed Management Area	Area (acres)		Runoff Rate (gpd/ac)	Flow (mgd)	
	Watershed	City		Watershed	City
Los Angeles River	533,000 (311,000 Measured Developed)	185,000 (148,000 Measured Developed)	190	59	28
Ballona Creek	84,000	67,000	230	20	16
Urban Santa Monica Bay	182,000	28,000	320	15	10
Dominguez Channel/Los Angeles Harbor	70,000	15,000	230	16	4
Total	869,000	295,000	NA	110	58

4.2.4 Dry Weather Runoff Composition

As detailed above, dry weather runoff comes from a variety of activities such as landscape irrigation runoff, street washing, car washing, ground water seepage, illegal connections, hydrant flushing, construction runoff, and other commercial activities. These activities occur on a wide range of land use types. Runoff is then routed to the storm water collection system and to the receiving waters through a variety of channels, pipe, culverts, etc. The composition of dry weather runoff is therefore affected by where it is coming from, and what it is coming into contact with, which can include an assortment of pollutants. A partial list of these pollutants include:

- Pesticides
- Fertilizers
- Oils
- Human waste
- Animal waste
- Trash
- Yard Trimmings
- Particles from atmospheric deposition
- Hazardous products
- Sediment

For the IRP, water quality data was reviewed from several sources. A summary of these data and their sources is presented in Table Nos. 4-9 through 4-12.

Table 4-9
Summary of Reported Dry Weather Runoff Water Quality Data - General Constituents

Constituent	Unit	Ashland Storm Drain ¹	Ballona Creek ¹	Pico-Kenter Storm Drain ¹	Sepulveda Channel ¹	Sawtelle Blvd ²	Overland Overpass ³	Storm Drains ⁴
pH	N/A	7.6	8.8	7.6	8.7	-	-	-
Chemical Oxygen Demand (COD)	mg/L	252	51	88	73	-	-	-
Biochemical Oxygen Demand (BOD)	mg/L	-	-	-	-	5.6	<10	-
Dissolved Oxygen (DO)	mg/L	1.6	>15	6.6	>15	-	-	-
Total Dissolved Solids (TDS)	mg/L	6,058	1,625	1,493	4,071	-	-	-
Total Suspended Solids (TSS)	mg/L	299	8	103	13	-	-	-
Volatile Suspended Solids (VSS)	mg/L	86	5	42	7	-	26	-
Dissolved Organic Compounds (DOC)	mg/L	34	9	15	16	-	-	-
Salinity	ppm	2.2	1.2	0.9	2.1	-	-	-
Alkalinity	mg/L	357	212	260	145	-	-	-
Hardness	mg/L	1,080	722	353	1,434	-	-	-
Conductivity	mu/cm	-	-	-	-	1,141	1110	-
Detergent	ppm	2.5	0.75	0.75	0.5	-	-	-
Oil and Grease	mg/L	-	-	-	-	2.2	3.5	-

Notes:

1. Southern California Coastal Water Research Project Authority (SCCWRP) 1992 - 93 Annual Report. Toxicity Identification of Dry Weather Urban Discharge. (www.sccwrp.org)
2. Ballona Creek Treatment Facility, Feasibility Study/Preliminary Design Draft Report. Sampling at the Sawtelle Blvd sampling station from 1981 to 1993.
3. Ballona Creek Treatment Facility, Feasibility Study/Preliminary Design Draft Report. Six dry weather samples collected from October to December 1993 in Ballona Creek
4. Drew Ackerman, Kenneth Schiff, Heather Trim, Mike Mullin. Characterization of Water Quality in the Los Angeles River. Sampling of storm drain outfalls into the Los Angeles River on September 10, 2000.

Table 4-10 Summary of Reported Dry Weather Urban Runoff Water Quality Data - Bacteria								
Constituent	Unit	Ashland Storm Drain ¹	Ballona Creek ¹	Pico-Kenter Storm Drain ¹	Sepulveda Channel ¹	Sawtelle Blvd ²	Overland Overpass ³	Storm Drains ⁴
<i>e.coli</i>	mg/L	-	-	-	-	-	-	21,199
<i>Enterococcus</i>	(mpn/100 ml)	-	-	-	-	-	-	4,124
Fecal Coliform	(mpn/100 ml)	-	-	-	-	8,000	1,000	-
Total Coliform	(mpn/100 ml)	-	-	-	-	190,000	>1,600	79,593
Notes: 1. Southern California Coastal Water Research Project Authority (SCCWRP) 1992 - 93 Annual Report. Toxicity Identification of Dry Weather Urban Discharge 2. Ballona Creek Treatment Facility, Feasibility Study/Preliminary Design Draft Report. Sampling at the Sawtelle Blvd sampling station from 1981 to 1993. 3. Ballona Creek Treatment Facility, Feasibility Study/Preliminary Design Draft Report. Six dry weather samples collected from October to December 1993 in Ballona Creek 4. Drew Ackerman, Kenneth Schiff, Heather Trim, Mike Mullin. Characterization of Water Quality in the Los Angeles River. Sampling of storm drain outfalls into the Los Angeles River on September 10, 2000.								

Table 4-11 Summary of Reported Dry Weather Urban Runoff Water Quality Data - Metals								
Constituent	Unit	Ashland Storm Drain ¹	Ballona Creek ¹	Pico-Kenter Storm Drain ¹	Sepulveda Channel ¹	Sawtelle Blvd ²	Overland Overpass ³	Storm Drains ⁴
Chromium	mg/L	-	-	-	-	-	-	<0.01
Copper	mg/L	-	-	-	-	0.019	0.012	<0.01
Iron	mg/L	-	-	-	-	-	-	0.54
Lead	mg/L	-	-	-	-	0.019	<.1	<0.01
Nickel	mg/L	-	-	-	-	-	-	<0.02
Zinc	mg/L	-	-	-	-	0.061	0.02	0.01
Notes: 1. Southern California Coastal Water Research Project Authority (SCCWRP) 1992 - 93 Annual Report. Toxicity Identification of Dry Weather Urban Discharge 2. Ballona Creek Treatment Facility, Feasibility Study/Preliminary Design Draft Report. Sampling at the Sawtelle Blvd sampling station from 1981 to 1993. 3. Ballona Creek Treatment Facility, Feasibility Study/Preliminary Design Draft Report. Six dry weather samples collected from October to December 1993 in Ballona Creek 4. Drew Ackerman, Kenneth Schiff, Heather Trim, Mike Mullin. Characterization of Water Quality in the Los Angeles River. Sampling of storm drain outfalls into the Los Angeles River on September 10, 2000.								

Table 4-12
Summary of Reported Dry Weather Urban Runoff Water Quality Data - Nutrients

Constituent	Unit	Ashland Storm Drain ¹	Ballona Creek ¹	Pico-Kenter Storm Drain ¹	Sepulveda Channel ¹	Sawtelle Blvd ²	Overland Overpass ³	Storm Drains ⁴
Ammonia (NH ₃)	mg/L	0.76	0.05	0.11	0.06	-	-	<0.02
Nitrate	mg/L	-	-	-	-	-	-	2.7
Total Kjeldal Nitrogen (TKN)	mg/L	-	-	-	-	-	-	1.5
Total Phosphorus (Total-P)	mg/L	-	-	-	-	-	-	0.3

Notes:

1. Southern California Coastal Water Research Project Authority (SCCWRP) 1992 - 93 Annual Report. Toxicity Identification of Dry - Weather Urban Discharge
2. Ballona Creek Treatment Facility, Feasibility Study/Preliminary Design Draft Report. Sampling at the Sawtelle Blvd sampling station from 1981 to 1993.
3. Ballona Creek Treatment Facility, Feasibility Study/Preliminary Design Draft Report. Six dry weather samples collected from October to December 1993 in Ballona Creek
4. Drew Ackerman, Kenneth Schiff, Heather Trim, Mike Mullin. Characterization of Water Quality in the Los Angeles River. Sampling of storm drain outfalls into the Los Angeles River on September 10, 2000.

4.2.5 Dry Weather Runoff Management Objectives

There are three key objectives relating to dry weather runoff quality and quantity. Initially there is the National Pollution Discharge Elimination System (NPDES) permit goal, which is to reduce or eliminate non-stormwater runoff flows and to reduce pollutants entering the receiving waters, which includes reducing all dry weather flows.

Next there is the Santa Monica Bay Bacterial TMDL goal, which serves to eliminate or treat all dry weather flow entering the Santa Monica Bay. For the other receiving waters within the City, the TMDLs are not yet known. However, the City may have to achieve the same target in these other receiving waters.

Finally there is the IRP goal, which is to maximize the beneficial use of stormwater runoff. While there is no numerical target for this goal, meeting this goal will be considered when determining the alternatives for managing runoff.

These goals will be incorporated into the runoff options presented in Section 6.

4.3 Wet Weather Runoff

4.3.1 Introduction

Wet weather runoff is substantially different from dry weather runoff due to the intermittent nature and potentially large volumes that characterize wet weather conditions. The following subsections present information on wet weather runoff volumes and water quality characteristics.

4.3.2 Wet Weather Runoff Volume Estimates

4.3.2.1 Approach

Because of the high variability and intermittent nature of wet weather runoff, developing estimates of volumes is complex. For this report, multiple volume estimates have been developed to represent both the total long-term average amount of wet weather runoff that can be expected, as well as event-based estimates for specific management purposes as discussed in Section 4.3.4.

Long-term annual average runoff estimates have been used for a number of years to provide a relative indication of total volume of water that may be discharged from different watersheds and land use types, and as a step in the process of estimating relative pollutant loads to receiving waters contributed from watersheds. These are based on the relatively straight forward concept of applying a long-term average rainfall depth to drainage areas, estimating the fraction of rainfall that would become runoff based on land use characteristics, and the associated runoff coefficients. Runoff estimates can be developed based on current land use patterns. If there is expected to be a significant change in land use in the future (e.g. new development or redevelopment) that would substantially alter the overall runoff coefficient of a watershed, a corresponding revised runoff estimate can be made. Long-term volume estimates also provide an indication of the total amount of runoff that is theoretically available when considering options for capture and beneficial use of runoff.

4.3.2.2 Long-Term Average Annual Runoff Volume

The City of Los Angeles, comprised of approximately 295,000 acres (465 square miles), receives a long-term annual average rainfall of about 14.95 inches of rain per year (based on National Weather Service Data).

Annually, rainfall over the past 100 years (1900-2000) has ranged from less than 5 inches to over 30 inches, and the rainfall across the city varies from higher amounts towards the mountains and lower amounts at the coast. The City's land use, which ranges from open space to dense commercial uses, results in an overall average imperviousness of approximately 46 percent based on the 1998 Southern California Association of Governments (SCAG) land use data and impervious factors for each land use type from the City's Geographic Information System (GIS) database. Based on this imperviousness, the resulting runoff coefficient is 0.47 (using the standard calculation of: $\text{runoff coefficient} = 0.1 + 0.8 \times \text{impervious rate}$) meaning that 47 percent

of the rain in Los Angeles does not percolate into the ground, but instead flows into the storm drain system.

For purposes of runoff management planning, long-term annual average precipitation and existing land use distribution were used to calculate total runoff for each of the watersheds. The long-term average annual total wet weather runoff from land within the City jurisdiction was calculated to be 172,000 acre-feet/yr. Estimated wet weather runoff volumes are presented in Table 4-13.

Table 4-13 Estimated Wet Weather Runoff Volume						
	City of Los Angeles				Entire Watershed	
Watershed	Area ¹ (Acres)	Average Annual Rainfall ² (acre-feet/yr)	Average Annual Runoff ³ (acre-feet/yr)	Average Annual Volume (million gallons)	Area ¹ (Acres)	Average Annual Rainfall (acre-feet/yr)
Los Angeles River	185,000	230,500	108,300	35,300	533,000	664,000
Ballona Creek	67,000	83,500	39,000	12,700	84,000	104,700
Santa Monica Bay (excl. Ballona Creek)	28,000	34,900	16,300	5,300	182,000	226,700
Dominguez Channel	15,000	18,700	8,700	2,900	70,000	87,200
Increase from Total New Development by 2020 ⁴	NA	NA	2,000	NA	NA	NA
Total	295,000	367,600	174,300	56,200	869,000	1,082,600
Notes:						
¹ Areas from City of LA GIS database.						
² Rain gauge. rainfall = Area x 14.95 inches of rain per year, rainfall from National Weather Service Data, measured at LAX rain gauge.						
³ Calculation based on a runoff coefficient of 0.47, derived from the Watershed Protection Division's Pollutant Load Model.						
⁴ Total runoff reflects the assumed 2% new developments by 2020.						

The range of total wet weather volume varies greatly from year to year. As shown in Figure 4-4, based on land use data from 1998, and applying historical rainfall totals to a constant land use, total runoff volume could range from 50,000 acre-feet to over 350,000 acre-feet. Long-term average annual runoff is a viable method of estimating volume for runoff management because it establishes a parameter for comparing options and estimating beneficial use opportunities. Unlike planning for flood control, using peak volumes is inappropriate because that will establish parameters for sizing facilities that are financially prohibitive to construct and will be underutilized most of the time.

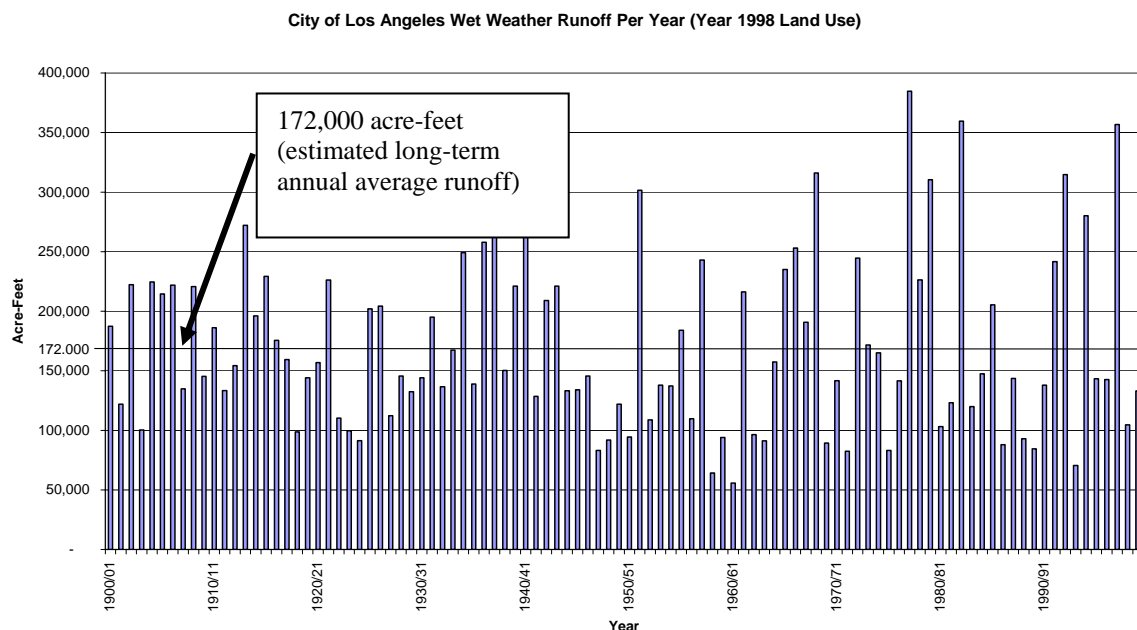


Figure 4-4
Potential Variability of City of Los Angeles Estimated Wet Weather Runoff Per Year
(Year 1998 Land Use (SCAG) and 1900-2000 rainfall (County of Los Angeles))

It is assumed that there could be approximately 2 percent additional new developments (not including redevelopments) by the year 2020. This translates to an additional 6,000 acres of developed land within the City. The increase in runoff from these 6,000 acres would be approximately 3,500 acre-feet/yr of runoff. Assuming that approximately 50 percent of the new developments would effectively incorporate on-site best management practices (BMPs) to reduce runoff volume leaving the site and entering the storm drain system, then the increase in annual runoff would be 1,750 acre-feet/yr by 2020. When added to the 172,000 acre-feet/yr of average annual runoff today, the amount would be approximately 174,000 acre-feet/yr. This was reflected in Table 4-13.

Runoff from land within the City jurisdiction, however, represents only a portion of the drainage for each of these watersheds, ranging from about 15 percent in the Santa Monica Bay Watershed to almost 80 percent of the Ballona Creek Watershed. Furthermore, in most watersheds, there is co-mingling of runoff from multiple jurisdictions and conveyed through drainage facilities owned by different jurisdictions. This includes:

- Runoff generated entirely from within the City conveyed through City-owned storm drain systems to receiving waters
- Runoff generated from within the City conveyed through storm drains or channels owned by Los Angeles County DPW or other Cities to receiving waters

- Runoff generated from outside the City conveyed through City-owned storm drains or channels to receiving waters

For the purposes of IRP planning, needs will be assessed and facility planning conducted for runoff generated from the City only. The management of runoff from outside the City is not being evaluated as part of this effort, though during implementation in some instances, they City may partner with other jurisdictions for finding the most appropriate solutions. Therefore managing runoff volumes will depend on City wide land use, but the watershed values will be defined as well.

4.3.3 Wet Weather Runoff Composition

As with dry weather runoff, wet weather runoff can contain pesticides, fertilizers, oils, trash, etc depending on the land use. The water quality data that is presented in Table Nos. 4-14 through 4-17 show the existing water quality (from 1994-2000 and also from June 2001 to July 2002) for Ballona Creek and the Los Angeles River. All of the data was obtained from the Los Angeles County Public Works Department website at <http://dpw.co.la.ca.us/wmd/npdes/>. The 1994-2000 data comes from the “Stormwater Quality Summary Data” and represents an average value over the years. The 2001-2002 water quality data comes from the Storm Water Quality Monitoring Reports and the data listed shows the range of data collected over that year.

Having the existing water quality data is beneficial for several reasons. First, though water quality at a specific site will vary from year to year, based on the given land use the water quality issues will remain consistent from year to year (e.g. though an industrial site that has a high concentration of metals in its runoff in a given year will not have that exact amount the next year, metals in the runoff will remain a constituent of concern that next year). Additionally, when determining treatment and beneficial use options, it is imperative to have existing water quality data because when the options are considered and the constituents are looked at within a sub-watershed, the pollutant load model will utilize these values as the representative water quality without any treatment, as a basis for comparison.

Table 4-14 Water Quality Data In Ballona Creek and the Los Angeles River General Chemicals and Minerals			
Parameter	Water Quality Data		
	Units	Ballona Creek (1994 – 2000 Mean)	Los Angeles River (1994 – 2000 Mean)
pH	N/A	7.3	7
hardness	mg/L	103	79
Turbidity	NTU	74	127
Sulfate (SO ₄)	mg/L	39	28
Chloride	mg/L	24	16
Total suspended solids (TSS)	mg/L	191	366
Detergents (as MBAS)	mg/L	0.1	0.05
Fluoride	mg/L	0.2	0.15
Cyanide	mg/L	S.I.D.	S.I.D.
Total dissolved solids (TDS)	mg/L	199	144
Calcium	mg/L	27	23
Magnesium	mg/L	8	5.9
Potassium	mg/L	3.2	3.7
Sodium	mg/L	20	17
Bicarbonate	mg/L	67	45
Nitrate	mg/L	4.1	4.5
Alkalinity	mg/L	63	42
Chemical Oxygen Demand (COD)	mg/L	103	79
Specific Conductance	umhos/cm	317	227
Volatile Suspended Solids (VSS)	mg/L/hr	57	66
Total Organic Carbon (TOC)	mg/L	10	10
Total Petroleum Hydrocarbons (TPH)	mg/L	2.5	2.5
Oil and Grease	mg/L	3.8	2.5
Biochemical oxygen demand (BOD)	mg/L	29	26
Notes: S.I.D. Statistically Invalid Data, not enough data. Only the constituents who had data available are listed in this table. Monitoring Locations: Ballona Creek-Stream Gage No. F38C-R between Sawtelle Blvd and Sepulveda Blvd in the City of Los Angeles; Los Angeles River: Stream Gage No. F319-R between Willow St. and Wardlow Rd. in the City of Long Beach. Source of data: LOS ANGELES COUNTY, 1994-2000 INTEGRATED, RECEIVING WATER IMPACTS REPORT, found at: http://ladpw.org/wmd/NPDES/Int_report/Tables/Table_4-5a.pdf			

Table 4-15			
Water Quality Data In Ballona Creek and the Los Angeles River			
Nutrients			
Parameter	Water Quality Data		
	Units	Ballona Creek (1994 – 2000 Mean)	Los Angeles River (1994 – 2000 Mean)
Ammonia (NH ₃)	mg/L	0.53	0.56
Nitrite-N (NO ₃)	mg/L	0.14	0.15
Dissolved Phosphorus	mg/L	0.25	0.42
Total Phosphorus	mg/L	0.36	0.62
NH ₃ -N	mg/L	0.43	0.47
Nitrate-N	mg/L	0.9	0.8
Total Kjeldahl Nitrogen (TKN)	mg/L	3.3	3.5
<p>Notes:</p> <p>Only the constituents who had data available are listed in this table.</p> <p>Monitoring Locations: Ballona Creek-Stream Gage No. F38C-R between Sawtelle Blvd and Sepulveda Blvd in the City of Los Angeles; Los Angeles River: Stream Gage No. F319-R between Willow St. and Wardlow Rd. in the City of Long Beach.</p> <p>Source of data: LOS ANGELES COUNTY, 1994-2000 INTEGRATED, RECEIVING WATER IMPACTS REPORT, found at: http://ladpw.org/wmd/NPDES/Int_report/Tables/Table_4-5a.pdf</p>			

Table 4-16			
Water Quality Data In Ballona Creek and the Los Angeles River			
Metals			
Parameter	Water Quality Data		
	Units	Ballona Creek (1994 – 2000 Mean)	Los Angeles River (1994 – 2000 Mean)
Arsenic (As)	µg/L	S.I.D.	4
Barium (Ba)	µg/L	54	106
Cadmium (Cd)	µg/L	S.I.D.	1.9
Copper (Cu)	µg/L	22	49
Lead (Pb)	µg/L	12	109
Nickel (Ni)	µg/L	6.4	14.5
Zinc (Zn)	µg/L	136	253
<p>Notes:</p> <p>S.I.D. Statistically Invalid Data, not enough data.</p> <p>Only the constituents who had data available are listed in this table.</p> <p>Monitoring Locations: Ballona Creek-Stream Gage No. F38C-R between Sawtelle Blvd and Sepulveda Blvd in the City of Los Angeles; Los Angeles River: Stream Gage No. F319-R between Willow St. and Wardlow Rd. in the City of Long Beach.</p> <p>Source of data: LOS ANGELES COUNTY, 1994-2000 INTEGRATED, RECEIVING WATER IMPACTS REPORT, found at: http://ladpw.org/wmd/NPDES/Int_report/Tables/Table_4-5a.pdf</p>			

Table 4-17 Water Quality Data In Ballona Creek and the Los Angeles River Indicator Bacteria			
Parameter	Units	Water Quality Data	
		Ballona Creek (1994 – 2000 Mean)	Los Angeles River (1994 – 2000 Mean)
Total Coliform	MPN/100 mL	1,704,131	2,213,291
Fecal Coliform	MPN/100 mL	917,648	1,477,645
Fecal Streptococcus	MPN/100 mL	531,761	757,013
Fecal Enterococcus	MPN/100 mL	433,639	358,468
Notes: Only the constituents who had data available are listed in this table. Monitoring Locations: Ballona Creek-Stream Gage No. F38C-R between Sawtelle Blvd and Sepulveda Blvd in the City of Los Angeles; Los Angeles River: Stream Gage No. F319-R between Willow St. and Wardlow Rd. in the City of Long Beach. Source of data: LOS ANGELES COUNTY, 1994-2000 INTEGRATED, RECEIVING WATER IMPACTS REPORT, found at: http://ladpw.org/wmd/NPDES/Int_report/Tables/Table_4-5a.pdf			

4.3.4 Wet Weather Runoff Management Objectives

While long-term average annual runoff calculations serve specific objectives, as noted above, event-based estimates of both hydrograph flows and event volumes are necessary for developing and evaluating options and facilities to meet specific objectives. For example, while peak flow estimates for large, infrequent storm events (e.g. 10-year, 25-year) are used for determining drainage system capacity, from a water quality perspective information on smaller, more frequent events are typically evaluated. In section 4.3.4.1, estimates are developed based on a preliminary determination of what may be required to meet the adopted wet weather bacteria TMDL, for Santa Monica Bay, and potentially other watersheds where TMDLs will be established.

A second quantitative goal for management of wet weather runoff is the IRP guiding principle of increasing the beneficial use of runoff, as discussed in Section 4.3.4.2.

A third quantitative runoff management goal applies to the sizing of treatment control or infiltration BMPs as discussed in Sub section 4.3.4.3.

4.3.4.1 TMDL Runoff Volume Estimate

The TMDL implementation requirements require the consideration of estimates of runoff from certain sized rainfall events. Currently, there are two adopted TMDLs that define numeric targets for management of wet weather runoff:

- The Trash TMDLs for Ballona Creek and the Los Angeles River that establishes a zero target for trash in receiving waters from all runoff.
- The Santa Monica Bay Wet Weather Bacterial TMDL that has set a numeric limit of 17 exceedance days for bacterial concentration at Santa Monica Bay beaches.

To meet the trash TMDL, the City will use a combination of source controls plus capture devices throughout the Los Angeles River and Ballona Creek watersheds. The City is currently working on implementing a plan to install, over the next ten years, a variety of capture devices which include approximately 45 Continuous Deflection Separators® units (detailed in Section 5), 34,000 catch basin inserts, 34,000 catch basin screens, and 50 end of pipe baskets.

Currently, the bacterial TMDL only applies to the Santa Monica Bay WMA. However, to anticipate what the potential impacts would be if the other pathogen impaired water bodies throughout the City were to be required to meet the same requirements as the Santa Monica Bay TMDL requirements, estimates of the values to be managed are developed City-wide. The following discussion details what the runoff volume would be that would need to be managed if this occurred.

Currently, the Santa Monica Bay Bacteria TMDL uses a reference system that determines an allowable number of exceedance days. The Regional Board used the 90th percentile “storm year” as the cut off point. Therefore, in 10% of the years (based on an average over time), or the “wetter years”, there will be more than the allowable number of exceedance days, after which possible penalties or enforcement actions will be taken. This is because of anti-degradation policies. So, when determining the number of exceedance days for the Santa Monica Bay, the Regional Board looked at the then current number of exceedances in each wet year. They determined, based on daily sampling, that the number was 17 exceedances, so the target is 17. In another example, Manhattan State Beach at 40th Street only has 4 exceedances currently. Therefore, its target is 4.

The City is required to meet the 17 exceedance days limit for all discharges into the Santa Monica Bay. For the other impaired water bodies, such as the Los Angeles River and Ballona Creek, the IRP assumes this same limit of 17 exceedance days in order to identify a target volume of wet weather runoff that would need to be managed City wide.

For purposes of calculating a volume of runoff to comply with the bacterial TMDL regulatory limit, rainfall data was tabulated for the past 50 years. For each year, the amount of rainfall per day was listed and arranged from highest rainfall amount to lowest rainfall amount. This rainfall data can be found in Appendix F.

The 18th largest rain day for each year was identified and listed (see Appendix F). Theoretically, in order to be in compliance, the City would have to manage the runoff only from storms equal to or smaller than the amount that fell on the 18th day. For the 50 years of rainfall data, the rainfall amount (inches of rain) for the 18th day from each

year was listed. On a preliminary basis, it was determined that 90 percent of the time, this amount was equal to or less than 0.45 inches of rain. So, if the City were to manage all storms that were 0.45 inches or smaller (any storm greater than 0.45 inches will be allowed to be discharged untreated), compliance would be achieved 90 percent of the time.

The 0.45 inch storm is assumed to be the “largest targeted storm” that needs to be managed in order to meet the Santa Monica Bay Bacterial TMDL. Since the Santa Monica Bay Bacterial TMDL is currently in effect, the City is currently conducting a separate Santa Monica Bay Bacterial TMDL Implementation Plan to manage these flows. However the IRP also discusses managing the Santa Monica Bay flows. So for the Santa Monica Bay Watershed, based on the 0.45-inch storm and the existing average imperviousness, on a watershed wide basis this rainfall amount translates to 900 acre-feet (300 million gallons) of runoff that needs to be managed per storm event for the entire watershed, and 500 acre-feet (160 million gallons) of runoff for the City’s portion.

This same approach can be applied throughout the City to other impaired water bodies. Again, the 0.45 inch storm is assumed to be the “largest targeted storm” that the City would need to manage if this Santa Monica Bay Bacterial TMDL were to be applied throughout the City, as described above. Again, though no other TMDL has yet been established, it is reasonable to assume that future TMDLs will allow for treatment of a portion of the overall runoff and not all runoff, and therefore the Santa Monica Bay Bacterial TMDL target is being used as a goal for wet weather management City wide.

The associated runoff that would result from the 0.45 inches of rain falling on all of the watersheds that drain to the City, at the existing average imperviousness, translates to approximately 11,500 acre-feet (3,800 million gallons) of total runoff, and for the City’s portion this translates to approximately 5,200 acre-feet (1,700 million gallons) of total runoff. For reference, the City’s portion (5,200 acre-feet, or 1,700 million gallons) is equal to the amount of water that would fill 15,000 Olympic sized swimming pools or 45 Rose Bowls. Due to the typical peak flow nature of storm events, analyses conducted for the TMDL showed that it is not feasible to treat or divert storm runoff at actual flow rates, and operational storage is essential. This operational storage would be required for at least a few days to allow reasonable sizing of treatment, diversion or delivery to beneficial use facilities to “work off” the storage to be ready to capture additional runoff events. This implies that up to 5,200 acre-feet (1,700 million gallons) of short-term operational storage of runoff may be required throughout the City to manage the City’s portion of the runoff only. Table 4-18 lists the volumes of runoff for the various watersheds on a watershed wide and Citywide basis.

Table 4-18		
Wet Weather Daily Quantity Management Target		
Watershed	Daily Runoff (million gallons) Per 0.45 Inch Rain Event	
	Watershed	City of Los Angeles
Los Angeles River	2,500	1,050
Ballona Creek	500	390
Santa Monica Bay	300	160
Dominguez Channel	500	100
Total	3,800	1,700
Note: Calculated data based on data presented previously in this section. Calculated data based on 0.45-inch storm (or 0.45/12-foot storm event), 0.47 runoff coefficient, and areas shown in Table 4-8.		

Based on analysis of long-term hydrologic data, the sum of rainfall (or runoff) of all storm events of 0.45 inches and less would translate to capturing and treating, diverting or reusing approximately 25 percent¹ of the overall annual average rainfall on a long-term basis, recognizing that this would vary from year to year. This is only the volume of runoff from storms of 0.45 inches and less (i.e. this volume includes no runoff from storms exceeding 0.45 inches of rain – not even the runoff from the first 0.45 inches for these storms). This is illustrated in Figure 4-5 using the downtown Los Angeles rain gage as an example. The figure shows the fraction of the total rainfall versus the daily depths. Within the City of Los Angeles, this translates to managing approximately 43,000 acre-feet per year (14,000 million gallons/yr) on a long-term average basis.

¹ Calculations can be found in Appendix C

Figure 4-5: Percent of Total Long Term Average Annual Rainfall Volume versus Daily Storm Event

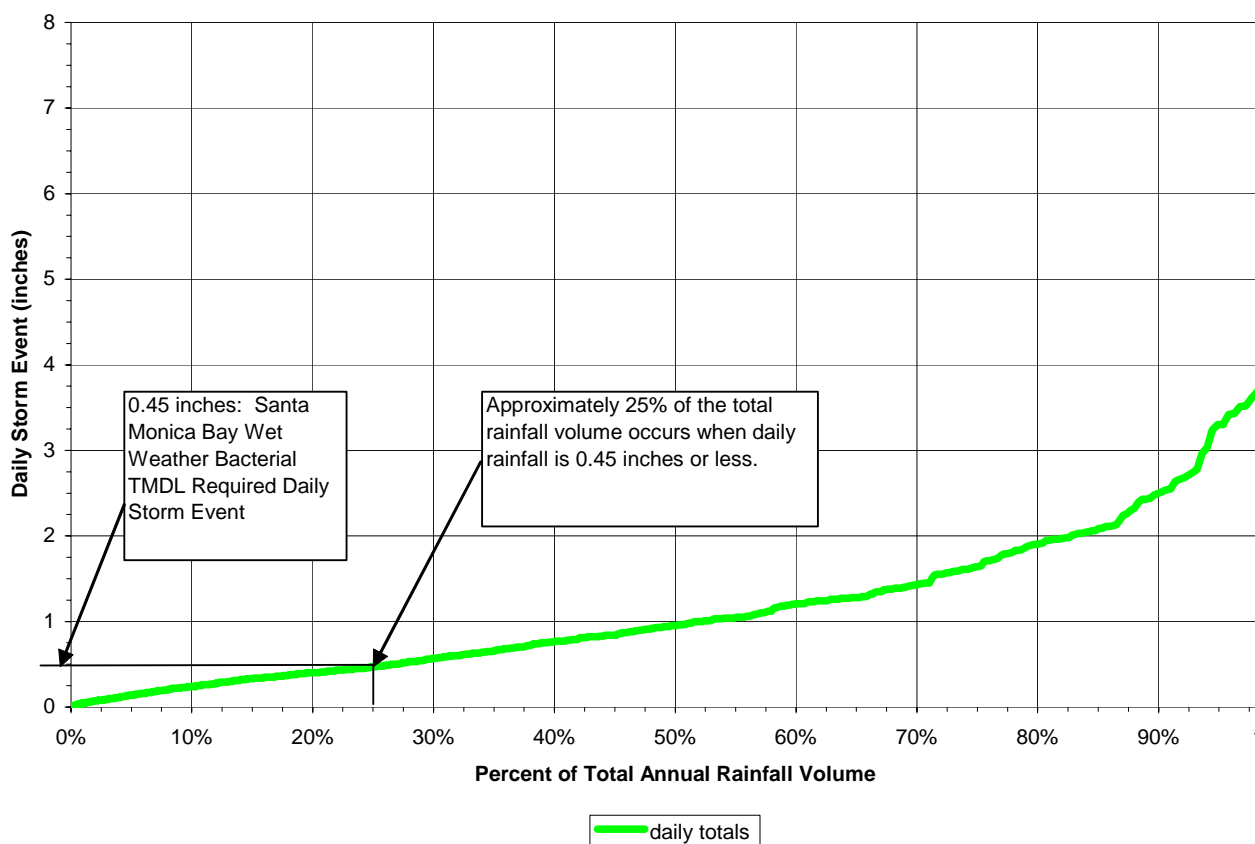


Figure 4-5
Percent of Total Long Term Average Annual Rainfall Volume Versus Daily Storm Event (note: data are based on long-term average)

4.3.4.2 IRP Beneficial Use Goal

If the only goal were to meet this TMDL requirement with the minimum operating cost, then any rainfall day or event that exceeded the target would not be diverted or treated. One of the IRP principles, however, is to maximize the beneficial use of runoff, with a goal of beneficially using 50 percent of runoff. Currently, the City of Los Angeles beneficially uses approximately 14,000 to 24,000 acre-feet per year (acre-feet/yr) (4,500 to 7,800 million gallons per year (million gallons/yr)) of runoff primarily through groundwater recharge basins in the San Fernando Valley (Los Angeles County Annual Hydrologic Reports, 1996-2001). This volume is contributed from land mostly outside of City jurisdictions (per Watermaster).

Future development and redevelopment may be able to capture some additional runoff by onsite BMPs such as cisterns and infiltration devices. Establishing a facility approach for capturing and treating runoff also allows the City if necessary to modify

or expand facilities to accommodate future TMDLs that might require the treatment of a larger volume than that required by the bacterial TMDL.

As noted previously, at least 43,000 acre-feet/yr (14,000 million gallons/yr) of runoff from within the City may require temporary capture and management just to meet TMDL requirements if a similar TMDL implementation requirement were to be applied to all watersheds. If all of this were either treated and discharged, or diverted to the sewer system following storms to meet the TMDL, no additional beneficial use would occur. However, if some or most of this could be put to beneficial use, it represents a large fraction of the maximum beneficial use goal. Unfortunately, the majority of this volume of runoff would be temporarily collected over short durations and during the wet winter months when beneficial use opportunities are limited, and the “operational storage” needs to be emptied quickly. Therefore, to increase the beneficial use of some or most of this volume, seasonal storage will be required. Conceptually, runoff would initially be captured at the local watershed or drainage area level in operational storage, and then pumped over a short period of time to empty the operational storage volume to larger, regional seasonal storage basins to be used in higher demand periods. Alternatively, where there is the ability to develop more groundwater recharge basins with the capability to infiltrate water over short periods of time following storm events, long-term reservoir storage needs can be reduced and the groundwater basin effectively becomes the long-term storage.

Furthermore, if it were possible to develop sufficient seasonal storage and use or groundwater recharge opportunities, even more long-term runoff volume up to the maximum goal of 50 percent could be captured using essentially the same local diversion and operational storage facilities as identified above to meet the TMDL. This would be accomplished by operating the diversion and capture, operational storage and transfer facilities to their maximum capacity under all runoff events, while still bypassing larger flows (resulting in an allowable exceedance day). Using an analysis analogous to the capture curves generated for the unit basin storage volume approach used for sizing treatment Best Management Practices (BMPs) to meet Standard Urban Storm Water Mitigation Plans (SUSMP) requirements, it can be shown that by using the storage basins to capture runoff from a portion of all storm events, including larger events that capture the runoff from 0.45 inches of rainfall, and drawing them down over 48 hours, over 70 percent of the long term runoff could theoretically be captured from an area of approximately 50 percent imperviousness.

4.3.4.3 New Development / Redevelopment Requirements

The SUSMP is a model guidance document for use by builders, land developers, and public agencies (including City department capital projects and others) to select post construction BMPs and to obtain municipal approval for projects that fall into specific categories (single-family hillside residences, certain commercial and residential developments, automotive repair shops, parking lots with 5,000 square feet or more or with 25 or more parking spaces, etc.) (RWQCB, 2000b). SUSMPs are intended to address storm water pollution from new development and redevelopment by the

private sector as well as equivalent public works projects. SUSMP requirements are detailed in Section 3.

An estimated 2,800 MG of runoff throughout the City can be managed annually by implementation of SUSMP requirements for new and redevelopments. Additional amounts could be managed through retrofit.

Section 5

Existing Programs and Facilities

5.1 Introduction

The City has a stormwater program managed by the Bureau of Sanitation Watershed Protection Division. The City's stormwater program addresses flood control, pollution abatement, public education, and enforcement; conducts monitoring; and applies and investigates the science behind the tools. The stormwater program provides technical expertise and guidance to all City departments, bureaus, and divisions to ensure implementation and compliance with the countywide municipal storm water National Pollution Discharge Elimination System (NPDES) permit. Furthermore, stormwater program staff prepares and transmits annual reports to the County for submittal to the Regional Water Quality Control Board (RWQCB), and is the responsible agency that certifies that the City is in compliance with all permit requirements. The City is accountable for complying with the requirements of the permit, including the development and implementation of storm water elements based on the permits model programs. This section will describe the dry and wet weather runoff management programs and facilities including: the dry weather runoff diversion program, public education programs, public agency programs, stormwater pollution prevention plans, development construction programs, and development planning programs.

5.2 Dry Weather Runoff Diversion Facilities

Studies conducted in the early 1990s revealed that urban runoff was a major source of contamination, causing water quality problems in the Santa Monica Bay. Results from an epidemiological study conducted in the mid-1990s for the Santa Monica Bay Restoration Project, at specific sites along the shoreline impacted by urban runoff, demonstrated that people who swam within 100 yards of a flowing storm drain increased their risk of becoming sick (Haile 1996).

To date, dry weather runoff discharges to the Santa Monica Bay have been the primary focus of the City's efforts. To protect human health, in the 1990s the City began evaluating the impacts of diverting to the collection system the low flows that were being discharged directly into the Santa Monica Bay. Presently, the City has identified a total of 20 drains along the coast for diversion. The locations of these drains are presented in Figure 5-1. The drainage areas associated with these drains are tributary to the Hyperion Service Area and are within the Coastal Interceptor Sewer (CIS) shed of the City's wastewater collection system. The drainage area for these drains make up most of the Urban Santa Monica Bay WMA. Currently, the City has not identified any coastal-draining low flows that are tributary to the Terminal Island Treatment Plant (TITP).

The discharges from Marina Del Rey and Ballona Creek were excluded from further study since they discharge well beyond the surf zone, i.e., 1,000 feet and 500 feet respectively from the shore. Note that though Ballona Creek's point of discharge is not included in the current programs since the discharge point does not affect the surf zone, Ballona Creek is on the 303d list for bacteria and a separate TMDL is anticipated (see Section 4) that would require that the runoff to Ballona Creek be managed.



Figure 5-1
Existing and Planned Dry Weather Runoff Diversions

A summary of drain owners and proposed diversion schedule is presented in Table 5-1. By the end of 2003, the City, County, and City of Santa Monica will have constructed 10 structures to divert dry weather urban runoff from the Santa Monica Bay and into the CIS of the City's wastewater collection system or to the Santa Monica Urban Runoff Recycling Facility (SMURRF). It is planned that all 20 structures will be operating by the year 2005.

Diversions are put into operation from April 15 to September 30 of each year. There may be rain events during this “dry period”. Currently, the City manually shuts down the pumps during these rain events. The new dry weather bacteria TMDL requires year-round diversions during non-rain events. However, the City is required to get permission from the State to implement year-round diversions, and the City is currently working on securing this approval.

While most of the diversions along the coast discharge to the CIS, two discharge to a dedicated urban runoff treatment facility. The SMURRF is adjacent to the Santa Monica Pier. Construction began April 1999 and the facility has been operating since December 2000. It is the first full-scale, dry-weather runoff recycling facility in the United States.

The SMURRF uses conventional and advanced treatment systems to process a peak flow of 500,000 gallons per day (gpd) of urban runoff generated in parts of the cities of Santa Monica and Los Angeles. The runoff water is diverted from the City's two main storm drains, the Pico-Kenter drain and the Santa Monica Pier drain. Since this facility does not include redundant equipment, the collected low flows will be routed to the CIS when it is off-line for maintenance.

The SMURRF is designed to remove pollutants such as trash, sediment, oil, grease, and pathogens. The plant treatment scheme includes the following processes:

- Coarse and fine screening to remove trash and debris
- Degritting systems to remove sand and grit
- Flow-equalization to stabilize stormwater flows to the secondary treatment process
- Dissolved Air Flotation, DAF to remove oil and grease
- Micro-filtration to remove turbidity
- Ultra-violet (UV) radiation to kill pathogens
- Provisions have been made to add reverse osmosis to meet more stringent ocean discharge or groundwater recharge requirements.

The treated water meets California's Title 22 requirements and is used for irrigation and toilet flushing in nearby commercial buildings. Landscape irrigation customers will include Caltrans highway landscaping along the Santa Monica Freeway, City of Santa Monica parks, the Woodlawn Cemetery, and school grounds. Dual-plumbed customers will include the City of Santa Monica's Public Safety Facility and the Water Garden located at Olympic and Cloverfield.

<p>Table 5-1 Implementation Schedule of Dry Weather Runoff Facilities for the Santa Monica Bay Storm Drains</p>					
Storm Drain (N to S)	Drain Owner	History	Diversion Schedule		
			2003	2004	2005
Castlerock	City	Monitor	Design/Const	Divert to HTP	Divert to HTP
Santa Ynez Canyon	County	Monitor	Monitor	Design/Const	Divert to HTP
Marquez Avenue	City	Monitor	Monitor	Design/Const	Divert to HTP
Bay Club Drive	City	Const 2001	Divert to HTP	Divert to HTP	Divert to HTP
Pulga Canyon	County	Monitor	Monitor	Design/Const	Divert to HTP
Temescal Canyon	County	Under Const	Divert to HTP	Divert to HTP	Divert to HTP
Palisades Park	City	Const 2000	Divert to HTP	Divert to HTP	Divert to HTP
Santa Monica Canyon	County	Under Const	Divert to HTP	Divert to HTP	Divert to HTP
Montana Avenue	County	Monitor	Design/Const	Divert to HTP	Divert to HTP
Wilshire Blvd	County	Monitor	Design/Const	Divert to HTP	Divert to HTP
Santa Monica Pier	Santa Monica	Const 1997	To SMURRF	To SMURRF	To SMURRF
Pico-Kenter	County	Const 1993	To SMURRF	To SMURRF	To SMURRF
Ashland Avenue	County	Const 2001	Divert to HTP	Divert to HTP	Divert to HTP
Rose Avenue ²	County	Const 1997	Divert to HTP	Divert to HTP	Divert to HTP
Thornton Avenue	City	Const 1999	Divert to HTP	Divert to HTP	Divert to HTP
Brooks Avenue ²	County	Const 2001	Divert to HTP	Divert to HTP	Divert to HTP
Venice Pavilion	City	Under Const	Divert to HTP	Divert to HTP	Divert to HTP
Playa Del Rey	County	Const 2001	Divert to HTP	Divert to HTP	Divert to HTP
North Westchester	County	Monitor	Monitor	Design/Const	Divert to HTP
Imperial Highway	County	Under Const	Divert to HTP	Divert to HTP	Divert to HTP
<p>Notes:</p> <p>1. Source of data: Bureau of Sanitation Watershed Protection Division</p> <p>2. These flows are diverted to Hyperion via the Ashland Avenue Diversion Structure.</p>					

5.3 Public Education Programs (Non-Structural BMPs)

Another existing program is the City's public education program. The Countywide Stormwater NPDES permit requires a comprehensive educational public outreach program to measurably increase the knowledge of the target audiences regarding the storm drain system, the impacts of urban runoff pollution on receiving waters, and potential solutions to implement BMPs to reduce pollution; and to change behavior by encouraging the target audiences to implement appropriate solutions. The City has developed and implemented stormwater public outreach programs for the four target audiences (General Public, Businesses, Schools, and Public Agency Employees) as outlined in the LACDPW Stormwater/Urban Runoff Public Education Program, Five-Year Public Education Plan. The City contributes \$400,000 toward the countywide public education program, and it spends over \$1 million for the City's own public education program.

The City's public education program consists of a combination of printed materials, videos, as well as presentations and performances. These include a speaker's bureau to deliver presentations on the Stormwater Program to community groups and to conduct interviews with the media; participation in community festivals and other events; a school assembly program; and the use of various media to reach a wide audience (e.g., billboards, bus ads, etc.)

This activity also includes catch basins stenciling, which the City conducted since 1993. Over 30,000 catch basins have been stenciled with the "NO DUMPING - THIS DRAINS TO OCEAN" message, shown in Figure 5-2.

The City created several posters and brochures that are applicable to specific industries. There are posted specific to industries such as the automobile repair industry and the food and restaurant industry. There are a series of pamphlets that describe storm drain protection measures. These pamphlets include:

- Auto Maintenance & Car Care
- Food Service Industry
- Fresh Concrete & Mortar Application
- General Construction & Site Supervision
- Heavy Equipment & Earthmoving Activities
- Home Repair & Remodeling
- Horse Owners & Equine Industry



Figure 5-2
Catch Basin Stencil

- Landscaping, Gardening & Pest Control
- Painting
- Pet Care
- Private Sewage Disposal Systems
- Roadwork & Paving

The City also works in partnership with many other agencies to develop and execute programs and educational materials.

5.4 Public Agency Programs

The City has prepared a “Public Agency Activities Stormwater Guide” (Guide) describing the NPDES permit requirements applicable to City activities that may have an impact on stormwater quality, organized according to the following major categories of activities performed by City staff:

- Sewage Systems Operations;
- Public Construction Activities Management;
- Vehicle Maintenance/Material Storage Facilities Management;
- Landscape and Recreational Facilities Management;
- Storm Drain Operation and Management;
- Streets and Roads Management;
- Parking Facilities Management;
- Public Industrial Activities; and
- Emergency Procedures.

In addition to listing specific NPDES permit requirements (such as catch basin cleaning and street sweeping), each section of the Guide highlights Best Management Practices (BMPs) that may be implemented to further improve the quality of stormwater and nonstormwater runoff. Over 290 copies of the Guide have been distributed to 47 City departments and agencies. Mandatory training of City employees on the Guide emphasizes the impact their daily activities can have on the quality of urban runoff.

5.4.1 Storm Water Pollution Prevention Plans (SWPPPs)

Site-specific Stormwater Pollution Prevention Plans (SWPPPs) are required to be developed and implemented for most of the City facilities that conduct the following: vehicle and equipment repairs, painting, fueling, lubrication, serve as salvage yards, serve as chemical storage facilities, have landscaping or parking facility management, or serve as temporary storage areas for waste oil. SWPPPs identify potential sources of pollution that may affect the quality of stormwater discharge from a facility and also describe and ensure the implementation of BMPs to reduce the pollutants.

Site-specific SWPPPs have been prepared for the 205 City vehicle maintenance and material storage facilities. This number represents all applicable City operating facilities as of June 1999. Employee training programs for the SWPPPs are also conducted at these facilities. The City conducts both planned and surprise audits of its facilities to assure compliance with the SWPPPs.

The Bureau of Sanitation Watershed Protection Division works with program liaisons from each department to monitor the implementation and effectiveness of the BMPs identified in SWPPPs. SWPPPs are living documents that are kept current with the activities and practices of each facility.

5.4.2 Inline Treatment

The City is installing many inline treatment units to mitigate immediate urban runoff pollution impacts. Structural Best Management Practices (BMPs) refer to any physical modification or technology implemented as part of the urban runoff management system. A number of structural BMPs have been constructed with the City.

Various technologies provide treatment within the storm drain system. These technologies generally use deflection, solids separation, or filtration devices that remove particulate matter as it enters the storm drain system, or use infiltration that promotes recharge of the local groundwater aquifer. The following technologies are being implemented by the City:

- **Rapid Sand Filter:** A below-grade reinforced concrete structure filters runoff from a 9,200-square-foot parking lot. The flow percolates through an 18-inch sand filter layer and discharges to a nearby storm drain system that, in turn, leads to Santa Monica Bay shown in Figure 5-3. The City has installed one rapid sand filter.

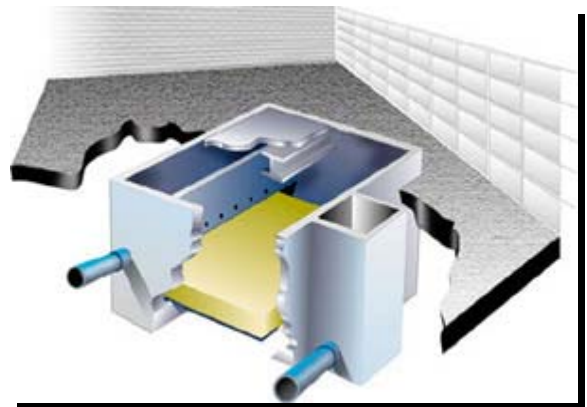


Figure 5-3
Schematic of Rapid Sand Filter

- **Catch Basin Inserts:** Catch basin inserts capture trash before it is allowed to enter the storm drain system. To date the City has installed 167 catch basin inserts to prevent trash from moving down the storm drain system. The City has conducted a pilot study on five different types of catch basin inserts containing filter media. An example is shown in Figure 5-4.



Figure 5-4
Example of Catch Basin Insert

- **Stormceptor® Units:** Stormceptor® Units are devices that capture oil, grease, hydrocarbons, and sediment. There are five Stormceptor® units currently installed in the City, and two additional units are planned for installation. Runoff flows into a grated concrete trench through pipe to the Stormceptor®. At the Stormceptor®, runoff is diverted into the treatment chamber by a weir and drop pipe arrangement. Oil, grease, and hydrocarbons are trapped at the top, sediment settles at the bottom of the chamber, and water flows into the outlet pipe. A built-in bypass feature prevents trapped contents from flushing out during intense rainstorms. Figure 5-5 shows a cutaway of a Stormceptor® unit and its flow path.



Figure 5-5
Schematic of a Stormceptor®

- **Catch Basin Trash Deflectors:** The City has installed deflectors on the opening of 638 catch basins. Trash deflectors prevent trash from entering the storm drain as shown in Figure 5-6.



Figure 5-6
Catch Basin Trash Deflector

- **Continuous Deflection Separators® (CDS):** These units capture trash and large sediments. Three demonstration units have been installed in the Coliseum, Westlake, and Downtown areas of the City. CDS units are used to capture trash and large sediment particles as shown in Figure 5-7.

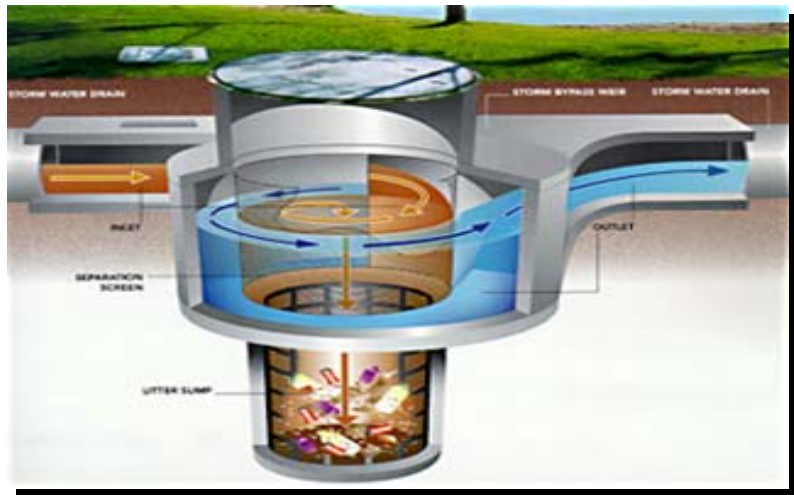


Figure 5-7
Cross Section of Continuous Deflection Separator

- The City has also installed five End-of-Pipe Trash Baskets and one Netting Trash Trap System in the City.
- Additionally, the City is interested in piloting an anti-bacteria foam study.

5.5 Development Construction Program

The Countywide NPDES permit requires that prior to the issuance of any building or grading permit, appropriate Wet Weather Erosion Control Plans (WWECPs) and SWPPPs must be prepared to include appropriate construction BMPs. These BMPs are intended to minimize the impact of construction activities, including earth disturbance, erosion, sedimentation, fertilization of new landscaping, and construction debris including wash water runoff and handling of cleaning agents and other construction materials. The WWECP is required for projects that will entail soil disturbance during the rainy season.

The City has prepared a handbook to guide private developers and contractors in the selection, design, and the application of urban runoff BMPs. City plan checking, engineering, and inspection staff has been trained in the requirements for construction activities. These requirements also apply to public projects. The City has a construction activity inspection program in place to monitor compliance with these requirements.

5.6 Development Planning Program

The Development Planning Program requires that certain new developments or redevelopments that may potentially have a significant effect on stormwater quality must comply with the Standard Urban Stormwater Mitigation Plan (SUSMP). The SUSMP identifies stormwater mitigation measures, or best management practices (BMPs), and requires that applicable BMPs be incorporated into the project design plans. SUSMP requirements are detailed in Section 3.

Section 6

Dry Weather Runoff Options

6.1 Introduction

Dry weather runoff must be managed for several reasons including managing water quality and quantity. There are National Pollutant Discharge Elimination System (NPDES) requirements, Total Maximum Daily Load (TMDL) requirements, and Standard Urban Storm Water Mitigation Plans (SUSMPs) requirements, which were discussed in detail in Section 4 of this report.

Options for managing dry weather urban runoff within the City will be discussed in this section. Options for managing wet weather runoff are discussed in Section 7. The options detailed here are the building blocks that will be used in the next step to create comprehensive runoff alternatives. Generally, an alternative will incorporate a variety of options in order to meet all of the runoff needs. Each option that is detailed in this section is not expected to exclusively manage the entire runoff volume, but rather to form a piece of the puzzle. The discussion of the alternatives can be found in Section 8.

Calculations associated with determining the volume of dry weather runoff throughout the City were detailed in Section 4. The following table summarizes the dry weather flows for each watershed.

Table 6-1			
Runoff throughout City per Watershed			
Watershed	Runoff Rate (gpd/ac)	Runoff from City (mgd)	Runoff from Entire Watershed (mgd)
Los Angeles River	190	28	59
Ballona Creek	230	16	20
Santa Monica Bay	320	10	15
Dominguez Channel	230*	4	16
Total		58	110
* For Dominguez Channel, no runoff data available, so runoff rate equal to that of Ballona Creek assumed			
Source: Calculated data. See assumptions and calculations detailed in Section 4.			

Of the 110 mgd of flow from the entire watershed, only 97 mgd of it would flow into the City. The remaining 13 mgd come from areas not within the City that do not flow onto the City. A portion of flow (8 mgd) comes from the Los Angeles River Watershed but flows to the Los Angeles River south of the City boundary. Therefore, the flow would not impact the City. The other 5 mgd is from the portion of the Santa Monica Bay Watershed that is outside the City and drains directly into the ocean. Therefore, for this discussion, the total runoff flow, watershed wide, that the City could manage equals 97 mgd.

Options for managing dry weather urban runoff include both source control measures and methods that address runoff that has entered the storm drain system. Source control has been defined in many ways with regard to urban runoff. For the IRP, source control is defined as a measure or program that reduces the volume of runoff generated and/or improves the quality of that runoff before it leaves a site and enters the storm drain system. Additionally, runoff can be managed after it enters the storm drain system by measures including diversion to the wastewater system, treatment and discharge, treatment and beneficial use, and non-urban regional recharge. The purpose of this section is to describe dry weather options to be considered in the IRP. Evaluation of these options in the context of complete alternatives will consider costs, pollutant removal, suitability and other performance measures as discussed in the Alternatives Analysis Volume and summarized in Section 8.

6.2 Source Control Options

Source control options involve reducing or eliminating dry weather urban runoff or improving the quality of that runoff at its source. There are several measures that can be taken to reduce the quantity and associated pollutants of runoff before it enters the storm drain system or the receiving waters. A detailed description of those options that have the greatest impact on dry weather urban runoff is presented here. Source control options include those that reduce the amount of flow generated, those that reduce or minimize the introduction of pollutants in dry weather flow, and options that can retain both dry and wet weather flow on site.

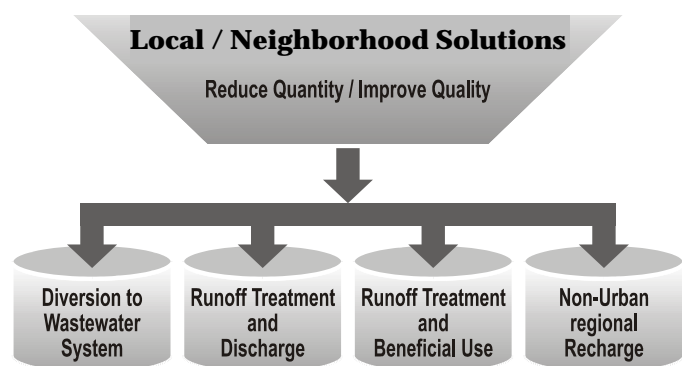


Figure 6-1
Runoff Management Options

6.2.1 Options to Reduce Flow Generated

6.2.1.1 Increase Public Education and Participation

The City's current public education programs are discussed in detail in Section 5. The City has developed and implemented stormwater public outreach programs for four target audiences (General Public, Businesses, Schools, and Public Agency Employees) as outlined in the City of Los Angeles Department of Public Works Stormwater/Urban Runoff Public Education Program, Five-Year Public Education Plan. Efforts include a speaker's bureau to deliver presentations on the Stormwater Program to community groups and to conduct interviews with the media, participation in community festivals and other events, a school assembly program, and the use of various media to reach a wide audience (e.g., billboards, bus ads, etc.), production of several industry specific posters and brochures, and stenciling of catch basins.

Continuing with these programs after the five year plan is complete, expanding the target audiences, increasing the number of industry specific brochures, and expanding the speakers groups will result in increased public education and participation. The public education program can be enhanced by also incorporating the items described below.

6.2.1.2 Smart Irrigation

As part of the City's water conservation program, the Department of Water and Power (DWP) is investigating the implementation of "Smart Irrigation" devices in residential communities in the City. "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 use, the units would also reduce or eliminate over-watering, a significant contributor to dry weather runoff. Additionally, the City is looking at constructing two weather stations in the Valley, which will allow for a more accurate reading for the devices. Currently the Smart Irrigation devices rely on signals from Glendale.

Two studies are underway in the City on Smart Irrigation, one for commercial and multi family residences, and one for single family residences. At commercial and multi family properties in the Valley, the City installed 81 devices at 52 locations (larger facilities required more than one device). Two different types of device were used. The Weather Track (Hydropoint), was installed at 46 locations with 72 installations, and the Water to Save device was installed at 6 locations with 9 installations. The devices were installed in 2002, and the study conclusions are being compiled on data taken during all of 2003. The report will be available in the summer of 2004.

The single family residential study is just beginning to be conducted as well. In February and March of 2004, 500 installations were completed at single family residences in the Valley. This study began with phone interviews, then site visits where the properties were assessed, which narrowed down the potential locations from 40,000 properties to the 500 that were selected for the study. The data on this project is in its infancy stage, therefore not available for the IRP at this point. The City will begin compiling the past as well as new data for these residences.

As no results from the City's studies were available, the IRP looked at a water conservation study that was conducted by the Irvine Ranch Water District where Evapotranspiration ET controllers for irrigation were installed. The devices were installed in low-density areas of single-family homes within the District. Based on estimates from this study (IRWD, November 2003), the device reduces the runoff by up to 70 percent.

Based on the results from the Irvine Ranch Water District Study, percent effective values for all land uses that irrigate were estimated for the City of Los Angeles. These percentages range from 5% at land uses such as commercial/institutional up to the

highest percent effective of 70% for low density single family homes (as in the Irvine Ranch Water District study).

To estimate the potential reduction in runoff by the installing ET controllers in Los Angeles, the IRP team considered only the area within the boundary of the City's jurisdiction (a total area of 295,000 acres). The total dry weather urban runoff rate for the entire city area was estimated to average 196 gallons/day/acre (see Section 4). For the purposes of the IRP, this runoff rate was multiplied by the estimated land area for each land use type resulting in estimates of the DWUR for each land use type.

To determine the probable reduction in the total runoff from each land use, the IRP team used best engineering judgment of the possible percent reduction that could be expected for each land use type, which ranged from 0 to 70 percent. These percentages were based on the nature of each land use, the typical percent of area requiring irrigation, the estimated percent of area with automatic irrigation already installed, and the findings from the IRWD study. For example, it was estimated that approximately 50 percent of the DWUR from high density residential units would be eliminated with use of smart irrigation devices, while for industrial land uses such as chemical processing plants, it was estimated that 0 percent could be reduced because due to the nature of this land use. Based on this estimate, if smart irrigation devices were installed 100 percent implementation at all applicable land use types within the City, an estimated maximum of 16 mgd of DWUR would be eliminated (see Appendix E or calculations).

As there would be inevitable situations where implementation of smart irrigation is not feasible, rather than assuming 100 percent implementation it was assumed that 70 percent implementation of a City-wide program could realistically occur. Based on these assumptions, the City's dry weather urban runoff could be reduced by 11 mgd. This is approximately 11 percent of the total targeted watershed dry weather urban runoff of 97 mgd. As this is a preliminary estimate only, additional studies would need to be conducted in order to determine the actual amount of runoff that could be reduced through the installation of smart irrigation devices in the City.

This approach could over-estimate the reduction of runoff since the number of City properties with underground irrigation systems and automatic controllers is unknown. In addition, future implementation would depend on available funding, customer acceptance, reliability, and commercial availability of smart irrigation controllers. More detailed studies would be needed to determine the full benefits of a smart irrigation program.

6.2.1.3 Washing Vehicles

Washing vehicles at designated car washes can both reduce the quantity of runoff generated as well as improve the water quality. Runoff coming from designated car washing facilities does not run off the site and into the storm drain system, but rather it is treated or diverted to the wastewater system. However, when vehicles are washed at home or in areas that are not regulated as car washes are, the runoff is

allowed to run into the storm drain system, carrying with it the cleaning solvents used to wash the vehicles, oils and grease from the vehicles, and sediments. By individuals not washing their vehicles at home, both the volume of runoff as well as this pollution is eliminated from the storm drain system. Encouraging this practice can be done by incorporating it into the public education program described above.

6.2.1.4 Sweeping Sidewalks and Driveways

One way to reduce dry weather runoff is to reduce the amount of water used to wash sidewalks and driveways. By sweeping sidewalks and driveways rather than washing them, overall runoff will be reduced proportionally. This volume of runoff would therefore be eliminated from the storm drain system. In addition, not using the amount of water required to wash sidewalks and driveways will also have the added benefit of increasing water conservation.

6.2.2 Options to Improve Quality

Improving water quality can be done through a variety of source controls. Following is a list of some ways to improve water quality on-site:

- Eliminate littering
- Pick up pet waste
- Recycle motor oil
- Provide Employee Training
- Provide Storm Drain System Stenciling & Signage
- Protect Trash Storage Areas
- Cover Outdoor Material Handling and Storage Areas
- Maintain fleet vehicles
- Repair & clean maintenance bays
- Sweep parking areas, driveways, and sidewalks
- Install clarifiers/ oil-water separators
- Maintain loading docks
- Use proper waste handling and disposal methods

6.2.3 Options to Retain or Treat Flow On-Site

Several options that are designed to provide source control of wet weather urban runoff will also impact dry weather urban runoff. They would not be used to control only dry weather runoff. These options include the following:

- Retention Grading
- Driveway Dry Well
- Bioretention Areas

The following sections will discuss the various types or source controls available for retaining or treating dry weather runoff on-site.

6.2.3.1 Retention Grading

Residential front and backyard retention grading is a "sunken garden" that holds runoff and rainwater until it can be absorbed into the ground. This type of grading works best in highly permeable soils. The depressed area can also be placed over coarse aggregate rock to achieve a higher infiltration rate. If designed accordingly and implemented City wide, these mini retention structures are capable of handling small storm event and most major storm events. During dry weather, runoff from landscape irrigation and other activities would be routed to these areas to reduce runoff volumes.

6.2.3.2 Dry Wells/Driveway Dry Well

Dry wells are a common means of storm water management in many areas of the United States. Driveway dry wells involve adding a grate at the end of the driveway. They are designed to capture and store stormwater until the water percolates into the subsurface soils, essentially acting as a small dry pond. They serve the dual purpose of retaining and cleansing runoff and rainwater, giving the water within it time to percolate into the ground rather than carrying motor oil and other pollutants into the City storm drain system. In general, dry wells are used as a localized BMP for a single site or very small drainage area.

Effective implementation of dry wells requires an understanding of drainage patterns and subsurface permeability. Dry well designs should incorporate the following:

- Types and distribution of subsurface soils
- Site usage and chemical storage
- Anticipated volume of storm water
- Permeability and storage capacity of the subsurface soils
- Drainage area feeding the dry well

- Information on historical precipitation events
- Depth and local use of groundwater
- Characteristics of the drainage surfaces (e.g. concrete, asphalt, grass, dirt)

In a small area, dry wells can help prevent excess and stagnated water in yards or turf areas, groundwater recharge, as well as storage of peak storm flows. Additionally, driveway dry wells can be installed, which involve adding a grate at the end of a driveway that captures water and directs it into a box containing sand and crushed rock.

One major concern about the use of dry wells is that, unmaintained or unmonitored installations could be a risk to groundwater quality (e.g. from illegal dumping). Specific installation requirements and monitoring could be developed to mitigate this risk. As with all the options maintenance of these installations is important to provide consistent treatment.

6.2.3.3 Bioretention Areas

Bioretention areas designed such that runoff is directed into shallow landscaped depressions. These depressions and the surrounding areas are designed to provide onsite treatment, incorporating many of the pollutant removal mechanisms that operate in forested ecosystems. They are commonly located in parking lot islands, median strips, swales, or within small pockets of residential land uses.

The bioretention area is commonly graded such that runoff is conveyed as sheet flow to the treatment area, which consists of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. Runoff passes first over or through a sand bed, which slows the runoff's velocity, distributes it evenly along the length of the ponding area, which consists of a surface organic layer and/or ground cover and the underlying planting soil. The ponding area is graded with its center depressed. Water is ponded to a depth of about six inches and gradually infiltrates the bioretention area or is evapotranspired.

The design can be modified to include an underdrain within the sand bed to collect the infiltrated water and discharge it to a downstream wastewater system. This modification is needed in areas where impervious subsoils could prevent complete infiltration in the soil system. In the case of this modification, the bioretention area would act more as a filter that discharges treated water than as an infiltration device.

Innovations in the designs of bioretention areas could include both aerobic and anaerobic zones in the treatment area. The anaerobic zone will promote denitrification.

Testing of installations has shown removal of between 93 and 98 percent of metals, between 68 and 80 percent of total Kjeldahl nitrogen, and between 70 and 83 percent

of total phosphorus. These installations could also provide as high as 90 percent removal of suspended solids and bacteria.

6.3 Diversion to Wastewater System

This option involves diverting dry weather runoff that has reached the storm drain system to the wastewater collection system for treatment at existing wastewater treatment plants. As a first step, the available capacity of the existing treatment plants was reviewed. For the year 2020, it is indicated that expansions at the treatment plants will be required to meet wastewater needs. In this section, the current design capacities and flows at the treatment plants are used for the analysis. Based on the wastewater system analysis performed independent of the runoff analysis, only Terminal Island Treatment Plant will have available capacity, in the amount of 11 mgd. Therefore, when all of the service level alternatives are analyzed together to create the integrated alternatives, consideration will be taken as to the impacts that runoff will have on the wastewater system for the year 2020 (when diversion to wastewater options are part of the alternative).

Additionally, an analysis of the collection system was performed. The sections that follow will discuss improvement requirements.

A summary of the existing flow conditions at the four treatment plants is presented in Table 6-2. It should be noted that the Burbank Water Reclamation Plant was not included in this analysis since it is not in the City's jurisdiction.

Table 6-2 Currently Available Treatment Plant Capacity				
Plant	Existing ADWF Capacity (mgd)	Current Flow (mgd)	Currently Available Capacity (mgd)	Available Capacity in 2020 (mgd)
Tillman WRP (TWRP)	64	51	13	0
Los Angeles/Glendale WRP (LAGWRP)	15	18	0	0
Hyperion Treatment Plant (HTP)	450	340	110	0
Terminal Island Treatment Plant (TITP)	30	17	13	11
Notes:				
1. City of Los Angeles Monthly Performance Report for HTP, TITP, TWRP, LAGWRP.				
2. TWRP and LAG ADWF capacity based on derated capacity.				

6.3.1 Meeting Current Requirements

The current and planned diversions along the coast meet the requirements of the Santa Monica Bay Bacteria TMDL by managing the dry weather coastal flows. Section 5.2 discusses these diversions in detail.

6.3.2 Meeting Potential Future Requirements

If the potential future TMDLs had similar requirements to the Santa Monica Bay TMDL, to meet the requirements through the diversion to wastewater option, the City may have to divert the runoff from the entire City or WMA to the wastewater system.

The City's wastewater service area is divided up into seven "sewersheds" for the purposes of managing wastewater flows to the wastewater system. Figure 3-2 presents a summary of these sheds. As this section discusses the options of diverting runoff to the wastewater system, the runoff flows are divided generally by the sewershed to which the drainage areas would most logically be tributary. Based on the tributary areas and the calculated runoff rates for each watershed (discussed in Section 4), the estimated dry weather flow potentially tributary to each sewershed was determined. A summary of the estimated dry weather urban runoff flows from each watershed to each sewershed is presented in Table 6-3, which shows both the watershed wide flows, as well as the City's portion of the runoff.

Table 6-3 Watershed and City Wide Dry Weather Runoff – Potential Diversion to Wastewater System									
Watershed	Sewershed								
	Watershed Wide Flow in mgd (City Wide Flow in mgd)								
	TWRP	VSL/FA	LAGWRP	Hyperion Metro	Hyperion Tunnel	Hyperion Coastal	TITP	Other ¹	Total
Los Angeles River	17 (15)	7(5)	6 (2)	21 (6)	--	--	--	8 (0)	59 (28)
Ballona Creek	--	--	--	14 (12)	6 (4)	--	--	--	20 (16)
Santa Monica Bay	--	--	--	--	--	10 (10)	--	5 (0)	15 (10)
Dominguez Channel	--	--	--	--	--	--	16 (4)	--	16 (4)
Total	17 (15)	7 (5)	6 (2)	35 (18)	6 (4)	10 (10)	16 (4)	13 (0)	110 (58)
Notes:									
1. Watershed flows that do flow into the City, therefore do not reach the Sewersheds.									
2. Source: Total flows calculated as shown in Section 4. Divided based on the sewershed boundaries, Figure 6-3.									

As shown, the total watershed wide flow to the sewersheds is 97 mgd (110 mgd minus 13 mgd - see Section 6-1) and the total City flow to the sewersheds equals 58 mgd.

Based on this information, the City could not manage the entire flow from the City and from the appropriate portions of the watersheds by diverting it to the wastewater system based on the current capacities at the wastewater treatment plants. Other factors involved in the diversion to wastewater system option include the collection system capacities and the facilities required to divert the runoff to the wastewater system. The City would have to install diversions at several points throughout the system as discussed below.

6.3.2.1 Runoff by Planning Shed

Runoff planning sheds, as detailed in Section 3, separate the watersheds into smaller sheds based on the natural drainage patterns. Figure 3-2 shows the runoff planning sheds and the natural collection points of runoff within each planning shed. For the diversion to wastewater option, the collection points represent the potential general locations for the diversions. Table 6-4 shows the watershed wide dry weather runoff flows to each runoff planning shed, as the facilities would need to be sized based on the entire amount of flow that would reach the plant.

Table 6-4 Dry Weather Flows at Proposed Diversion Locations					
#	WMA	Runoff Planning Shed	Watershed Wide Flow (mgd)	Closest Major Interceptor Sewer ¹	Pipe Size Required for Diverted Flow to Reach URP or WW Plant (inches)
1	Los Angeles River	Bell Creek	3		48
2	Los Angeles River	Browns Creek	3		48
3	Los Angeles River	Aliso Wash	2		78
4	Los Angeles River	Wilbur Wash	1	VORS	42
5	Los Angeles River	Limekiln Canyon	2	VORS	42
6	Los Angeles River	Caballero Canyon	1	NOS	54
7	Los Angeles River	Bull Creek	2	AVORS	90
8	Los Angeles River	Tujunga Wash	6	NOS	58
9	Los Angeles River	Pacoima Wash	7	EVIS	42
10	Los Angeles River	Arroyo Seco	5	NEIS	24
11	Los Angeles River	Los Angeles River Reach 3	4	NOS	48
12	Los Angeles River	Los Angeles River Reach 2	12	NOS	60
13	Los Angeles River	Burbank Western Channel	2	NHIS	30
14	Los Angeles River	Verdugo Wash	0	NOS	48
15	Los Angeles River	Compton Creek	3	COS	78
16	Ballona Creek	Ballona Creek	3	WHIS	54
17	Ballona Creek	Sepulveda Channel	16	NOS	126
18	Dominguez Channel	Dominguez Channel	16	CIS	NA
19	Santa Monica Bay	SMB1	10	CIS	42
20		SMB2		AVORS	196
21		SMB3		COS	NA
20	Los Angeles River & SMB	Watershed flow not reaching City	13		NA
	Total		110		NA
Notes:					
1. VORS - Valley Outfall Relief Sewer ; NOS - North Outfall Sewer; AVORS - Additional Valley Outfall Relief Sewer; NEIS - North East Interceptor Sewer ; EVIS- East Valley Interceptor Sewer ; NEIS- North East Interceptor Sewer ; NHIS- North Hollywood Interceptor Sewer; COS - Coastal Outfall Sewer ; WHIS- Wilshire-Hollywood Interceptor Sewer ; CIS- Coastal Interceptor Sewer . Refer to Wastewater Volume for maps of collections system.					
2. Source: Calculated data based on City's GIS database and runoff rates, as detailed in Section 4.					

At each of these diversion locations, the following would need to be built: temporary storage, pumping stations, diversion structures to the wastewater system or pipelines diverting the runoff directly to the treatment plant, collection piping to capture runoff prior to discharging into rivers or creeks that are 303d listed waterbodies.

6.4 Treatment and Discharge

Another option for managing dry weather urban runoff is to capture and treat the runoff and discharge it back to the intended receiving water to improve water quality. Used in conjunction with source controls, this option will meet current and future dry weather TMDLs. However, this option is not aligned with beneficial use goals, as the treated runoff is released back into receiving waters and is not put to beneficial use. Treatment requirements will depend upon the specific water quality objectives to be met for regulatory compliance.

6.4.1 Meeting Current Requirements

In meeting the current regulations by the treatment and discharge option, the City would build treatment facilities along the Santa Monica Bay to capture and treat the coastal flows only. As the 10 mgd along the coast is already being (or planned to be) diverted to the wastewater system, this is not a practical option. Note that, as discussed previously, the additional 5 mgd along the coast does not drain to the City.

6.4.2 Meeting Potential Future Requirements

If the potential future bacteria TMDLs were to result in similar implementation requirements City-wide as the Santa Monica Bacteria TMDL, and were achieved through treatment and discharge, the City would have to treat and discharge up to 87 mgd of flow (of the total 97 mgd that needs to be managed, as the 10 mgd of coastal diversions will remain, see Section 6.1). The following discusses the factors involved in locating and installing the treatment plants to treat this runoff, as well as specific treatment process needs.

For the treatment and discharge option, the same runoff planning sheds that were discussed in Section 3 (shown in Figure 3-2) are utilized, with the collection points representing the locations of the treatment facilities.

Potential types of contaminants generated in each planning shed were determined based on land use. The impaired water bodies, detailed in Section 3, are impaired for a number of constituents. Dry weather urban runoff is a significant source of several, but certainly not all, constituents. Table 6-5 details the potential contaminants that come from dry weather urban runoff from different land uses, and Table 6-6 shows the planning sheds and their estimated land use breakdown.

Table 6-5 Potential Contaminants By Land Use	
Land Use	Potential Contaminants
Commercial	Pesticides, nutrients
Industrial	Organic chemicals, heavy metals, bacteria
Multi-Family Residential	Pesticides, bacteria
Open Space/Agriculture	Pesticides, bacteria
Single Family High Density	Pesticides, bacteria
Single Family Low Density	Pesticides, bacteria
Single Family Med Density	Pesticides, bacteria
Transportation/Utilities/Mixed	Organic chemicals, heavy metals, nutrients
Water	NA

Table 6-6
Land Use by Runoff Planning Shed Within the City

Runoff Planning Shed	Single Family High Density		Single-Fam. Low Density		Multi Family		Commercial		Industrial		Transportation/Utilities Mixed		Open Space/Agriculture		Water		Unknown		Total Area of Sub-watershed
	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total	
Bell Creek	7,475	65%	460	4%	460	4%	1,150	10%	115	1%	460	4%	1,380	12%	0	0%	0	0%	11,500
Browns Creek	3,480	29%	600	5%	840	7%	0	0%	1,080	9%	1,200	10%	720	6%	4,080	34%	0	0%	12,000
Aliso Wash	5,700	60%	570	6%	380	4%	950	10%	475	5%	285	3%	1,140	12%	0	0%	0	0%	9,500
Wilbur Wash	2,000	50%	80	2%	160	4%	200	5%	120	3%	160	4%	1,280	32%	0	0%	0	0%	4,000
Limeklin Canyon	2,820	47%	180	3%	240	4%	720	12%	360	6%	240	4%	1,434	24%	6	0%	0	0%	6,000
Caballero Creek	2,420	44%	0	0%	440	8%	770	14%	110	2%	275	5%	1,485	27%	0	0%	0	0%	5,500
Bull Creek	8,505	63%	270	2%	945	7%	1,215	9%	135	1%	405	3%	1,890	14%	135	1%	0	0%	13,500
Tujunga Wash	17,532	54%	325	1%	3,250	10%	3,575	11%	1,625	5%	2,275	7%	3,900	12%	16	0%	2	0%	32,500
Pacoima Wash	10,640	38%	560	2%	1,120	4%	0	0%	1,680	6%	1,680	6%	4,200	15%	7,840	28%	280	1%	28,000
Arroyo Seco	6,304	47%	41	0%	810	6%	945	7%	675	5%	1,350	10%	3,375	25%	0	0%	1	0%	13,500
Los Angeles Riv 3	4,987	36%	139	1%	1,529	11%	1,390	10%	1,807	13%	1,390	10%	2,641	19%	4	0%	13	0%	13,900
Los Angeles Riv 2	3,378	23%	45	0%	2,100	14%	2,850	19%	2,850	19%	1,800	12%	1,950	13%	23	0%	5	0%	15,000
Burbank W.Ch	1,800	20%	450	5%	180	2%	180	2%	270	3%	450	5%	5,670	63%	0	0%	0	0%	9,000
Verdugo	308	31%	20	2%	1	0%	1	0%	60	6%	50	5%	560	56%	0	0%	0	0%	1,000
Compton Creek	4,949	49%	0	0%	1,818	18%	1,616	16%	808	8%	707	7%	202	2%	0	0%	0	0%	10,100
Ballona Creek	5,440	32%	170	1%	4,760	28%	3,400	20%	340	2%	340	2%	2,380	14%	170	1%	0	0%	17,000
Sepulveda Ch	20,835	42%	1,500	3%	7,000	14%	6,500	13%	2,000	4%	1,500	3%	10,500	21%	150	0%	15	0%	50,000
Dominguez Ch	4,466	30%	5	0%	1,950	13%	2,250	15%	3,300	22%	1,800	12%	1,050	7%	150	1%	30	0%	15,000

Source: City GIS database. Excludes Santa Monica Bay areas as these areas will be studied in detail in the separate Santa Monica Bay Bacteria TMDL project.

The flow and contaminant information from the various planning sheds and the information on the impaired water bodies that the planning sheds discharge to can be used to select appropriate BMPs and treatment facilities. Note that many inline BMPs do not provide bacteria reduction, thus BMPs alone cannot be expected to meet bacteria TMDLs.

The following list details several constituents of concern and the potentially likely requirements for meeting TMDLs for dry weather:

- Bacteria – dry weather urban runoff is a definite source; assume treatment is disinfection with appropriate pre-treatment;
- Trash – not a significant dry weather runoff issue; would be incidentally removed as pretreatment for disinfection;
- Pesticides – dry weather runoff can be a source but solutions are source control, change in use and formulations, etc.; treatment not a viable option;
- Nutrients – phosphates and detergents from car washing may be a significant source of nutrients in dry weather runoff (see Los Angeles River TMDL); continue to increase source controls;
- TCE/PCE- not in urban runoff; this is a remediation and groundwater problem;
- Selenium – not in typical urban runoff; naturally occurring, possible groundwater influence controls other regulations; and
- Other organics, toxics, PCBs, PAHs, etc. – typically not a consistent component of dry weather runoff– more related to spills, dumping, miscellaneous sources; increase control over illicit connections and illicit discharges (IC/ID) and source control; treatment not a viable option (except, for example oil skimming as pre-treatment to disinfection). Therefore, Bacteria is the primary constituent of concern for dry weather urban runoff treatment.

6.5 Treatment and Beneficial Use

For this option, treated runoff would be beneficially used rather than discharged to a receiving water (e.g. irrigation as in the Santa Monica Urban Runoff Recycling Facility (SMURRF) Project as discussed in Section 4). For dry weather flow, most of the runoff could potentially be diverted directly to beneficial use, particularly during the summer months when demands for non-potable water are high (due to the higher irrigation demands in the summertime). Treatment of the runoff before going to the beneficial use would be determined by the use.

6.5.1 Meeting Current and Future Requirements and Goals

The current regulations only require that the Santa Monica Bay runoff be managed. As these flows are diverted to the wastewater system, the requirement to manage these flows is met, however no beneficial use is achieved and the goals of the IRP are not met. If the flows were diverted to dedicated treatment facilities rather than Hyperion, the runoff would be beneficially used. If future regulations are met through the treatment and beneficial use option, the City is maximizing the beneficial use goal of the IRP. The following discussion involves managing runoff City wide through treatment and beneficial use.

6.5.1.1 Meeting Non-Potable Water Demands

One of the IRP goals is to reduce the use of potable water supplies in meeting non-potable water demands. LADWP and the City are currently expanding their use of recycled water (discussed in depth in the *Water Management Volume*) and the SMURRF project is currently on line to deliver a small amount of runoff to non-potable users in Santa Monica. The future goal of the IRP is to greatly increase runoff reuse within the City. Additionally, it is likely that future regulations will require that the City manage its runoff. Therefore, by creating facilities to beneficially use runoff, addressing the future regulations would have begun.

As stated, non-potable water demands are being assessed as a part of the recycled water planning effort for the IRP (*Volume 2: Water Management*). From a recent review of the available information, City treatment plants are currently providing recycled water to meet beneficial use (for irrigation and industrial use) of approximately 10,000 acre-ft/yr. In addition, the SMURRF project also provides approximately 0.5 mgd of runoff for reuse, which is approximately 400 acre-ft/yr (based on 270 days as SMURRF operates only during the dry season, assumed to be 9 months).

To evaluate additional potential demand for recycled water or other non-potable sources such as urban runoff, DWP's top users were analyzed. From this analysis, a large number of potential customers have been identified who could beneficially use recycled water. These users include public parks, cemeteries, golf courses, industrial, commercial, institutional, and homeowners associations. The estimate of this future demand is approximately 104,000 acre-ft/yr. This un-met recycled water demand could be partially supplied by treated runoff. The most common use of the non-potable water will be for irrigation, which means that this demand would be the highest during the dry season.

A computer modeling analysis was performed based on the recycled water demands in the City and the available dry weather runoff. The same model that was used for the recycled water analysis in *Volume 2: Water Management* was used here. It is a GIS based model written in AMLs (Arc Macro Language). The specific details on the model can be found in the *Volume 2: Water Management*.

Based on this inputted data, the model determined which of the recycled water demands could be realistically met through treated runoff. The runoff available

throughout the City is that which was shown in Table 6-4 (also see Figure 3-2), presented in previous sections of this document, totaling 97 mgd (approximately 26,000 million gallons/year). Table 6-7 identifies the amount of this runoff that could, after treatment, be used to meet the recycled water demands. Figure 6-2 identifies the demands throughout the City that could be met by using treated runoff. See the note in Table 6-7 for source of data.

Table 6-7		
Potential Non-Potable Water Demands Met with Treated Runoff		
Service Area	Total Demand Served	
	(acre-ft/year)	(million gallon/year)
Aliso Wash	1,400	460
Canoga	3,250	1,050
Reseda	2,900	950
Tujunga / Burbank	9,050	2,950
LA River Reach 3	1,100	360
Dominguez Channel	8,500	2,770
Compton Creek	1,450	470
Ballona	10,850	3,530
Verdugo Wash	100	30
LA River/Arroyo	9,600	3,130
Total	48,200	15,700
Note: Source: Calculated data based on the recycled water model developed by the Southern California Comprehensive Water Reclamation and Reuse Study (Allocation and Distribution Model (ADM), a GIS based computer model). See Water Management Volume for detail of model.		

In meeting these recycled water demands, facilities that would need to be constructed include: runoff diversion facilities, possibly with operating storage, treatment facilities (as in the Treatment and Discharge Option section above) treated to Title 22, pipeline for collection and distribution and pumping stations. Title 22 is in reference to the California Code of Regulations section pertaining to various aspects of drinking water and recycled water standards. Tertiary recycled water meeting Title 22 standards can be used for a wide variety of industrial and irrigation purposes where high-quality, non-potable water is needed, and this level of treatment would be required of these dry weather runoff treatment facilities.

Meeting the non-potable demands throughout the City can feasibly be done through the use of either recycled water or treated runoff, or more likely a combination of both. Identifying which source would best serve a given area is site specific. The areas discussed here that can be served by treated runoff may sometimes be served more logically by recycled water. Therefore, when the alternatives are determined, the IRP will integrate the two non-potable supplies to come up with one integrated solution.

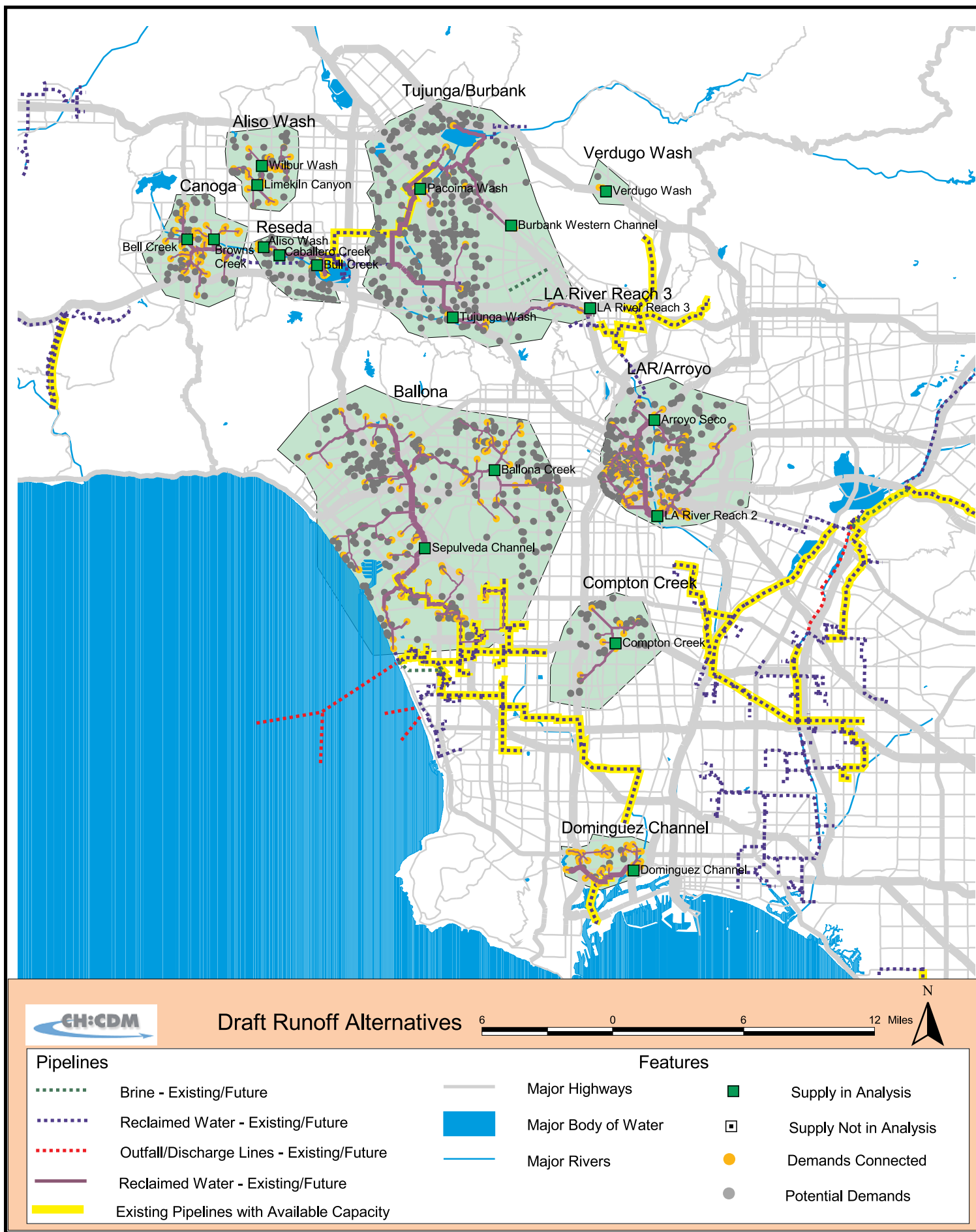


Figure 6-2
Non-Potable Demands Near Potential Runoff Treatment Locations

6.5.1.2 Supplying Water to Wetlands

Wetlands are another type of project that may be used to implement the beneficial use option. Wetlands are considered a beneficial use as they do many things to improve the community and environment, such as restore habitat, they are aesthetically pleasing, they are considered a public amenity, etc. Water is required to support wetlands, and diverting runoff to wetlands is therefore considered a beneficial use.

Current empty land space is the optimum place for constructing new wetlands, and open space and vacant land within the City will be considered as potentially suitable areas. As shown in Table 6-8, the approximate maximum acreage available is 2,700 acres.

Table 6-8 Land Use Opportunities for Wetlands within the City of Los Angeles	
Land Use	Acres
Urban Vacant	2,500
Other Open Space & Recreation	200
Total	2,700

For planning purposes, 10 percent of the open space acreage will be considered as potentially suitable for development of wetlands, or approximately 300 acres. As an example, these 300 acres could be constructed as one-hundred 3-acre wetland areas throughout the City. Typical loading rates for wetlands range from 2 to 10 cm/day (0.066 to 0.328 ft/day). The optimum loading rate depends on a variety of factors including type of wetland and flow (i.e., surface or subsurface) and would be determined on a site specific basis. Based on these values, 7,200 to 35,900 acre-ft/yr (2,350 to 11,700 MG/yr) of runoff flow could be beneficially used as wetland areas.

One concern regarding new wetlands development is the potential for the wetland to become an inland lake water body that in the future, could be listed on the 303d list as an impaired water body and would have to be treated. Another concern is that standing water in wetlands can cause a breeding of mosquitoes, which can pass on diseases such as the West Nile virus. These issues will need to be considered before implementation.

6.6 Regional Recharge

This option considers regional recharge of captured dry weather runoff to groundwater storage in basins from which the City receives water. This includes consideration of both the San Fernando Valley Basin as well as the Los Angeles Coastal Plain Basins. Regional recharge of dry weather runoff provides challenges, including concerns over water quality. As protection of groundwater quality is of paramount importance, runoff source quality, including considerations of pre-treatment, play key roles in determining options. The regional recharge option focuses on large scale projects to capture and infiltrate runoff from large areas within

the City. Subsection 6.2, Source Control Options, discusses infiltration on a small local scale basis.

It is also important to note that many of the options discussed in Subsection 7.6 for wet weather runoff apply to dry weather runoff. However, other BMPs or pre-treatment devices may need to be installed upstream of the recharge basins. The treatment method could be as simple as a trash and solids removal device or as complex as a filtration device depending on the quality of runoff. All installations would have site specific requirements.

The purpose of this section is to provide background information regarding current regional recharge operations as well as possible regional options.

6.6.1 Basin Characteristics and Potential Locations

In order to consider groundwater recharge as an option for beneficial use of runoff, appropriate locations with adequate capacity for infiltrating the runoff into local groundwater basins must be identified. Table 6-9 lists the characteristics of the groundwater basins underlying the City of Los Angeles as described in the document *Groundwater and Surface Water in Southern California, A Guide to Conjunctive Use* (Published by the Association of Groundwater Agencies).

Table 6-9				
Groundwater Basins Underlying the City of Los Angeles				
	Available Storage Capacity (acre-ft/yr)	Operational Safe yield (acre-ft/yr)	Potential to Store (acre-ft/yr)	Current Artificial Recharge (acre-ft/yr)
San Fernando Valley Basin	0 to 550,000	105,000	150,000	61,000
Los Angeles Coastal Plain Basins				
Central Basin	789,000	217,367	1,089,000	
West Coast Basin	300,000	64,468		
Santa Monica Basin	Not Available	100		
Hollywood Basin	Not Available	4,400		
Note: Source: <i>Groundwater and Surface Water in Southern California, A Guide to Conjunctive Use</i>				

As described in Table 6-9 there is a potential to store more than 1,000,000 acre-feet of groundwater with the Los Angeles Coastal Basin. However, the geology within the basin includes many disjointed clay layers, which do not easily lend themselves to infiltration. Theoretically, there are areas within the basin that could be used for regional recharge. Locating and developing these areas could require a significant effort beyond the scope of the IRP. Based on this information we are not assuming any infiltration for reuse within this basin. That being said, there may be opportunities for treatment and injection for seawater barriers.

In the San Fernando Valley Basin, west of the 405 Freeway, the soil consists of very dense clay, which would have infiltration rates much too small for an infiltration basin. On the east side of the San Fernando Valley Basin, the soil is sandy with a deep groundwater level, which is optimal for infiltration. As a point of fact, all of the existing spreading grounds within the San Fernando Valley are located in this region (see Table 6-10). Figure 6-3 identifies the areas in the City where soils are “good” for infiltration (i.e. optimal for implementing infiltration options), “fair” or “poor” for infiltration.

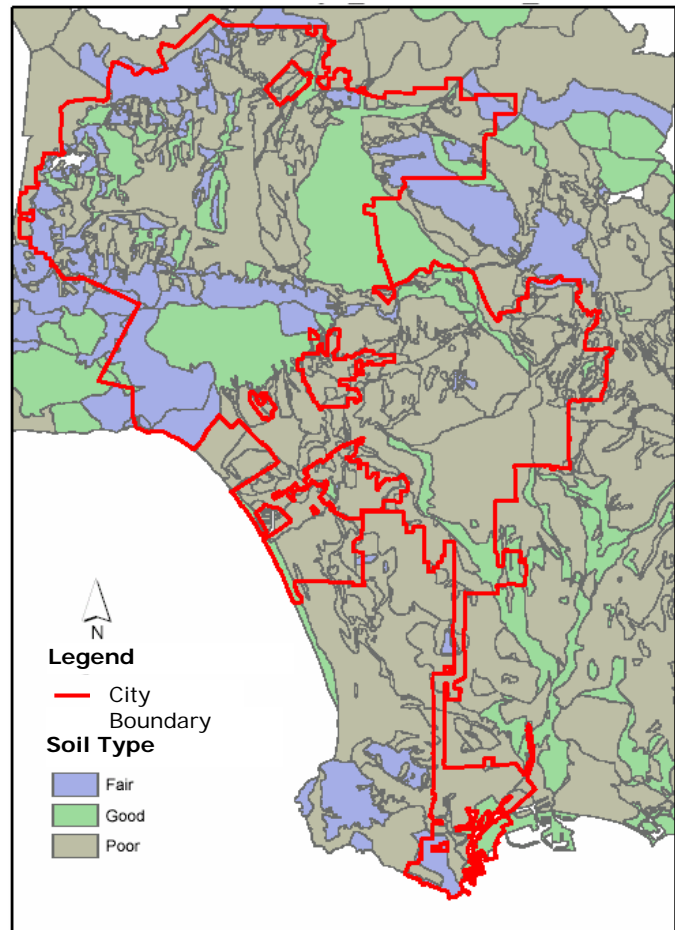


Figure 6-3
Soils Map

Table 6-10		
Spreading Grounds in the San Fernando Basin		
Spreading Grounds	Total Area [acres]	Maximum Intake Capacity [ft ³ /s]
Lopez	18	25
Pacoima	169	600
Hansen	158	400
Branford	12	1540
Tujunga	110	400
Headworks	50	70
Note: Source: Upper Los Angeles River Area Watermaster		

Based on these basin characteristics, the IRP will be primarily looking at regional recharge options within the East San Fernando Valley Basin only.

6.6.2 Options for Dry Weather Regional Recharge

6.6.2.1 Meeting Current and Future Goals

The guiding principles from the first phase of the IRP recommended that the City look to maximize the amount of dry weather urban runoff (DWUR) that is beneficially used. As an additional benefit, any DWUR that is beneficially used will reduce the quantity that is discharged to waterways and must meet the current and future TMDLs.

As stated above, there are areas within the City, regional or sub-regional, where recharge is a viable option. Regional recharge is generally a viable option for managing wet weather runoff. However, if the facilities were in place to manage wet weather runoff, the same facilities could be used for dry weather runoff as well. Section 7 of this document further discusses the regional recharge option.

Current regulations require the City to manage only Coastal flows. As stated above, the Coastal Basin does not lend itself to significant infiltration as an option. Therefore, regional recharge is not a feasible option for managing dry weather runoff along the coast.

6.6.3 Considerations for Regional Recharge

The regional recharge option includes using existing regional spreading grounds such as Hansen, Pacoima, or a new constructed facility. Discussions with DWP has determined several challenges to this use including the following:

- The capacity of the current operating spreading grounds are already being used during storm events and, depending upon the amount of rainfall during a particular year that is stored upstream of the spreading grounds, this can extend well into the summer months. Therefore, seasonal storage would be required.
- While there are some possibilities for new spreading grounds at several gravel pits within the San Fernando Valley Basin (Boulevard and Sheldon) the general configuration of a gravel pit does not allow for upstream sediment removal and as a result it could be prone to plugging. It is actually more likely that these pits could provide a better use as seasonal storage. If necessary, pretreatment facilities could be located adjacent to the site and the treated water pumped to spreading grounds. However, a problem with this option is that the pits are getting close to the groundwater table and could require lining before they could be used.
- Currently, the spreading grounds collect and infiltrate some of the best quality runoff. In order to protect groundwater and the spreading grounds' integrity, either runoff of a comparable quality would have to be identified or pretreatment measures (including monitoring) would be needed. Some comparable areas have been identified that could be of comparable quality in the northwestern San Fernando Valley. However, to use this water, it would need to be captured, stored and pumped to the spreading grounds.

It is important to note that the LADPW is responsible for operation of the spreading grounds and that the items discussed above will need to be coordinated with them, so as not to overlap other future plans for these sites.

The second basic strategy is infiltration using community/neighborhood size infiltration basins, which could be located under parks, parking lots, etc. The primary advantage in using these systems is that they will help prevent the runoff from ever entering the storm drains or channels. The disadvantage is that are important considerations that must be made in locating and designing these systems, many of which are site specific. Some of the key considerations include:

- Soil characteristics and infiltration capacity
- Source water quality (some areas may require significant treatment)
- Maintenance and oversight of individual user systems
- Source water and groundwater monitoring

As these considerations vary from site to site, a protocol, including limitations, would need to be developed in order to use these systems throughout the City.

Another issue that may affect the viability of some infiltration options is the liability/risk associated with unknown contaminants. Should the water being infiltrated at some point in the future be determined as contributing to the degradation of the groundwater basin, this could leave the City liable for cleanup costs.

Section 7

Wet Weather Runoff Options

7.1 Introduction

Discharges from the storm drainage system occur during and after rainfall events, throughout the watersheds, that are large enough to produce runoff. Wet weather runoff must be managed for several reasons including managing water quality and quantity. There are National Pollutant Discharge Elimination System (NPDES) requirements, Total Maximum Daily Load (TMDL) requirements, and Standard Urban Storm Water Mitigation Plans (SUSMPs) requirements, which were discussed in detail in Section 4 of this report.

Options for managing wet weather urban runoff within the City will be discussed in this section. Options for managing dry weather runoff were discussed in Section 6. The options detailed here are the building blocks that will be used in the next step to create comprehensive runoff alternatives. Generally, an alternative will incorporate a variety of options in order to meet all of the runoff needs. Each option that is detailed in this section is not expected to exclusively manage the entire runoff volume, but rather to form a piece of the puzzle. The discussion of the alternatives can be found in Section 8.

Figure 7-1 illustrates the types of options for managing wet weather runoff that will be considered for the IRP. Source control has been defined in many ways with regard to urban runoff. For this study, source control will be defined as any activity that reduces runoff volume and/or improves the runoff quality that flows into the storm

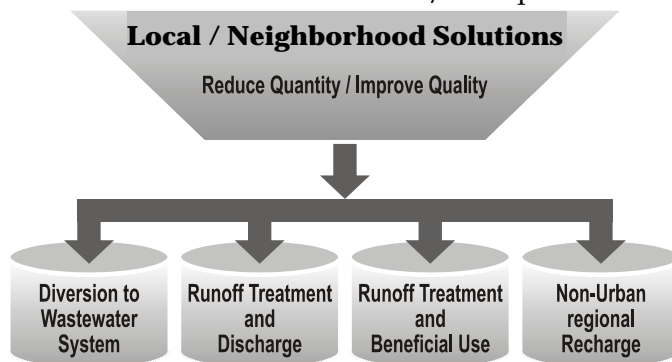


Figure 7-1
Runoff Management Options

drain system. Alternatively, runoff can be managed after it enters the stormwater collection system. The options identified for managing runoff include diversion to the wastewater collection system, treatment and discharge, treatment and beneficial use, and regional recharge. Regulatory considerations for developing these options are discussed in Subsection 7.2. Detailed discussion about each option is presented in Subsections 7.3 through 7.7.

7.2 Regulatory Considerations

The regulatory considerations that were identified for analyzing the options for managing wet weather runoff include the following:

- The Los Angeles County NPDES Stormwater Permit including Standard Urban Storm Water Mitigation Plans
- Santa Monica Bay Bacteria TMDL
- Potential Future TMDLs

7.2.1 Stormwater Permit and Standard Urban Storm Water Mitigation Plans

The City's Stormwater Program is managed by the Department of Public Works, Bureau of Sanitation, Watershed Protection Division; but extends over many City departments and bureaus. Watershed Protection Division staff are responsible for a variety of support activities and act as technical advisors to other City Departments, outside agencies and the public on the use of Best Management Practices (BMPs). These activities include the identification, analysis and testing of potential BMPs for City use. Critical factors such as cost, pollutant removal, suitability of location, ease of implementation and maintenance are considered to evaluate the effectiveness of the BMPs before implementation.

As discussed in Section 5, the City is implementing a number of programs to comply with the county wide municipal stormwater permit that addresses wet weather runoff management. These include source control measures such as public education, public agency programs, and stormwater pollution prevention plans and the development construction program. The City also carries out a development planning program that requires certain new development and redevelopment projects to comply with SUSMP provisions.

Standard Urban Storm Water Mitigation Plans (SUSMPs) are intended to address storm water pollution from new development and redevelopment by the private sector as well as equivalent public works projects. A detailed discussion of the SUSMPs can be found in Section 5 of this document.

The City recently revised its New Development BMP program as presented in their *Development Best Management Practices Handbook* (DPW BOS, 2002). A summary of the current BMP system for source control follows:

- S-1 - Housekeeping Practice
- S-2 - Public Education/Participation
- S-3 - Employee Training
- S-4 - Conserve Natural Areas/Vegetation Controls
- S-5 - Protect Slopes and Channels
- S-6 - Provide Storm Drain System, Stenciling and Signage

- S-7 – Trash Storage Areas
- S-8 – Outdoor Material Handling and Storage Areas
- S-9 – Loading/Unloading Dock Areas
- S-10 – Waste handling and Disposal
- S-11 – Vehicle Fleet Maintenance
- S-12 – Repair/Maintenance Bays
- S-13 – Parking Areas
- S-14 – Provide Proof of Ongoing BMP Maintenance

In addition, the City identified the following Treatment Control BMPs that will reduce runoff volumes and improve runoff quality prior to entering the stormwater collection system:

- T-1 – Catch Basin Inserts
- T-2 – Catch Basin Screens
- T-3 – Infiltration Trench
- T-4 – Infiltration Basin
- T-5 – Extended/Dry Retention Basins
- T-6 – Wet Pond
- T-7 – Dry Well
- T-8 – Cisterns
- T-9 – Vegetated Swales and Strips
- T-10 – Constructed Wetlands
- T-11 – Biofilters
- T-12 – Continuous Separation Systems
- T-13 – Vortex/Hydrodynamic Systems
- T-14 – Media Filtration
- T-15 – On-line Filtrations Systems
- T-16 – Clarifiers/Oil-Water Separation
- T-17 – Primary Wastewater Treatment
- T-18 – Rain Diversion System

Also as indicated in Subsection 5.4.2, the City has been implementing a number of inline BMPs to mitigate wet weather urban runoff pollution.

7.2.2 Santa Monica Bay Wet Weather Bacteria TMDL

The Santa Monica Bay Bacteria TMDL was discussed in detail in Section 4 of this report. It is the current TMDL that is being used as a guiding point for making assumptions as to what a Citywide TMDL implementation could be in the near future.

7.2.3 Runoff Management Requirements

The following sections of this report will discuss the options for managing wet weather runoff. Each option will discuss two scenarios: 1) meeting only the current coastal regulation (Santa Monica Bay Bacteria TMDL), and 2) meeting potential future regulations, as discussed in Section 4, assuming that the same requirements of the

Santa Monica Bay Bacteria TMDL were to be applied to impaired water bodies City wide.

7.2.3.1 Current Requirements

Applying the same wet weather runoff principles discussed in Section 4.3 of this report, the total volume of wet weather runoff from the Santa Monica Bay watershed is estimated as 160 million gallons in one event, for the a storm event of 0.45 inches and a runoff coefficient of 0.47 (refer to Section 4.3). This is an estimate of the volume of runoff that would need to be managed in order to meet the current regulations only. Some of this volume could be managed through on-site or localized source control measures that retain wet weather runoff and reduce the volume that enters the storm drain systems. The rest would need to be temporarily captured and either diverted to the wastewater system, treated and discharged or retained for beneficial use.

7.2.3.2 Potential Future Requirements

In anticipating potential regulations for wet weather runoff, the planning assumption used is to assume that similar implementation requirements to the current Santa Monica Bay TMDLs would affect the rest of the City, as was discussed in Section 4. If these requirements were to be implemented, the City would potentially need to manage up to 5,200 acre-feet (1,700 million gallons) of runoff per event. Managing a rain day of 0.45 inches or less amounts to about 43,000 acre-feet/yr of runoff as discussed in Section 4. Issues associated with meeting the potential future requirements are discussed for each of the runoff management options detailed below.

7.3 Source Control Options

As shown in Figure 7-1, source control is an important first step in managing wet weather runoff. Source control involves reducing or eliminating wet weather runoff and/or changing site conditions to improve runoff quality at its source. There are several BMPs available for reducing urban runoff volumes and improving its water quality. A summary of these BMPs is provided below. A more detailed description of those BMP that have the greatest impact on wet weather urban runoff is then presented in the following sections.

7.3.1 Overview of Source Control BMPs

The City recently revised its BMP program as presented in their Development Best Management Practices Handbook (DPW BOS, 2002). As described above, the handbook identifies 14 BMPs that provide source control. These can be applicable to both new development and as retrofit on existing properties. Source Control BMPs generally consist of efforts such as education and implementation of “good housekeeping” practices for individuals, businesses, and industry. It may also include industrial process changes to minimize waste production. Enforcement activities to prevent illegal discharges and connections and ensure industrial discharge permit compliance would also be considered non-structural BMPs.

The City addresses BMPs through the following NPDES model programs (see Section 5 for additional information and photos):

- Catch basin stenciling program
- Catch basin cleaning
- Ballona Creek Illicit Connection Monitoring
- Filtration / Infiltration Rapid Sand Filter
- Catch Basin Insert
- Stormceptor System
- Low Flow Diversion
- Continues Deflection Separator

In addition, the City identified several Treatment Control BMPs in the development BMP Handbook that will reduce runoff volumes and improve runoff quality prior to entering the storm water collection system. Of these, three options have been identified as providing source control at the individual lot level: rain barrels/cisterns, infiltration using porous pavement, and infiltration trenches. These options are described in this section. These options will be analyzed for source control on residential lots throughout the watershed. Rain barrels and cisterns as source control for other types of land uses were not analyzed because of limited data available, however their use City wide could be possible for many additional land uses.

The information presented here is based on information presented in the City's BMP Manual, information presented by the TreePeople organization (www.treepeople.org), and information presented by the Low Impact Development Center (www.lowimpactdevelopment.org).

7.3.2 Rain Barrels and Cisterns

Rain barrels and cisterns are low-cost water conservation devices that can be used to reduce runoff volume and, for smaller storm events, delay and reduce the peak runoff flow rates. They store and divert runoff from impervious roof areas. This stored runoff can provide a source of chemically untreated 'soft water' for gardens and compost, free of most sediment and dissolved salts. Because residential irrigation can account for up to 40 percent of domestic water consumption (per LA DWP Water Recycling Group Data), water conservation measures such as rain barrels can be used to reduce the demand on the municipal water system, especially during the hot summer months.

Individual cisterns can be located beneath each downspout, or the desired storage volume can be provided in one large, common cistern that collects rainwater from

several sources. Pre-manufactured residential-use cisterns come in sizes ranging from 100 to 1,400 gallons. Cisterns designed for more than just supplemental use, for full time domestic use, should be sized based upon a minimum of 30 gallons per day per person when considering all potential domestic water uses and should be associated with the proper treatment prior to use.

Using rain barrels and cisterns in urban and suburban areas is being encouraged in a number of jurisdictions across North America. In the City of Toronto, Canada a citywide Rain Barrel Program was initiated in 1996 in which the residents have access to free downspout disconnection by a City contractor. City residents, while not offered any direct financial incentives, are educated on the economic and environmental advantages rain barrels and downspout disconnection will have for them, such as helping to keep the beaches of Lake Ontario clean.

7.3.2.1 Analysis of Cistern Option

The cistern analysis consisted of estimating the potential runoff volume reduction and potable water savings by irrigating residential landscaping with captured storm water for cistern systems ranging in size from 60 to 10,000 gallons. In addition, the size of a system to capture and use all of the captured rainwater over a selected 11-year historical rainfall period was determined. The following data and assumptions were used in this analysis (Appendix E for more detailed information):

- Flow projections presented in the DWP 2000 UWMP were used to estimate the average potable water usage for single-family residential (SFR) and multi-family residential (MFR) households in Los Angeles. The average potable water demand in the year 2000 was found to be 389 gallons/day/residence for SFR and 234 gallons/day/residence for MFR.
- Literature on typical outdoor water usage data was reviewed to estimate the average irrigation demand for single and multiple family residences in the City of Los Angeles (Vickers, 2001 and AWWA, 1995). The average irrigation demand was estimated to be 135 gallons/day/residence for SFR (35 percent of total usage), 50 gallons/day/residence for MFR with 2 to 4 units in the building (20 percent of total usage) and 25 gallons/day/residence for MFR with 2 to 4 units in the building (10 percent of total usage).
- Data from the California Department of Finance was downloaded regarding the current number of SFR (612,557) and MFR (725,097) in the City of Los Angeles. It was assumed that buildings with 2 to 4 units have an average of 3 units, building with more than 5 units have an average of 10 units, and mobile home parks have an average of 25 units. These assumptions were used to estimate an average of 7.1 units per MFR building and that the average irrigation demand is 250 gallons/day/building.
- Data from the City GIS database was used regarding areas and runoff coefficients for land use types in the City of Los Angeles. It was found that SFR occupy a total of 123,103 acres of the City and have a weighted average runoff coefficient of 0.43.

It was found that MFR occupy a total of 28,928 acres of the City and have a weighted average runoff coefficient of 0.70. See Appendix E, Table E-1.

- These data were used to calculate that the average SFR lot has an area of 8,755 square feet (0.20 acres) and that 3,590 square feet of it are impervious. This lot size includes roadways and sidewalks. It was estimated that 7,225 square feet of this area is the residential lot (85 feet by 85 feet or 0.17 acres). It was estimated that the average roof shadow area is 2,000 square feet and the average driveway area is 400 square feet.
- These data were used to calculate that the average MFR lot has an area of 12,300 square feet (0.28 acres) and that 9,240 square feet of it are impervious. This lot size includes roadways and sidewalks. It was estimated that 10,000 square feet of this area is the residential lot (100 feet by 100 feet or 0.23 acres). It was estimated that the average roof shadow area is 5,000 square feet and the average parking area is 2,340 square feet.
- Rainfall data from January 1990 to December 2001 at the Los Angeles International Airport rainfall gauge was used to develop a model of the rainfall and resulting irrigation opportunities in the city. There were 658 rainfall events during this period. Of these events, 375 were very small (0.00 to 0.1 inches in total rainfall) and were eliminated from the data. The largest storm had a total rainfall of 3.5 inches and occurred January 3, 1955. Per information from TreePeople and generally accepted formulas for converting the amount of impervious area to a runoff coefficient, it was assumed that 90 percent of the rainfall on a rooftop could be captured as runoff. It was assumed that irrigation would be stopped 1 day before a rainfall event with total rainfall greater than 0.1 inches and would be initiated 2 days after the event.
- It was assumed that collecting runoff from sources other than rooftops would not be used as a method source control. Other sources (e.g., driveways) were assumed to be of variable quality. Other land use types may use cisterns but would require offsite use of the collected water and would therefore not be considered source control.
- It was assumed that water would be used for irrigation only. Based on this assumption, treatment of the collected water would not be required.
- It was assumed that the cisterns would not be emptied other than through irrigation. If the cisterns were full, collected runoff would be discharged to the stormwater collection system.

Based on these data and assumptions, the amount of water that could be collected and irrigated on SFR and MFR was estimated. An example of this analysis for a 1,000-gallon cistern at a SFR is presented in Appendix E, Table E-2. Of the 283 storms during the 11-year study period, the cistern was full 102 times before the storm began and thus provided no reduction in the runoff to the stormwater collection system.

Over the study period, 189,100 gallons of water would be collected on the roof for one lot and 75,900 gallons would be irrigated. The remaining runoff would be discharged to the stormwater collection system.

The estimated amount of water irrigated for each cistern capacity for the prototypic SFR and MFR are summarized in Appendix E, Table E-3. For this study, the cost per acre-foot of water irrigated was calculated to determine the most cost effective cistern capacity. It was determined that 1,000 gallon cisterns would be the most cost effective size to store runoff from rooftops for SFR and MFR if the system had a 10-year service life.

The effect of installing cisterns on all residences in the City on runoff from the design storm (0.45 inches) was also analyzed. A summary of this analysis is presented in Appendix E, Table E-4. Of the estimated 1,700 million gallons of runoff from a 0.45-inch storm, approximately 440 million gallons could be captured in cisterns, assuming 1,000-gallon cisterns are installed to capture runoff from the roofs of all single and multi-family residences. While this provides a substantial amount of water conservation and can significantly reduce the amount of runoff to be managed in the storm drain system, it is not a reliable method by itself for meeting TMDL requirements since the cisterns may be full at the start of the storm.

7.3.3 Porous Pavement

Areas such as roadways, driveways, and parking areas covered with impermeable pavement are one of the largest contributors to wet weather urban runoff. Porous pavement is a special type of material used to allow water to pass through while being strong enough to support vehicular traffic.

Concrete block pavements have been available for many years and have been used primarily as aesthetic treatments to parking areas and low volume roadways. In the last 20 years, high-density plastic grids have also entered the market place. There are many configurations and applications that have been developed for each of these materials. Most of the systems are supported by a stone base that has large pore spaces. This base acts both as pavement support and as a reservoir to store water so that it can be infiltrated, if the soil conditions allow, or detained and slowly released to the storm drain system. Supplemental storage facilities, such as underground vaults or drainage blankets, can be used in conjunction with these systems. Each pavement type is generally described below.

- **Porous Concrete:** This pavement has stable air pockets encased within it that allow water to drain uniformly through into the ground below, where it can be naturally filtered. The material becomes stronger and more stable when it gets wet, so it does not deteriorate as fast as other paving materials. Its use should be restricted to parking lots and local roads since it supports lighter loads than standard concrete. Since it is cement based, it will not release harmful chemicals into the environment such as with oil-based asphalt. It has been in use throughout Europe for about the last fifty years, and a domestic formula known as the Portland Cement Pervious

Pavement has been used successfully since the 1970s in the U.S., particularly in Florida. The pavement is a special blend of Portland cement, sand-free coarse aggregate rock, and water.

- **Grass Pavers:** Plastic rings in a flexible grid system are placed on a base of blended sand, gravel and topsoil, then filled with a topsoil such as sandy loam and planted with vegetation. This pavement gives designers a turfgrass alternative to asphalt or concrete for such low-traffic areas as firelanes, overflow and event parking, golf cart paths, residential driveways, and maintenance and utility access lanes. The support base and the rings' walls prevent soil compaction and reduce rutting and erosion by supporting the weight of traffic and concentrated loads, while the large void spaces in the rings allow a strong root network to develop. The end result is a load-bearing surface covered with natural grass and which is typically around 90 percent pervious, allowing for stormwater pollution filtration and treatment. Ancillary benefits include airborne dust capture and reductions in the urban heat island effect. Most manufacturers also produce the paver rings from post-consumer recycled plastic materials.
- **Gravel Pavers:** This pavement option is intended for high frequency, low speed traffic areas. The same ring structure as with the grass paver is used, but the voids in the rings are filled with gravel in order to provide greater load bearing support for unlimited traffic volumes and/or parking durations. Manufacturers provide specifications on the sieve analysis that should be used to generate the clean gravel fill for the rings, and a geotextile fabric is used to prevent the gravel infill from migrating to the soil subbase. Gravel pavers can be used for automobile and truck storage yards, high-throughput parking lots, service and access areas, loading docks, boat ramps, and outdoor bulk storage areas.
- **Interlocking Concrete Paving Blocks:** The unique shape of these interlocking precast units leaves drainage openings that typically comprise approximately 10 percent of the paver surface area. When properly filled with permeable material, the voids allow for drainage of stormwater through the pavement surface into the layers below. The system is a highly durable, yet permeable pavement capable of supporting heavier vehicular loads than grass or gravel pavers and offering the most flexibility in widespread application. Interlocking concrete paving blocks are resistant to heavy loads, easy to repair, require little maintenance, and are of high quality. These systems also have the highest materials and construction costs.
- **Pervious crushed stone:** The TreePeople design team suggested that parking stalls could be covered with a pervious crushed stone. The pervious stone surface would allow stormwater and auto-related contaminants to be absorbed and trapped in the soils below at safe concentrations.

Regional environmental factors, such as the amount, intensity, and frequency of rainfall and the local soil's permeability, will determine the ability of the paver system to pass stormwater easily through its top layers and then store and release the water

in a timely manner into the underlying soil. Whether or not runoff will be generated from the paver for a given storm will depend on the paver ratio of open to impervious spaces, the storm precipitation rate, the surface slope and the storage capacity in the base layer below. The depth of this storage layer is dictated by the structural considerations, while the void space in the layer is a function of the stone fill. The system should be designed to infiltrate the design storm and then complete release of the water within at least 48 hours (24 hours is recommended). If the in-situ soil does not allow for release within 48 hours, the site is not suitable for the use of permeable pavers. Possible modifications to the system, however, include the use of an overflow drainage pipe for low permeability subgrades and / or for storms exceeding the design storm. Systems can also be designed to drain water away from the pavement to more pervious layers that can accommodate the inflow, to storage areas that allow for slow infiltration, or to a pipe for discharge as filtered stormwater. In situations with a discharge pipe, infiltration does not occur, but the system is used to enhance storage, reduce peak runoff rates and filter pollutants.

7.3.4 Retention Grading

Residential front and backyard retention grading is a "sunken garden" that holds runoff and rainwater until it can be absorbed into the ground. This type of grading works best in highly permeable soils (Los Angeles type 2 and 3). These mini retention structures are capable of handling a flash flood that could occur during a 100-year storm event. During a more intense storm, excess rainwater would flow into the existing storm drain system. The depressed area can also be placed over coarse aggregate rock to achieve a higher infiltration rate.

7.3.5 Driveway Dry Well

Dry wells (also known as French Drains) are a common means of storm water management in many areas of the United States. Driveway dry wells involve adding a grate at the end of the driveway. They are designed to capture and store stormwater until the water percolates into the subsurface soils, essentially acting as a small dry pond. They serve the dual purpose of retaining and cleansing runoff and rainwater, giving the water within it time to percolate into the ground rather than carrying motor oil and other pollutants into the City storm drain system. In general, dry wells are used as a localized BMP for a single site or very small drainage area.

Effective implementation of dry wells requires an understanding of drainage patterns and subsurface permeability. Dry well designs should incorporate the following:

- Types and distribution of subsurface soils
- Site usage and chemical storage
- Anticipated volume of storm water
- Permeability and storage capacity of the subsurface soils

- Drainage area feeding the dry well
- Information on historical precipitation events
- Depth and local use of groundwater
- Characteristics of the drainage surfaces (e.g. concrete, asphalt, grass, dirt)

In a small area, dry wells can help prevent excess and stagnated water in yards or turf areas, groundwater recharge, as well as storage of peak storm flows. Additionally, driveway dry wells can be installed, which involve adding a grate at the end of a driveway that captures water and directs it into a box containing sand and crushed rock.

One major concern about the use of dry wells is that unmaintained or unmonitored installations could be a risk to groundwater quality, for example: illegal dumping. Specific installation requirements and monitoring could be developed to mitigate this risk. As with all the options maintenance of these installations is important to provide consistent treatment.

7.3.6 Bioretention Areas

Bioretention areas are an option in which runoff is directed into shallow landscaped depressions. These depressions and the surrounding areas are designed to provide onsite treatment, incorporating many of the pollutant removal mechanisms that operate in forested ecosystems. They are commonly located in parking lot islands, median strips, swales or within small pockets of residential land uses.

The bioretention area is commonly graded so that excess is conveyed as sheet flow to the treatment area, which consists of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. Runoff passes first over or through a sand bed, which slows the runoff's velocity, distributes it evenly along the length of the ponding area, which consists of a surface organic layer and/or ground cover and the underlying planting soil. The ponding area is graded, its center depressed. Water is ponded to a depth of about six inches and gradually infiltrates the bioretention area or is evapotranspired.

The design can be modified to include an underdrain within the sand bed to collect the infiltrated water and discharge it to a downstream wastewater system. This modification is needed in areas where impervious subsoils could prevent complete infiltration in the soil system. In the case of this modification, the bioretention area would act more as a filter that discharges treated water than as an infiltration device.

Innovations in the designs of bioretention areas could include both aerobic and anaerobic zones in the treatment area. The anaerobic zone will promote denitrification.

Testing of installations has shown removal of between 93 and 98 percent of metals, between 68 and 80 percent of total Kjeldahl nitrogen, and between 70 and 83 percent of total phosphorus. These installations could also provide as high as 90 percent removal of suspended solids and bacteria. Information on bioretention can be found through the Low Impact Development Center.

7.3.7 Analysis of Source Control Infiltration Options

Infiltrating runoff requires that the soils be permeable enough to allow percolation into the groundwater basin. Sandy or sandy loam soils have the highest percolation rates. Much of the City area, however, has predominantly clay soils that do not permit extensive infiltration. As a general rule, the DWP assumes that only the portion of the San Fernando Valley east of Highway 405 has sandy soils. For this analysis, it will be assumed that concerns presented by the Upper Los Angeles River Area Watermaster as reflected in the City's BMP handbook would need to be resolved before widespread use of infiltration for source control could be recommended.

If infiltration source control methods could be more widely used, an estimate of the maximum amount runoff that could be captured by retrofitting infiltration BMPs on properties within the City could be estimated.

Based on GIS data, the land use for this area is as follows:

- Single Family (total of high and low density) – 29,965 acres
- Multi-Family – 2,322 acres
- Commercial – 2,277 acres
- Industrial – 1,858 acres
- Transportation – 5,676 acres
- Open space and Agricultural – 27,602 acres.
- Total – 69,700 acres.

The runoff to be diverted to on-site infiltration was calculated as the portion of the total estimated runoff that could be diverted from the City's driveways and parking areas that is in the East San Fernando Valley area. As presented in Appendix E, an estimated 5 percent of SFR lots are covered with driveways with an impervious ratio of 1.0 and a runoff coefficient of 0.9. Based on the total number of single family residential lots Citywide, an estimated 62 mgd of runoff is generated during the target ½-inch storm event. Similarly, an estimated 61 mgd of runoff is generated from the parking areas at multi family residences, 185 mgd from commercial property, 4 mgd from government, 15 mgd from schools, and 5 mgd from recreational and cemetery properties (for a total estimated runoff of 332 mgd, see Table 7-1).

Approximately 21 percent of the City's total area is located in the east San Fernando Valley. Thus, the total estimated runoff that can be infiltrated in the east San Fernando Valley area is 71 mgd.

Table 7-1		
Alternative WR1a: Wet Weather Runoff Managed by On-Site Percolation		
Land Use	Runoff Generated Citywide	Runoff Managed in East Valley
Residential	123 mgd	26 mgd
Commercial	185 mgd	39 mgd
Government Facilities	4 mgd	1 mgd
Schools	15 mgd	3 mgd
Recreational Areas and Cemeteries	5 mgd	1 mgd
Total	332 mgd	71 mgd

7.3.8 Neighborhood Recharge

Neighborhood recharge involves installing recharge facilities in portions of vacant urban lots, abandoned alleys, and City parklands, where the soil is highly permeable. This option involves installing underground storage, such as a honeycomb shaped device that allows the runoff to be stored underground, while still maintaining a safe area above ground for human activity. The runoff would be pumped or flow by gravity to the site where it would be collected temporarily until it is able to infiltrate.

The amount of runoff that could be managed by neighborhood recharge was determined by assuming that only the east San Fernando Valley area has soil that is appropriate for infiltration. East San Fernando Valley includes the following sub-watersheds: Tujunga Wash, Pacoima Wash, Reach 3 Los Angeles River, Burbank Western Channel, and Verdugo Wash. Based on an analysis of the City's GIS, the total area available for neighborhood recharge facilities is approximately 831 acres, which includes vacant urban lots, abandoned alleys, and 25 percent of City parklands. Assuming an infiltration rate of 2 ft/day (CH2M Hill, Sun Valley Park Drain and Infiltration Project, 2004), the runoff that could potentially be managed by recharge facilities would be 550 mgd.

The total runoff from the east San Fernando Valley area is only 500 mgd, however. This estimation is based on the approximate total runoff from the aforementioned watersheds that are in the East San Fernando Valley from the largest target storm of ½-inch (see Table 7-3).

7.4 Diversion to Wastewater System

As shown in Figure 7-1, another option for managing wet weather runoff is diversion to the wastewater system. This option is a current practice for the City for dry weather (low flows). This section will discuss how this option could be applied to wet weather flows and the potential impacts to the wastewater system.

7.4.1 Meeting Current Requirements

To meet current Santa Monica Bay bacteria TMDL requirements, a portion of the estimated wet weather runoff from a maximum rainfall of 0.45 inches in the Santa Monica Bay watershed could be diverted to the wastewater system for conveyance and treatment. As discussed in Section 4, the estimated runoff from a 0.45-inch storm in the Santa Monica Bay watershed (within the City) is 160 million gallons.

Approximately 960 acres of the watershed is in the proximity of the Terminal Island Treatment Plant, while the remaining (approximately 27,040 acres) are in the Hyperion Treatment Plant wastewater service area. Based on these areas, the estimated 160 million gallons of runoff divides between the two as follows: 5 million gallons to Terminal Island and 155 million gallons to Hyperion.

In order to divert to the wastewater system, flow would have to be bled into the wastewater system during off peak hours (midnight to 5 am). Therefore, operational storage would need to be built. Diverting 5 million gallons to Terminal Island over these five hours would result in a flowrate of 24 mgd (flowrate for 5 million gallons in a 5 hour period: $5 \text{ million gallons} \times 24 \text{ hours} / 5 \text{ hours} = 24 \text{ mgd}$). Similarly, diverting 155 million gallons to Hyperion Treatment Plant over five hours would result in a flowrate of 744 mgd. For Hyperion, this rate far exceeds the plant's capacity of 450 mgd, therefore additional measures would need to be taken.

In addition to treatment plant improvements that would need to be made, other factors need to be looked at as well. Storage would need to be provided, and assuming that the volume of storage required would be equal to the volume of runoff in one day, that would require storage capacity of 155 million gallons at Hyperion or distributed in multiple locations, and 5 million gallons at Terminal Island.

Additionally, the diversions would need to be sized and constructed accordingly. This would require the building of the diversion itself as well as any improvements that may need to be made to the collection system in order to handle the flow. There are several existing diversions along the coastline for low flows, and these diversions could possibly be retrofitted to handle wet weather flows as well.

7.4.2 Meeting Potential Future Requirements

Diversion to the wastewater system is not a feasible option for wet weather flows when attempting to divert the entire flow that would be generated from the potential future TMDL requirements. As discussed in Section 4, the estimated runoff from a 0.45-inch storm in all watersheds (within the City) is 1,700 million gallons. The estimated 1,700 million gallons of runoff in one storm event translates to a flow during off peak hours (midnight to 5 am) of 8,100 mgd. Though diversion could occur

at selected areas with minor tributary areas, this is generally not being considered as a feasible option.

7.5 Treatment and Discharge

As shown in Figure 7-1, another option for managing wet weather runoff is treatment and discharge. For the IRP, treatment and discharge refers to diverting runoff from the storm drain system to a dedicated runoff treatment facility. Treated effluent from this facility would be discharged back to the storm drain system. This section will discuss how this option could be applied to wet weather flows.

7.5.1 Meeting Current Requirements

In order to meet the bacteria TMDL requirements only, the City would be required to capture 160 million gallons of runoff in one day to treatment and discharge facilities. Under this option, runoff from the target storm event (up to 160 mgd) would be diverted, held in temporary operational storage, treated and discharged. For example, for the adopted bacteria TMDL, three conceptual treatment plants were identified along the coast, which are shown in Figure 7-2 and listed in Table 7-2, with operational storage up to the volume of runoff in one day. The flow to each of these treatment plants is as follows:

Table 7-2 Proposed Coastal Treatment Plants	
Proposed Treatment Facility	Volume of Runoff in One Day (million gallons)
Santa Monica Bay 1	125
Santa Monica Bay 2	30
Santa Monica Bay 3	5
Note: Source: Calculated based on City GIS data and runoff rate (see Section 4).	

In order to divert the flows to a treatment and discharge facility, the runoff would have to be captured and a collection system installed, possibly pumped to the facility, and treated. As discussed in Subsection 6.4, treatment considerations will depend upon the target constituents. Assuming that bacteria are the governing constituents for wet weather runoff, similar considerations as for the dry weather TMDL would apply. However, trash and suspended sediment would be much more present in wet weather runoff, so pretreatment requirements prior to disinfection would be more extensive. Additionally, the storage equal to at least the daily volume would need to be provided. The plant would need to be designed to treat that volume in one day in order to be prepared for another storm event the following day.

7.5.2 Meeting Potential Future Requirements

To meet potential future regulations using treatment and discharge as the option, up to 21 diversion and treatment plants would be needed. These treatment plants could be located at the diversion points shown in Figure 7-2 and discussed in Section 6, with the difference being that the plants would need to treat a much higher flow volume and rate. However, this higher flow would only be during the wet weather. Table 7-3 identifies the potential design flow rate for each of these treatment plants assuming that the volume of runoff that would come from one 0.45 inch storm would be drained from operating storage and treated over a 24 hour period. Under the TMDL Implementation Plan that is underway, a variety of plant configurations and other integrated approaches will be investigated. Each plant would also need operational storage equal to the amount of runoff generated in one day. A collection system and pumping stations would also be required.

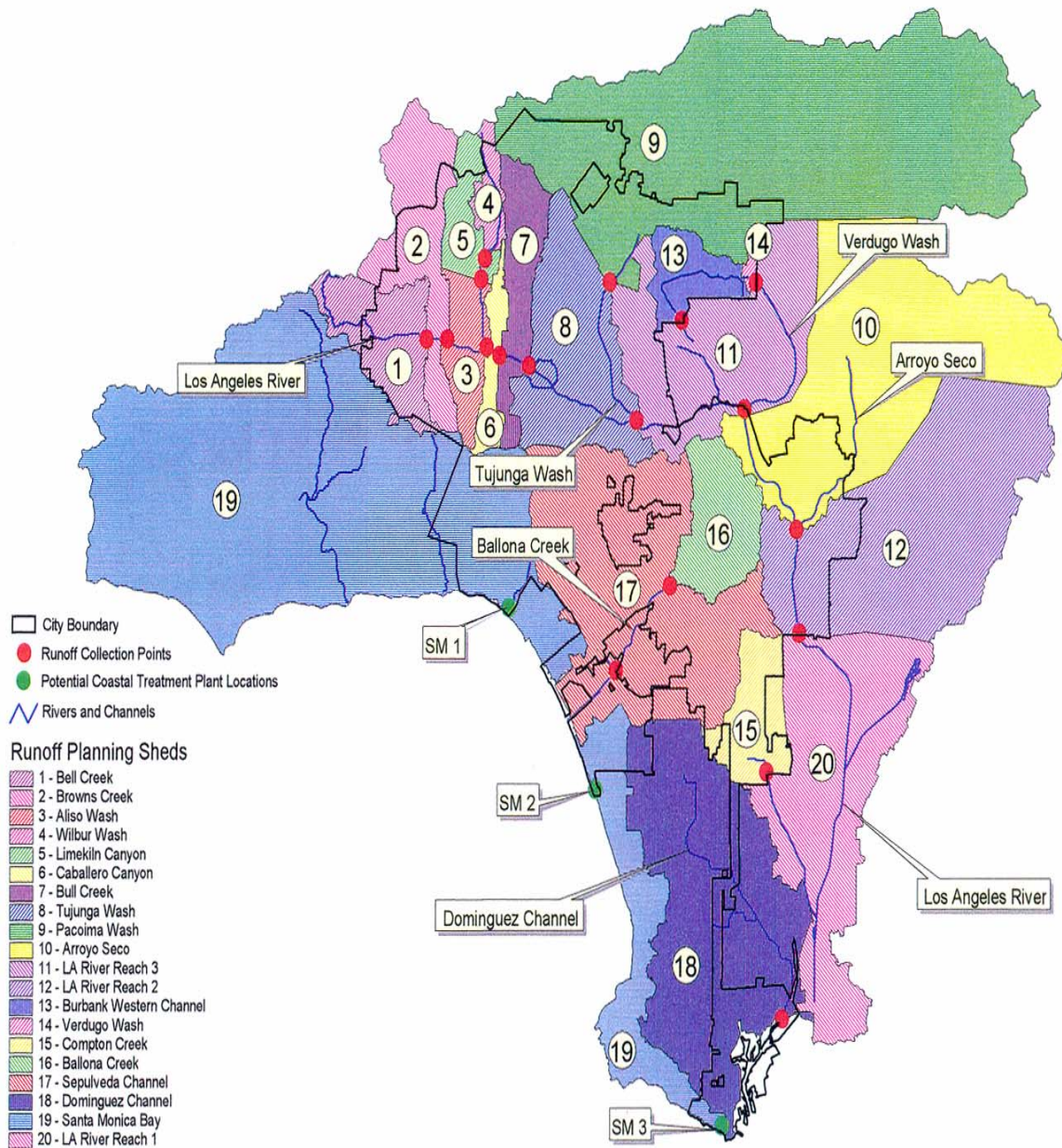


Figure 7-2
Potential Locations of Runoff Treatment Plants

Table 7-3 Wet Weather Flows at Proposed Treatment and Discharge Locations		
Runoff Planning Shed	Approximate Tributary Area (acres)	Design Flow Rate ¹ (mgd)
Bell Creek	11,500	65
Browns Creek	12,000	70
Aliso Wash	9,500	50
Wilbur Wash	4,000	25
Limekiln Canyon	6,000	35
Caballero Canyon	5,500	30
Bull Creek	13,500	75
Tujunga Wash	32,500	190
Pacoima Wash	28,000	160
Arroyo Seco	13,500	75
LA River Reach 3	13,900	80
LA River Reach 2	15,000	85
Burbank Western Channel	9,000	50
Verdugo Wash	1,000	5
Compton Creek	10,100	60
Ballona Creek	17,000	90
Sepulveda Channel	50,000	285
Dominguez Channel	15,000	110
Santa Monica Bay 1	21,100	125
Santa Monica Bay 2	5,900	30
Santa Monica Bay 3	1,000	5
		Total: 1,700
Notes:		
1. Assumes all captured flow from a 0.45 inch storm event would be drained from operational storage and treated for discharge over a 24-hour period.		
2. Source: area is from City GIS database; flows calculated based on areas and 0.45-inch target storm, 0.47 runoff coefficient (see Section 4)		

7.6 Treatment and Beneficial Use

As shown in Figure 7-1, another option for managing wet weather runoff is treatment and beneficial use. For the IRP, treatment and discharge refers to diverting runoff from the storm drain system to a dedicated runoff treatment facility. Treated effluent from this facility would be beneficially used for irrigation or industrial use. This section will discuss how this option could be applied to wet weather flows.

7.6.1 Meeting Current and Future Requirements and Goals

In order to meet the current regulations, treatment and beneficial use of runoff could be incorporated along the Santa Monica Bay watershed. To meet the potential future regulations, the Citywide design flows indicated in Table 7-3 could be met through treatment and beneficial use as well. The potential locations shown in Figure 7-2 and summarized in Table 7-3 could be points of collection for treatment and beneficial use. The volume would require seasonal storage up to the amount of runoff flow in one day.

When addressing the potential future requirements throughout the City, identifying storage possibilities is the controlling factor. The total wet weather volume for the entire City that would need to be managed in order to meet potential TMDL implementation requirements is 43,000 acre-feet/yr (14,000 million gallons annually). The source control option discussion (Subsection 7.3) identifies local opportunities for reducing this amount at the source through the use of cisterns and other devices, and then using the runoff later as a beneficial use on site. While these efforts will reduce the volume of runoff and will account for beneficial uses of runoff, for the purposes of the discussion in this section, these amounts will not be subtracted from the total volume.

The ability to beneficially use wet weather runoff will greatly depend on the seasonal storage capacity. As discussed in Section 6, the primary beneficial use of runoff is to meet irrigation demands. Therefore, to meet these demands (which are typically non-existent during rain events and low throughout the rainy season), the wet weather runoff would need to be stored until the demand exists. The following section discusses seasonal storage opportunities.

7.6.2 Seasonal Storage for Beneficial Use

As discussed in the section above, seasonal storage is required for beneficially using wet weather runoff since the majority of demands exist during the dry weather months. Therefore, identifying seasonal storage opportunities is a key factor in the success of the treatment and beneficial use option. There are two ways to store wet weather runoff throughout the City, the first is a regional approach and the second is a more localized approach.

A regional approach would include the use of out-of-service reservoirs for seasonal storage. Conversion of the out-of-service Chatsworth reservoir is one option for storing the wet weather runoff. The total volume available in the Chatsworth Reservoir is 10,600 acre-feet (3,500 million gallons). Assuming that the reservoir has

an available operating capacity of 50 percent, there is the potential to store approximately 5,300 acre-feet (1,750 million gallons). This leaves up to 32,400 acre-feet (12,250 million gallons) that would need to be stored elsewhere. Using the Chatsworth reservoir would require the runoff to be diverted to it, which would require a collection system, pumping stations, and treatment either before storage or before the beneficial use.

A more localized approach to seasonal storage would be to construct distributed underground storage facilities, locally located in open spaces, parks, schools, etc. throughout the City. These can be installed in new/redevelopment projects as well as retrofit locations. There are several types of underground storage facilities that can be considered. Conceptual data presented here is for a modular storage media. This media holds the runoff in a honeycomb like box under the ground and it has approximately 95 percent voids, so the almost all of the storage volume would be filled with water. The maximum depth is 8 feet, which translates to approximately 2.44 million gallons/acre of water storage potential. This media is also discussed in the recharge section as it can be built so that the water will either infiltrate into the ground. Conversely, the containers can be constructed as impermeable to prohibit infiltration.

Per the City's land use data, the City currently has an estimated open space area of 6,000 acres, which includes parks, open space, and vacant lots. Schools sites are also a potential option for installing modular storage media under playgrounds and athletic fields, and the total school area in the City is approximately 6,000 acres, as shown in Table 7-4. Assuming that only 25 percent of this area has no buildings on it or other structures, this equals approximately 1,500 acres of potentially suitable land. Additionally, there are approximately 900 abandoned alleys, of various unknown dimensions, that could potentially be converted to underground storage facilities. In the process they could also be rebuilt to enhance the environment, thus creating a beneficial use in and of itself. The following table summarizes the approximate underground storage potential throughout the City.

Table 7-4		
Underground Storage Potential throughout the City		
Land Use	Acres (acres)	Potential Storage Volume¹ (million gallons)
Open space	6,000	15,000
Schools (assume only ~ 25 percent suitable land)	1,500	4,000
Alleys	900 count	Unknown
Total	7,500	19,000
Note: 1. Assuming 4.22 million gallons of storage per acre of land.		
Source: SCAG land use data; storage volume based on area and 8-feet of depth.		

Based on these values, the City theoretically has the potential to store the entire volume of wet weather runoff in order to meet the potential future regulations if the Chatsworth reservoir as well as the underground storage options were utilized. This stored water could then draw down and be beneficially used during the dry weather months. Ways of beneficially reusing wet weather runoff are similar to those discussed for dry weather runoff which is detailed in Subsection 6.5 of this report.

7.7 Regional Recharge

This option considers regional recharge of captured wet weather runoff to groundwater storage in basins from which the City receives water. This includes consideration of both the San Fernando Valley Basin as well as the Los Angeles Coastal Plain Basins. Regional recharge of dry weather runoff provides challenges, including concerns over water quality. As protection of groundwater quality is of paramount importance, runoff source quality, including considerations of pre-treatment, play key roles in determining options. The regional recharge option focuses on large-scale projects to capture and infiltrate runoff from large areas within the City. Subsection 7.3, Source Control Options, discusses infiltration on a small local scale basis.

It is also important to note that many of the options discussed in Subsection 6.6 for dry weather runoff apply to wet weather runoff. Subsection 6.6 provides background information regarding current regional recharge operations as well as basin characteristics and possible regional options.

7.7.1 Meeting Current and Future Goals

The guiding principles from the first phase of the IRP recommended that the City look to maximize the amount of wet weather urban runoff that is beneficially used. As an additional benefit, any wet weather runoff that is beneficially used will reduce the quantity that is discharged to waterways and must meet the current and future TMDLs.

Regional recharge is generally a viable option for managing wet weather runoff. Based on the basin characteristics discussed in Subsection 6.6, the IRP will be primarily looking at infiltration options within the East San Fernando Valley Basin only. Therefore, to meet current regulations through the regional recharge option, runoff would have to be transported from Santa Monica Bay to the East Valley. This option is not considered a viable option. However, in order to meet future goals, and the goals of the IRP, regional recharge of runoff from the Valley is being considered a viable option.

Based on the assumption to recharge only in the East Valley, the flows from the entire Valley are being considered. The total runoff generated in the Valley from the 0.45 inch storm event is 4,000 acre-feet (1,300 million gallons) watershed wide, and 2,900 acre-feet (750 million gallons) for the City only. This amount could potentially all be diverted to the groundwater basins in the East Valley.

These amounts account for the runoff from the 0.45-inch storm only. As this represents approximately 25 percent of the total annual runoff generated in the City (discussed in detail in Section 4), there is a great deal more runoff available to recharge. Once the capture, storage, and diversion facilities are in place, flows from storms that exceed 0.45 inches can be diverted as well.

7.7.2 Considerations for Regional Recharge

The regional recharge option includes using existing regional spreading grounds such as Hansen, Pacoima, or a new constructed facility. Discussions with DWP has determined several challenges to this use including the following:

- The capacity of the current operating spreading grounds are already being used during storm events and, depending upon the amount of rainfall during a particular year that is stored upstream of the spreading grounds, this can extend well into the summer months. Therefore, seasonal storage would be required.
- While there are some possibilities for new spreading grounds at several gravel pits within the San Fernando Valley Basin (Boulevard and Sheldon) the general configuration of a gravel pit does not allow for upstream sediment removal and as a result it could be prone to plugging. It is actually more likely that these pits could provide a better use as seasonal storage. If necessary, pretreatment facilities could be located adjacent to the site and the treated water pumped to spreading grounds. However, a problem with this option is that the pits are getting close to the groundwater table and could require lining before they could be used.
- Currently, the spreading grounds collect and infiltrate some of the best quality runoff. In order to protect groundwater and the spreading grounds' integrity, either runoff of a comparable quality would have to be identified or pretreatment measures (including monitoring) would be needed. Some comparable areas have been identified that could be of comparable quality in the northwestern San Fernando Valley. However, to use this water, it would need to be captured, stored and pumped to the spreading grounds.

It is important to note that the LACDPW is responsible for operation of the spreading grounds and that the items discussed above will need to be coordinated with them, so as not to overlap other future plans for these sites.

7.8 Summary

Overall, none of the individual options would be appropriate as a stand-alone solution for managing the entire amount of runoff throughout the City. However, a combination of the five options would create a total solution. The alternatives analysis section of this report (Section 8) discusses the combination of options to create the total solution.

Section 8

Alternatives Analysis

8.1 Approach

The IRP has identified planning parameters that will result in the need for new programs, infrastructure and facilities to meet the 2020 needs. These planning parameters, or drivers, include population growth, increased wastewater flows, increased dry and wet weather runoff flows, increased demands for drinking water and current and future regulations to protect water quality in the basin. In addition, the IRP has an established set of Guiding Principles to guide future planning, which includes such objectives as producing and using as much recycled water as possible from existing and planned facilities, increasing water conservation and increasing the beneficial use of runoff.

Alternatives are the means of accomplishing the objectives (which include options from each service function). They answer the question, “How are we going to accomplish the objectives?” In the Sections 6 and 7 of this document, the potential runoff options (or projects) for meeting these drivers were discussed, and the options for wastewater and water were discussed in the Facilities Plan *Volume 1: Wastewater Management* and *Volume 2: Water Management* respectively. To meet the 2020 needs, the IRP needed to develop integrated alternatives, which include combinations of wastewater, recycled water and runoff options into complete alternatives. By considering the system using an integrated watershed approach, more holistic alternatives could be identified and evaluated.

As shown in Figure 8-1, the IRP team used a multi-step process to create and evaluate alternatives: (1) develop preliminary alternatives, (2) evaluate preliminary alternatives, (3) refine alternatives and develop hybrid alternatives, (4) evaluate hybrid alternatives and (5) screen to final alternatives for environmental analysis. Additional discussion of the alternatives and the evaluation process is presented in the Facilities Plan *Volume 4: Alternatives Development and Analysis*.

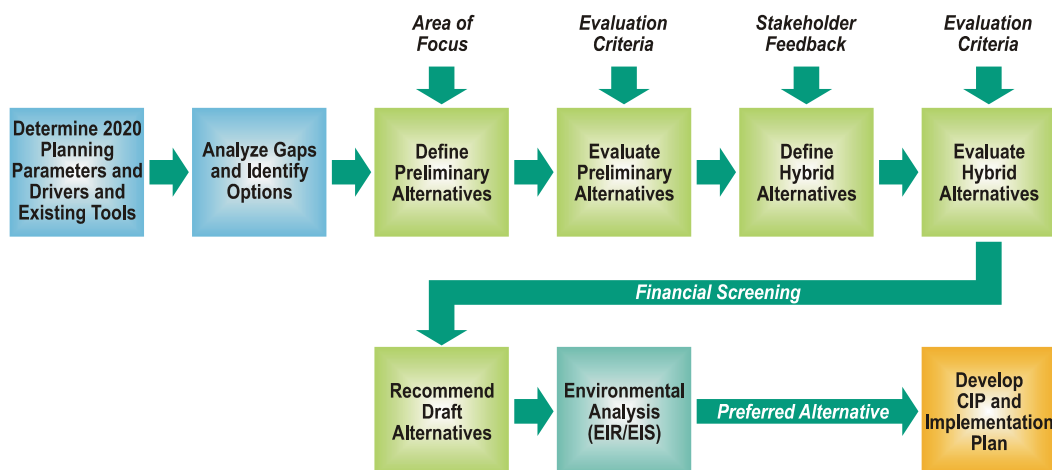


Figure 8-1
IRP Approach to Creating Alternatives

8.2 Preliminary and Hybrid Alternatives

8.2.1 Preliminary Alternatives

The first step in creating alternatives was defining preliminary alternatives. Each preliminary alternative was constructed with the different area of focus to reflect tradeoffs:

- **Low cost/minimum requirements:** Alternative includes lower cost solutions to meet minimum requirements
- **High beneficial use of water resources:** Alternatives offer higher levels of water recycling, conservation and beneficial use of runoff to reduce imported water supplies
- **High adaptability :** Alternatives provide adaptability to respond to changing conditions (e.g., changing flows, technology, or regulations)
- **More decentralized:** Alternative includes more and smaller local projects rather than fewer and larger regional projects.
- **Lower risk:** Alternatives offer relatively lower risk from regulatory or ease-of-implementation perspectives

All preliminary alternatives were constructed to meet current requirements related to regulatory requirements, system capacity, minimum levels of water recycling, beneficial use of runoff, conservation and discharges to the Los Angeles River. But, not all alternatives are the same in terms of meeting future regulations. Some alternatives were designed to meet current regulations, some were designed to be flexible to meet new regulations; and some alternatives have anticipated future regulations and were designed to meet those from the start.

The detailed analysis of the preliminary alternatives can be found in *Volume 4: Alternative Development and Analysis*. Table 8-1 shows the components of each of the preliminary alternatives. The rows list all of the options available for managing the wastewater, water and runoff systems. The columns show each of the preliminary alternatives. The table can be read by selecting an alternative and reading down the column to see which options are included, and to what level, for that alternative. The cells that are blank indicate that the option listed in that row was not included in the alternative.

The Steering Group played an important role in the development, evaluation and screening of alternatives by providing a “sounding board” throughout the process, giving the necessary feedback to keep the facilities planning efforts aligned with the Guiding Principles. Many Steering Group members elected to completed surveys used in the decision-making process. For other members, feedback was received via discussion during the workshop sessions through letters, emails, IRP open comment

forms, during telephone conversations and individual meetings that were held as part of the workshops follow up activities.

8.2.2 Hybrid Alternatives

Using feedback from the Steering Group, the next step included creating a series of hybrid alternatives. To create the hybrid alternatives, the team sought feedback from the Steering Group and identified key concepts to carry forward. The goal was to create alternatives that combined the best elements of the preliminary alternatives, thereby allowing them to perform better than the original preliminary alternatives. A set of nine hybrid alternatives were created as a result of the analysis of the preliminary alternatives.

The evaluation of the hybrid alternatives and selection of recommended draft alternatives is discussed in depth in *Volume 4: Alternative Development and Analysis*. Table 8-2 shows the components of each of the hybrid alternatives. The rows list all of the options available for managing the wastewater, water and runoff systems. The columns show each of the hybrid alternatives. The table can be read by selecting an alternative and reading down the column to see which options are included, and to what level, for that alternative. The cells that are blank indicate that the option listed in that row was not included in the alternative.

These nine hybrid alternatives were then analyzed by comparing their costs with their expected benefits on wastewater management, recycled water, dry weather urban runoff and wet weather urban runoff. Using this analysis, a limited number of recommended draft alternatives were selected for detailed environmental analysis, and are described in the sections that follow.

These recommended draft alternatives include:

- Alternative 1: Hyperion Water Treatment Plant expansion with high potential for water resources projects (Hyb1C)
- Alternative 2: Tillman and LAG Water Replenishment Plant expansions with high potential for water resources projects (Hyb2C)
- Alternative 3: Tillman Water Replenishment Plant expansion with moderate potential for water resources projects (Hyb3B)
- Alternative 4: Tillman Water Replenishment Plant expansion with high potential for water resources projects (Hyb3C)

A preferred alternative will be selected a part of the EIR analysis.

8.3 Runoff Management Projects in Recommended Draft Alternatives

After an intensive process that was built on stakeholder preferences, 21 initial alternatives were narrowed down to four alternatives. These alternatives will meet the wastewater infrastructure needs of the population of 2020. These alternatives will also maximize the beneficial use of recycled water and urban runoff, optimize the use of our existing facilities and water resources, reduce pollution and minimize our dependency on imported water. The runoff portion of the alternatives is described in the sections that follow. For a detailed description of all the components of each of the alternatives, see *Volume 4: Alternatives Development and Analysis*.

8.3.1 Alternative 1 (Hyperion Expansion/Moderate Potential for Water Resources Projects)

The selected options for managing runoff in Alternative 1 are such that they will work along with the wastewater system. The wastewater system for Alternative 1 includes expanding Hyperion to 500 mgd, upgrading Tillman to advanced treatment with no expansion and providing collection system improvements. Refer to the Volume 4: Alternatives Development and Analysis for a detailed description of the components of each of the alternatives.

Stemming from the wastewater system improvements, runoff management options were selected and combined to create a complete alternative. Following is a summary of the dry weather runoff options included in Alternative 1:

- Divert coastal runoff from the coastal watersheds to Hyperion for treatment.
- Install automatic evapotranspiration (ET) irrigation controllers (i.e., “Smart Irrigation devices”) Citywide.
- Divert approximately 5 mgd of dry weather runoff from the Compton Creek, and Ballona Creek subwatersheds to urban runoff plants for treatment and reuse.
- Divert approximately 15 mgd from the inland watersheds to wastewater system for treatment, from Browns Creek, Wilbur Wash, Limkiln Canyon, Caballero Canyon, Bull Creek and Pacoima Wash.

For wet weather runoff, the following options were included in Alternative 1:

- Manage runoff from new/redevelopment areas per Standard Urban Stormwater Mitigation Plan (SUSMP).
- Capture, treat and beneficially use or discharge wet weather runoff tributary to the Santa Monica Bay to meet the Santa Monica Bay Beaches Bacteria TMDL.

Table 8-1
City of Los Angeles
Integrated Resources Plan (IRP) - Preliminary Alternatives Matrix

		Low Cost (LC)		High Beneficial Use of Water Resources (WR)					High Adaptability (HA)		More De-centralized (MD)		Low Risk (LR)	
Option		LC1	WR1a	WR1b	WR2a	WR2b	WR3a	WR3b	HA1	HA2	MD1		LR1	LR2
Wastewater Treatment														
Tillman - Upgrade treatment (64 mgd) (Reverse Osmosis)	64 mgd						64 mgd	64 mgd			64 mgd		64 mgd	64 mgd
Tillman - Upgrade and increase capacity to 80 mgd (Reverse Osmosis)									80 mgd					
Tillman - Upgrade and increase capacity to 100 mgd (Reverse Osmosis)					100 mgd	100 mgd								
Tillman - Upgrade and increase capacity to 120 mgd (Reverse Osmosis)			120 mgd	120 mgd						120 mgd				
Los Angeles-Glendale - Maintain existing capacity (15 mgd) (Title 22)	15 mgd										15 mgd			15 mgd
Los Angeles-Glendale - Increase capacity to 20 mgd (Title 22)			20 mgd	20 mgd	20 mgd	20 mgd								
Los Angeles-Glendale - Increase capacity to 30 mgd (Title 22)							30 mgd	30 mgd						
Los Angeles-Glendale - Upgrade treatment (15 mgd) (Reverse Osmosis)									15 mgd				15 mgd	
Los Angeles-Glendale - Upgrade treatment (20 mgd) (Reverse Osmosis)														
Los Angeles-Glendale - Upgrade and increase capacity to 30 mgd (Reverse Osmosis)										30 mgd				
New Reclamation Plant - Build 10 mgd capacity near downtown (Title 22)					10 mgd	10 mgd								
New Reclamation Plant - Build 30 mgd capacity in valley (Title 22)							30 mgd	30 mgd						
New Reclamation Plant - Build 10 mgd capacity near downtown (Reverse Osmosis)									10 mgd		10 mgd			
New Reclamation Plant - Build 30 mgd capacity in valley (Reverse Osmosis)											30 mgd			
Hyperion - Maintain existing capacity (450 mgd)			450 mgd	450 mgd	450 mgd	450 mgd			450 mgd	450 mgd	450 mgd			
Hyperion - Increase capacity to 500 mgd	500 mgd						500 mgd	500 mgd						500 mgd
Hyperion - Increase capacity to 550 mgd													550 mgd	
Terminal Island - Maintain existing capacity (30 mgd)	30 mgd		30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd		30 mgd	30 mgd
Wastewater Sewer System														
Build new interceptor sewer - Valley Spring Lane Interceptor Sewer	X		X	X	X	X	X	X	X		X		X	X
Build new interceptor sewer - Glendale Burbank Interceptor Sewer (GBIS)	X		X	X	X	X	X	X	X	X	X		X	X
Build new interceptor sewer - North East Interceptor Sewer (NEIS) Phase 2	X		X	X	X	X	X	X	X	X	X		X	X
Build new interceptor sewer - for New Plant (10 mgd - 5 miles)					X	X			X		X			
Build new interceptor sewer - for New Plant (30 mgd - 5 miles)							X	X			X			
Build new buried storage tank - 60 MG at Tillman									X	X				
Build new buried storage tank - 20 MG at Los-Angeles Glendale			X*	X*	X*	X*	X*	X*	X	X	X*			
Build new buried storage tank - 10 MG at new plant					X*	X*			X		X*			
Build new buried storage tank - 20 MG at new plant							X*	X*			X*			
Recycled Water (Non-Potable Demands)														
Meet Los Angeles River minimum requirements using treated wastewater	X		X	X	X	X	X	X	X	X	X		X	X
Meet Irrigation/Industry demands using treated wastewater (low/medium/high)	Low		High	Low	High	Low	High	Low	Medium	Medium	Medium		Low	Low
Recharge groundwater basin using treated wastewater				High										
Meet Irrigation/Industry demands using treated runoff (low/medium/high)						Medium		Medium						
Recharge groundwater basin using treated runoff			High	High	High	High	High	High						
Conservation Programs														
Increase conservation efforts to DWP's planned 2020 levels	X		X	X	X	X	X	X	X	X	X		X	X
Increase conservation efforts further			X	X	X	X	X	X	X	X	X			
Dry Weather Urban Runoff														
Local/Neighborhood Solutions														
Smart Irrigation			X	X	X	X	X	X	X	X	X			
Increase public education and participation	X		X	X	X	X	X	X	X	X	X		X	X
Regional Solutions														
Diversion to Wastewater System (WW) or Divert to Urban Runoff Plant or wetlands and Beneficially Use (URP) ¹														
Divert - coastal (10 mgd)	WW		WW	WW	WW	WW	WW	WW	WW	WW	WW		WW	WW
Divert - inland (Bell Creek 2.8 mgd)			WW	WW		URP		URP					WW	
Divert - inland (Browns Creek 3 mgd)			WW	WW		URP		URP					WW	WW
Divert - inland (Aliso Wash 1.8 mgd)			WW	WW									WW	
Divert - inland (Wilbur Wash 1 mgd)						URP		URP					WW	WW
Divert - inland (Limekiln Canyon 1.5 mgd)						URP		URP					WW	WW
Divert - inland (Caballero Canyon 1mgd)			WW	WW									WW	WW
Divert - inland (Bull Creek 2.4 mgd)			WW	WW									WW	WW
Divert - inland (Tujunga Wash 6 mgd)													WW	
Divert - inland (Pacoima Wash 7 mgd)													WW	WW
Divert - inland (Arroyo Seco 5 mgd)													WW	
Divert - inland (Reach 3 LAR 4 mgd)													WW	
Divert - inland (Reach 2 LAR-12 mgd)													WW	
Divert - inland (Burbank Western Channel 1.8 mgd)													WW	
Divert - inland (Compton Creek 2.6 mgd)						URP		URP					WW	
Divert - inland (Ballona Creek 3.3 mgd)						URP		URP					WW	
Divert - inland (Sepulveda Channel 16 mgd)													WW	
Divert - inland (Dominguez Channel 16 mgd)													WW	
Percent of Dry Weather Runoff Managed (of watershed - 97 mgd)	10%		30%	30%	21%	28%	21%	28%	21%	21%	21%		100%	20%
Wet Weather Urban Runoff														
Local/Neighborhood Solutions														
New/Redevelopment Areas - On-site treatment/discharge	X		X	X	X	X	X	X	X	X	X		X	
New/Redevelopment Areas - On-site percolation	X		X	X	X	X	X	X	X	X	X		X	
Retrofit Areas - Cisterns (On-site storage/use)														
Residential (Low/Medium/High)			Low	High	High	High	High	High			High			
Schools (Low/Medium/High)			Low	High	High	High	High	High			High			High
Government (Low/Medium/High)			Low	High	High	High	High	High			High			High
On-site percolation (infiltration trenches/basins, reduce paving/hardscape)														
Residential			X	X	X	X	X	X			X			
Schools			X	X	X	X	X	X			X			X
Government			X	X	X	X	X	X			X			X
Commercial			X	X	X	X	X	X			X			
Rec/Cemetaries			X	X	X	X	X	X			X			X
Neighborhood recharge														
Vacant Lots (East Valley) (Low/Medium/High)			Medium	Low	Low	Low	Low	Low	High	High	Low			High
Parks/Open Space (East Valley) (Low/Medium/High)			Medium	Low	Low	Low	Low	Low	High	High	Low			High
Abandoned Alleys (East Valley) (Low/Medium/High)			Medium	Low	Low	Low	Low	Low	High	High	Low			High
Regional Solutions														
Non-urban regional recharge			X	X	X	X	X	X						
Runoff treatment and beneficial use/discharge														
Treat and benefical use/discharge (coastal area)	X		X	X	X	X	X	X	X	X	X		X	X
Treat and benefical use/discharge (all areas)													X	
Percent of Representative storm (1/2-inch) managed (of citywide 1,700 mgd)	10%		48%	48%	58%	58%	58%	58%	39%	39%	55%		100%	42%
Current/Anticipated Regulations Level of Compliance														
California Toxics Rule	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Current Total Maximum Daily Loads (TMDLs) - Bacteria (Santa Monica), Trash	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Future Total Maximum Daily Loads (projection)	No		Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial		Yes	Partial
Notes:														
*Storage for daily (diurnal) peaks														
¹ Flows indicated assume no smart irrigation. Implementing smart irrigation citywide would reduce total dry weather runoff estimates by ~11 mgd														
Definitions of areas of focus:														
Low Cost or Low Initial Investment: alternatives that either include the lower cost solutions or that include a low initial investment (I.e., a "wait and see" approach)														
High Beneficial Use of Water Resources: alternatives that include high levels of recycled water, conservation, and beneficial use of runoff.														
High Adaptability: alternatives that are most able to adjust to changing conditions, such as population, wastewater flows and regulations														
More Decentralized: alternatives with solutions based on many small-scale projects centered on small neighborhoods, households or even individuals														
Low Risk: alternatives that have a better chance of implementation (from an environmental, regulatory and/or political and public acceptance perspective) or rely less on unproven or new technology.														

Table 8-2
City of Los Angeles
Integrated Resources Plan (IRP) - Hybrid Alternatives Matrix

1	Option	LCMR	WR3a	HA1	LR1	Hyb1A	Hyb1B	Hyb1C	Hyb2A	Hyb2B	Hyb2C	Hyb3A	Hyb3B	Hyb3C
2	Wastewater Treatment													
3	Tillman - Upgrade treatment (64 mgd) (Advanced Treatment)	64 mgd	64 mgd		64 mgd	64 mgd	64 mgd	64 mgd						
4	Tillman - Upgrade and increase capacity to 80 mgd (Advanced Treatment)			80 mgd					80 mgd	80 mgd	80 mgd			
5	Tillman - Upgrade and increase capacity to 100 mgd (Advanced Treatment)											100 mgd	100 mgd	100 mgd
6	Tillman - Upgrade and increase capacity to 120 mgd (Advanced Treatment)													
7	Los Angeles-Glendale - Maintain existing capacity (15 mgd) (Title 22)	15 mgd				15 mgd	15 mgd	15 mgd				15 mgd	15 mgd	15 mgd
8	Los Angeles-Glendale - Increase capacity to 20 mgd (Title 22)													
9	Los Angeles-Glendale - Increase capacity to 30 mgd (Title 22)		30 mgd											
10	Los Angeles-Glendale - Upgrade treatment (15 mgd) (Advanced Treatment)				15 mgd									
12	Los Angeles-Glendale - Upgrade and increase capacity to 30 mgd (Advanced Treatment)			30 mgd					30 mgd	30 mgd	30 mgd			
13	New Reclamation Plant - Build 10 mgd capacity near downtown (Title 22)													
14	New Reclamation Plant - Build 30 mgd capacity in valley (Title 22)		30 mgd											
15	New Reclamation Plant - Build 10 mgd capacity near downtown (Advanced Treatment)													
16	New Reclamation Plant - Build 30 mgd capacity in valley (Advanced Treatment)													
17	Hyperion - Maintain existing capacity (450 mgd)			450 mgd					450 mgd	450 mgd	450 mgd	450 mgd	450 mgd	450 mgd
18	Hyperion - Increase capacity to 500 mgd	500 mgd	500 mgd			500 mgd	500 mgd	500 mgd						
19	Hyperion - Increase capacity to 550 mgd				550 mgd									
20	Total Effective Hyperion Service Area Treatment Capacity ² (mgd)	546	546	529	607	546	546	546	529	529	529	521	521	521
21	Terminal Island - Maintain existing capacity (30 mgd)	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd	30 mgd
22	Wastewater Sewer System													
23	Build new interceptor sewer - Valley Spring Lane Interceptor Sewer	X	X		X									
24	Build new interceptor sewer - Glendale Burbank Interceptor Sewer (GBIS)	X	X	X	X	X	X	X	X	X	X	X	X	X
25	Build new interceptor sewer - North East Interceptor Sewer (NEIS) Phase 2	X	X	X	X	X	X	X	X	X	X	X	X	X
26	Build new interceptor sewer - for New Plant (10 mgd - 2 miles)													
27	Build new interceptor sewer - for New Plant (30 mgd - 2 miles)		X											
28	Build new buried storage tank - 60 MG at Tillman ³			X		X	X	X	X	X	X	X	X	X
29	Build new buried storage tank - 20 MG at Los-Angeles Glendale		X*	X*		X*	X*	X*	X*	X*	X*	X*	X*	X*
30	Build new buried storage tank - 10 MG at new plant													
31	Build new buried storage tank - 20 MG at new plant		X*											
32	Recycled Water (Non-Potable Demands)													
33	Meet Los Angeles River minimum requirements using treated wastewater	X	X	X	X	X	X	X	X	X	X	X	X	X
34	Meet Irrigation/Industry demands using treated wastewater	X	X	X	Low	X	X	X	X	X	X	X	X	X
37	Recharge groundwater basin using treated wastewater													
39	Meet Irrigation/Industry demands using treated runoff (low/medium/high)						Low	Low		Low	Low		Low	Low
42	Recharge groundwater basin using treated runoff		High											
43	Conservation Programs													
44	Increase conservation efforts to DWP's planned 2020 levels	X	X	X	X	X	X	X	X	X	X	X	X	X
45	Increase conservation efforts further		X	X			X	X		X	X		X	X
46	Dry Weather Urban Runoff													
47	Local/Neighborhood Solutions													
48	Smart Irrigation		X	X			X	X		X	X		X	X
49	Increase public education and participation	X	X	X	X	X	X	X	X	X	X	X	X	X
50	Regional Solutions													
	Diversion to Wastewater System (WW) or													
51	Divert to Urban Runoff Plant or wetlands and Beneficially Use (URP) ¹													
52	Divert - coastal (10 mgd)	WW	WW	WW	WW	WW	WW	WW	WW	WW	WW	WW	WW	WW
53	Divert - inland (Bell Creek 2.8 mgd)				WW									
54	Divert - inland (Browns Creek 3 mgd)				WW			WW			URP ⁴			URP ⁴
55	Divert - inland (Aliso Wash 1.8 mgd)				WW									
56	Divert - inland (Wilbur Wash 1 mgd)				WW			WW			URP ⁴			URP ⁴
57	Divert - inland (Limekiln Canyon 1.5 mgd)				WW			WW			URP ⁴			URP ⁴
58	Divert - inland (Caballero Canyon 1mgd)				WW			WW			URP ⁴			URP ⁴
59	Divert - inland (Bull Creek 2.4 mgd)				WW			WW			URP ⁴			URP ⁴
60	Divert - inland (Tujunga Wash 6 mgd)				WW									
61	Divert - inland (Pacoima Wash 7 mgd)				WW			WW			URP ⁴			URP ⁴
62	Divert - inland (Arroyo Seco 5 mgd)				WW									
63	Divert - inland (Reach 3 LAR 4 mgd)				WW									
64	Divert - inland (Reach 2 LAR-12 mgd)				WW									
65	Divert - inland (Burbank Western Channel 1.8 mgd)				WW									
66	Divert - inland (Compton Creek 2.6 mgd)				WW		URP	URP		URP	URP		URP	URP
67	Divert - inland (Ballona Creek 3.3 mgd)				WW		URP	URP		URP	URP		URP	URP
68	Divert - inland (Sepulveda Channel 16 mgd)				WW									
69	Divert - inland (Dominguez Channel 16 mgd)				WW									
73	Percent of Dry Weather Runoff Managed (of watershed - 97 mgd)	10%	21%	21%	100%	10%	26%	42%	10%	26%	42%	10%	26%	42%
75	Wet Weather Urban Runoff													
76	Local/Neighborhood Solutions													
77	New/Redevelopment Areas - On-site treatment/discharge	X	X	X	X	X	X	X	X	X	X	X	X	X
78	New/Redevelopment Areas - On-site percolation	X	X	X	X	X	X	X	X	X	X	X	X	X
79	Retrofit Areas - Cisterns (On-site storage/use)													
80	Residential		X											
81	Schools		X					X			X			X
82	Government		X					X			X			X
83	On-site percolation (infiltration trenches/basins, reduce paving/hardscape)													
84	Residential		X											
85	Schools		X					X			X			X
86	Government		X					X			X			X
87	Commercial		X											
88	Rec/Cemetaries		X											
89	Neighborhood recharge													
90	Vacant Lots (East Valley) (Low/Medium/High)		Low	High			High	Med		High	Med		High	Med
91	Parks/Open Space (East Valley) (Low/Medium/High)		Low	High			High	Med		High	Med		High	Med
92	Abandoned Alleys (East Valley) (Low/Medium/High)		Low	High			High	Med		High	Med		High	Med
102	Regional Solutions													
106	Non-urban regional recharge		High					Med			Med			Med
107	Runoff treatment and beneficial use/discharge													
108	Treat and beneficial use/discharge (coastal area)	X	X	X	X	X	X	X	X	X	X	X	X	X
109	Treat and beneficial use/discharge (all areas)				X									
110	Percent of Representative storm (1/2-inch) managed (of citywide 1,700 mgd)	10%	58%	39%	100%	10%	39%	47%	10%	39%	47%	10%	39%	47%
111	Current/Anticipated Regulations Level of Compliance													
112	California Toxics Rule	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
113	Current Total Maximum Daily Loads (TMDLs) - Bacteria (Santa Monica Bay), Trash	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
114	Future Total Maximum Daily Loads (projection)	No	Partial	Partial	Yes	No	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial
115	Notes:													
116	*Storage for daily (diurnal) peaks													
117	¹ Flows indicated assume no smart irrigation. Implementing smart irrigation citywide would reduce total dry weather runoff estimates by ~11 mgd													
118	² Effective Capacity is the total treatment capacity, minus solids and brine return flows to the sewer													
119	³ Includes new GBIS extension from NOS to GBIS.													
120	⁴ Runoff is treated and discharged. Runoff can potentially be treated and beneficially used if future demands are identified.													
121	Definitions:													
122	LCMR - Low Cost/Minimum Requirements: alternative includes lower cost solutions or low initial investment by meeting minimum requirements.													
123	WR - High Beneficial Use of Water Resources: alternatives that include high levels of recycled water, conservation, and beneficial use of runoff.													
124	HA - High Adaptability: alternatives that are most able to adjust to changing conditions, such as population, wastewater flows and regulations.													
125	LR - Lower Risk: alternatives that are lower in risk from a regulatory perspective (LR1) or in terms of ease of implementation from a technical,													
126	environmental and/or political and public acceptance perspective (LR2).													

- Capture the runoff from neighborhoods and percolate it into the groundwater basin in vacant lots, parks/open space and/or abandoned alleys in the eastern portion of the San Fernando Valley and percolate it into the groundwater basin (neighborhood recharge).
- Capture rooftop runoff from the single family residences and from schools and government facilities and store it onsite in 10,000 gallon cisterns. Use the collected runoff for onsite landscape irrigation to offset potable water demands.
- Capture runoff from residential, schools, government, commercial, and recreation areas and percolate it into the groundwater basin in the eastern portion of the San Fernando Valley where the soil conditions are optimal for percolation.
- Capture non-urban runoff in the northwest and eastern portions of the San Fernando Valley and convey it to existing regional recharge basins (spreading basins) in the area.

As stated above, each of these options are detailed in Sections 6 and 7 of this document, as well as in *Volume 4: Alternatives Development and Analysis*. As the recommended draft alternatives were selected from the hybrid alternatives, Alternative 1 was formerly called Hyb1C, therefore refer to Table 8-2 to see which options were included in the alternative.

Tables 8-3 and 8-4 list the total amounts of runoff managed for Alternative 1. For dry weather runoff, the total runoff managed is 41 mgd, which is 42 percent of the total estimated annual average dry weather runoff in the City (97 mgd). The wet weather runoff managed by Alternative 1 is 791 mgd, 47 percent of total 1,700 million gallons of runoff generated during a ½ -inch storm event.

Table 8-3 Alternative 1 Summary of Dry Weather Runoff Managed by 2020			
Option	Area	Use	Volume Managed
Reduction (Conservation) Using Smart Irrigation			
Coastal Area	Westside	Treat and Discharge	11 mgd
Diversion to Wastewater System			
Coastal Area	Westside	Treat and Discharge	9 mgd
Browns Creek	Valley	Treat and Discharge	3 mgd
Wilbur Wash	Valley	Treat and Discharge	1 mgd
Limekiln Canyon	Valley	Treat and Discharge	1.5 mgd
Caballero Canyon	Valley	Treat and Discharge	1 mgd
Bull Creek	Valley	Treat and Discharge	2.4 mgd

Table 8-3 Alternative 1 Summary of Dry Weather Runoff Managed by 2020			
Option	Area	Use	Volume Managed
Pacoima Wash	Valley	Treat and Discharge	7 mgd
Diversion to Urban Runoff Plant for Reuse			
Compton Creek	Southside	Reuse	2 mgd
Ballona Creek	Westside	Reuse	3 mgd
Total Dry Weather Runoff Managed (mgd)			41 mgd
Percent of Dry Weather Runoff Managed (of watershed – 97 mgd)			42%

Table 8-4 Alternative 1 Summary of Wet Weather Runoff Managed by 2020			
Option	Area	Use	Volume Managed
On-site Percolation			
Schools	East Valley	Beneficial Use	3 mgd
Government	East Valley	Beneficial Use	1 mgd
Neighborhood - Vacant Lots	East Valley	Beneficial Use	220 mgd
Neighborhood - Parks/open space	East Valley	Beneficial Use	70 mgd
Neighborhood - Abandoned alleys	East Valley	Beneficial Use	10 mgd
Non-urban regional recharge	East Valley	Beneficial Use	245 mgd
On-site Storage / Use (Cisterns)			
Schools	Citywide	Beneficial Use	49 mgd
Government	Citywide	Beneficial Use	31 mgd
On-site Treat and Discharge			
New/Redevelopment Areas	Citywide	Treat and Discharge	2 mgd
Regional Solutions			
Urban runoff plants	Westside (coast)	Treat and Discharge	160 mgd
Total Wet Weather Runoff Managed (mgd)			791 mgd
Percent of Runoff from ½ inch storm citywide (1,700 mgd)			47%

8.3.2 Alternative 2 (Tillman and LAG Water Reclamation Plant Expansion/ High Potential for Water Resources Projects)

The selected options for managing runoff in Alternative 2 are such that they will work along with the wastewater system. The wastewater system for Alternative 2 includes expanding Tillman to 80 mgd with advanced treatment and expanding LAG to 30 mgd with advanced treatment as well as collection system improvements. Refer to the *Volume 4: Alternatives Development and Analysis* for a detailed description of the components of each of the alternatives.

Stemming from the wastewater system improvements, runoff management options were selected and combined to create a complete alternative. Following is a summary of the dry weather runoff options included in Alternative 2:

- Divert coastal runoff from the coastal watersheds to Hyperion for treatment.
- Install automatic evapotranspiration (ET) irrigation controllers (i.e., “Smart Irrigation devices”) Citywide.
- Divert approximately 5 mgd of dry weather runoff from the Compton Creek, and Ballona Creek subwatersheds to urban runoff plants for treatment and reuse.
- Divert approximately 15 mgd from the inland watersheds to urban runoff plants or constructed wetlands from Browns Creek, Wilbur Wash, Limkiln Canyon, Caballero Canyon, Bull Creek and Pacoima Wash.

For wet weather runoff, the following options were included in Alternative 2:

- Manage runoff from new/redevelopment areas per Standard Urban Stormwater Mitigation Plan (SUSMP).
- Capture, treat and beneficially use or discharge wet weather runoff tributary to the Santa Monica Bay to meet the Santa Monica Bay Beaches Bacteria TMDL.
- Capture the runoff from neighborhoods and percolate it into the groundwater basin in vacant lots, parks/open space and/or abandoned alleys in the eastern portion of the San Fernando Valley and percolate it into the groundwater basin.
- Capture rooftop runoff from the single family residences and from schools and government facilities and store it onsite in 10,000 gallon cisterns. Use the collected runoff for onsite landscape irrigation to offset potable water demands.
- Capture runoff from residential, schools, government, commercial, and recreation areas and percolate it into the groundwater basin in the eastern portion of the San Fernando Valley where the soil conditions are optimal for percolation.

- Capture non-urban runoff in the north-west and eastern portions of the San Fernando Valley and convey it to existing regional recharge basins (spreading basins) in the area.

As stated above, each of these options are detailed in Sections 6 and 7 of this document, as well as in *Volume 4: Alternatives Development and Analysis*. As the recommended draft alternatives were selected from the hybrid alternatives, Alternative 2 was formerly called Hyb2C, therefore refer to Table 8-2 to see which options were included in the alternative.

Tables 8-5 and 8-6 list the total amounts of runoff managed for Alternative 2. For dry weather runoff, the total runoff managed is 41 mgd, which is 42 percent of the estimated annual average dry weather runoff in the City (97 mgd). The wet weather runoff managed by Alternative 2 is 791 mgd, 47 percent of total 1,700 million gallons of runoff generated during a ½ -inch storm event.

Table 8-5 Alternative 2 Summary of Dry Weather Runoff Managed by 2020			
Option	Area	Use	Volume Managed
Reduction (Conservation) Using Smart Irrigation			
Coastal Area	Westside	Treat and Discharge	11 mgd
Diversion to Wastewater System			
Coastal Area	Westside	Treat and Discharge	9 mgd
Diversion to Urban Runoff Plant for Reuse			
Compton Creek	Southside	Reuse	2 mgd
Ballona Creek	Westside	Reuse	3 mgd
Diversion to Urban Runoff Plant or Constructed Wetlands			
Browns Creek	Valley	Treat and Discharge	3 mgd
Wilbur Wash	Valley	Treat and Discharge	1 mgd
Limekiln Canyon	Valley	Treat and Discharge	1.5 mgd
Caballero Canyon	Valley	Treat and Discharge	1 mgd
Bull Creek	Valley	Treat and Discharge	2.4 mgd
Pacoima Wash	Valley	Treat and Discharge	7 mgd
Total Dry Weather Runoff Managed (mgd)			41 mgd
Percent of Dry Weather Runoff Managed (of watershed – 97 mgd)			42%

Table 8-6 Alternative 2 Summary of Wet Weather Runoff Managed by 2020			
Option	Area	Use	Volume Managed
On-site Percolation			
Schools	East Valley	Beneficial Use	3 mgd
Government	East Valley	Beneficial Use	1 mgd
Neighborhood - Vacant Lots	East Valley	Beneficial Use	220 mgd
Neighborhood - Parks/open space	East Valley	Beneficial Use	70 mgd
Neighborhood - Abandoned alleys	East Valley	Beneficial Use	10 mgd
Non-urban regional recharge	East Valley	Beneficial Use	245 mgd
On-site Storage / Use (Cisterns)			
Schools	Citywide	Beneficial Use	49 mgd
Government	Citywide	Beneficial Use	31 mgd
On-site Treat and Discharge			
New/Redevelopment Areas	Citywide	Treat and Discharge	2 mgd
Regional Solutions			
Urban runoff plants	Westside (coast)	Treat and Discharge	160 mgd
Total Wet Weather Runoff Managed (mgd)			791 mgd
Percent of Runoff from ½ inch storm citywide (1,700 mgd)			47%

8.3.3 Alternative 3 (Tillman Water Reclamation Plant Expansion / Moderate Potential for Water Resources Projects)

The selected options for managing runoff in Alternative 3 are such that they will work along with the wastewater system. The wastewater system for Alternative 3 includes expanding Tillman to 100 mgd with advanced treatment, and collection system improvements. Refer to *Volume 4: Alternatives Development and Analysis* for a detailed description of the components of each of the alternatives.

Stemming from the wastewater system improvements, runoff management options were selected and combined to create a complete alternative. Following is a summary of the dry weather runoff options included in Alternative 3:

- Divert coastal runoff from the coastal watersheds to Hyperion for treatment.
- Install automatic evapotranspiration (ET) irrigation controllers (i.e., “Smart Irrigation devices”) Citywide.
- Divert approximately 5 mgd of dry weather runoff from the Compton Creek, and Ballona Creek subwatersheds to urban runoff plants for treatment and reuse.

For wet weather runoff, the following options were included in Alternative 3:

- Manage runoff from new/redevelopment areas per Standard Urban Stormwater Mitigation Plan (SUSMP).
- Capture, treat and beneficially use or discharge wet weather runoff tributary to the Santa Monica Bay to meet the Santa Monica Bay Beaches Bacteria TMDL.
- Capture the runoff from neighborhoods and percolate it into the groundwater basin in vacant lots, parks/open space and/or abandoned alleys in the eastern portion of the San Fernando Valley and percolate it into the groundwater basin (neighborhood recharge).

As stated above, each of these options are detailed in Sections 6 and 7 of this document, as well as in Volume 4: Alternatives Development and Analysis. As the recommended draft alternatives were selected from the hybrid alternatives, Alternative 3 was formerly called Alternative Hyb3B, therefore refer to Table 8-2 to see which options were included in the alternative.

Tables 8-7 and 8-8 list the total amounts of runoff managed for Alternative 3. For dry weather runoff, the total runoff managed is 25 mgd, which is 26 percent of the total estimated annual average dry weather runoff in the City (97 mgd). The wet weather runoff managed by Alternative 4 is 660 mgd, 39 percent of total 1,700 million gallons of runoff generated during a ½ -inch storm event.

Table 8-7 Alternative 3 Summary of Dry Weather Runoff Managed by 2020			
Option	Area	Use	Volume Managed
Reduction (Conservation) Using Smart Irrigation			
Coastal Area	Westside	Treat and Discharge	11 mgd
Diversion to Wastewater System			
Coastal Area	Westside	Treat and Discharge	9 mgd
Diversion to Urban Runoff Plant for Reuse			
Compton Creek	Southside	Reuse	2 mgd
Ballona Creek	Westside	Reuse	3 mgd
Diversion to Urban Runoff Plant or Constructed Wetlands			
Browns Creek	Valley	Treat and Discharge	--
Wilbur Wash	Valley	Treat and Discharge	--
Limekiln Canyon	Valley	Treat and Discharge	--
Caballero Canyon	Valley	Treat and Discharge	--
Bull Creek	Valley	Treat and Discharge	--
Pacoima Wash	Valley	Treat and Discharge	--
Total Dry Weather Runoff Managed (mgd)			25 mgd
Percent of Dry Weather Runoff Managed (of watershed – 97 mgd)			26%

Table 8-8 Alternative 3 Summary of Wet Weather Runoff Managed by 2020			
Option	Area	Use	Volume Managed
On-site Percolation			
Schools	East Valley	Beneficial Use	--
Government	East Valley	Beneficial Use	--
Neighborhood - Vacant Lots	East Valley	Beneficial Use	360 mgd
Neighborhood - Parks/open space	East Valley	Beneficial Use	120 mgd
Neighborhood - Abandoned alleys	East Valley	Beneficial Use	18 mgd
Non-urban regional recharge	East Valley	Beneficial Use	--
On-site Storage / Use (Cisterns)			
Schools	Citywide	Beneficial Use	--
Government	Citywide	Beneficial Use	--
On-site Treat and Discharge			
New/Redevelopment Areas	Citywide	Treat and Discharge	2 mgd
Regional Solutions			
Urban runoff plants	Westside (coast)	Treat and Discharge	160 mgd
Total Wet Weather Runoff Managed (mgd)			660 mgd
Percent of Runoff from ½ inch storm citywide (1,700 mgd)			39%

8.3.4 Alternative 4 (Tillman Water Reclamation Plant Expansion / High Potential for Water Resources Projects)

The selected options for managing runoff in Alternative 4 are such that they will work along with the wastewater system. The wastewater system for Alternative 4 includes expanding Tillman to 100 mgd with advanced treatment, and providing collection system improvements. Refer to *Volume 4: Alternatives Development and Analysis* for a detailed description of the components of each of the alternatives.

Stemming from the wastewater system improvements, runoff management options were selected and combined to create a complete alternative. Following is a summary of the dry weather runoff options included in Alternative 4:

- Divert coastal runoff from the coastal watersheds to Hyperion for treatment.
- Install automatic evapotranspiration (ET) irrigation controllers (i.e., “Smart Irrigation devices”) Citywide.

- Divert approximately 5 mgd of dry weather runoff from the Compton Creek, and Ballona Creek subwatersheds to urban runoff plants for treatment and reuse.
- Divert approximately 15 mgd from the inland watersheds to urban runoff plants or constructed wetlands from Browns Creek, Wilbur Wash, Limkiln Canyon, Caballero Canyon, Bull Creek and Pacoima Wash.

For wet weather runoff, the following options were included in Alternative 4:

- Manage runoff from new/redevelopment areas per Standard Urban Stormwater Mitigation Plan (SUSMP).
- Capture, treat and beneficially use or discharge wet weather runoff tributary to the Santa Monica Bay to meet the Santa Monica Bay Beaches Bacteria TMDL.
- Capture the runoff from neighborhoods and percolate it into the groundwater basin in vacant lots, parks/open space and/or abandoned alleys in the eastern portion of the San Fernando Valley and percolate it into the groundwater basin (neighborhood recharge).
- Capture rooftop runoff from the single family residences and from schools and government facilities and store it onsite in 10,000 gallon cisterns. Use the collected runoff for onsite landscape irrigation to offset potable water demands.
- Capture runoff from residential, schools, government, commercial, and recreation areas and percolate it into the groundwater basin in the eastern portion of the San Fernando Valley where the soil conditions are optimal for percolation.
- Capture non-urban runoff in the north-west and eastern portions of the San Fernando Valley and convey it to existing regional recharge basins (spreading basins) in the area.

As stated above, each of these options are detailed in Sections 6 and 7 of this document, as well as in *Volume 4: Alternatives Development and Analysis*. As the recommended draft alternatives were selected from the hybrid alternatives, Alternative 4 was formerly called Alternative Hyb3C, therefore refer to Table 8-2 to see which options were included in the alternative.

Tables 8-9 and 8-10 list the total amounts of runoff managed for Alternative 4. For dry weather runoff, the total runoff managed is 41 mgd, which is 42 percent of the estimated annual average dry weather runoff in the City (97 mgd). The wet weather runoff managed by Alternative 4 is 791 mgd, 47 percent of total 1,700 million gallons of runoff generated during a ½ -inch storm event.

Table 8-9 Alternative 4 Summary of Dry Weather Runoff Managed by 2020			
Option	Area	Use	Volume Managed
Reduction (Conservation) Using Smart Irrigation			
Coastal Area	Westside	Treat and Discharge	11 mgd
Diversion to Wastewater System			
Coastal Area	Westside	Treat and Discharge	9 mgd
Diversion to Urban Runoff Plant for Reuse			
Compton Creek	Southside	Reuse	2 mgd
Ballona Creek	Westside	Reuse	3 mgd
Diversion to Urban Runoff Plant or Constructed Wetlands			
Browns Creek	Valley	Treat and Discharge	3 mgd
Wilbur Wash	Valley	Treat and Discharge	1 mgd
Limekiln Canyon	Valley	Treat and Discharge	1.5 mgd
Caballero Canyon	Valley	Treat and Discharge	1 mgd
Bull Creek	Valley	Treat and Discharge	2.4 mgd
Pacoima Wash	Valley	Treat and Discharge	7 mgd
Total Dry Weather Runoff Managed (mgd)			41 mgd
Percent of Dry Weather Runoff Managed (of watershed – 97 mgd)			42%

Table 8-10 Alternative 4 Summary of Wet Weather Runoff Managed by 2020			
Option	Area	Use	Volume Managed
On-site Percolation			
Schools	East Valley	Beneficial Use	3 mgd
Government	East Valley	Beneficial Use	1 mgd
Neighborhood - Vacant Lots	East Valley	Beneficial Use	220 mgd
Neighborhood - Parks/open space	East Valley	Beneficial Use	70 mgd
Neighborhood - Abandoned alleys	East Valley	Beneficial Use	10 mgd
Non-urban regional recharge	East Valley	Beneficial Use	245 mgd
On-site Storage / Use (Cisterns)			
Schools	Citywide	Beneficial Use	49 mgd
Government	Citywide	Beneficial Use	31 mgd
On-site Treat and Discharge			
New/Redevelopment Areas	Citywide	Treat and Discharge	2 mgd
Regional Solutions			
Urban runoff plants	Westside (coast)	Treat and Discharge	160 mgd
Total Wet Weather Runoff Managed (mgd)			791 mgd
Percent of Runoff from ½ inch storm citywide (1,700 mgd)			47%

8.3.5 Leadership Projects

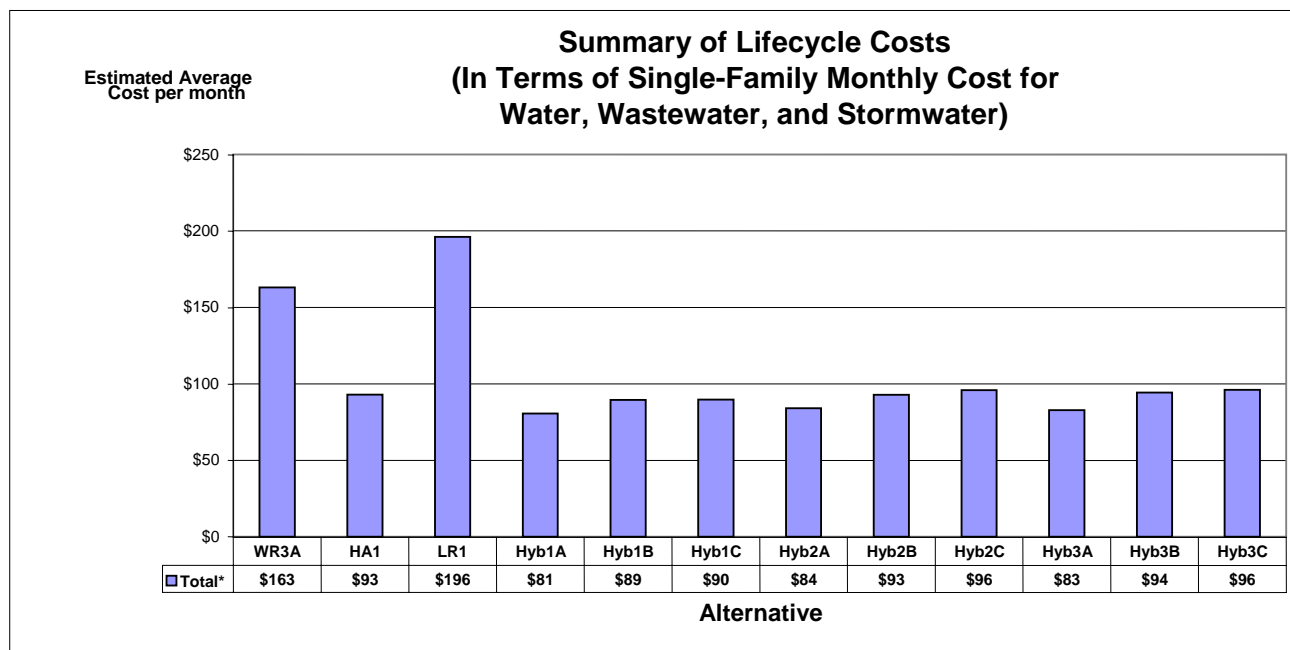
In addition to each of the options included in the alternatives, for each series of alternatives, leadership projects were identified where there was a need for further investigation on the technicalities, implementability, constraints, effectiveness, etc. of the option prior to full scale implementation. See *Volume 4: Alternatives Development and Analysis* for additional discussion on leadership projects.

8.3.6 Alternative Summary

The following tables summarize the components of each of the draft alternatives. Table 8-7 summarizes the dry weather components and Table 8-8 summarizes the wet weather components. Figure 8-2 shows the lifecycle costs for each of the recommended draft alternatives. See *Volume 4: Alternatives Development and Analysis* for detailed discussion of alternatives.

Table 8-11						
Alternatives 1, 2, 3 and 4						
Summary of Dry Weather Runoff Managed by 2020						
Option	Area	Use	Volume Managed			
			Alt 1 (Hyb1C)	Alt 2 (Hyb2C)	Alt 3 (Hyb3B)	Alt 4 (Hyb3C)
Reduction (Conservation) Using Smart Irrigation						
Coastal Area	Westside	Treat and Discharge	11 mgd	11 mgd	11 mgd	11 mgd
Diversion to Wastewater System						
Coastal Area	Westside	Treat and Discharge	9 mgd	9 mgd	9 mgd	9 mgd
Browns Creek	Valley	Treat and Discharge	3 mgd	--	--	--
Wilbur Wash	Valley	Treat and Discharge	1 mgd	--	--	--
Limekiln Canyon	Valley	Treat and Discharge	1.5 mgd	--	--	--
Caballero Canyon	Valley	Treat and Discharge	1 mgd	--	--	--
Bull Creek	Valley	Treat and Discharge	2.4 mgd	--	--	--
Pacoima Wash	Valley	Treat and Discharge	7 mgd	--	--	--
Diversion to Urban Runoff Plant or Constructed Wetlands						
Browns Creek	Valley	Treat and Discharge	--	3 mgd	--	3 mgd
Wilbur Wash	Valley	Treat and Discharge	--	1 mgd	--	1 mgd
Limekiln Canyon	Valley	Treat and Discharge	--	1.5 mgd	--	1.5 mgd
Caballero Canyon	Valley	Treat and Discharge	--	1 mgd	--	1 mgd
Bull Creek	Valley	Treat and Discharge	--	2.4 mgd	--	2.4 mgd
Pacoima Wash	Valley	Treat and Discharge	--	7 mgd	--	7 mgd
Diversion to Urban Runoff Plant for Reuse						
Compton Creek	Southside	Reuse	2 mgd	2 mgd	2 mgd	2 mgd
Ballona Creek	Westside	Reuse	3 mgd	3 mgd	3 mgd	3 mgd
Total Dry Weather Runoff Managed (mgd)			41 mgd	41 mgd	25 mgd	41 mgd
Percent of Dry Weather Runoff Managed (of watershed – 97 mgd)			42%	42%	26%	42%

Table 8-12 Alternatives 1, 2, 3 and 4 Summary of Wet Weather Runoff Managed by 2020						
Option	Area	Use	Volume Managed			
			Alt 1 (Hyb1C)	Alt 2 (Hyb2C)	Alt 3 (Hyb3B)	Alt 4 (Hyb3C)
On-site Percolation						
Schools	East Valley	Beneficial Use	3 mgd	3 mgd	--	3 mgd
Government	East Valley	Beneficial Use	1 mgd	1 mgd	--	1 mgd
Neighborhood - Vacant Lots	East Valley	Beneficial Use	220 mgd	220 mgd	360 mgd	220 mgd
Neighborhood - Parks/open space	East Valley	Beneficial Use	70 mgd	70 mgd	120 mgd	70 mgd
Neighborhood - Abandoned alleys	East Valley	Beneficial Use	10 mgd	10 mgd	18 mgd	10 mgd
Non-urban regional recharge	East Valley	Beneficial Use	245 mgd	245 mgd	--	245 mgd
On-site Storage / Use (Cisterns)						
Schools	Citywide	Beneficial Use	49 mgd	49 mgd	--	49 mgd
Government	Citywide	Beneficial Use	31 mgd	31 mgd	--	31 mgd
On-site Treat and Discharge						
New/Redevelopment Areas	Citywide	Treat and Discharge	2 mgd	2 mgd	2 mgd	2 mgd
Regional Solutions						
Urban runoff plants	Westside (coast)	Treat and Discharge	160 mgd	160 mgd	160 mgd	160 mgd
Total Wet Weather Runoff Managed (mgd)			791 mgd	791 mgd	660 mgd	791 mgd
Percent of Runoff from ½ inch storm citywide (1,700 mgd)			47%	47%	39%	47%



Benefits				Expand Hyperion to 500 mgd Upgrade Tillman (no capacity increase)			Expand & upgrade Tillman to 80 mgd Expand & upgrade LAG to 30 mgd			Expand & upgrade Tillman to 100 mgd		
	WR3A	HA1	LR1	Hyb1A	Hyb1B	Hyb1C	Hyb2A	Hyb2B	Hyb2C	Hyb3A	Hyb3B	Hyb3C
Potable Demand Reduction through conservation	109,800	109,800	87,300	87,300	109,800	109,800	87,300	109,800	109,800	87,300	109,800	109,800
Additional Recycled Water Usage (AF/yr)	63,000	23,200	20,800	21,700	38,700	38,700	21,700	39,600	49,900	21,700	40,100	52,800
DWUR Managed (% of watershed - 97 mgd)	21%	21%	100%	10%	26%	42%	10%	26%	42%	10%	26%	42%
WWUR Managed (% of citywide 1,700 mgd)	58%	40%	100%	10%	40%	49%	10%	40%	49%	10%	40%	49%
DWUR and WWUR Beneficially Used (AF/yr)	40,800	29,100	0	0	32,500	37,700	0	32,500	37,700	0	32,500	37,700
Positive Impacts on Public Lands (acres)	400	580	0	0	580	353	0	580	353	0	580	353
Recycled Water, Dry Weather and Wet Weather Runoff Options												
				Minimum Level	Additional Benefits	More Benefits	Minimum Level	Additional Benefits	More Benefits	Minimum Level	Additional Benefits	More Benefits

* Does not include budget for leadership

Acronyms

DWUR- Dry Weather Urban Runoff
WWUR- Wet Weather Urban Runoff
AF/yr- Acre-feet per year
MGD- Million gallons per day
LAG- Los Angeles- Glendale

Figure 8-2
Summary of Lifecycle Costs

8.4 Summary

Through working with the Steering Group, various City departments and staff, the IRP has taken numerous water, wastewater and runoff options and created comprehensive alternatives. The preliminary alternatives were evaluated and improved upon to create the hybrid alternatives, and the hybrid alternatives were then evaluated to determine the best, or recommended draft alternatives. From this, the environmental analysis will be conducted on each of these four alternatives to determine the final alternative that will be implemented by the City. The components of this alternative will be fine tuned through the implementation of leadership projects that will better define which pieces work and which need to be improved upon prior to full scale implementation. The details of the final alternative and the CIP can be found in *Volume 5: Adaptive Capital Improvement Program*. Volume 5 will be finalized in 2006.

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Appendix A

Regulatory Forecast



Technical Memorandum: Regulatory Forecast

To: *Chuck Turhollow, City of Los Angeles, Bureau of Sanitation
Project Manager, Los Angeles Integrated Resources Plan*

From: *Paul Gustafson, CH:CDM
Project Manager*

*Michele Plá, CH:CDM
Regulatory Expert, Facilities Planning Team*

Date: *May 15, 2003*

Abstract:

This technical memorandum identifies and summarizes the priority regulations and key policy issues that the City of Los Angeles must address in developing forward planning strategies. The memorandum will: (1) discuss the process of updating the regulatory forecast and the criteria for identifying priority regulations and key policy issues; (2) present the updated regulatory forecast; and (3) provide a summary of the key policy issues. Following this memorandum, sessions will be conducted with the City and the consultant team to develop appropriate environmental goals to meet the forecast.

Introduction and Purpose

Understanding the regulatory forecast and developing appropriate environmental quality goals are essential steps in the facilities planning process. For the Integrated Resources Plan (IRP), the overall approach the facilities planning team used to develop the forecast and associated goals is as follows:

- Update the forecast tables generated in Phase I [Integrated Plan for the Wastewater Program (IPWP)], and expand to include anticipated schedule.
- Interview senior staff to update “key policy issues”.
- Prepare technical memorandum summarizing the anticipated regulatory forecast.
- Conduct sessions with City and consultant team to develop appropriate environmental goals to meet the forecast.

The purpose of this memorandum is to summarize the anticipated regulatory forecast and identify key policy issues. The resulting environmental goals will be discussed in a separate document.

Updated Forecast Tables

In the IPWP, regulations and policies affecting the wastewater and stormwater programs were summarized in two documents: "Pertinent Regulatory Requirements and Key Policy Issues Technical Memorandum" (April 2000) and the "Stormwater Quality Management Technical Memorandum" (April 2001).

The priority regulations and key policy issues for stormwater, pretreatment; collection system management; wastewater treatment and operations; water recycling; air quality; biosolids management; and construction were summarized using four categories:

- ***Current policies and regulations:*** those which are in place and are part of a permit, order, or other enforceable tool.
- ***Emerging policies and regulations:*** those which are adopted, but not yet included in a permit, order or other enforceable tool.
- ***Proposed policies and regulations:*** those which are in various development stages, but not yet adopted.
- ***"Crystal Ball" policies and regulations:*** issues that have the potential of becoming proposed, emerging or current in the future. In developing these stages, and in applying them to specific regulations, the staff and consultants based their opinions on experience, communication within industry and regulatory agency leaders, and understanding of the regulatory environment in which the City's programs operate.

Because the IPWP documents were generated almost 2 years ago, the first step was to update the tables to:

- Identify if any of the requirements or policies or their phasing have been changed or eliminated (e.g., have we seen changes from proposed to current, do we have new crystal ball regulations)
- Test if the criteria for what is considered a key issue has changed in any way
- Identify to what extent the schedule for these key policy issues (when we expect them to truly impact the City's programs) has changed.

In addition, a similar table was generated for constructed wetlands.



The first step in this update was a review with the City of Los Angeles Bureau of Sanitation Regulatory Affairs Division staff of the complete list of tables that were prepared in the two Phase I documents. This review resulted in a number of deletions and additions of regulations, as well as many changes of the phase of the regulations. Not surprisingly, many regulations or policies that were proposed are now in the emerging phase, and some that were emerging a few years ago are now current.

The next step was to interview managers and key senior staff at the Bureau of Sanitation, Department of Water and Power, and the City Attorney's Office to discuss the revised forecast tables and get their feedback on what the resulting key policy issues are. The list of staff that have contributed to this effort is in Attachment A.

From information generated in those two steps, the regulatory forecast tables could be updated. Attachment B includes Tables B1 through B12, which summarize the updated regulatory forecast in the following order:

- Pretreatment (Table B1)
- Wastewater Collection System Management (Table B2)
- Wastewater Treatment and Operations – Donald C. Tillman Water Reclamation Plant (Table B3)
- Wastewater Treatment and Operations – LA-Glendale Water Reclamation Plant (Table B4)
- Wastewater Treatment and Operations – Hyperion Treatment Plant (Table B5)
- Wastewater Treatment and Operations – Terminal Island Treatment Plant (Table B6)
- Water Recycling (Table B7)
- Air Quality (Table B8)
- Biosolids Management (Table B9)
- Stormwater Runoff Management (Table B10)
- Construction Permits (Table B11)
- Constructed Wetlands (Table B12)

There are links and relationships between these priority regulations and key policy issues and those relationships are discussed below. This information is valuable to guide the development of environmental goals, which in turn, will play a major role in the alternative

analyses for the IRP Facilities Plan, which includes wastewater, stormwater runoff, and water recycling facilities.

Identifying Priority Issues

As shown in the regulatory forecast tables in Attachment B, there are many potential regulatory and/or policy issues that could affect the City. To allow for effective facilities planning, the IRP must focus on developing options/management approaches to address those issues considered a priority. During Phase I, a set of criteria was developed to help identify and focus on the priority issues. Consequently, in viewing the breadth and scope of the regulations that impact the City and that must be accounted for in developing a Facility Plan, the criteria originally developed during Phase I have been applied using the collective judgment and expertise of the staff interviewed (the City, County, and Regional Water Quality Control Board) and the consultant team. In each case, the intention has been to highlight the regulation or policy so that it is accounted for and considered in the course of developing alternatives for the IRP.

Criteria

To determine what regulatory issues in the forecast should be considered a priority, the IRP team developed the following criteria:

- Requires extraordinary resources to resolve
- Could cause damage to the City's prestige or reputation
- Requires a fundamental shift in how the program operates
- Requires legal action

Requires Extraordinary Resources to Resolve

This category is defined as a regulation or policy that would require:

- Money that has not been budgeted or cannot be easily absorbed in the annual operating or capital budget, thus requiring raising funds; or
- The use of funds that were planned for other essential items, thus changing the priorities of the program and either delaying other essential work or requiring a rate increase in order to do all essential work; or
- Significant amounts of money, without having a measurable environmental benefit; or

- An extraordinary level of effort in organizing community or political opinion/action (consultants, lobbyists, public information effort, time spent on this issue rather than other issues).

Could Cause Damage to Prestige or Reputation of the Agency

This category is defined as a regulation or policy that:

- Has strong public appeal; or
- Is of central concern to interest groups and could result in citizen lawsuits, and negative publicity; or
- Has strong political support and is high priority for the United States Environmental Protection Agency (EPA), the President, the Governor, legislatures, or elected officials so that regulators will pay very close attention to its implementation; or
- Is the subject of a national or state enforcement policy; or
- If not responded to can result in consistent and continued negative publicity for the program and the City; or
- Requires local, regional, or national leadership to resolve; or
- Would have negative economic impacts on the City or the region.

Requires a Fundamental Shift in How the Program Operates

This category is defined as a regulation or policy that would require:

- A new approach for the program or taking on new responsibility that has not previously been contemplated; or
- A different or new organization or alliance in order to be resolved; or
- New or different managerial, financial, or operational arrangements.

Requires Legal Action

This category is defined as a regulation or policy that:

- Would require new or different contract conditions or agreements; or
- Could result in a lawsuit; or
- Would require the City to obtain new legal or regulatory authority.



Summary of Priority Issues

As a result of the review of the above criteria and the interviews, the original list of priority regulations and key policy issues was modified and updated. Again, although there are many key regulations, a subset of these key regulations and issues was felt to warrant special attention in the near-term. In developing the associated environmental goals for the wastewater and runoff programs, the technical teams will use these priority issues.

The full list of priority regulations and key policy issues is presented in Table 1. Each of these is then discussed in greater detail. The full set of updated priority regulations and key policy issues is presented in Attachment B.



Table 1
Priority Regulations and Key Policy Issues

Priority Issues	Program	Revised Phase of Program	Timing of Issue
Beneficial use designations for all water bodies and narrative standards in the Basin Plan	Wastewater	Current	As National Pollutant Discharge Elimination System (NPDES) Permits are Renewed
Clean Water Act 303(d) listings for all water bodies (including urban lakes)	Wastewater, Runoff	Current/ Proposed	Every 4 Years
Total Maximum Daily Load (TMDL) Development - Draft Strategy for Developing TMDLs and Attaining Water Quality Standards in the Los Angeles Region	Wastewater, Runoff	Current and Proposed	Per Consent Decree – with a proposal to bundle different pollutant TMDLs for the same watershed
Clean Water Enforcement and Pollution Prevention Act of 1999, as amended in 2000 by SB2165	Wastewater	Current	Current and ongoing for all effluent limits in NPDES permits unless Time Schedule Order (TSO) in place
California Toxics Rule and the State Implementation Plan for the Inland Surface Waters and the Enclosed Bays and Estuaries of California	Wastewater	Emerging	As NPDES Permits are Renewed
Local County Ordinances on land application of Biosolids – Must be Class A/May have even stricter restrictions on quality and application—Exceptional Quality	Biosolids	Emerging/ Crystal Ball	1-10 years
Prohibition of bypass of the headworks for sanitary sewage and promulgation of Sanitary Sewer Overflow regulation for management of sanitary collection systems	Collection System Management	Current and Proposed	New Regulation ~18 months
Sanitary System Management Plans in NPDES Permits	Collection System Management	Emerging	As NPDES Permits are Renewed
Enforcement of Pretreatment requirements and standards on satellite systems	Wastewater	Proposed	As NPDES Permits are Renewed
Groundwater Recharge, action levels, requirements and public health goals for nitrogen and TOC; new pollutants, endocrine disrupters and pharmaceutically active chemicals	DWP, Wastewater and Runoff Management	Proposed/ Crystal Ball	With Adoption of SSO Rule early in 2005
VOCs & Ammonia from Biosolids Composting Facilities (Rule 1133) consistent with AB 1450	Wastewater	Current	1-5 years
Odor as a result of VOCs & H ₂ S from treatment plants and collection systems General Order # 034 from AQMD and potential for requirements from LARWQCB in NPDES permits	Wastewater and Collection System Management	Current/ Crystal Ball	2-20 years
Numerical Water Quality Standards for stormwater; as a result of TMDL development or across the board in the NPDES permit for all priority and toxic pollutants	Runoff and Watershed Management	Emerging per TMDLs; Crystal Ball for all stormwater permits	2 years for emerging 10-20 years for crystal ball

Beneficial Use Designations of Waters

The use designations for the Los Angeles River, Los Angeles Harbor, and Pacific Ocean beaches directly affect both current and future discharges from the treatment plants and the acceptable flow and quality of the runoff. Currently, the beneficial use designations for the Los Angeles River depend on the location and the access to the River. Uses include:

- REC-1 – Water contact recreation involving body contact with the water, as a potential and intermittent use depending on the location and access to the river;
- REC-2 – Non water contact recreation, in some area it is intermittent;
- WARM, COLD, – supports warm and cold water ecosystems such as fish, invertebrates and vegetation, existing, potential and intermittent depending on location;
- WILD – support terrestrial ecosystems and habitats for such as mammals, birds, reptiles and amphibians and invertebrates, existing, potential and intermittent depending on location;
- GRW – uses of water for natural or artificial recharge, existing, potential and intermittent depending on location;
- RARE – uses of water that support habitats necessary for rare, threatened or endangered plants or animals, existing in a few locations;
- SPW – uses of water that support high quality aquatic habitat for reproduction and early development of fish, existing in few locations in upper reaches of watershed in creeks;
- WET – support wetland ecosystems, including providing flood and erosion control and stream bank stabilization and purification of naturally occurring contaminants, existing in a few locations;
- MUN – uses for water supply, not limited to drinking water, potential on most reaches of the water and existing in a few.

The beneficial use designations for the Los Angeles Harbor are:

- IND – industrial activities that do not depend primarily on water quality, existing use for Marines and Inner Areas of the Harbor;
- NAV – for shipping by private, military or commercial vessels, existing for all area of the Harbor;
- REC 1; REC 2, - as stated above – existing for all areas of the Harbor;



- COMM – commercial and sport fishing including those intended for human consumption or bait, existing for all areas of the Harbor;
- MAR – support marine ecosystems including vegetation, kelp, fish and shellfish or wildlife, existing for all areas of the Harbor;
- RARE – existing for all area of the Harbor;
- SPWN – potential for public beach areas of the Harbor;
- SHELL – potential for all areas of the Harbor except public beaches where it is listed as existing.

The beneficial use designations for the Pacific Ocean beaches are primarily REC 1 and REC 2. In addition, NAV, COMM, MAR, WILD and RARE and SHELL are existing uses in most of the beach locations in Los Angeles County.

These designations have profound impacts; they not only directly define the effluent limits, but they will also determine the impairments of the water bodies and, thereby, the Total Maximum Daily Load (TMDL) analyses. This issue also affects future enforcement and the potential future treatment needs and consequently, resource requirements.

Clean Water Act 303(d) Listings for All Water Bodies (Including Urban Lakes)

Section 303(d) of the Clean Water Act requires the States to list water bodies that do not meet the beneficial uses, and where the application of the technology requirement will not remove the impairment. The beneficial use designations are the starting point. Most beneficial uses were designated in the 1970s or earlier. If the use existed in November 1975, it cannot be changed without a full analysis of the attainability of that use. The 303(d) listings of impaired waters for the Los Angeles River, Los Angeles Harbor and Santa Monica Bay; and soon, the urban lakes indicates where the uses are not met, based on water quality violations or other determinations. The 303(d) list also determines the potential source of the impairment and the high, medium or low priority of the impairment. The listings lead to the development and adoption of TMDL allocations, then to subsequent basin plan amendments and finally to new discharge permit requirements. This entire process is the major driver in the water quality program across the country. In Los Angeles it may result in far-reaching technology and management solutions to address the eventual permit standards to remove impairments and attain and maintain beneficial uses.

It is important to remember that the 1998 303(d) list is not the only concern in the TMDL program. It is true that many of the listings from 1998 are included in a Consent Decree, which contains a schedule for completion of the TMDLs (see below). However, 303(d) listings in 2003 and beyond (likely every 4 years) will carry schedules for completion of the TMDLs. Although EPA has yet to approve the final State 2003 list, it does contain some de-listings for

Ballona Creek, Marina Del Rey, Los Angeles Harbor, Los Angeles River in Sepulveda Basin, and Los Angeles River Estuary; new listings for Los Angeles City Lakes such as Lake Lindero, Ballona Wetland Watershed, reaches of the Los Angeles River, and Marina Del Rey. A new category on the list is called “watch.” This means that there is evidence that there are impairments, but it is not conclusive. Ballona Wetlands Watershed, Los Angeles Harbor, Los Angeles River Estuary, and Dominguez Channel are included on the “watch” list.

TMDL Development

In December 2002, the RWQCB, the SWRCB and EPA Region 9 jointly proposed a Strategy for Developing TMDLs and Attaining Water Quality Standards in the Los Angeles Region. The purpose of this strategy is to clarify when and how TMDLs will be developed over the next 10 years and how they will be coordinated with review of water quality standards and permit renewals. The strategy bundles the pollutant-specific TMDLs that are required in the Consent Decree by watershed so that there is a more efficient watershed/ecosystem approach to the TMDLs. The strategy opens the door to water quality standards revisions, which could be the result of use attainability type of studies or subclassification or refinement of uses.

The strategy also states that TMDL decisions will include guidelines describing how to implement the TMDLs through NPDES permits. Specifically, the strategy states that numerical waste load allocations that lead to numerical effluent limits will be expected for traditional point sources such as wastewater treatment plants. For wastewater NPDES permits, it is anticipated that TMDLs will have specific waste load allocations for individual treatment facilities. In the case of stormwater NPDES permits, the waste load allocation will likely be grouped under one or more general waste load allocations. This has already been demonstrated in the Santa Monica Bay TMDL for Bacteria. It has been assumed that all TMDLs must be adopted in Basin Plans prior to being implemented in NPDES permits. The strategy proposes that if a TMDL can be achieved in a single permitting action, a Basin Plan amendment may not be required.

The strategy also establishes a process by which stakeholder groups can lead the development of these watershed TMDLs and identifies opportunities for varying levels of stakeholder involvement in the TMDL process.

The strategy is clearly considered “proposed” at this time. The intention is that when the strategy becomes final it will be included in the SWRCB’s Continuing Planning Process, which EPA is asking all states to reinvestigate and use as part of the TMDL listing process.

California Toxics Rule

The 1987 amendments, section 303(c)(2)(b), to the Clean Water Act required that toxic pollutants be regulated to protect the water quality and beneficial uses of the nation's waters. Across most of the country, the National Toxics Rule is in effect. However, in California, as a result of lawsuits and other issues between the State and the EPA, the California Toxics Rule (CTR) was promulgated in May 2000. The Policy for Implementation of Toxic Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California (the State Implementation Plan or the SIP) was adopted with the CTR. The CTR and the SIP, which includes the implementation approach to applying toxic pollutant objectives for discharge permits, are expected to result in new and considerably more stringent effluent discharge standards for all NPDES permits. In general, these new standards will be extremely difficult to meet on a consistent basis without new and more extensive treatment or source control programs; such commitments would go well beyond any requirements that are implemented in the United States today. Where new water quality standards are not met, such as standards to protect human health through water quality limits for water bodies with beneficial uses for fishing and shellfish consumption, there is a potential for new 303(d) listings of impairments. As stated above, 303(d) listings lead to TMDLs which can lead to requirements for more treatment, or source control.

Land Application of Biosolids

In October 1999, the Board of Supervisors in Kern County passed an ordinance that banned land application of non-exceptional quality (EQ) biosolids by January 1, 2003. The Southern California Alliance of POTWs (Publicly Owned Treatment Works) (SCAP) and several major POTWs in Southern California tried to work with Kern County to assist with development of the ordinance that addresses the need for local control and oversight of biosolids land application in a logical manner. This effort has been largely unsuccessful. Controversial provisions include: expensive road impact fee, soil sampling every 40 acres, dioxin concentrations must be below 10 parts per billion (ppb), no Class B application after January 2003, 10 mile per hour (mph) wind limit for spreading, etc. EQ biosolids products are exempt from the provisions of the ordinance. The City of Los Angeles and other SCAP members have participated in lawsuits contending that the County is overreaching its jurisdiction, especially in regards to the California Environmental Quality Act (CEQA) by restricting interstate commerce by placing a road impact fee for biosolids trucks only and other issues. The Superior Court in Tulare County ruled in favor of Kern County on every count. The County has developed a new ordinance that limits the amount of biosolids of any quality on land due to potential impacts on the groundwater resources. This too is being contested by the City.

In the meantime, in King County, an ordinance that bans Class B biosolids in February 2003 was adopted pending completion of CEQA documentation. The ordinance allows for the use of EQ biosolids until February 2006, thereafter only EQ Biosolids in compost form will be allowed. A lawsuit was filed against the ordinance. The court ruled in favor of King County and the ordinance despite appeals by the Orange County Sanitation District (OCSD). The

OCSO request for extended time on their permit was denied. The court decision on the adequacy of the CEQA compliance document was appealed. Orange County filed an appeal on the Board of Supervisors decision to not extend their use of Class B biosolids land application. This appeal was denied.

In Riverside County an ordinance banning the land application of Class B biosolids was adopted in November 2001, and there are questions as to whether Class A will be acceptable without large buffer zones so as not to be objectionable to neighbors.

As a result of these developments in Kern, Kings and Riverside Counties, the land application of biosolids and the related regulatory issues are considered a priority key issue because the alternatives to the land application of biosolids are extremely expensive and limited in number. The City has already extensively invested in Class A technology and land application sites. However, continued restrictions would inevitably demand more treatment, research and development or more distant land application sites. The issues related to biosolids reuse and/or disposal will likely have profound impacts on the technology and management solutions as well as locations of disposal and reuse.

Prohibition of Sanitary Sewer Overflows

With over 6,500 miles of sanitary sewers in its system, and because of the prohibition against bypassing any treatment plants, the potential for a sewer spill or overflow (a permit violation) is significant; consequently, the bypass prohibition is a key priority issue. It should be noted that mandatory enforcement under Senate Bill 709 does not apply to these spills and overflows because they are not effluent limit violations and because they occur in the collection system rather than at the treatment plant. In addition to current prohibition of overflows, proposed regulations for sanitary sewer systems will have a profound impact on collection system management and capacity determinations. The City has already implemented the Capacity, Management, Operations and Maintenance (CMOMs) requirements. However, under a proposed Sanitary Sewer Overflow (SSO) Rule, these requirements would now be in the NPDES permit and under regulatory scrutiny, especially the capacity requirements. The City may need to review and revise the subcontract agreements with the 27 entities that are satellite systems to gain assurance that SSOs are not caused by the lack of CMOMs program in the satellite systems. The following two issues are also related to this priority key issue.

Sanitary System Management Plans

A requirement for Sanitary System Management Plans could be included in future NPDES permits in the absence of a final national SSO Rule. In Orange County, California, the permit has included essentially a CMOM program called the Sanitary System Management Plan as a direct result and concern of the Beach Closures that have been occurring there. It is possible that the Los Angeles Regional Water Quality Control Board (LARWQCB) will add this plan to the City's Hyperion Treatment Plant NPDES permit as soon as it comes up for renewal. This

is considered a priority key issue because it is likely that such regulation will occur even without a national SSO Rule.

Pretreatment Program Enforcement

The state has begun to question why pretreatment programs implemented by the contract agencies (satellite system) are not enforced through the Bureau of Sanitation. Although this is beyond what is contemplated in the draft SSO Rule, this could lead to major new contractual requirements or resources and enforcement requirements for the Bureau of Sanitation.

Overall, regarding the above three issues, the prohibition of SSO and the implementation of new SSO requirements will lead to the need to consider even more storage and treatment for wet weather flows in the sanitary system, both of which will be important technology and cost issues for the Facilities Plan.

Groundwater Recharge

Groundwater recharge is a primary option for both supplementing water supply and for management of effluent and runoff. The political reluctance to support the East Valley Reclamation Project, and the draft groundwater recharge regulations from the Department of Health Services (DOHS) has caused this issue to become an extremely high priority. It appears that the DOHS and the LARWQCB are concerned about new toxic chemicals, total organic carbon (TOC) and nitrogen, endocrine disruptors, boron, N-nitrosodimethylamine (NDMA), and pharmaceutically active chemicals. The attempts to include public health goals and action levels in permits (which would require monitoring for these constituents) have the flavor of regulation and raise public doubt about the safety of groundwater recharge of recycled water. (This is currently the issue on the Dominguez Gap Salt Water Barrier permit for the Terminal Island Treatment Plant effluent).

One of the guiding principles for the IRP is to maximize the use of recycled water. Currently, it is becoming increasingly difficult and time-consuming to permit well injection or surface spreading of recycled water if there is indication that the groundwater is, or will become a potable water supply. This means that options for expanding and maximizing industrial and irrigation uses for recycled water will be necessary if the water recycling program is to grow to meet the guiding principle objectives.

It appears that continued percolation or even injection of stormwater runoff will not be a problem in the short run. Blending of recycled effluent with runoff for spreading or injection will be subject to scrutiny and may require a higher level of treatment [microfiltration, reverse osmosis (RO), and ultraviolet disinfection (UV)] in addition to extensive monitoring.

Odor and Air Quality Concerns

Odor concerns are traditionally related to wastewater collection and treatment facilities. But, the Air Quality Management District's (AQMD) new VOC and ammonia rule (Rule 1133) could affect other facilities, such as the composting facility at Griffith Park. The AQMD

adopted Rule 1133 on January 10, 2003. The rule regulates biosolids composting, requiring enclosure of the active composting and venting of emissions from both the active composting and the curing and storage operations to a control device such as a biofilter. The rule also requires an 80% reduction in VOC emissions.

Existing operations must phase in controls over the next few years. Existing facilities such as the one at Griffith Park must submit an emissions control plan that will demonstrate compliance with emission reductions as stipulated by the new rule. New facilities will be required to have these controls in place at the onset of operations beginning in 2007.

In response to the AQMD's recent rulemaking effort, SCAP undertook a study of VOC and odorous emissions from biosolids composting operations through each phase of the process. Emissions tests were carried out at specially-created aerated static piles at the Griffith Park facility. The study concluded that the emissions from composting operations depend greatly on the mixing of the pile and other operational parameters.

Regulation of VOCs and H₂S concerns at treatment plants are part of current air quality regulatory schemes. Recently, the Region 2 RWQCB put specific odor control requirements in the San Francisco NPDES permit for the Southeast Water Pollution Control Plant. This brings the air quality regulation beyond a nuisance issue of odor, to a discharge permit issue. Further application of air quality or nuisance regulations to the collection system is possible, especially under a CMOM scenario. Control of collection system odor and air quality emissions may require significant technology and management options in order to address and control these odors.

Odor control impacts all aspects of the reputation and credibility of the collection, treatment and disposal systems and the owner organization. As the IRP is developed, the impacts of odor on the public and sensitive receptors must be considered in order to protect and enhance the long-term credibility and reputation of the City.

Numerical Water Quality Standards for Stormwater Runoff Management

Based on current interpretation of the stormwater section of the Clean Water Act and the implementing regulations, best management practices (BMPs) based on reducing the discharge pollutants to the maximum extent practicable (MEP) is how the water bodies of the nation are protected from pollution due to stormwater runoff during wet weather. However, under the scenario of an impaired water body on the 303(d) list, (or an impaired use of the water body) for which the main source is stormwater runoff, the result may be numerical water quality standards for a wet weather stormwater runoff management permit. In the case of the Santa Monica Bay Bacteria TMDL, there is a proposed numerical standard for the quality of the wet weather stormwater runoff. This scenario may not apply for every TMDL for which stormwater is a major source of the impairment, but it is a possible outcome.

There is a potential that the broad application of best management practices and MEP for the non-TMDL related (wet weather) stormwater runoff management will be removed as a result of a lawsuit. Each year, lawsuits are filed by environmental activists against the EPA and state permitting agencies throughout the nation. These are similar in that they contend that numerical water quality standards are required, under the Clean Water Act, for all NPDES discharges. Thus far, judges have not ruled that all stormwater permits must contain numerical water quality standards, but it is possible that such an interpretation could be made. Such a judgment would have profound and far-reaching consequences for the City of Los Angeles and for the technology and management choices under the IRP.

Management Issues That Lead to Additional Regulatory Concerns

There are two major management issues, which are part of the IRP Guiding Principles, which will lead to future additional regulatory concerns. Although strictly speaking these are not regulations themselves, decisions in the facilities plan on how to accommodate these management issues could lead to future regulatory concerns.

Brine Treatment and Disposal

As mentioned in this memorandum and others on the subject of the Clean Water Act, the basis of the water quality program is the beneficial uses of designated water bodies. From that designation and the objectives for protecting the uses derives all the water quality standards, NPDES requirements and prohibitions and the listing of impaired waters. As a result of these regulations and requirements it is becoming more and more difficult to discharge to inland surface waters where dilution is not available. Consequently, both the wastewater and the stormwater programs plan to consider water recycling and stormwater recycling as alternatives to waste discharge in the future. As mentioned above however, the DOHS standards for groundwater recharge and recycled water use, may lead to management options that do two things: 1) require a higher level of treatment with an associated brine that contains not only salt but concentrated levels of toxic pollutants, and 2) recycled water facilities located upstream in the wastewater and stormwater collection system so that traditional methods of brine disposal in the ocean, bay or harbors is not as cost effective. Therefore, it can be anticipated, that there will be future regulatory concerns about brine, what it contains, where it can be discharged and if there are any environmental impacts or water quality impacts to alternative brine discharge. In the previous technical analyses of regulations, continued brine discharge into the Los Angeles Harbor is mentioned as potentially being disallowed in the future due to section 303(d) listings for the Harbor. The priority key issue for the future is whether brine can be treated or reused or recycled, and if not, what are the feasible disposal options for the brine.

Los Angeles River Redevelopment

A watershed approach, as a management option for the Los Angeles River is currently proposed to address environmental, water quality and quality of life and economic development issues for the City. A major emphasis of this management approach would likely be the restoration of the River ecosystem while simultaneously providing flood control and water quality improvements. These challenges will be especially difficult considering the TMDL numeric wasteload allocations and the Federal Emergency Management Agency (FEMA) requirements, both of which will likely be very precise. A watershed and ecosystem approach could lead to additional regulatory standards and requirements that would inevitably have financial ramifications and could require changes in the way that wastewater treatment plants operate or whether additional or alternative treatment is desired. For example, wetlands may be constructed which would require a specific flow during dry weather, would require a specific water quality and which would prevent or restrict the amount of recycled water development. Additionally, new wetlands can lead to new designations of the river, with new beneficial uses (or better defined uses), which need to be protected via higher levels of water quality or quantity. Although these are only examples, and ones that are not fully understood, the point is that management options can lead to application of water quality regulations beyond what is now contemplated. In the course of developing options for the IRP specifically designed to address the current, emerging, proposed or crystal ball regulations it is possible that other regulations could be triggered. Future evaluation of the Los Angeles River redevelopment should consider these potential impacts.

Comparison Between Phase I and Phase II lists

The list of priority key issues contained herein on Table 1 is essentially the same since Phase I. The Phase I Wastewater and the Phase I Stormwater Management list are now combined into this one list. A few new items have been added. The first of these is TMDL development, due to their impact on the wastewater and stormwater runoff programs. Secondly, Groundwater Recharge Standards was added because of the IRP guiding principle that calls for increased water recycling. The air quality requirement for VOCs and ammonia at composting facilities was also added. In addition, the SSO issue has been expanded to include enforcement of pretreatment rules and the new Sanitary Sewer Management Plan, all of which are priority key issues and are all related to collection system management and contractual arrangements with satellite systems.

Connections Between the Priority Key Issues

The water quality program under the Clean Water Act is constructed to:

- Develop beneficial use designations;
- Develop water quality criteria for protection of beneficial uses;

- Apply these criteria to specific water bodies based on the specific beneficial uses that need to be protected; and
- Apply anti-degradation to ensure that high quality water bodies remain high quality.

The basis of the regulatory drivers is the designated beneficial uses of each particular water body. If those uses, or the standards adopted to protect those uses, are violated or impaired, the water body becomes listed on the 303(d) list as impaired. This listing then leads to a TMDL, which potentially leads to a higher level of protection through technology applications and management practices. Therefore, for both the wastewater and the stormwater runoff management programs, the connection between these priority key issues starts with the designated beneficial uses.

In the case of the wastewater program, the next steps will involve the water quality standards, which are primarily the CTR and SIP limits for the three non-ocean effluent discharges. Meeting these requirements and the environmental goals they represent will require major considerations of the technology and management options in the IRP. In some cases, such as the option for a higher level of treatment (that can be for both water recycling and effluent discharge or for alternative disposal to a wetland or redeveloped riparian habitat) such as membrane bioreactors or reverse osmosis the result is another set of concerns: brine and where it can be disposed without causing environmental or public health problems.

If water quality standards cannot be met, TMDLs may be the next step. We have already seen in the State adopted 2003 303(d) list, new listings based on the CTR standards. As with brine, other byproducts, such as odor and biosolids, must be considered in establishing environmental goals for the IRP.

For the stormwater runoff management program, the major consideration is the TMDLs, and the new requirements for technology and management solutions not required under the non-TMDL related stormwater runoff program. Many of the environmental goals and the subsequent technology and management options will be the same as found in the wastewater program and will include: more or better treatment; more or better disinfection; development of alternative treatment or disposal options; relocation of discharge or removal of discharge; or reduction of runoff at the source through a variety of management options.

In addition to and somewhat unrelated to the goals of treatment and management of effluent and stormwater or the by products of these processes, is the priority key issue of the SSO Rule, and the Sanitary System Management Plan. This proposed rule and new NPDES permit requirement leads to major capacity determinations (including size of pipes and interceptors) for the collection system and potential capacity enhancement in order to prevent overflows in the system. But this rule is not limited to the collection system because once the wet weather flow is contained in the system it also has to be treated. This means capacity determinations

for treatment of all the captured flow either at existing treatment plant or at new peak wet weather treatment facilities has to be part of the IRP analysis for meeting future regulations.

Conclusions/Next Steps

The regulatory issue of concern for the wastewater program will continue to be driven by designated beneficial uses, the quality of the effluent from the treatment plants and the requirements of TMDLs as they are developed.

As discussed earlier, this Regulatory Forecast Technical Memorandum serves to summarize the anticipated regulatory requirements and the key issues the City could face in the future. The next step will be to conduct strategy sessions with technical staff from the runoff and wastewater disciplines to review these key issues and strategize appropriate environmental goals to meet them. These environmental goals, in conjunction with the wastewater flow projections and urban runoff loading projections will be the basis from which options are developed from the IRP.

The development of environmental goals should be based on:

- The anticipated California Toxic Rule (CTR)/State Implementation Plan (SIP) requirements for each treatment plant;
- The water recycling requirements, especially those for groundwater recharge as they are more stringent than those for industrial/irrigation use; and
- The scheduled TMDLs from the 1998 list and the proposed 2003 list focusing particularly on the pollutant and water body on the list correlated to the effluent discharge.

Through this process, air quality and biosolids quality and management, and collection system capacity will continue to be priority key issues, because they meet all the criteria for identification of priority key issues.

Stormwater runoff management is a much larger and less manageable program compared to the wastewater program. The intermittent nature of the wet weather runoff and sheer volume and magnitude of it requires larger facilities and more effective and dispersed management solutions. But as with the wastewater program, the key priority issues for the stormwater program start with the beneficial uses and lead to TMDLs which lead back to permits. The environmental goals in this case should be based on the TMDL schedule for the 1998 list and the proposed 2003 list.



Attachment A

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Attachment B – Regulatory Forecast Tables

Table B1 Regulatory Forecast - Pretreatment			
Item	Regulations and Policies	Agency	Revised Phase
1	40 CFR part 403	EPA	Current
2	NPDES permits Permit No. CA0056227 (for Tillman Water Reclamation Plant) Permit No. CA0050000 (for LA-Glendale Water Reclamation Plant) Permit No. CA0053856 (for Terminal Island Treatment Plant) Permit No. CA0109991 (for Hyperion Treatment Plant)	LARWQCB	Current
3	Los Angeles Municipal Code, Ordinance No. 64.30	City	Current
4	Rules 1171 and 1122, replacement of organic degreasing agents with water soluble degreasers	SCAQMD	Current
5	Clean Water Act Enforcement and Pollution Prevention Act of 1999 (SB 709)	SWRCB, LARWQCB	Current
6	Grease trap ordinance (possibly through Administrative Order) (FOG)	EPA, City	Current
7	TMDL Wasteload Allocations and Implementation Plans	LARWQCB	Emerging
8	40 CFR Part 131 (California Toxics Rule)	EPA	Emerging
9	Policy for implementation of toxic standards for inland surface waters, enclosed bays, and estuaries of California (State Implementation Plan, adopted March 2, 2000)	SWRCB	Emerging
10	40 CFR Part 444 (Commercial Hazardous Waste Combustors)	EPA	Proposed
11	40 CFR Part 445 (Pretreatment standards associated with landfills)	EPA	Proposed
12	40 CFR Part 405-71 (Reformatting effluent guidelines and standards)	EPA	Proposed
13	40 CFR Part 442 (Transportation equipment cleaning)	EPA	Proposed
14	40 CFR Part 437 (Centralized waste treatment industry)	EPA	Proposed
15	40 CFR Part 403 (Streamlining general pretreatment regulations)	EPA	Proposed
16	40 CFR Part 435 (Synthetic based drilling fluids in the oil gas extraction)	EPA	Proposed
17	40 CFR Part 438 (metal products and machinery)	EPA	Proposed

Note: For additional discussion, refer to "Pertinent Regulations and Key Policy Issues Technical Memorandum" (CDM and CH2M HILL, April 2000)

Table B2 Regulatory Forecast - Wastewater Collection System Management			
Item	Regulations and Policies	Agency	Revised Phase
1	Clean Water Act National Pollutant Discharge Elimination System (NPDES)	EPA RWQCB/ SWRCB	Current
2	Cease and Desist Order 98-073 (sewage overflows)	RWQCB	Current
3	Porter-Cologne Water Quality Act California Water Code	RWQCB	Current
4	Regulation of Odors from Collection System (nuisance)	SCAQMD	Current
5	Sanitary Sewage Overflows <ul style="list-style-type: none"> Administrative requirements Capacity Assurance, Management, Operations, and Maintenance requirements (CMOM) Prohibitions on sewage overflow discharges to waters of the U.S.	EPA RWQCB	Proposed – National, Emerging – Local (due to OCSD beach closures) Current
6	Grease trap ordinance (possibly through Administrative Order) (FOG)	EPA	Current
7	Dry-Weather Urban Runoff Diversions to POTWs	RWQCB	Emerging/Proposed
8	Inflow & Infiltration Control Measures (part of CMOM)	RWQCB EPA	Proposed
9	Wet-Weather Urban Runoff Diversions / Bacteria TMDL Compliance	RWQCB	Proposed
10	Regulation of VOC and H2S Emissions from the Collection System (hazardous air pollutants)	EPA SCAQMD	Crystal Ball

Note: For additional discussion, refer to "Pertinent Regulations and Key Policy Issues Technical Memorandum" (CDM and CH2M HILL, April 2000)

Table B3 Regulatory Forecast - Wastewater Treatment and Operations Donald C. Tillman Water Reclamation Plant			
Item	Regulations and Policies	Agency	Revised Phase
1	NPDES permit (permit no. CA0056227) (New: March 2003)	LARWQCB	Current/Emerging
2	General Industrial Stormwater Permits	SWRCB	Current
3	Clean Water Enforcement and Pollution Prevention Act of 1999 (SB 709) (Revised)	EPA, SWRCB, LARWQCB	Current
4	Writ of Mandate and Stay of Permit	LARWQCB	Current/Emerging
5	Beneficial use designations for LA River (including narrative), leading to application of water quality standards (WQS) and listings of impairments.	LARWQCB	Current
6	Total Maximum Daily Loads (TMDLs) (LA River)	EPA, SWRCB, LARWQCB	Emerging
7	Water Quality Based Effluent Limitations	EPA, SWRCB, LARWQCB	Emerging
8	40 CFR Part 131 [California Toxics Rule (CTR)] Policy for implementation of toxic standards for inland surface waters, enclosed bays, and estuaries of California [State Implementation Plan (SIP)]	EPA, SWRCB	Emerging
9	Effluent-dependent waterbody provisions in SIP for development of permit levels for CTR discharge standards	SWRCB, LARWQCB	Proposed
10	More stringent Title 22 Requirements for Groundwater Recharge Operations (e.g., virus monitoring; percentage of reclaimed water in aquifers)	DOHS	Current/Proposed
11	Issues related to Los Angeles River (e.g., redevelopment of the river, groundwater recharge in unlined stretches of the river; options and technologies for effluent disposal	Environmental Advocate Organizations / City Council Ad Hoc Committee on River	Proposed
12	Nutrient Criteria for effluent discharges	EPA	Proposed
13	Pollutants that are not problems now, but will become in the future (e.g., NDMA)	EPA, SWRCB, LARWQCB	Crystal Ball
14	New aquatic and human health criteria (beyond CTR)	EPA, SWRCB, LARWQCB	Crystal Ball
15	Sediment criteria for metals	EPA, SWRCB, LARWQCB	Crystal Ball
16	Wildlife criteria to protect threatened and endangered species	EPA, SWRCB, LARWQCB	Crystal Ball
17	Controls or standards for endocrine disruptors and pharmaceutically active chemicals	EPA, SWRCB, LARWQCB	Crystal Ball
18	Substantial flow contributions from local contract agencies leading to increased pretreatment standards and amendments to agreements with contract agencies	EPA, SWRCB, LARWQCB	Crystal Ball

Note: For additional discussion, refer to "Pertinent Regulations and Key Policy Issues Technical Memorandum" (CDM and CH2M HILL, April 2000)

Table B4 Regulatory Forecast - Wastewater Treatment and Operations Los Angeles-Glendale Water Reclamation Plant			
Item	Regulations and Policies	Agency	Revised Phase
1	NPDES permit (permit numbers CA005000, and CA 00949333) (new: Nov/Dec 2002?)	LARWQCB	Current/Emerging
2	General Industrial Stormwater Permits	SWRCB	Current
3	Clean Water Enforcement and Pollution Prevention Act of 1999 (SB 709) (Revised)	EPA, SWRCB, LARWQCB	Current
4	Writ of Mandate and Stay of Permit	LARWQCB	Current/Emerging
5	Beneficial use designations for LA River (including narrative), leading to application of water quality standards (WQS) and listings of impairments.	LARWQCB	Current
6	Total Maximum Daily Loads(TMDLs) (LA River)	EPA, SWRCB, LARWQCB	Emerging
7	Water Quality Based Effluent Limitations	EPA, SWRCB, LARWQCB	Emerging
8	40 CFR Part 131 [California Toxics Rule (CTR)] Policy for implementation of toxic standards for inland surface waters, enclosed bays, and estuaries of California [State Implementation Plan (SIP)]	EPA, SWRCB	Emerging
9	Effluent-dependent waterbody provisions in SIP for development of permit levels for CTR discharge standards	SWRCB, LARWQCB	Proposed
10	More stringent Title 22 Requirements for Groundwater Recharge Operations (e.g., virus, monitoring; percentage of reclaimed water in aquifers)	DOHS	Proposed
11	Issues related to Los Angeles River (e.g., redevelopment of the river, groundwater recharge in unlined stretches of the river; options and technologies for effluent disposal	Environmental Advocate Organizations / City Council Ad Hoc Committee on River	Proposed
12	Nutrient criteria for effluent discharges	EPA	Proposed
13	Pollutants that are not problems now, but will become in the future (e.g., NDMA)	EPA, SWRCB, LARWQCB	Crystal Ball
14	New aquatic and human health criteria (beyond CTR))	EPA, SWRCB, LARWQCB	Crystal Ball
15	Sediment criteria for metals	EPA, SWRCB, LARWQCB	Crystal Ball
16	Wildlife criteria to protect threatened and endangered species	EPA, SWRCB, LARWQCB	Crystal Ball
17	Control or standards for endocrine disruptors and pharmaceutically active chemicals	EPA, SWRCB, LARWQCB	Crystal Ball
18	Substantial flow contributions from local contract agencies leading to increased pretreatment standards and amendments to agreements with contract agencies	EPA, SWRCB, LARWQCB	Crystal Ball

Note: For additional discussion, refer to "Pertinent Regulations and Key Policy Issues Technical Memorandum" (CDM and CH2M HILL, April 2000)

Table B5 Regulatory Forecast - Wastewater Treatment and Operations Hyperion Treatment Plant			
Item	Regulations and Policies	Agency	Revised Phase
1	NPDES permit (permit no. CA CA0109991)	LARWQCB	Current/Emerging
2	General Industrial Stormwater Permit		
3	Clean Water Enforcement and Pollution Prevention Act of 1999 (SB 709) (Revised)	EPA, SWRCB, LARWQCB	Current
4	The State Ocean Plan	SWRCB	Current/Proposed
5	40 CFR part 503, sludge regulations	EPA	Current
6	Kern County Ordinances on land application of biosolids; class A, EQ and fee for road use	Kern County	Current and Emerging
7	West Basin Water Recycling Project - Agreement	DWP, West Basin Municipal Water District	Current
8	Nutrient criteria for salt water bodies	EPA	Proposed
9	Effects of diversion of dry weather runoff flows to HTP	LARWQCB	Proposed
10	Effects of diversion of wet weather runoff flows to HTP for treatment and impact of bypass regulations on this option	EPA, LARWQCB	Proposed
11	Water Quality Limitation Associated with West Basin Project	DOHS, LARWQCB, West Basin	Crystal Ball
12	New aquatic and human health criteria (beyond CTR)	EPA, SWRCB, LARWQCB	Crystal Ball
13	Sediment criteria for metals	EPA, SWRCB, LARWQCB	Crystal Ball
14	Wildlife criteria to protect threatened and endangered species	EPA, SWRCB, LARWQCB	Crystal Ball
15	Controls or standards for endocrine disruptors and pharmaceutically active chemicals	EPA, SWRCB, LARWQCB	Crystal Ball

Note: For additional discussion, refer to "Pertinent Regulations and Key Policy Issues Technical Memorandum" (CDM and CH2M HILL, April 2000)

Table B6 Regulatory Forecast - Wastewater Treatment and Operations Terminal Island Treatment Plant			
Item	Regulations and Policies	Agency	Revised Phase
1	NPDES permit (permit no. CA0053856) (renewal pending)	LARWQCB	Current/Emerging
2	General Industrial Stormwater Permit		
3	Clean Water Enforcement and Pollution Prevention Act of 1999 (SB 709) (Revised)	EPA, SWRCB, LARWQCB	Current
4	Enclosed Bays and Estuaries Plan and application of CTR levels to NPDES permit	LARWQCB	Current/Emerging
5	Harbor Water Recycling Project (lead to studies for implementation of advanced treatment processes)	DWP	Current
6	40 CFR part 503, sludge regulations	EPA	Current
7	Kern County Ordinances on land application of biosolids; class A, EQ and fee for road use	Kern County	Current/Emerging
8	Chronic Toxicity Testing Requirements	LARWQCB	Current
9	Bay Protection and Toxics Cleanup program	SWRCB	Emerging
10	Groundwater Replenishment and Industrial Reuse-Permit	LARWQCB, DOHS,	Emerging/Current
11	Increased control requirements of toxic pollutants in order to recycle effluent (e.g., Boron, NDMA, MTBE, perchlorates)	SWRCB /DOHS	Proposed
12	Nutrient criteria for effluent discharges	EPA	Proposed
13	Effect of possible changes in the local industrial activity - impacts on trace elements that could require higher level of treatment for groundwater recharge or effluent discharge	LARWQCB/DOHS	Crystal Ball
14	New aquatic and human health criteria (beyond CTR)	EPA, SWRCB, LARWQCB	Crystal Ball
15	Sediment criteria for metals	EPA, SWRCB, LARWQCB	Crystal Ball
16	Wildlife criteria to protect threatened and endangered species	EPA, SWRCB, LARWQCB	Crystal Ball
17	Control or standards for endocrine disruptors and pharmaceutically active chemicals	EPA, SWRCB, LARWQCB	Crystal Ball
18	Removal of Discharge Brine (from proposed RO facilities) Waste from LA Harbor	LARWQCB	Crystal Ball

Note: For additional discussion, refer to "Pertinent Regulations and Key Policy Issues Technical Memorandum" (CDM and CH2M HILL, April 2000)

Table B7 Regulatory Forecast - Water Recycling			
Item	Regulations and Policies	Agency	Revised Phase
1	California Code of Regulations, Title 22, Division 4, Chapter 3 (wastewater reclamation criteria)	DOHS	Current
2	Water Quality Control Plan (Basin Plan)	LARWQCB	Current
3	Reclamation NPDES permits	LARWQCB (close coordination with DOHS)	Current
4	Use of reclaimed water in instances where the public may be exposed	Los Angeles County Health Department	Current
5	Vector control requirements	State and local	Current
6	Increased degree of removal of pathogens and toxic compounds (e.g., <i>Cryptosporidium</i> , <i>Giardia</i>)	DOHS	Emerging
7	Establishment of more consistent water reclamation criteria (e.g., site-specific basis)	DOHS	Emerging
8	TMDLs	LARWQCB	Emerging
9	Triennial Review Process	LARWQCB	Emerging
10	California Toxics Rule	EPA	Emerging
11	Enhanced Surface Water Treatment Rule	EPA	Proposed
12	Proposed Title 22 Revisions	DOHS	Proposed
13	Control of endocrine disrupters and disinfection by-products	DOHS	Proposed
14	Alternative disinfection methods (e.g., UV radiation)	DOHS	Proposed
15	Considerations and/or Proposals for Recognition of Effluent Dependent Water Bodies and Expanded Water Recycling efforts	LARWQCB	Proposed
16	Water Conservation and Reclaimed Water Marketing Rules	LARWQCB	Proposed
17	Advanced treatment processes (reverse osmosis or other membrane-based treatment requirements, ultraviolet disinfection, etc.)	DOHS, EPA, SWRCB, LARWQCB	Crystal Ball
18	Dilution allowances for discharges to the ocean and enclosed bays	LARWQCB	Crystal Ball
19	Incidental groundwater recharge in the LA Angeles River	LARWQCB	Crystal Ball
20	Direct potable reuse	DOHS	Crystal Ball
21	Brine lines for disposal of membrane-process wastes	LARWQCB	Crystal Ball
22	Revitalization/de-urbanization of the LA River (concrete removal, bike paths, public and commercial uses, etc.)	Los Angeles County; possibly US Army Corps of Engineers	Crystal Ball
23	Aquatic/wildlife maintenance flows for the LA River	DFG, USFWS	Crystal Ball
24	Viruses in reclaimed water (monitoring, DNA verification and identification, etc.)	DOHS	Crystal Ball
25	Arsenic limitations due to presence in water supplies	EPA, SWRCB	Crystal Ball

Note: For additional discussion, refer to "Pertinent Regulations and Key Policy Issues Technical Memorandum" (CDM and CH2M HILL, April 2000)

Table B8 Regulatory Forecast - Air Quality			
Item	Regulations and Policies	Agency	Revised Phase
1	Clean Air Act (CAA) and the 1990 Clean Air Act Amendment (CAAA) 40 CFR 50 – 99 CAA Title III, Section 112 (r) – RMP CAA Title III, Section 112 (r) – General Duty Clause	EPA CARB SCAQMD Administrative Agency OES	Current
2	Addendum to the 1997 Air Quality Management Plan (AQMP) and the State Implementation Plan 1994 AQMP 1997 AQMP 1997 AQMP Addendum The SIP	EPA CARB SCAQMD	Current
3	Title V Operating Permits 1990 Clean Air Act Amendments (CAA), Title V	EPA SCAQMD	Current
4	Solvent Cleaning Operations and Solvent Degreasers Rule 1171 and 1122, respectively	SCAQMD	Current
5	Odor and Dust from Treatment Plants General Order #034	SCAQMD Local Jurisdictions such as the Cities of El Segundo and Los Angeles	Current
6	California Accidental Release Prevention (Cal ARP) Program	Administrative Agencies – Fire Departments & Local Health Departments OES	Current
7	Portable Equipment Registration and Permits	CARB SCAQMD	Current
8	Maximum Achievable Control Technology for Publicly Owned Treatment Works (POTWs MACTs) and the Integrated Urban Air Toxics Strategy (The Strategy) 64 CFR 57572 and the 1990 Clean Air Act Amendments (CAAA), Title III for the POTWs MACTs Clean Air Act (CAA), Section 112 (k) for The Strategy Section 129 – New Source Performance Standards (NSPS) for POTW Combustion Sources	EPA SCAQMD	Emerging/Curr ent
9	Diesel Particulate Matter as a Toxic Air Contaminant, California Toxic Air Contaminant Act (AB 1807, Tanner Act) Air Toxic “Hot Spots” Information and Assessment Act (AB 2588)	CARB SCAQMD	Current
10	Environmental Justice Initiatives (1997 AQCD)	SCAQMD	Current
11	Architectural Coatings Rule 1113 1994 AQMP 1997 AQMP	SCAQMD	Emerging
12	Environmental Health Protection for Children SB 25	CARB	Emerging
13	Proposed Amendments to the New Source Review of Carcinogenic Air Contaminants (Rule 1401) & Control of Toxic Air Contaminants from Existing Sources (Rule 1402) Rule 1401	SCAQMD	Current

Table B8 Regulatory Forecast - Air Quality			
Item	Regulations and Policies	Agency	Revised Phase
	Rule 1402 Multiple Air Toxics Exposure Study (MATES – II)		
14	New Source Review/Best Available Control Technology (BACT) 1990 Clean Air Act Amendment (CAAA) and SCAQMD Regulation XIII	EPA SCAQMD	Current
15	Replacement of Fleet Vehicles for Government and Airport Operations – Rule 1190 Health and Safety Code, Section 40447.5 and SCAQMD Proposed Rule 1190	SCAQMD	Current
16	VOCs & Ammonia from Biosolids Composting Facilities (Rule 1133) AB 1450	SCAQMD	Current
17	Environmental Justice Act SB 115	State Office of Planning and Research Cal EPA	Current
18	Hazardous Air Pollutants (HAPs) Emission from wastewater collection system	EPA	Crystal Ball
19	Laws, Regulations, and Rules that result in Cross-Media Pollution Transfers	SCAQMD	Crystal Ball
20	Future List of Carcinogenic Substances	CARB	Crystal Ball
21	Environmental Justice Issues (exposure/risk issues)	SCAQMD	Emerging

Note: For additional discussion, refer to “Pertinent Regulations and Key Policy Issues Technical Memorandum” (CDM and CH2M HILL, April 2000)

Table B9 Regulatory Forecast - Biosolids Management			
Item	Regulations and Policies	Agency	Revised Phase
1	40 CFR 503 (Regulations governing handling/treatment of biosolids)	EPA	Current
2	Resource, Conservation, and Recovery Act (Waste Discharge Guidelines and Landfill Construction Regulations)	EPA RWQCB CISWMB	Current
3	Conditional Use Permits	Local Jurisdictions	Current
4	California Integrated Solid Waste Management Act, Assembly Bill 939 (AB 939)	California Integrated Waste Management Board	Current
5	Persistent Bioaccumulation Toxic Chemicals (reporting thresholds of PBTs)	EPA	Emerging
6	Kern County Biosolids Ordinance (imposes fees and bans land application of non-exceptional quality biosolids)	Kern County	Current
7	Biosolids Environmental Management System (to ensure biosolids are properly managed)	EPA, City of Los Angeles	Current
8	USDA Proposed Organics Rule (prevents biosolids from being used in organic crops)	USDA	Current
9	SB 205: Amendments to the Porter- Cologne Water Quality Act (development of waste discharge requirements for biosolids) (SWRCB General Order)	SWRCB/RWQCB	Current
10	Local Ordinances Banning Land Application of Biosolids	Local Jurisdictions (Cities & Counties)	Current Emerging/Proposed
11	Dioxin Reassessment (proposed amendments to 40CFR Part 503 regarding Dioxin in biosolids)	EPA	Emerging/Proposed
12	Radioactivity (NRC and EPA are evaluating whether radioactivity needs to be regulated in B.S.)	NRC, EPA City of Los Angeles	Proposed
13	Round 2 of 40 CFR Part 503 for Dioxin	EPA	Proposed
14	Beyond Class A cake	Local Jurisdictions	Crystal Ball
15	Fertilizer Regulations (labeling of biosolids)	California Department of Food and Agriculture	Crystal Ball

Note: For additional discussion, refer to "Pertinent Regulations and Key Policy Issues Technical Memorandum" (CDM and CH2M HILL, April 2000)

Table B10 Regulatory Forecast - Stormwater/Runoff Management			
Item	Regulations and Policies	Agency	Revised Phase
1	Clean Water Act, Section 402(p) and Phase I regulations for MS4	EPA, LARWQCB	Current
2	National Pollutant Discharge Elimination System – Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles (Permit No. CAS614001)	LARWQCB	Current
3	Beneficial Use Designations per Clean Water Act (CWA) and State Resolutions (except for MUN)	LARWQCB and SWRCB	Current
4	New development specific design criteria for mitigating storm water impacts for the California Coastal Zone	California Coastal Commission	Current
5	Standard Urban Stormwater Mitigation Plan	County of Los Angeles Department of Public Works	Current
6	Policy Statement on the Environment	City of Los Angeles Adopted 1/26/99	Current
7	Storm water Ordinance No. 172172, Effective 10-01-98	City of Los Angeles Department of Public Works Bureau of Sanitation	Current
8	Section 303(d) of the Clean Water Act – Impaired Water Bodies	EPA, SWRCB and LARWQCB	Emerging and Proposed (new list Jan 2003)
9	Total Maximum Daily Loads (TMDLs) including Consent Decree Schedule for Completion of TMDLs in Los Angeles Region	LARWQCB, SWRCB and EPA	Emerging
10	Region 9 Draft Guidance for Issuing Permits for Discharges into Impaired Waters in the Absence of a TMDL	EPA, LARWQCB	Current
11	Trash and Bacteria TMDL for the Los Angeles River, Ballona Creek and Santa Monica Bay and Beaches	LARWQCB, EPA	Current/Emerging
12	Water Quality Enforcement Policy – LA Region	LARWQCB, SWRCB	Emerging
13	Treatment of Dry Weather Urban Runoff (per TMDLs to reduce load allocations to water body)	LARWQCB	Crystal Ball
14	Treatment of Wet Weather Urban Runoff (per Santa Monica Bay wet weather Bacteria TMDL)	LARWQCB	Proposed
15	Application of Numerical WQS in stormwater permits as a result of the TMDL	LARWQCB	Emerging
16	Application of Numerical WQS in stormwater NPDES permits for all priority pollutants and CTR pollutants	EPA, SWRCB and LARWQCB	Crystal Ball
17	Redirection, Reuse, or Treatment of Stormwater - see water recycling issues	LARWQCB/DOHS	Current/ Emerging and Proposed and Crystal Ball

Note: For additional discussion, refer to the "Stormwater Quality Management Technical Memorandum" (CDM and CH2M HILL, April 2001)

Table B11 Construction Permits		
Regulations and Policies	Agency	Phase
Permits under Section 404 of the Clean Water Act Permit under Section 10 of the Rivers and Harbors Act	U.S. Army Corps of Engineers EPA	Current
Consultation under the Endangered Species Act	U.S. Department of Interior (U.S. Fish and Wildlife Service) EPA	Current
General NPDES Permits Individual NPDES Permits	Regional Water Quality Control Board	Current
Review under Sections 1600-1607 of the California Fish and Game Code (streambed alteration) Review under Section 2080 <i>et seq.</i> of the <i>Cal Fish and Game Code</i> relative to state listed endangered species	Department of Fish and Game	Current
Review and approval of historic property surveys	State Historic Preservation Office	Current
Coastal Development Permits	California Coastal Commission City of Los Angeles (for dual jurisdiction permits)	Current
Permits to construct pollution control devices and/or new emission sources	South Coast Air Quality Management District	Current
Encroachment Permits	California Department of Transportation	Current
Various land use, right-of-way, and construction permits	County of Los Angeles	Current
Review, coordination, and approvals from various City departments.	City of Los Angeles	Current
Conditional Use Permits; Approval of haul routes	Other Cities	Current
Scrutinizing of construction activities to a greater degree	State and Local Agencies	Emerging
Asbestos & Serpentine (airborne)		Emerging

Note: For additional discussion, refer to "Pertinent Regulations and Key Policy Issues Technical Memorandum" (CDM and CH2M HILL, April 2000)

Table B12 Constructed Wetlands		
Regulations and Policies	Agency	Phase
Permits under Section 404 of the Clean Water Act Permit under Section 10 of the Rivers and Harbors Act	U.S. Army Corps of Engineers EPA	Current
Consultation under the Endangered Species Act	U.S. Department of Interior (U.S. Fish and Wildlife Service) EPA	Current
General NPDES Permits Individual NPDES Permits	Regional Water Quality Control Board	Current
Review under Sections 1600-1607 of the California Fish and Game Code (streambed alteration) Review under Section 2080 <i>et seq.</i> of the <i>Cal Fish and Game Code</i> relative to state listed endangered species	Department of Fish and Game	Current
Beneficial use designations for wetland in Basin Plan (including narrative), leading to application of water quality standards (WQS) and listings of impairments.	LARWQCB	Current
40 CFR Part 131 [California Toxics Rule (CTR)] Policy for implementation of toxic standards for inland surface waters, enclosed bays, and estuaries of California [State Implementation Plan (SIP)]	LARWQCB	Emerging
Effluent-dependent waterbody provisions in SIP for development of permit levels for CTR discharge standards	SWRCB/LAWRQCB	Proposed

Appendix B
Summary of the Steering Group Process
and Their Recommendations for Integrated
Resources Planning Development

City of Los Angeles Integrated Plan for the Wastewater Program



**Summary of
the Steering Group Process
and Their Recommendations
for Integrated Resources
Planning Policy Development**

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433 SOUTH SPRING ST. 4TH FLOOR
LOS ANGELES, CA 90013-1957

On behalf of the City of Los Angeles Bureau of Sanitation, I would like to express our deepest gratitude to the Steering Group members for your phenomenal insight, vision and commitment during this first phase of our Integrated Resources Planning effort.

When we began this journey over 2 years ago, we started with a goal of providing an interactive stakeholder process and technical framework to assist our City's decision makers in developing supportable policies for the wastewater services that would integrate all of our City's water quality and water supply activities and elements. We began with a goal of building improved community involvement, understanding and support, through early and continued dialogue in this policy development process.

I think we have made dramatic progress toward meeting our goals. Together, we have shaped a strong and vibrant vision for the future of Los Angeles. I believe we have forged mutual respect and trust in our time together. We have built a framework for a sustainable future for the Los Angeles Basin, one where we can be sure that we have sufficient wastewater services, adequate water supply, and proper and proactive protection and restoration of our environment.

We have developed a progressive plan that, when implemented, will provide for reliable services while maximizing the use of our existing infrastructure, minimizing the need for extensive new construction, and aggressively conserving, protecting and beneficially reusing our limited natural resources.

I am proud of what we have accomplished together so far, and am truly excited about continuing our partnership through the ongoing planning and implementation of this shared dream for a healthy and safe tomorrow.

Thank you for your incredible efforts and contributions toward the Integrated Plan for the Wastewater Program.

Sincerely,

Judith A. Wilson, Director

Bureau of Sanitation

INTRODUCTION AND OVERVIEW

The Integrated Plan for the Wastewater Program (IPWP) describes a future vision of wastewater and stormwater management in the City of Los Angeles (City) that explicitly recognizes the complex relationships that exist among all of the City's water resources activities and functions. Addressing and integrating the water, wastewater, and stormwater needs of the City in the Year 2020, the IPWP also takes an important step towards comprehensive basin-wide water resources planning in the Los Angeles area.

We have participated in this process and assisted in the development of these policy recommendations because we want to be sure that Los Angeles has adequate water supply, wastewater treatment, flood control, and stormwater pollution prevention, while protecting and restoring our environment and improving our quality of life. With comprehensive planning and bold innovations, we can attempt to ensure that we meet the needs of Los Angeles.

This integrated process is a departure from the City's traditional single purpose planning efforts for separate agency functions, and will result in greater efficiency and additional opportunities for citywide benefits, including potential overall cost savings. This integrated process also highlights the benefits of establishing partners with other City-wide and regional agencies, City departments, and other associations, both public and private. The City selected a 20-year planning horizon for this program. Attached to this document is a glossary of terms used throughout this statement.

The goal of the IPWP effort is to define a general direction for planning by developing a set of policy recommendations to guide future investments. Therefore, the broad overview of technical issues was appropriate for relative comparisons. As a policy development guide, the IPWP acknowledges that actions taken to manage wastewater, biosolids and stormwater both affect and are affected by the water supply and water quality protection measures taken by the City and others.

Because the City not only treats wastewater generated within the City, but also manages and treats wastewater from 27 other nearby communities (i.e., "Contract

Agencies" such as the cities of Santa Monica and Beverly Hills), this regional approach is essential in system planning. In that context, the IPWP presents policy recommendations that attempt to be responsive to the overall, long-term water resources needs of the community and the environment.

Just as the IPWP recognizes the complex interrelationships in the urban water cycle, it also acknowledges that decisions regarding the City's environment and water resources should be fundamentally community-driven. For this reason, a stakeholder Steering Group was organized to capture and address the community's objectives and preferences regarding the future picture of water resources management in Los Angeles. The Steering Group is comprised of individuals representing a wide range of political, economic, geographic, environmental and social interests from throughout the City.

The Steering Group focused on defining its values with respect to public health, infrastructure, the environment, cost efficiency, quality of life, and education. It also studied the means of achieving those objectives: through building facilities; through managing resources; and through managing demands.

Through ten interactive workshops and a series of site visits and facilities tours, the Steering Group reviewed the wastewater, water and stormwater service needs of the City, as presented by City/Consultant staff, for the Year 2020. The Steering Group, as a whole, did not,



IPWP Steering Group members tour the Los Angeles Aqueduct Filtration Plant

Introduction and Overview

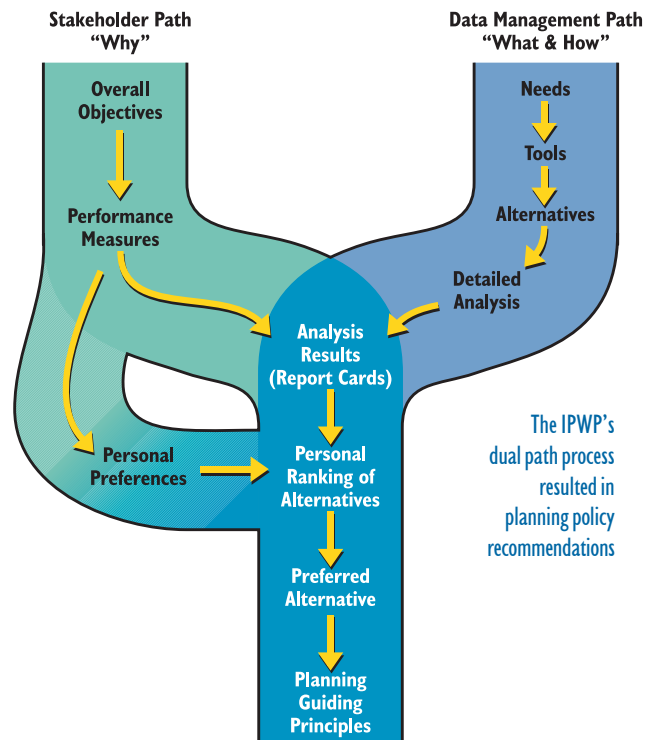
and was not asked to, render an opinion on the acceptability of growth in the region. Such considerations were outside the scope of the Steering Group's objectives. Nonetheless, this document provides policy recommendations about growth and its associated potential impacts that were assumed for the planning process. The Steering Group recommends that the City convene, through a separate forum, a working group to address broader growth issues.



IPWP Steering Group members visit
West Basin Municipal Water District's water reclamation plant

The Steering Group also reviewed the interrelationships of wastewater, water, recycled water and stormwater service functions. The City/consultant staff presented to the Steering Group a number of integrated, alternative approaches for addressing future needs. The evaluation of alternatives relied upon value-based criteria that were developed by the Steering Group and considered the overall goals and objectives of the City. The Steering Group also developed performance measures, as well as their own individual satisfaction levels for each performance measure, which were then used to quantify how well a certain alternative performed in achieving the stated objectives.

City and Consultant staff interviewed each Steering Group member to determine how they, as individuals, would use the evaluation criteria in making personal decisions regarding alternatives. Based on the information considered in this exercise, the City and Consultant staff analyzed interview results, which indicated a preferred thematic alternative. In workshops, the Steering Group confirmed the



"preferred" alternative that best met the diverse interests and objectives of the group. And from this preferred thematic alternative, the Steering Group identified the basic policy features that they now recommend for consideration by the City Council in planning for the future of the City.

The report that follows summarizes the recommendations and views of the IPWP stakeholder Steering Group. It reflects many hours of time and effort on the part of City/Consultant staff and Steering Group members devoted to developing an understanding of the City's needs, the tools available to address those needs, and the trade-offs required to arrive at a consensus approach to action.



IPWP Steering Group members at Workshop 6

BACKGROUND

The Integrated Plan for the Wastewater Program (IPWP)

Begun in October 1999 as the first phase of the City's overall Integrated Resources Planning process, the IPWP sought to accomplish two basic goals as part of developing wastewater planning policies:

- Enlist the public in the entire planning and design development process at a very early stage beginning with the determination of policies to guide planning; and
- Integrate water supply, water conservation, water recycling, and stormwater management issues with wastewater facilities planning through a regional watershed approach.

In implementing these goals, the IPWP combined traditional engineering-based planning concepts with consideration of less traditional technologies and non-structural options. These varied alternatives were evaluated in the context of the views of a broad cross-section of the community to establish planning policies that were both technically sound and publicly acceptable.

The Public Participation Process

As mentioned, a key component of the City's IPWP process was the involvement of the public at an early point in the facilities planning process. The City had never previously undertaken a comprehensive public outreach and involvement effort to this extent. Open dialog was important not only to gain public understanding of the wastewater program development

process, but also to capture the collective ideas, experiences and opinions of the City's residents and customers.

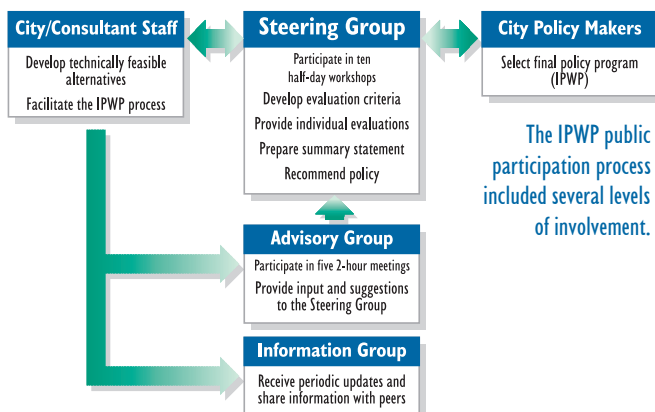
To enlist public input, the City developed and implemented a comprehensive public outreach effort. Over a six-month period, over 1,100 organizations, agencies, associations, institutions and individuals were



IPWP facilitator Paul Brown and Bureau of Sanitation Director Judith Wilson participate in Workshop 6

contacted directly to determine their ability and willingness to participate in the planning development process. To provide flexibility, three different levels of participation were made available to all for self-selection:

Steering Group. The Steering Group committed to active participation through an extensive series of technical workshops. This level of participation represented the greatest commitment of time and energy. This group was responsible for guiding the process and ultimately developing the planning policy recommendations presented in this report. They were also responsible for keeping their respective organizations informed of project progress. A total of 54 people committed to this level of participation. Of this group, 31 members, representing organizations totaling more than 67,000 people, participated in a key interview process and formed the basis for policy recommendations.



Background

Advisory Group. Participants in the Advisory Group provided feedback and comments to the City and the Steering Group through a series of quarterly meetings. This level of participation required a commitment to attend the meetings and to provide feedback from the organizations that the Advisory Group represented. Like the Steering Group, the Advisory Group was also responsible for keeping their respective organizations informed of project progress. A total of 74 people, representing organizations serving a total of more than 68,000 people, joined at this level of participation.

Information Group. Members of the Information Group expressed an interest in being kept informed about the project, but its members were not required to commit to attend meetings or provide feedback to the process. A total of 61 people, representing organizations with a combined membership of over 16,500 people and 17 governmental agencies, joined at this level of participation.

In an effort to enlist as much involvement of the community as possible, the City also developed an additional outreach effort. Coordinated with the City Councilmembers' Neighborhood Councils, approximately 40 additional organizations were identified and contacted, and over a dozen of these organizations sponsored a special presentation at their regular meetings to learn more about the project and how they could contribute. As a result of this effort, over 60 additional participants were enlisted into the process.

In addition to the community-based outreach effort, a variety of City, County and regional officials participated in the process:

City, County and Regional Officials. City, County and regional officials were kept informed of the IPWP process through various means. The Board of Public Works, the City Council offices, and Mayor's office received Steering Group workshop minutes, Advisory Group meeting minutes, and periodic newsletters. They also received regular briefings on the project from the Director of the Bureau of Sanitation.

Technical and Management Advisory Committees. Staff members from various City departments (e.g., Bureau of Sanitation, Planning, Department of Water and Power, Bureau of Engineering, Environmental Affairs, City

Administrative Officer, Chief Legislative Analyst) and other agencies (Los Angeles County Department of Public Works, California Department of Transportation (Caltrans), Army Corps of Engineers) guided the project through technical and management advisory committees.

Technical Development

As stated, from the outset, the City sought to consider the future needs for the wastewater system in the context of its relationships with both the potable water system and the stormwater system. The City/Consultant technical team prepared an extensive technical study, which defined the Year 2020 needs for each of the key service functions:

- Potable water
- Wastewater collection, treatment and discharge
- Recycled water; and
- Stormwater (both dry weather and wet weather)

The technical team used population projections



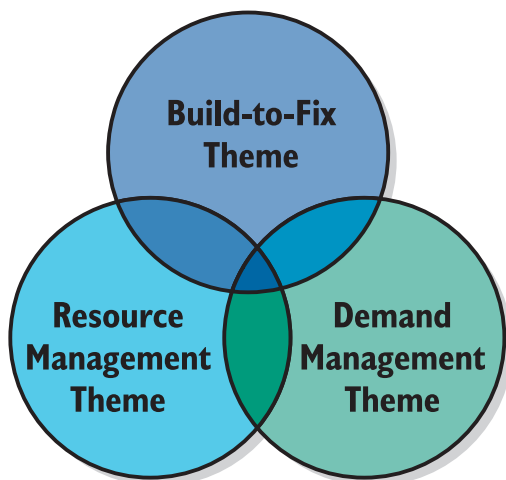
The IPWP recognizes the relationships between multi-agency service functions

provided by the Southern California Association of Governments to estimate Year 2020 water and wastewater needs. The technical team identified the differences, or "gaps", between Year 2020 needs and current capabilities. These gaps included wastewater collection and treatment infrastructure, potable water supply sources, and wet and dry weather urban runoff quality gaps. To address these "gaps", the technical team constructed a series of technical alternatives,

using combinations of both structural and non-structural options. As a starting point for discussion, the technical team created a set of "thematic" alternatives focusing on one of three broad approaches:

- Building more facilities (Build-to-Fix)
- Managing demand on the systems (Demand Management)
- Managing resources from the systems (Resource Management)

The Build-to-Fix theme focused on building new infrastructure to meet Year 2020 needs. The demand management theme focused on managing (reducing) demands to meet Year 2020 needs. The resource management theme focused on beneficial use or reuse of resources to meet Year 2020 needs. Although each theme was distinct, there was an overlap in the alternative components. For example, some methods of managing resources from the system inherently involved some construction (e.g., building more facilities).



The IPWP considered three broad approaches in developing thematic alternatives

In addition to the technical team's quality review process, some Steering Group members participated in a subcommittee to review the evaluation model for the project. While careful attention was paid to make sure that the technical information used in the IPWP was accurate and defensible, the goal of the IPWP was

the development of recommendations for planning policies. The evaluation of the thematic alternatives, therefore, focused on allowing the Steering Group to make relative comparisons between different planning approaches; it was not focused on developing conceptual designs, physical layouts or re-evaluating the needs assessment.

Planning Policy Guidelines

To evaluate alternatives, the Steering Group developed a series of performance-based criteria that reflected their objectives and values. These evaluation criteria defined the essential purposes of this planning process. The primary objectives developed by the Steering Group included:

- Protect the Health and Safety of the Public
- Provide Effective Management of the System Capacity
- Protect the Environment
- Enhance Cost Efficiency
- Protect Quality of Life
- Promote Education

The Steering Group also identified sub-objectives for each primary objective. In addition, the Steering Group developed quantifiable performance measures for each sub-objective, enabling a systematic comparison of alternatives. Taken together, the Steering Group's identification of objectives, sub-objectives, and performance measures constitute the evaluation criteria used in the IPWP.

Under all conditions and alternatives, it was assumed as a starting point, that the City would comply with all existing and future legal requirements.

A key feature of this process involved documenting the individual importance and satisfaction that Steering Group members attached to evaluation criteria. City and Consultant staff interviewed each Steering Group member to determine how they, as individuals, would use the evaluation criteria in making personal decisions regarding alternatives. This system was used to develop the preferred thematic alternative.

Background

Detailed documentation of the IPWP development, including background technical data, stakeholder evaluation process and descriptions of the overall preferred thematic alternative is provided in a separate document titled *Integrated Plan for the Wastewater Program*. This Summary Statement is included as a section of that document and is the only section formally developed and approved by the Steering Group.

The following table summarizes the assumed levels of performance of the Steering Group's preferred thematic alternative based on policy-level technical analyses for Year 2020:

Features of the Steering Group's Preferred Thematic Alternative	
Service Function	Level of Implementation ⁽¹⁾
Wastewater Collection and Treatment	Focus on building new treatment facilities "upstream" in the system and size collection facilities to convey less flow "downstream" at the Hyperion Treatment Plant. Because there are adequate solids treatment processes downstream at the Hyperion Treatment Plant and Terminal Island Treatment Plant, it was assumed that these new upstream facilities would not include solids treatment processes.
Recycled Water	Beneficially reuse approximately 80% of the "recyclable" water in the system, of which use approximately 48% for irrigation, approximately 17% for industry, approximately 27% for groundwater recharge, and approximately 8% for environmental enhancement.
Inflow and Infiltration into the wastewater system	Reduce by approximately 50% through inflow reduction programs (approximate 13% reduction) and infiltration reduction programs (approximate 37% reduction), based infiltration and inflow generated from a 10-year, 24-hour duration storm.
Water Conservation	Continue current planned conservation programs, and increase conservation efforts beyond what is currently planned. It was estimated that these combined efforts would reduce potable water demand in year 2020 by approximately 18% (compared to 1990 levels).
Dry Weather Urban Runoff	Prevent approximately 38 million gallons per day from entering the receiving waters by diverting them to the wastewater system (22 million gallons per day) and to their own treatment facilities for reuse (16 million gallons per day).
Wet Weather Urban Runoff	Capture and beneficially use approximately 50% of the annual average wet weather urban runoff through onsite percolation treatment controls (approximately 20%) and storage and reuse facilities (approximately 30%).
Biosolids Management	Reuse 100% of biosolids generated at the wastewater treatment facilities.

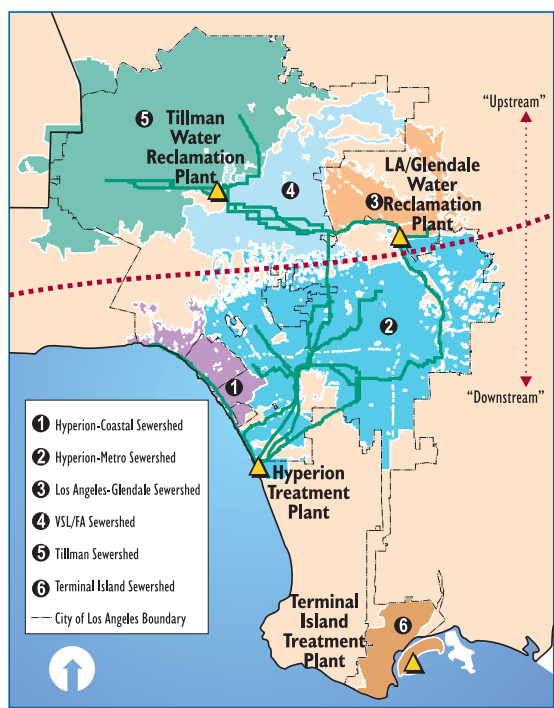
Note: ⁽¹⁾ The assumed level of implementation for the Steering Group's preferred thematic alternative was based on broad technical analyses appropriate for policy-level planning. The actual levels of implementation will be further refined in the next, more detailed, phase of facilities planning.

RECOMMENDED ELEMENTS OF PLANNING POLICY

At the completion of the evaluation process, the Steering Group identified the structural and non-structural elements of an approach that would do the best job in addressing the system needs for the Year 2020 while meeting the individual objectives of the Steering Group. The following discussion presents both the majority and minority viewpoints of the interviewed Steering Group members. The broad elements that are recommended by the majority of the Steering Group for consideration by City Council in water resources planning are as follows:

Building new wastewater facilities "upstream" in the system

Under all conditions, there will be a need to construct and operate new or expanded wastewater facilities. Through the IPWP process, it has been shown that facilities placed upstream in the system offer greater opportunities for system operational flexibility, for beneficial reuse of treated effluent, and for reducing dependency on imported water for such uses as irrigation, industrial use, etc.



For wastewater system planning, the City of Los Angeles service area was split into "upstream" and "downstream" areas

For these reasons, all (31) of the interviewed Steering Group members prefer the building of new wastewater facilities in the upper part of the system. Because there are adequate solids treatment processes downstream at the Hyperion Treatment Plant and Terminal Island Treatment Plant, it was assumed that these new upstream treatment facilities would not include solids treatment processes.

Producing and using as much recycled water as possible from the existing and planned facilities

Treated wastewater should be recognized as a valuable water resource, not a nuisance product to be disposed. Because of our location in Southern California, the need to maximize opportunities to responsibly use recycled water must be recognized. *For this reason, all (31) of the interviewed Steering Group members support maximizing recycled water opportunities.*



The IPWP Steering Group tours the Donald C. Tillman Water Reclamation Plant

Recycled water can be used for irrigation, industrial uses, environmental enhancement and groundwater recharge. *All (31) of the interviewed Steering Group members would support the use of recycled water for irrigation and industrial uses.* The majority (19) of the interviewed Steering Group members would support the use of recycled water for any use. Five Steering Group members strongly preferred using recycled water for irrigation, industrial uses and groundwater recharge, rather than for environmental enhancement. Four Steering Group members strongly preferred using recycled water for irrigation, industrial uses and

environmental enhancement, rather than for groundwater recharge. Two Steering Group members were concerned with using recycled water for groundwater recharge; one member did not want it due to technical/public health issues, and the second member did not want it unless the concept had been approved by the public through a voting/referendum procedure.

All Steering Group members support providing a public education program on the benefits and risks associated with using recycled water.

Reducing the amount of rainfall-dependent inflow and infiltration as much as possible

During wet weather conditions, the wastewater system should be used to convey and treat wastewater, not wet weather urban runoff (i.e., stormwater) that makes its way into the system. Inflow and infiltration (I/I) of stormwater reduces conveyance capacity, increases the hydraulic demands at treatment plants, shortens the effective design lives of both types of facilities, and increases operation and maintenance costs.



Maintenance hole cover inserts prevent stormwater from making its way into the wastewater system

For these reasons, the majority (26) of the interviewed Steering Group members support reduction in inflow and infiltration. Five Steering Group members prefer demand management techniques other than I/I reduction, or they prefer only a minimal I/I reduction program. These Steering Group members cited objections to

potential work on private property, noting that a "collective" rather than decentralized approach was more favorable to them, and/or they expressed concerns regarding the reliability and cost-effectiveness of I/I reduction.

Increasing the level of water conservation beyond what is currently planned

Water conservation programs have proven to be effective, especially whenever the public appreciates both the need to conserve and the resultant benefits that accrue. In Southern California, water conservation is an important aspect of daily life, and the sustainable use of available water resources is paramount to quality of life and environmental resources. The energy crisis has emphasized the importance of considering conservation as a means to meet needs.

Recognizing the reduction in the availability of imported water and the resultant wastewater flows generated, the majority (27) of the interviewed Steering Group members support increased levels of water conservation beyond the levels currently planned by the Department of Water and Power. These Steering Group members also support the concept of responsibility and accountability of each individual user to help eliminate water waste.

Three Steering Group members, while supporting increased conservation, preferred a moderate program involving the City's plan to increase market penetration of current conservation efforts. Four Steering Group members were either somewhat or fully satisfied with the current levels of conservation, and felt that additional conservation would be less desirable. These Steering Group members expressed concern that new programs could be unnecessary or could promote undesired growth.

Increasing the amount of dry weather urban runoff that is diverted and treated or captured and beneficially used

The primary benefit of increased dry weather urban runoff diversion will accrue in reduced pollution throughout the City's waterways; this will have a major impact on the region's quality of life. In addition, dry weather urban runoff could potentially provide additional beneficial water reuse opportunities.

To protect all beneficial uses, all (31) of the interviewed Steering Group members supported a moderate dry weather urban runoff program. *Of these members, the majority (26) support an extensive dry weather urban runoff capture and beneficial reuse program.* It was assumed that these diversions would not impair the beneficial uses of the receiving waters. Five members expressed concerns regarding the technical feasibility and cost-effectiveness of an extensive program.

One member considered diversions as a near-term solution and preferred a long-term goal of preventing pollution of dry weather urban runoff, thereby keeping waters needed for beneficial uses in the rivers and streams in the Los Angeles basin.

Increasing the amount of wet weather urban runoff that can be captured and beneficially used

By capturing and beneficially using wet weather urban runoff, the City has the opportunity to further reduce its dependence on imported water. *For this reason, all (31) of the interviewed Steering Group members support capturing and beneficially using wet weather urban runoff.*



Steering Group member Andy Lipkis leads a tour of the Tree People BMP House in Los Angeles

Beneficially reusing biosolids

The requirements for biosolids beneficial reuse continue to become more stringent at the reuse locations and therefore require increased levels of treatment. The City's current beneficial use arrangements in Kern County will, at the very least, require the production of Class "A" biosolids in the

very near future. Opportunities at alternative reuse locations will likely be similarly restrictive. However, the Steering Group recognizes the benefits to the community of the beneficial reuse of this important resource.



City staff demonstrates the beneficial use of biosolids at the Green Acres Farm in Kern County

Therefore, almost all (29) of the interviewed Steering Group members support the beneficial reuse of biosolids. Where possible, biosolids should be beneficially reused locally (within Los Angeles County). For one Steering Group member, a moderate amount of biosolids reuse was preferable to reuse of all biosolids because of concerns regarding the safety of some reuse methods. One other Steering Group member would be equally satisfied with any level of biosolids reuse. Several Steering Group members supported biosolids handling "upstream" at point of generation (i.e., decentralized treatment), rather than downstream at one central treatment facility (e.g., Hyperion Treatment Plant).



Steering Group members and City staff admire the crops grown in soil fertilized with biosolids at the Green Acres Farm

Focusing on lower-cost solutions, within the framework of the policy elements noted above

Providing for improvements in, and maintenance of, wastewater, recycled water, stormwater and water services that are adequate for meeting future needs may require increased investment in the programs which, in turn, could result in increased user costs. A wide range of possible costs for future actions is indicated by the alternatives studied in the IPWP process. In fact, individual economic preferences were considered in selecting the Steering Group's preferred thematic alternative. Many alternatives feature options that require significant investments, yet offer the added value of achieving level-of-service and environmental goals that are important for the City and may result in economic savings over time. Nonetheless, it is possible, within the scope of the desired options and policies outlined above, to strive for the lowest cost solutions that meet performance requirements.

For these reasons, the majority (25) of the interviewed Steering Group members support the use of lower cost solutions where they are available within the framework of the other policy elements.

Of this majority, some (15) members indicated a maximum cost (which varied) above which they would be completely unsatisfied. Six Steering Group members did not favor lower cost solutions. Of these six members, three of them expressed no preference with regard to costs, i.e., they indicated that they would be equally satisfied with any monthly household cost required by any alternative within the range of consideration. The three others felt that lower cost solutions might not offer the benefits and flexibility that moderate spending could provide, and they indicated a preference for costs within the middle of the expected range. Some members support a "growth-pays-for-growth" concept.

Within each of these elements, the Steering Group identified specific planning policy recommendations that should be used in moving forward with wastewater facilities planning. In addition, the Steering Group also developed programmatic planning policy recommendations that addressed a wide range of the "non-technical" elements. These programmatic policy recommendations were seen as overarching and enhancing the entire process.

SPECIFIC PLANNING POLICY RECOMMENDATIONS

Based on the work accomplished in the IPWP, the Steering Group was able to recommend a series of policies that should be used by the City to guide facilities development in an integrated manner. These specific recommendations include action items, which, at a minimum, should be carried forward in the immediate future. Additional steps will also need to be developed in the future to ensure implementation by Year 2020. Also, these recommendations are not intended to preclude consideration of additional technical recommendations and action items that achieve the Steering Group's stated policy objectives.

Wastewater Treatment Recommendations

The following recommendations are based on the Steering Group's preferred thematic alternative. The Steering Group's preferred thematic alternative assumed building new treatment facilities upstream in the system. Because there are adequate solids treatment processes downstream at the Hyperion Treatment Plant and Terminal Island Treatment Plant, it was assumed that these new upstream facilities would not include solids treatment processes.

Specific Recommendations

Locate new wastewater treatment facilities in the upstream portions of the service area to maximize the potential for water reuse in the future.

Consider community impacts in evaluating potential sites for new facilities, including the proximity of new facilities to population.

Coordinate wastewater treatment facilities planning with other activities (inflow/infiltration reduction; water conservation; dry weather flow diversions) so that the need for expansion and/or new construction is minimized.

Continue to monitor technological developments and conduct appropriate pilot plant operations that could result in improved treatment quality as well as reduced operation and maintenance costs, including waterless treatment technology for onsite uses.

Ensure that all wastewater treatment operations comply, at a minimum, with all federal, state and local requirements.



Steering Group members visit the Donald C. Tillman Water Reclamation Plant in the San Fernando Valley

Action Items

Identify the sequence and timing for treatment facilities planning.

Regularly monitor population projections, water consumption rates and wastewater generation information to verify planning needs.

Establish a water quality forum to discuss environmental issues, upcoming regulations and public education programs.

Continue to implement the industrial source control program and regularly consider updates to address potential new industries not currently covered in the program.

Investigate, and implement as appropriate, options for denitrification (e.g., mechanical/biological unit processes, constructed wetlands, etc.).

Wastewater Collection System Recommendations

The following recommendations are based on the Steering Group's preferred thematic alternative. The Steering Group's preferred thematic alternative assumed building new treatment facilities upstream in the system and sizing the collection facilities to convey less flow downstream to the Hyperion Treatment Plant.

Specific Recommendations

Like wastewater treatment facilities planning, coordinate wastewater collection system facilities planning with other activities (inflow/infiltration reduction; water conservation; dry weather flow

Specific Planning Policy Recommendations

diversions) so that the need for new construction is minimized.

Reduce, if not eliminate, all avoidable wastewater overflows system-wide, especially those occurring during dry weather that reach receiving waters. Achieve reductions through proactive enforcement of ongoing programs as well as any enhancements that are necessary or appropriate.

Action Items

Identify the sequence and timing for collection facilities planning.

Increase flow-monitoring locations citywide to improve the calibration of the dynamic hydraulic model of the collection system.

Establish a water quality forum to discuss environmental issues, upcoming regulations and public education programs.

Encourage expedient and reasonable resolution of the outstanding concerns of the community, environmental groups and regulatory agencies.

Water Recycling Recommendations

The following recommendations are based on the Steering Group's preferred thematic alternative. The Steering Group's preferred thematic alternative assumed beneficially using approximately 80% of the "recyclable" water in the system. This assumed level of implementation was based upon broad technical analyses appropriate for policy-level planning. The actual level of implementation will be further refined in the next, more detailed, phase of facilities planning.

Specific Recommendations

Maximize water recycling whenever possible. Focus efforts on irrigation and industrial demands, while continuing to develop environmental enhancement and groundwater recharge uses.

Maximize recycled water usage using expanded upstream plant facilities.



Recycled water is used to irrigate crops

Develop water reuse projects with no significant public health risks.

Continue to monitor technological developments and conduct appropriate pilot plant operations that could result in improved treatment quality that meets public health requirements.

Ensure that all wastewater effluent discharges comply, at a minimum, with all federal, state and local requirements.

Continue to coordinate water-recycling planning on a regional basis.

Promote the growth of demand for, and opportunities for development of, greater water recycling within the Los Angeles basin.

Develop an education program on the benefits and risks associated with recycled water use.

Action Items

Conduct biological study to determine the minimum flow necessary to maintain riparian habitat and aquatic-dependent species in surface waters within the Los Angeles basin.

Protect all beneficial uses of surface waters within the Los Angeles basin.

Provide incentives to encourage recycled water use.

Conduct a cost/benefit analysis for producing and delivering additional recycled water to end-users.

Coordinate with the Department of Health Services to ensure that groundwater recharge meets any requirements necessary to protect public health.

Review the recycled water market, and develop/implement proactive marketing efforts to maximize recycled water use, emphasizing irrigation and industrial purposes.

Seek outside funding (e.g. State, Federal, grants) to support recycled water delivery.

Conduct a cost/benefit analysis of the potential need to increase to higher level of treatment for groundwater recharge if recycled water becomes greater percentage of basin water consumption.

Seek potential partners to share both the costs and benefits of recycled water.

Conduct feasibility study for locations of additional spreading of recycled water in the Los Angeles basin.

Establish a water quality forum to discuss environmental issues, upcoming regulations and public education programs.

Inflow/Infiltration Reduction Recommendations

The following recommendations are based on the Steering Group's preferred thematic alternative. The Steering Group's preferred thematic alternative assumed reducing inflow/infiltration into the wastewater system by approximately 50% through inflow reduction programs (approximate 13% reduction) and infiltration reduction programs (approximate 37% reduction), based upon infiltration and inflow generated from a 10-year, 24-hour duration storm. This assumed level of implementation was based upon broad technical analyses appropriate for policy-level planning. The actual level of implementation will be further refined in the next, more detailed, phase of facilities planning.

Specific Recommendations

Maximize the reduction of inflow into the wastewater collection system.

Maximize the reduction of infiltration into the wastewater collection system.



Maintenance hole inserts reduce inflow

Action Items

Develop agreements with contract agencies to promote correction of inflow problems in their jurisdictions, including corrections on private properties.

Develop an action plan to correct infiltration from private laterals with options for financial assistance for homeowners.

Develop an action plan for sealing the sewers and house connections, and making maintenance holes more watertight.

Develop an action plan for enforcement of existing laws for disconnecting illegal area drains and re-routing downspouts on industrial and residential properties.

Establish goals for inflow source detection in main lines and lower laterals.

Invest in cost-effective infiltration detection methods.

Continue to monitor the system performance to identify any changes in the characteristics for the various sewer basins and incorporate the changes in the ongoing planning, reduction and upgrade efforts as necessary.

Develop an intensive inspection program to ensure results are achieved.

Water Conservation Recommendations

The following recommendations are based on the Steering Group's preferred thematic alternative. The Steering Group's preferred thematic alternative assumed that these combined conservation efforts would reduce potable water demand in 2020 by approximately 18% (compared to 1990 levels). This assumed level of implementation was based upon broad technical analyses appropriate for policy-level planning. The actual level of implementation will be further refined in the next, more detailed, phase of facilities planning.

Specific Recommendations

At a minimum, fully implement the currently planned conservation programs identified by the Department of Water and Power in the 2000 Urban Water Management Plan.

In addition, identify, evaluate, and implement, as appropriate, new opportunities for increased water conservation (beyond those measures already in place or planned).

Monitor technological developments throughout the world and conduct appropriate pilot testing to assess the likelihood of successful implementation in the Los Angeles basin.

Develop a comprehensive methodology for evaluating the "water conservation effectiveness" of new potential water conserving fixtures and appliances that consider both the associated water savings as well as their ability to successfully perform their designed function.

Coordinate the water conservation activities with all future wastewater facilities planning activities.

Specific Planning Policy Recommendations

Action Items

Increase marketing and incentives to complete currently planned ultra-low flush toilet replacement and clothes washer replacement programs.

Invest in landscape water savings marketing and incentives.

Increase marketing and incentives to retrofit commercial, industrial and institutional toilets with ultra-low flush toilets.

Research and study applicability of retrofitting toilets with "Super" ultra-low flush toilets or waterless urinals.

Increase marketing and incentives for retrofitting car washes.

Research and study applicability of xeriscape-based landscape ordinances.

Determine the effects of increased conservation on raw wastewater concentrations and evaluate the impacts on wastewater treatment plant operation.

Bring all users to current conservation standards (e.g., through additional metering and potential subsidy).

Expand public education program.

Periodically review and update the conservation program, including funding/incentive programs.

Establish an enforcement mechanism for conservation ordinances.

Measure success of incentive-based conservation efforts and consider a tiered pricing structure, if needed.

Require all new construction to include individual metering.

Develop a plan for providing individual metering (both new and retrofit) to encourage individual user accountability and responsibility.

Dry Weather Urban Runoff Management Recommendations

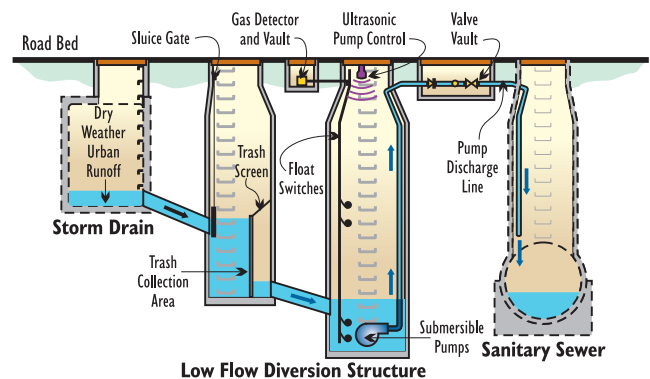
The following recommendations are based on the Steering Group's preferred thematic alternative. The Steering Group's preferred thematic alternative assumed preventing approximately 38 million gallons

per day of dry weather urban runoff from entering the receiving waters by diverting them to the wastewater system (approximately 22 million gallons per day) and to their own treatment facilities for reuse (approximately 16 million gallons per day). This assumed level of implementation was based upon broad technical analyses appropriate for policy-level planning. The actual level of implementation will be further refined in the next, more detailed, phase of facilities planning.

Specific Recommendations

Diversions to the wastewater system during dry weather

- *Maximize the amount of dry weather urban runoff in the coastal areas that is intercepted (before it reaches the beaches and the Santa Monica and San Pedro Bays) and diverted to the coastal wastewater collection system for conveyance to the Hyperion Treatment Plant for treatment or diverted to an urban runoff treatment facility for treatment.*



Low flow diversion structures capture dry weather urban runoff in the storm drains and pump it to the wastewater collection system

Treatment

- *Maximize the amount of dry weather urban runoff that is treated in other areas of the City. Treatment could include urban runoff treatment facilities, constructed wetlands technologies to provide a natural pollutant removal process, or a combination of treatment technologies. Compliance with the Standard Urban Stormwater Management Plan will also result in treatment of some dry weather urban runoff.*

Action Items

Diversions:

- Resolve contractual differences in Contracting Cities Agreement to allow year-round diversions during dry weather. The current agreements prevent diversions during November through March. In the interim, plan/implement seasonal diversions.
- Address control issue of existing diversions to allow for year-round diversions during dry weather.
- Conduct evaluation of site-specific technical issues related to inflow, sewer capacity, monitoring and diversion controls and automation.
- Pilot test select sites for additional diversions for implementability and reliability.
- Identify sites for additional diversions, using criteria from evaluation and pilot tests.
- Develop agreements with affected agencies for sites identified for potential diversion.
- Conduct detailed sewer capacity evaluation to determine availability of excess sewer capacity to accommodate additional diversions.
- Conduct cost/benefit evaluation for additional diversions as compared to other treatment options.



Constructed wetlands provide a natural process to remove pollutants from urban runoff

Treatment:

- Monitor performance of the existing urban runoff

plant with regard to treatment performance, influent water quality variability, operational challenges and costs.

- Address site-specific technical challenges related to storm-drain low flow collection and delivery to an urban runoff plant.
- Conduct site-specific market identification study to determine availability of potential end users for treated dry weather urban runoff.
- Pilot test to identify and fine-tune preferred treatment technologies.
- Conduct a cost/benefit analysis to determine the relative trade-offs between capital and operation costs of an urban runoff plant versus additional diversions.
- Conduct pilot testing to demonstrate the ability of constructed wetlands to meet water quality goals.
- Identify available sites for constructed wetlands.

Continue development of public education programs and enforcement plans to change the waste disposal behavior for everyone who works or lives in the Los Angeles basin, thereby reducing and eliminating urban runoff pollution.

Develop and implement a stormwater management plan with regional and site-specific Best Management Practices to capture, treat or infiltrate wet and dry weather urban runoff to meet runoff capture goals.

Wet Weather Urban Runoff Management Recommendations

The following recommendations are based on the Steering Group's preferred thematic alternative. The Steering Group's preferred thematic alternative assumed capturing and beneficially using approximately 50% of the annual average wet weather urban runoff through onsite percolation controls (approximately 20%) and storage and reuse facilities (approximately 30%). This assumed level of implementation was based upon broad technical analyses appropriate for policy-level planning. The actual level of implementation will be further refined in the next, more detailed, phase of facilities planning.

Specific Recommendations

Maximize the amount of wet weather urban runoff that can be captured and beneficially used through on-site treatment controls using percolation technology. At a minimum, the City should focus on applying this technology to new developments or to areas undergoing redevelopment, as required by the Regional Water Quality Control Board's Standard Urban Stormwater Mitigation Plan.



Onsite percolation controls capture stormwater from streets and percolate it into the ground

Maximize the amount of additional wet weather urban runoff that is captured and beneficially used through a centralized storage facility, decentralized storage facilities (onsite retrofits), or a combination of both.

Promote the concept of multi-purpose facilities in developing wet weather capture and use facilities.

Action Items

Develop and implement a stormwater management plan with regional and site-specific Best Management Practices to capture, treat or infiltrate wet and dry weather urban runoff to meet runoff capture goals.

Maintain, or if possible, improve groundwater quality. Conduct water quality evaluation of best management practice performance.

Conduct site identification study. Screen candidate sites considering soil type, site size, depth to groundwater, groundwater contamination issues, etc.

Conduct percolation studies and soil testing.

Conduct studies to determine pretreatment requirements.

Conduct studies for technical options to meet established water quality standards.

Seek outside sources of funding (e.g., State, Federal, grants).

Select design storm for stormwater capture for sites or projects that extend beyond the current legal requirements (i.e., Standard Urban Stormwater Mitigation Plan).

Research beneficial use options and conduct market survey of potential end users.

Conduct cost/benefit analysis, including infrastructure to deliver water to end-users.

Work with the Upper Los Angeles River Area water master to resolve issues of water "ownership" and permissibility of capturing and using rainwater for landscape irrigation purposes.

Establish agreements with individuals and the Upper Los Angeles River Area water master to permit private parties to capture and beneficially use stormwater in the Upper Los Angeles River Area.

Fully implement the requirements of the Standard Urban Stormwater Mitigation Plan.

Coordinate with the County and other agencies in development of programs.

Consider ordinances to standardize and schedule maintenance of facilities on private properties.

Biosolids Management Recommendations

The following recommendations are based on the Steering Group's preferred thematic alternative. The Steering Group's preferred thematic alternative assumed reusing 100% of the biosolids generated at the wastewater treatment facilities.

Specific Recommendations

Modify treatment processes so that only Class A (or better) quality biosolids are produced at all plants if used for land application.

Beneficially reuse 100% of biosolids produced.

Maximize reuse of biosolids within the City, Contract Agencies, and Los Angeles County whenever it is feasible, environmentally responsible, and in compliance with all regulations.

Action Items

Investigate alternate technologies for producing higher-quality biosolids or new uses of biosolids.



City staff and Steering Group members tour the Green Acres Farm in Kern County

Provide additional research and education of alternative biosolids management technologies (e.g., composting toilets and neighborhood sewage systems). Research would include evaluating potential changes to the building code to facilitate implementation; developing incentives to encourage implementation; investigating appropriate education/outreach programs; and setting specific implementation targets and schedule.

Encourage the use of biosolids by City residents and investigate any existing City regulations that might restrict biosolids use.

Programmatic Recommendations

Public Health and Safety

All regulations pertaining to public health and safety must be met.

Protecting the Environment

All regulations pertaining to protection of the environment must be met.

Enhance Cost Efficiency

Proper cost accounting practices must be utilized in developing costs for projects and should take into consideration the potential economic benefits associated with a given environmental project (such as job creation, reduced imported water costs, etc.) as well as the additional benefits gained from multi-use projects.

Develop and maintain database of funding sources and partnering opportunities.

Promote Quality of Life

New facilities and programs should be planned and implemented in a way that ensures that no communities suffer disproportionately from adverse human health or environmental effects, and that all people live in clean, healthy, and sustainable communities.

New wastewater facilities should, whenever and wherever possible, be sited in a way that does not concentrate construction in areas that already have experienced recent disruptions.

New facilities should, whenever and wherever possible, enhance public lands.

Promote Education

The public must be involved in the ongoing development of wastewater facilities planning.



IPWP assistant manager Robert Manning explains the wastewater system to the Steering Group members

Design a comprehensive public education program to raise public understanding of wastewater issues, opportunities and implications to enable the public to effectively participate in the policy development conversations and to become partners with the City in implementing conservation strategies.

Develop a public education effort that begins with research to determine the levels of awareness and the best methods to use to achieve the desired level of awareness. At a minimum, the undertaking should cover water recycling benefits and risks, conservation, and urban runoff.

Specific Planning Policy Recommendations

Promote Development of New Technologies

Investigate new technologies showing promise to meet the City's objectives (e.g., cisterns, waterless toilets, etc.)

Promote Cooperation with other Agencies and City Departments

Continue to look for integration opportunities, both within the City and externally with other agencies and groups, to develop partnerships and programs with mutually beneficial goals and objectives.

In summary, the Steering Group has generally recommended a policy of balanced and diversified investments in both the facilities and programs that offer reductions in the demands on infrastructure and efficient use of facilities and resources. Their views reflect a profound respect for the community, the environment, and the natural and fiscal resources that the City has

been entrusted with protecting. This Summary Statement is not intended to preclude consideration of additional technical recommendations and action items that achieve the Steering Group's stated policy objectives. The policy objectives in this Summary Statement are intended for broad planning purposes and community outreach efforts only and should not be used for other purposes without Steering Group notification and acceptance.

The Steering Group has demonstrated a desire to provide ongoing input in the future of potable water, wastewater, recycled water and stormwater in the City, as well as a commitment to public education on the importance of integrated resource management. Their collective efforts have produced a vision of the future that should improve the environment and help sustain a high quality of life for the diverse communities of Los Angeles.



CONFIRMATION OF SUMMARY STATEMENT RECOMMENDATIONS

The Steering Group confirms that it has participated in the IPWP process and that the recommendations contained in this Summary Statement reflect the work that has been completed.

We have participated in this process and assisted in the development of these policy recommendations because we want to be sure that Los Angeles has adequate water supply, wastewater treatment, flood control, and stormwater pollution prevention, while protecting and restoring our environment and improving our quality of life. With comprehensive planning and bold innovations, we can attempt to ensure that we meet the needs of Los Angeles.

Steering Group Member

Date

Comments

Domingo Leon 9-18-2001
for the Society Hispanic Engineers

Domingo F. Leon

*It was a great honor for me
to represent the Hispanic
community in this steering
group to assess the future
of the water sector of L.A.*

Phillip C. Hagar
FOR THE APARTMENT ASSOCIATION "
OF GREATER LOS ANGELES



Phillip C. Hagar

*"THIS IS JUST THE
BEGINNING OF THE
JOURNEY "*

Cherie Mann 9/18/01

North Valley Coalition

Cherie Mann

*You give hope for the future
Thank you*

D.R. "Curt" Curtiss
Past President
Westchester-Vitalization

Curt Curtiss

Now to implement

Confirmation of Summary Statement Recommendations

Steering Group Member

Date

Comments

Johnnie Raines

Johnnie Raines

9/19

Happy to have been a part of the process

Deborah Berg

Deborah Berg

9/19/01

Thank you for the opportunity to participate in this impressive effort

Lucia M. McGovern

Lucia M. McGovern

9/20/01

It was great to provide input on something very vital to the City's infrastructure

Scott Wilson

Scott Wilson

9/20/01

Wrote to implement the vision

Charles A. Tolbert

Charles A. Tolbert

9/21/01

Thanks for the opportunity to be a part of making history. I've learned a lot.

Mark Gold

Mark Gold

9-24-01

Heal the Bay is eager to help the City implement this progressive vision

Julie Inouye

Vista del Mar Neighbors Assoc.
Playa del Rey

Julie Inouye

9/24/01

Thank you for being leaders in this "New Direction" for the City of L.A. Now, let's make our ideas become reality!

Steering Group Member

Date

Comments

Polly Ward
Polly Ward

9/24/01 I'm impressed by the outreach into the greater community

Andy Lipkis
Andy Lipkis

9/24/01 This is the exact integration of programs that TreePeople has been pushing for 10 years. We're here to make it happen

Charles Brink
Charles Brink

9-24-01 a good first start

Zigmund Vays
Zigmund Vays

09/25/01 It was a great example of productive team work.

Cindy O'Connor
Cindy O'Connor

9/25/01 Exactly the way public business should be done

Charles Church
Charles Church

9/25/01 Thank you FOR TRYING TO PREPARE FOR THE FUTURE.

Charles E. Gremer
Charles Gremer

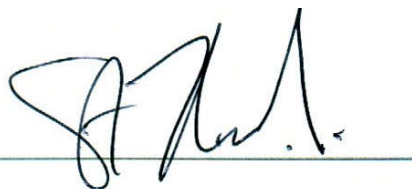
Keep up the good work. You're given me a lot of education. I hope I helped you out.

Confirmation of Summary Statement Recommendations

Steering Group Member

Date

Comments



Steve Fleischli

9/25/01

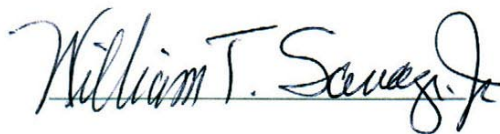
Let's settle that
Savage case.



Sheila H. Bernard

9/26/01

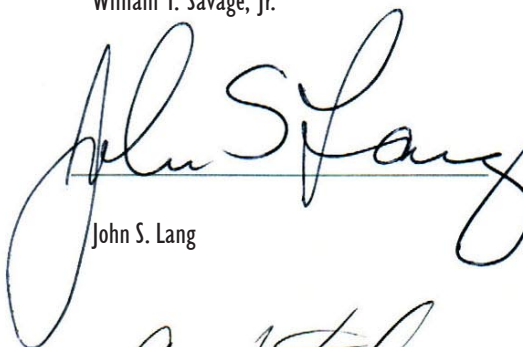
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handle water in a new way.



William T. Savage, Jr.

9/26/01

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labyrinth to better use of resources.



John S. Lang

9/26/01

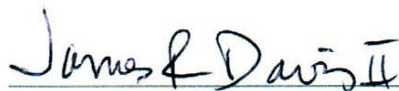
LET'S BUILD IT
RIGHT!



Gary Futral

9/28/01

Relying on our infrastructure



James R. Davis II

9/28/01

This is a GOOD sign



Dorothy Green

10/3/01

The process has been extra-
ordinary. Keep up the
good work.

Steering Group Member

Date

Comments

Linda Scheid 10/9/2001 Lets keep the
process going.
Great start.

Linda Scheid

Elenore A. Williams

Elenore A. Williams

10/9/01 I was proud to participate in
this very important project
affecting water for L.A. in the future.

Dr. Daniel L. Morgan 10/11/01

Dr. Daniel L. Morgan

Delighted to serve the
community & department in
such meaningful fashion

Judith L. Schwartz 10/11/01

Judith L. Schwartz

The process was excellent -
and thorough and
reached the entire commu-
nity of stakeholders

Deborah J. Smith

Deborah J. Smith

11-8-01

We look forward to working
with the City to make water
a safe and sustainable resource
for this region.

IPWP Steering Group

Monica Avila, Pacoima Neighborhood Watch
Andrew H. Barrera, Valley Economic Development Center, Inc.
Deborah Berg, Women's Transportation Seminar
Sheila H. Bernard, Lincoln Place Tenants Association
Charles Brink, Resident of Van Nuys
Maria Lou Calanche, USC - Civic & Community Relations
Charles Church, Resident of Canoga Park
Joe Coria, Boyle Heights Chamber of Commerce
Curt Curtiss, Westchester Vitalization Corporation
James R. Davis, II, National Institute for Communities Enlightenment
Rocky Delgadillo, Resident of Los Angeles
Carlos Ferreyra, Valley Glen Neighborhood Association
Steve Fleischli, Santa Monica Baykeeper
Gary Futral, Engineering Contractors Association
Judy Garris, Santa Susana Mountain Park Association
Mark Gold, Heal the Bay
Charles Gremer, West Hills Property Owners Association
Dorothy Green, Los Angeles - San Gabriel Rivers Watershed Council
Mary Hambel, City of Culver City/RBF
Phillip C. Hagar, Apartment Association of Greater Los Angeles
Jonathan Hou, California Chinese American Association
of Construction Professionals
Julie Inouye, Vista Del Mar Neighborhood Association
John S. Lang, South Shores Homeowners Association
Larry Lehtihalmel, Resident of Granada Hills
Domingo F. Leon, Society of Hispanic Professional Engineers, Inc.
Andy Lipkis, Tree People
William G. Luddy, Carpenters/Contractors

Elsa Lopez, Madres de Este de Los Angeles/Santa Isabel
Cherie Mann, North Valley Coalition
Gretchen Martin, Resident of Chatsworth
Lucia M. McGovern, West Basin Municipal Water District
Daniel L. Morgan, Guidance Church of Religious Science
Cindy O' Connor, League of Women Voters of Los Angeles
Manuel Padron, Resident of Marina Del Rey
Ray Pearl, Building Industry Association
Johnnie Raines, 8th District Empowerment Congress
Lynne Joy Rogers, Los Angeles Urban League Business
William T. Savage, Jr., Westwood Hills Property Owners Association
Linda Scheid, Miracle Mile Apartment Association
Judith L. Schwartz, Central City Association
Jayne Shapiro, Resident of Encino
Deborah J. Smith, Regional Water Quality Control Board
Wesley Staples, Cahuenga Hills Tennis Condominiums
Bruce Steele, Occidental College
Jesse C. Taylor, Jr., SEIU Local 347
Charles A. Tolbert, New Life Academy/Apostolic Faith Home Assembly
Zigmund Vays, Community Enhancement Services
Victor N. Viereck, North Hollywood Residents Association
Alonzo Villarreal, La Collectiva
Polly Ward, Studio City Residents Association
Geraldine Washington, NAACP
Brian Whelan, US Army Corps of Engineers
Elenore A. Williams, Habitat for Humanity
Scott Wilson, North East Trees

I N M E M O R I U M

Robert Manning
1962 - 2001

Johnnie Raines
1925 - 2001

They helped realize this vision for a better Los Angeles



Domingo F. Leon

Society of Hispanic
Professional Engineers, Inc.

"It was a great honor to represent the Hispanic constituents in the Steering Group to assess the future of the Wastewater Plan of L.A."



Phillip C. Hagar

Apartment Association
of Greater Los Angeles

"This is just the beginning of the journey."



Cherie Mann

North Valley Coalition

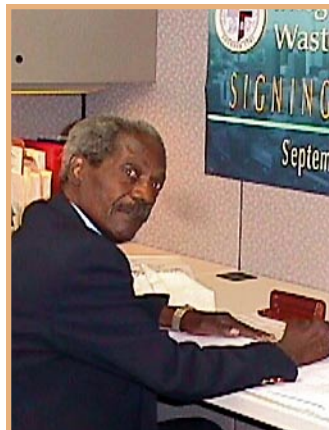
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Westchester Vitalization
Corporation

"Now to implement."



Johnnie Raines

8th District
Empowerment Congress

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IPWP Signatories

Deborah Berg

Women's Transportation Seminar

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Lucia M. McGovern

West Basin
Municipal Water District

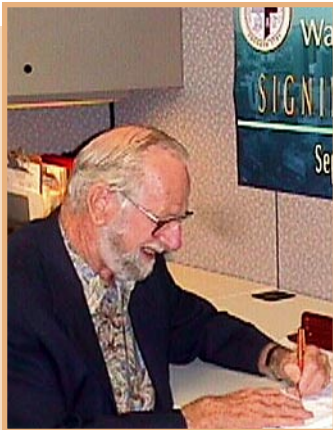
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North East Trees

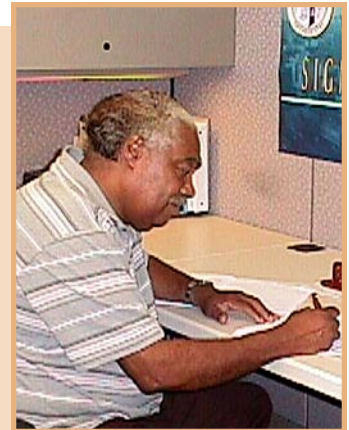
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Neighborhood Association

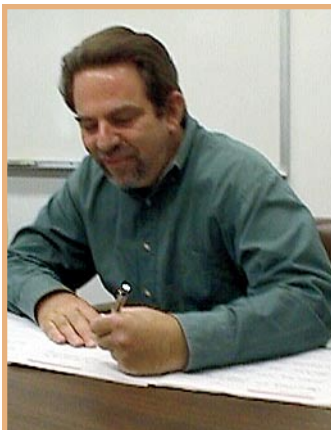
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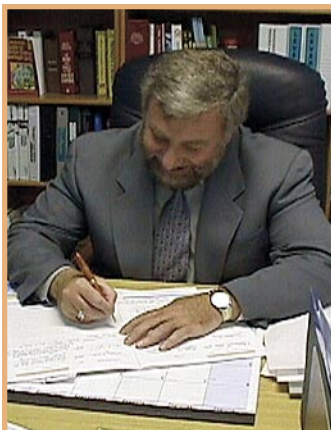
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League of Women Voters
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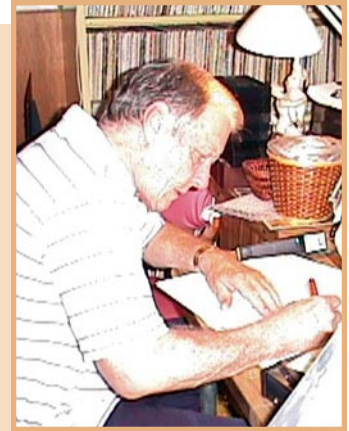
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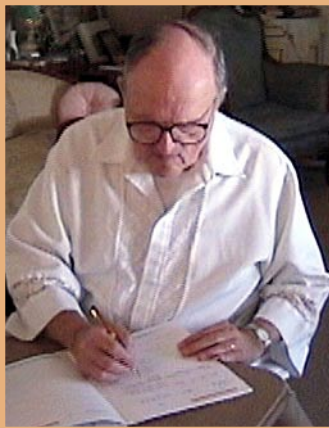


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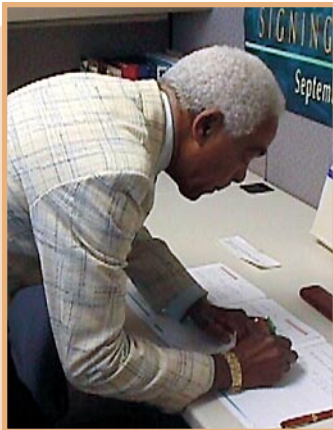
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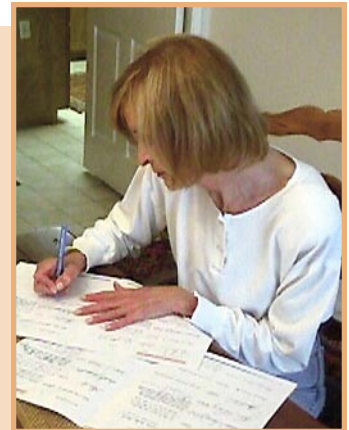
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"We look forward to working with the City to make water a safe and sustainable resource for this region."



Glossary of Terms

Basin

A drainage area whose boundary is dictated by gravity flow.

Beneficial uses

Designations for water bodies that (in California) Regional Water Quality Control Boards establish so appropriate water quality objectives can be established for that water body. The designated beneficial uses, together with water quality objectives form water quality standards. Such standards are mandated for all water bodies within the state under the California Water Code. In addition, the federal Clean Water Act mandates standards for all surface waters, including wetlands. In the Los Angeles Region, there are 24 Beneficial Use designations. Example designations include Municipal and Domestic Supply (MUN), Water Contact Recreation (REC-I), Wetland Habitat (WET), and Marine Habitat (MAR).

Best Management Practice (BMP)

Any program, technology, process, siting criteria, operating method, measure or device that controls, prevents, removes, or reduces pollution.

Biosolids

Solid materials resulting from wastewater treatment that meets government criteria for beneficial use, such as for fertilizer.

Class A biosolids

A designation established by the U.S. Environmental Protection Agency in the Standards for the Use or Disposal of Sludge (40 CFR 503), in which disinfection processes reduce pathogen levels in biosolids to "below detectable levels."

Collection system

The network of piping and pumping stations that conveys raw wastewater (sewage) from homes, businesses, etc., to a facility for treatment.

Composting

An enhanced process of rapidly oxidizing a solid material using atmospheric oxygen.

Conservation

Act of using the resources only when needed for the purpose of protecting from waste or loss of resources.

Conserve

To save a natural resource, such as water, through intelligent management and use.

Constructed wetlands

Wetlands that are designed and built similar to natural wetlands; some are used to treat wastewater. Constructed wetlands for wastewater treatment consist of one or more shallow depressions or cells built into the ground with level bottoms so that the flow of water can be controlled within the cells and from cell to cell. Roots and stems of the wetland plants form a dense mat where biological and physical processes occur to treat the wastewater. Constructed wetlands are being used to treat domestic, agricultural, industrial, and mining wastewaters.

Contamination

The state of being contaminated or impure (not pure) by contact or mixture; the state of having a substance introduced into the air, water, or soil that reduces its usefulness to humans and other organisms in nature.

Contracting cities/agencies

Neighboring cities or agencies in the Los Angeles area that rely on the City of Los Angeles to provide wastewater treatment and disposal services, through a formal agreement.

Discharged

Released into a water body.

Disposal

A disposing of or getting rid of something, as in the disposal of waste material.

Downstream

In the direction of a stream's current.

Dry weather urban runoff

Runoff to the storm drain system that occurs when there is no measurable precipitation. Typically includes flows from car washing, landscape irrigation, street washing, dewatering during construction activities, and illicit connections and dumping into the storm drains.

Dynamic hydraulic model

A computer program designed to simulate how a system performs over time, under varying flow conditions.

Effluent

Treated water (or product) leaving a facility.

Environmental justice

The fair treatment of people of all races, cultures and income levels with respect to the development, implementation and enforcement of environmental laws, regulations and policies.

Environmental Protection Agency (EPA)

The U.S. agency responsible for efforts to control air and water pollution, radiation and pesticide hazards, ecological research, and solid waste disposal.

Gravity

The force of attraction, characterized by heaviness or weight, by which terrestrial bodies tend to fall toward the center of the earth.

Groundwater

Water that infiltrates into the earth and is stored in usable amounts in the soil and rock below the earth's surface; water within the zone of saturation.

Groundwater discharge

The flow or pumping of water from an aquifer.

Groundwater recharge

The addition of water to an aquifer.

Habitat

The arrangement of food, water, shelter, and space suitable to animal's needs.

Impermeable

Impassable; not permitting the passage of a fluid through it.

Industrial source control program

An established pre-treatment program for industries, which requires removal of constituents from their wastewater before it enters the City's wastewater collection system, i.e., the pollutants are removed or controlled by the generator (or user) rather than by the City.

Infiltration

See Rainfall-Dependent Infiltration (RDI)

Inflow

That portion of precipitation that enters sewers through holes in maintenance holes and through roof leaders by illegal connection.

Infrastructure

The underlying foundation or basic framework of a system.

Maintenance hole

An opening that allows a person to gain access to a structure.

National Pollutant Discharge Elimination System (NPDES)

Part of the Clean Water Act requiring municipal and industrial wastewater treatment facilities to obtain permits which specify the types and amounts of pollutants that may be discharged into water bodies.

National Water Quality Standards

Maximum contaminant levels for a variety of chemicals, metals, and bacteria set by the Safe Drinking Water Act.

Natural resource

Something (as a mineral, forest, or kind of animal) that is found in nature and is valuable to humans.

Non-permeable surfaces

Surfaces that will not allow water to penetrate, such as sidewalks and parking lots.

Onsite retrofits

Improvements or management practices that manage runoff before it reaches the storm drain system.

Percolation

The gradual downward flow of water from the surface of the earth into the soil.

Percolation studies

Investigations to determine how much water can flow from the surface of the earth into the soil.

Pilot tests

Small-scale applications intended to demonstrate the applicability of a process if applied in a larger scale.

Pollutant

An impurity (contaminant) that causes an undesirable change in the physical, chemical, or biological characteristics of the air, water, or land that may be harmful to or affect the health, survival, or activities of humans or other living organisms.

Population

The organisms inhabiting a particular area or biotope.

Potable

Fit or suitable for drinking, as in potable water.

Rainfall- Dependent Infiltration (RDI)

Rainfall runoff that enters a sewer system and service connections from the ground during, after, and as a result of a rainfall event, through such sources as (but not limited to) defective pipes, pipe joints, connections, and maintenance holes.

Recharge

Replenish a water body or an aquifer with water.

Reclaim

To return to original condition.

Reclaimed water

See recycled water

Recyclable

In the context of the IPWP, refers to wastewater flows to plant sites that either have recycling facilities or could accommodate them, or to flows from Hyperion that could be exported to West Basin Municipal Water District for additional treatment. For the IPWP, the total 2020 "recyclable" flows were estimated to be 420 million gallons per day.

Recycled water

Treated wastewater that can be used to offset potable drinking water use. Recycled water can be used for irrigation, industrial uses and groundwater recharge.

Regional Board

Regional Water Quality Control Board (RWQCB): California agencies that implement and enforce Clean Water Act NPDES permit requirements, and are issuers and administrators of these permits as delegated by the EPA. There are nine regional boards working with the State Water Resources Control Board.

Reuse

To use again, especially after reclaiming or reprocessing.

Riparian

Relating to or living or located on the bank of a natural watercourse (as a river) or sometimes of a lake or a tidewater.

River

A large natural stream emptying into an ocean, lake, or other water body.

Runoff

Water that flows across surfaces rather than soaking in; eventually enters water body; may pick up and carry a variety of pollutants.

Sewage

Liquid waste conveyed in a sewer; wastewater

Sewer

A pipe or conduit constructed or installed to convey wastewater.

Stakeholder

Someone with an interest or share in a process or project outcome.

Stormwater

Runoff caused by rainfall.

Stormwater system

The system used for the collection of wet weather urban runoff.

Thematic

Of, or relating to, a specific and distinctive quality, characteristic or concern.

Treatment plant

Facility for cleaning and treating fresh water for drinking, or cleaning and treating wastewater before discharging into a water body.

Upstream

In the opposite direction of a stream's current.

Urban runoff

See runoff.

VSL/SA

Valley Spring Lane/Forman Avenue

Wastewater

Spent water after homes, industries, commercial establishments, public places, and similar entities have used their water.

Wastewater treatment

Physical, chemical, and biological processes used to remove pollutants from wastewater before reusing or discharging it into water body.

Water conservation

Practices that reduce water use.

Water cycle

The cycle of the earth's water supply from the atmosphere to the earth and back, which includes precipitation, transpiration, evaporation, runoff, infiltration, and storage in water bodies and groundwater. Also referred to as the "hydrologic cycle".

Water quality

The condition of water with respect to the amount of impurities in it.

Watershed

Land area from which water drains to a particular water body.

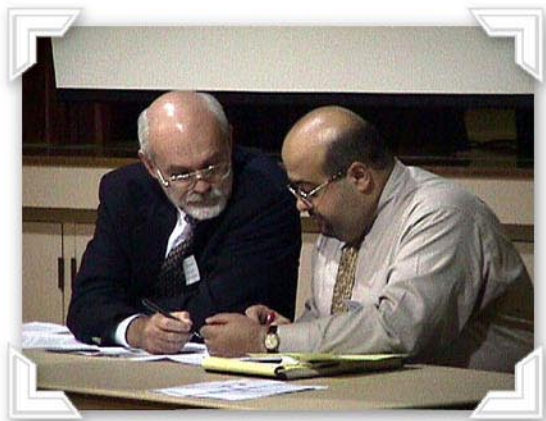
Wet weather urban runoff

Water (originating as precipitation) that flows across surfaces rather than soaking in; eventually enters water body; may pick up and carry a variety of pollutants.











Camp Dresser & McKee and CH2MHILL in cooperation with the City of Los Angeles

Appendix C
Metered Flow Data Used in Urban Dry
Weather Runoff Calculation for the Los
Angeles River WMA

Integrated Resources Plan

Appendix C

Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman WRP	Burbank WRP	LAG WRP	Groundw ater	LA River @ Tujnuga (F300)	LA River @ W'dlow (F319)	West Burb Chan (F285)	Verd Wash (F252)	Rio Hondo (F45)	Comp Creek (F37)	Total Est Runoff at Tuj	Total Est Runoff at W'dlow
Count	537	537	537	537	537	537	537	537	537	537	537	537
Low	13.6	4.4	9.6	2.7	16.8	75.0	4.2	0.6	0.0	0.5	-25.8	1.0
50th %	52.2	5.6	16.2	2.7	52.7	94.4	7.0	3.4	0.4	0.7	-0.1	20.4
90th %	62.1	6.4	18.6	3.6	62.1	133.8	8.4	7.1	2.7	0.7	6.7	61.3
95th %	64.6	6.8	19.1	3.6	64.6	142.9	9.0	8.4	3.5	0.7	10.9	76.9
Max	69.1	6.8	24.8	3.6	287.0	177.1	28.4	18.7	11.6	1.4	231.6	95.0
Average	50.4	5.5	16.2	2.9	51.0	101.6	7.0	4.0	1.0	0.7	0.6	26.5
Raw Data												
5/4/96	48.0	5.5	14.2	2.7	59.2	80.2	6.9	1.5 *	0.4	0.7	11.2	9.7
5/12/96	52.8	5.5	17.4	2.7	45.9	80.2	5.9	1.7 *	0.4	0.7	-6.9	1.7
5/15/96	50.1	5.5	19.2	2.7	50.0	80.2	5.9	3.4 *	0.4	0.7	-0.1	2.7
5/16/96	51.4	5.5	14.7	2.7	65.3	80.2	5.6	3.0 *	0.4	0.7	13.8	5.9
5/17/96	51.9	5.5	17.9	2.7	47.3	80.2	6.7	2.1 *	0.4	0.7	-4.7	2.1
5/18/96	50.1	5.5	18.8	2.7	52.5	80.2	6.4	2.1 *	0.4	0.7	2.4	3.1
5/19/96	49.4	5.5	18.7	2.7	50.7	80.2	6.9	1.7 *	0.4	0.7	1.3	3.9
5/21/96	51.5	5.5	19.4	2.7	49.2	80.2	6.9	1.7 *	0.4	0.7	-2.3	1.1
5/25/96	49.9	5.5	20.7	2.7	47.3	80.2	6.9	1.8 *	0.4	0.7	-2.6	1.5
5/27/96	49.2	5.5	20.3	2.7	43.1	80.2	6.2	2.5 *	0.4	0.7	-6.1	2.5
5/30/96	50.4	5.5	16.8	2.7	42.9	80.2	6.5	2.3 *	0.4	0.7	-7.5	4.7
5/31/96	48.6	5.5	21.9	2.7	47.6	80.2	6.5	2.4 *	0.4	0.7	-1.1	1.5
6/2/96	50.2	5.3	19.3	2.7	46.7	80.2	6.2	1.5 *	0.4	0.7	-3.5	2.7
6/3/96	50.2	5.3	19.7	2.7	52.9	80.2	6.1	1.5 *	0.4	0.7	2.7	2.2
6/4/96	51.5	5.3	19.2	2.7	53.2	80.2	6.0	1.5 *	0.4	0.7	1.7	1.5
6/5/96	51.1	5.3	19.3	2.7	52.1	80.2	6.0	1.4 *	0.4	0.7	1.0	1.8
6/6/96	50.9	5.3	20.1	2.7	51.0	80.2	5.5	1.3 *	0.4	0.7	0.1	1.2
6/7/96	51.4	5.3	19.3	2.7	52.9	80.2	6.1	1.3 *	0.4	0.7	1.5	1.5
6/8/96	50.0	5.3	19.1	2.7	48.5	80.2	6.3	1.3 *	0.4	0.7	-1.5	3.0
6/9/96	49.1	5.3	19.0	2.7	50.2	80.2	5.8	1.3 *	0.4	0.7	1.1	4.1
6/10/96	49.2	5.3	19.2	2.7	51.0	80.2	5.8	1.3 *	0.4	0.7	1.8	3.8

Integrated Resources Plan

Appendix C Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman WRP	Burbank WRP	LAG WRP	Groundw ater	LA River @ Tujnuga (F300)	LA River @ W'dlow (F319)	West Burb Chan (F285)	Verd Wash (F252)	Rio Hondo (F45)	Comp Creek (F37)	Total Est Runoff at Tuj	Total Est Runoff at W'dlow
6/11/96	51.0	5.3	18.9	2.7	50.4	80.2	5.9	1.3 *	0.4	0.7	-0.7	2.3
6/12/96	50.4	5.3	18.6	2.7	49.9	80.2	5.9	1.2 *	0.4	0.7	-0.5	3.2
6/13/96	50.3	5.3	18.1	2.7	53.1	80.2	6.0	1.1 *	0.4	0.7	2.8	3.7
6/14/96	50.2	5.3	18.6	2.7	51.8	80.2	6.8	1.1 *	0.4	0.7	1.7	3.4
6/15/96	50.9	5.3	18.8	2.7	49.6	80.2	6.1	1.1 *	0.4	0.7	-1.3	2.5
6/16/96	49.5	5.3	20.4	2.7	49.8	80.2	6.1	1.2 *	0.4	0.7	0.3	2.2
6/20/96	50.6	5.3	17.9	2.7	52.8	80.2	6.5	1.0 *	0.4	0.7	2.2	3.6
6/22/96	50.7	5.3	20.0	2.7	48.6	80.2	6.3	1.0 *	0.4	0.7	-2.0	1.5
6/23/96	48.9	5.3	20.5	2.7	49.6	80.2	6.3	1.0 *	0.4	0.7	0.7	2.7
6/24/96	50.9	5.3	19.2	2.7	48.8	80.2	5.7	1.0 *	0.4	0.7	-2.1	2.0
6/25/96	50.7	5.3	18.9	2.7	52.8	80.2	5.0	1.0 *	0.4	0.7	2.1	2.5
6/26/96	49.9	5.3	17.1	2.7	50.1	80.2	5.0	0.8 *	0.4	0.7	0.2	5.2
6/28/96	50.3	5.3	19.3	2.7	47.3	80.2	5.7	0.6 *	0.4	0.7	-3.0	2.5
6/29/96	49.2	5.3	17.8	2.7	51.6	80.2	5.4	0.6 *	0.4	0.7	2.4	5.2
6/30/96	48.4	5.3	17.9	2.7	49.1	80.2	4.6	0.8 *	0.4	0.7	0.7	5.9
7/2/96	51.0	5.3	17.8	2.7	51.3	78.9	5.2	0.8 *	0.4	0.7	0.2	2.0
7/3/96	50.8	5.3	17.7	2.7	52.2	82.1	5.6	0.9 *	0.4	0.7	1.4	5.6
7/4/96	49.3	5.3	17.3	2.7	52.1	100.8	5.3	1.1 *	0.4	0.7	2.8	26.2
7/5/96	49.8	5.3	16.6	2.7	52.7	81.4	6.3	1.4 *	0.4	0.7	2.9	7.1
7/6/96	49.5	5.3	18.0	2.7	49.3	86.6	6.3	1.2 *	0.4	0.7	-0.3	11.1
7/7/96	49.3	5.3	18.6	2.7	51.9	80.2	6.3	1.3 *	0.4	0.7	2.6	4.3
7/8/96	49.8	5.3	18.7	2.7	54.5	87.9	6.3	1.4 *	0.4	0.7	4.7	11.4
7/9/96	51.5	5.3	17.9	2.7	53.4	89.2	5.8	1.4 *	0.4	0.7	1.9	11.8
7/10/96	51.7	5.3	19.0	2.7	51.5	89.9	7.1	1.4 *	0.4	0.7	-0.2	11.2
7/11/96	51.2	5.3	18.9	2.7	49.3	84.7	6.6	1.6 *	0.4	0.7	-1.8	6.7
7/12/96	51.4	5.3	19.7	2.7	50.3	88.6	6.7	1.4 *	0.4	0.7	-1.1	9.4
7/13/96	49.5	5.3	18.1	2.7	49.7	86.6	6.2	1.5 *	0.4	0.7	0.2	11.1
7/14/96	49.4	5.3	19.9	2.7	49.8	90.5	6.9	1.5 *	0.4	0.7	0.5	13.3
7/15/96	51.3	5.3	24.8	2.7	52.4	100.2	6.5	1.5 *	0.4	0.7	1.1	16.0
7/16/96	51.1	5.3	24.8	2.7	51.3	104.1	6.1	2.1 *	0.4	0.7	0.2	20.2
7/17/96	50.4	5.3	21.0	2.7	51.3	106.7	6.3	3.3 *	0.4	0.7	0.9	27.2

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Appendix C

Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman	Burbank		Groundw	LA River	LA River	West	Verd	Rio	Comp	Total Est	Total Est
	WRP	WRP	LAG WRP	ater	@ Tujnuga	@ W'dlow	Burb	Wash	Hondo	Creek	Runoff at	Runoff at
					(F300)	(F319)	Chan	(F252)	(F45)	(F37)	Tuj	W'dlow
7/18/96	50.7	5.3	16.0	2.7	50.7	78.2	6.5	3.0 *	0.4	0.7	0.0	3.6
7/20/96	51.3	5.3	17.0	2.7	49.1	77.6	5.9	1.8 *	0.4	0.7	-2.1	1.3
7/23/96	50.7	5.3	18.2	2.7	52.0	80.2	6.6	1.7 *	0.4	0.7	1.3	3.2
7/27/96	51.1	5.3	18.0	2.7	45.0	84.7	7.0	1.2 *	0.4	0.7	-6.1	7.6
7/29/96	49.1	5.3	20.4	2.7	60.4	80.2	7.9	1.2 *	0.4	0.7	11.3	2.7
7/31/96	51.3	5.3	16.5	2.7	58.3	86.6	6.7	1.0 *	0.4	0.7	7.1	10.9
8/1/96	50.6	4.4	15.8	2.7	56.8	83.4	6.0	1.0 *	0.4	0.7	6.1	9.9
8/2/96	51.1	4.4	16.9	2.7	52.1	98.9	7.2	1.0 *	0.4	0.7	1.0	23.8
8/3/96	49.8	4.4	16.7	2.7	50.6	90.5	7.4	0.9 *	0.4	0.7	0.8	17.0
8/4/96	47.9	4.4	16.6	2.7	50.2	97.0	6.7	1.0 *	0.4	0.7	2.4	25.4
8/5/96	48.8	4.4	16.5	2.7	53.8	87.3	5.9	0.8 *	0.4	0.7	5.0	14.9
8/6/96	49.6	4.4	16.3	2.7	49.9	102.1	5.8	1.0 *	0.4	0.7	0.3	29.2
8/7/96	49.9	4.4	15.7	2.7	55.5	84.7	7.0	0.8 *	0.4	0.7	5.6	12.0
8/8/96	50.7	4.4	15.7	2.7	53.7	103.4	6.9	1.0 *	0.4	0.7	3.0	29.9
8/9/96	35.1	4.4	15.2	2.7	48.9	97.0	6.6	1.1 *	0.4	0.7	13.8	39.5
8/10/96	45.8	4.4	14.6	2.7	42.7	91.8	6.3	1.0 *	0.4	0.7	-3.2	24.3
8/12/96	48.7	4.4	17.0	2.7	48.6	79.5	6.3	1.0 *	0.4	0.7	-0.1	6.7
8/13/96	50.1	4.4	18.5	2.7	52.2	95.0	5.6	1.0 *	0.4	0.7	2.1	19.3
8/14/96	48.6	4.4	18.2	2.7	51.8	102.1	5.4	1.0 *	0.4	0.7	3.2	28.3
8/15/96	47.2	4.4	18.7	2.7	51.0	103.4	5.8	1.0 *	0.4	0.7	3.8	30.4
8/16/96	52.2	4.4	17.9	2.7	55.7	90.5	4.7	1.0 *	0.4	0.7	3.5	13.4
8/17/96	49.6	4.4	19.2	2.7	51.7	100.8	4.8	1.0 *	0.4	0.7	2.1	24.9
8/18/96	46.4	4.4	18.3	2.7	49.8	92.4	5.2	1.0 *	0.4	0.7	3.4	20.6
8/19/96	47.5	4.4	18.2	2.7	40.4	90.5	5.3	1.0 *	0.4	0.7	-7.1	17.7
8/21/96	53.0	4.4	18.0	2.7	41.1	86.0	5.5	1.0 *	0.4	0.7	-11.9	7.8
8/22/96	53.7	4.4	17.5	2.7	35.4	79.5	4.8	1.0 *	0.4	0.7	-18.3	1.2
8/25/96	45.5	4.4	18.7	2.7	46.1	81.4	6.3	1.0 *	0.4	0.7	0.6	10.2
8/26/96	49.3	4.4	18.3	2.7	48.0	82.1	6.3	1.0 *	0.4	0.7	-1.3	7.4
8/27/96	50.1	4.4	18.9	2.7	48.7	84.0	5.9	1.0 *	0.4	0.7	-1.4	7.9
8/28/96	48.5	4.4	19.4	2.7	48.5	88.6	6.1	0.8 *	0.4	0.7	0.0	13.5
8/31/96	48.2	4.4	18.3	2.7	49.4	77.6	7.4	0.8 *	0.4	0.7	1.2	3.9

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Appendix C

Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman	Burbank		Groundw	LA River	LA River	West	Verd	Rio	Comp	Total Est	Total Est
	WRP	WRP	LAG WRP	ater	@ Tujnuga	@ W'dlow	Burb	Wash	Hondo	Creek	Runoff at	Runoff at
					(F300)	(F319)	Chan	(F252)	(F45)	(F37)	Tuj	W'dlow
9/1/96	47.5	4.7	17.2	2.7	47.6	75.6	7.0	0.8 *	0.4	0.7	0.0	3.6
9/2/96	47.0	4.7	18.4	2.7	42.3	75.0	6.1	0.8 *	0.4	0.7	-4.7	2.3
9/4/96	52.3	4.7	17.9	2.7	51.8	100.8	6.7	0.8 *	0.4	0.7	-0.6	23.3
9/5/96	52.8	4.7	17.9	2.7	52.7	96.3	6.9	0.8 *	0.4	0.7	0.0	18.3
9/6/96	52.2	4.7	19.1	2.7	53.2	95.0	6.9	0.8 *	0.4	0.7	1.0	16.3
9/7/96	51.6	4.7	18.6	2.7	56.1	89.2	6.2	0.8 *	0.4	0.7	4.5	11.6
9/8/96	50.2	4.7	19.6	2.7	51.3	86.6	6.5	0.8 *	0.4	0.7	1.1	9.5
9/9/96	50.6	4.7	17.8	2.7	53.6	80.2	5.9	0.8 *	0.4	0.7	3.0	4.4
9/10/96	50.4	4.7	17.5	2.7	52.0	82.7	6.1	0.8 *	0.4	0.7	1.5	7.5
9/11/96	52.2	4.7	16.1	2.7	53.1	78.9	6.0	0.9 *	0.4	0.7	0.9	3.2
9/12/96	51.4	4.7	16.9	2.7	51.6	87.9	6.9	1.0 *	0.4	0.7	0.2	12.3
9/13/96	51.9	4.7	17.6	2.7	49.3	80.2	7.0	1.0 *	0.4	0.7	-2.6	3.3
9/14/96	49.9	4.7	18.4	2.7	48.4	79.5	6.7	1.0 *	0.4	0.7	-1.5	3.9
9/15/96	49.5	4.7	17.8	2.7	43.3	80.2	6.7	1.0 *	0.4	0.7	-6.2	5.5
9/16/96	49.6	4.7	17.7	2.7	47.2	84.0	5.4	1.0 *	0.4	0.7	-2.4	9.4
9/17/96	51.5	4.7	17.8	2.7	54.0	81.4	5.5	1.0 *	0.4	0.7	2.4	4.7
9/18/96	49.2	4.7	17.4	2.7	50.5	100.2	4.7	1.0 *	0.4	0.7	1.3	26.2
9/19/96	49.8	4.7	18.6	2.7	50.7	80.8	4.7	1.0 *	0.4	0.7	1.0	5.1
9/21/96	49.7	4.7	18.1	2.7	51.0	77.6	7.3	1.0 *	0.4	0.7	1.3	2.4
9/22/96	47.4	4.7	18.6	2.7	49.8	77.6	7.1	1.0 *	0.4	0.7	2.4	4.2
9/24/96	49.5	4.7	17.6	2.7	50.3	80.8	7.8	1.0 *	0.4	0.7	0.8	6.3
9/26/96	49.8	4.7	18.2	2.7	53.6	81.4	7.1	1.0 *	0.4	0.7	3.8	6.2
9/27/96	49.6	4.7	17.9	2.7	53.7	83.4	7.1	1.0 *	0.4	0.7	4.1	8.5
9/28/96	49.2	4.7	18.8	2.7	52.0	82.7	6.9	1.0 *	0.4	0.7	2.8	7.4
9/29/96	49.5	4.7	18.4	2.7	48.8	80.2	7.3	1.0 *	0.4	0.7	-0.7	4.9
9/30/96	49.1	4.7	18.3	2.7	49.3	80.2	7.4	1.0 *	0.4	0.7	0.3	5.4
2/1/97	54.8	6.0	17.7	3.6	73.7	119.6	6.5	9.0	4.4	1.4	18.9	37.4
2/2/97	54.2	6.0	17.8	3.6	72.4	118.9	6.2	9.0	4.3	1.2	18.2	37.3
2/3/97	58.2	6.0	18.3	3.6	62.1	118.3	6.1	9.0	4.1	1.1	3.8	32.2
2/4/97	57.8	6.0	17.4	3.6	60.8	115.7	6.5	5.7	4.0	0.9	3.0	30.9
2/5/97	55.4	6.0	17.8	3.6	67.9	116.4	6.5	4.8	3.5	0.8	12.5	33.6

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Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman WRP	Burbank WRP	LAG WRP	Groundw ater	LA River @ Tujnuga (F300)	LA River @ W'dlow (F319)	West Burb Chan (F285)	Verd Wash (F252)	Rio Hondo (F45)	Comp Creek (F37)	Total Est Runoff at Tuj	Total Est Runoff at W'dlow
2/6/97	55.1	6.0	18.8	3.6	66.6	117.6	6.5	8.4	4.9	0.7	11.5	34.1
2/7/97	55.1	6.0	17.4	3.6	61.4	121.5	6.3	8.4	3.2	0.6	6.3	39.5
2/8/97	53.1	6.0	16.8	3.6	60.1	113.8	6.4	7.8	2.1	0.6	7.0	34.3
2/9/97	51.6	6.0	17.0	3.6	54.3	117.0	6.3	7.8	2.6	0.6	2.7	38.8
2/10/97	55.5	6.0	19.0	3.6	117.6	97.0	7.1	18.7	3.0	0.6	62.1	12.8
2/11/97	55.8	6.0	18.2	3.6	80.8	136.4	7.1	9.7	7.1	0.6	25.0	52.8
2/12/97	54.4	6.0	18.5	3.6	67.2	91.8	5.9	7.8	2.9	0.6	12.9	9.4
2/13/97	54.4	6.0	17.2	3.6	64.6	92.4	5.4	7.1	2.9	0.5	10.3	11.2
2/14/97	53.9	6.0	16.8	3.6	64.0	91.1	5.8	7.1	1.7	0.6	10.1	10.8
2/15/97	52.5	6.0	15.0	3.6	63.3	91.1	5.8	7.1	2.8	0.5	10.9	14.1
2/16/97	50.6	6.0	17.9	3.6	65.9	93.1	5.6	7.1	2.8	0.6	15.4	15.1
2/17/97	55.4	6.0	17.7	3.6	287.0	177.1	28.4	11.0	2.8	0.6	231.6	94.5
2/18/97	54.5	6.0	17.2	3.6	72.4	131.9	7.1	7.8	2.3	0.6	17.9	50.6
2/19/97	55.0	6.0	17.6	3.6	60.1	91.8	6.5	7.1	3.3	0.6	5.1	9.6
2/20/97	53.9	6.0	17.2	3.6	55.6	89.9	6.5	7.1	3.0	0.6	1.7	9.1
2/21/97	53.2	6.0	17.9	3.6	60.8	87.9	5.7	7.1	5.3	0.7	7.6	7.2
2/22/97	52.5	6.0	18.1	3.6	63.3	86.0	5.4	7.1	3.6	0.7	10.8	5.8
2/23/97	52.6	6.0	17.3	3.6	60.1	86.6	6.5	7.1	3.0	0.6	7.6	7.2
2/24/97	54.4	6.0	18.4	3.6	63.3	85.3	7.1	7.1	3.0	0.7	8.9	2.9
2/27/97	52.0	6.0	18.5	3.6	63.3	83.4	7.1	7.8	4.1	0.6	11.3	3.3
2/28/97	52.5	6.0	17.9	3.6	63.3	84.0	7.1	7.1	3.6	0.6	10.8	4.0
3/1/97	49.7	5.7	18.4	3.6	54.3	91.1	6.4	7.1	3.0	0.5	4.6	13.7
3/2/97	49.9	5.7	17.8	3.6	50.4	93.7	6.3	7.1	3.0	0.5	0.6	16.7
3/3/97	52.0	5.7	18.9	3.6	51.1	95.7	6.0	7.8	3.6	0.5	-0.9	15.5
3/4/97	44.7	5.7	18.3	3.6	46.5	98.9	5.9	7.1	3.6	0.5	1.9	26.6
3/5/97	42.6	5.7	17.8	3.6	36.2	93.7	5.9	7.1	3.5	0.6	-6.4	24.1
3/8/97	47.3	5.7	18.2	3.6	42.7	80.2	5.5	7.1	3.0	0.6	-4.6	5.4
3/9/97	43.7	5.7	17.5	3.6	51.1	90.5	5.6	7.1	3.2	0.6	7.4	20.0
3/10/97	51.4	5.7	18.8	3.6	55.6	96.3	5.8	7.1	3.1	0.6	4.2	16.8
3/11/97	49.6	5.7	18.7	3.6	58.8	100.8	5.7	7.1	2.9	0.6	9.2	23.3
3/12/97	53.7	5.7	18.6	3.6	64.0	94.4	5.2	7.1	3.0	0.6	10.3	12.8

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Appendix C

Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman	Burbank		Groundw	LA River	LA River	West	Verd	Rio	Comp	Total Est	Total Est
	WRP	WRP	LAG WRP	ater	@ Tujnuga	@ W'dlow	Burb	Wash	Hondo	Creek	Runoff at	Runoff at
					(F300)	(F319)	Chan	(F252)	(F45)	(F37)	Tuj	W'dlow
3/13/97	56.3	5.7	18.4	3.6	64.0	95.7	5.5	7.1	2.8	0.7	7.7	11.7
3/14/97	55.2	5.7	18.6	3.6	66.6	95.7	5.8	7.1	3.6	0.7	11.4	12.6
3/15/97	54.9	5.7	18.5	3.6	67.9	93.7	5.8	7.1	2.8	0.7	13.0	11.1
3/16/97	54.1	5.7	16.6	3.6	67.2	92.4	5.8	7.1	1.9	0.7	13.1	12.4
3/17/97	55.8	5.7	17.3	3.6	64.6	91.8	5.4	7.1	2.4	0.7	8.9	9.4
3/18/97	55.9	5.7	16.5	3.6	62.7	92.4	5.2	7.8	2.1	0.6	6.8	10.7
3/19/97	55.6	5.7	16.3	3.6	60.8	92.4	5.3	7.1	1.9	0.6	5.1	11.1
3/20/97	54.1	5.7	16.7	3.6	60.8	89.9	5.6	7.1	1.6	0.6	6.7	9.8
3/21/97	53.8	5.7	16.7	3.6	64.6	90.5	5.9	7.1	2.1	0.6	10.9	10.7
3/22/97	53.4	5.7	17.2	3.6	70.5	89.2	6.1	7.1	1.7	0.6	17.0	9.3
3/23/97	52.1	5.7	16.2	3.6	62.7	88.6	5.8	7.1	1.7	0.6	10.7	11.0
3/24/97	54.5	5.7	18.3	3.6	65.9	88.6	5.9	7.1	2.1	0.6	11.5	6.5
3/25/97	54.3	5.7	18.4	3.6	65.9	89.9	5.8	6.5	1.9	0.6	11.6	7.8
3/26/97	54.5	5.7	18.5	3.6	63.3	86.6	5.8	6.4	1.4	0.6	8.8	4.3
3/27/97	54.0	5.7	18.0	3.6	62.7	87.9	5.9	6.3	1.4	0.6	8.7	6.6
3/28/97	52.2	5.7	18.5	3.6	64.6	89.2	6.2	6.5	1.4	0.6	12.5	9.2
3/29/97	52.8	5.7	17.9	3.6	67.9	89.2	5.8	6.4	1.3	0.6	15.1	9.3
3/30/97	51.8	5.7	15.5	3.6	65.3	90.5	5.9	6.4	1.3	0.6	13.5	13.9
3/31/97	54.5	5.7	18.4	3.6	62.1	89.9	5.6	6.5	1.7	0.6	7.6	7.7
4/1/97	53.8	5.4	18.3	3.6	51.7	87.3	5.2	6.5	1.2	0.6	-2.1	6.2
4/2/97	43.8	5.4	17.4	3.6	48.5	75.6	5.0	6.1	1.0	0.6	4.7	5.6
4/5/97	53.3	5.4	16.9	3.6	59.5	84.0	5.1	6.5	1.6	0.6	6.1	4.8
4/6/97	52.8	5.4	17.6	3.6	58.2	86.6	4.8	7.1	1.4	0.6	5.4	7.3
4/7/97	55.4	5.4	18.5	3.6	62.7	85.3	4.7	7.1	2.0	0.6	7.4	2.6
4/8/97	55.8	5.4	18.4	3.6	54.9	88.6	4.9	7.1	1.3	0.6	-0.8	5.4
4/10/97	56.3	5.4	16.9	3.6	58.2	83.4	5.4	7.1	1.4	0.6	1.9	1.3
4/11/97	55.8	5.4	17.9	3.6	62.7	86.0	5.4	6.5	1.2	0.6	7.0	3.3
4/12/97	53.2	5.4	16.8	3.6	62.1	83.4	5.9	6.5	2.5	0.6	8.8	4.4
4/13/97	51.6	5.4	10.6	3.6	60.1	79.5	6.2	6.5	1.3	0.6	8.5	8.4
4/15/97	56.2	5.4	18.3	3.6	55.6	84.7	5.9	6.5	1.0	0.6	-0.6	1.2
4/16/97	57.7	5.4	18.8	3.6	62.7	86.6	5.2	7.1	2.7	0.6	5.0	1.2

Integrated Resources Plan

Appendix C Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman WRP	Burbank WRP	LAG WRP	Groundw ater	LA River @ Tujnuga (F300)	LA River @ W'dlow (F319)	West Burb Chan (F285)	Verd Wash (F252)	Rio Hondo (F45)	Comp Creek (F37)	Total Est Runoff at Tuj	Total Est Runoff at W'dlow
4/26/97	56.6	5.4	18.6	3.6	60.8	86.6	5.1	6.5	3.9	0.6	4.2	2.4
5/11/97	57.1	5.0	17.1	3.6	58.2	84.7	4.7	5.9	1.2	0.6	1.1	2.0
5/13/97	48.8	5.0	17.8	3.6	61.4	84.0	5.2	6.1	1.4	0.8	12.6	8.9
5/17/97	53.8	5.0	17.9	3.6	58.2	84.0	5.1	6.5	2.1	0.8	4.4	3.8
5/19/97	59.1	5.0	17.8	3.6	59.5	87.3	5.1	6.5	3.0	0.8	0.4	1.9
5/20/97	58.3	5.0	17.9	3.6	64.0	92.4	4.7	6.5	3.6	0.8	5.7	7.7
5/22/97	57.5	5.0	17.5	3.6	60.8	91.1	4.7	6.5	4.2	0.8	3.2	7.6
5/23/97	59.1	5.0	17.2	3.6	56.9	86.0	4.5	6.5	2.8	0.8	-2.2	1.1
5/24/97	55.0	5.0	15.9	3.6	60.1	83.4	4.2	6.5	2.8	0.8	5.1	3.9
5/25/97	52.2	5.0	16.2	3.6	53.7	80.8	4.2	6.5	1.6	0.8	1.5	3.9
5/29/97	58.4	5.0	17.0	3.6	60.8	85.3	4.2	7.1	7.1	0.8	2.4	1.3
5/30/97	57.1	5.0	17.4	3.6	60.1	86.6	4.2	6.5	8.4	0.8	3.0	3.5
5/31/97	56.9	5.0	17.9	3.6	58.2	84.7	4.2	7.1	8.4	0.8	1.3	1.3
6/1/97	56.7	5.7	17.2	3.6	54.3	87.9	6.5	7.1	11.6	0.7	-2.4	4.8
6/2/97	59.8	5.7	17.9	3.6	60.1	90.5	6.5	7.1	11.6	0.7	0.3	3.6
6/3/97	57.8	5.7	15.2	3.6	56.9	92.4	7.1	6.5	9.0	0.7	-0.9	10.2
6/4/97	56.8	5.7	13.2	3.6	60.1	86.0	7.1	7.1	3.7	0.7	3.4	6.8
6/5/97	54.5	5.7	17.3	3.6	58.8	90.5	7.1	7.1	2.8	0.7	4.4	9.5
6/6/97	53.9	5.7	16.3	3.6	60.1	91.1	7.1	6.5	2.7	0.7	6.3	11.8
6/7/97	55.7	5.7	16.3	3.6	64.6	92.4	6.5	6.4	1.9	0.7	9.0	11.3
6/8/97	55.5	5.7	16.0	3.6	62.7	91.8	7.1	6.4	2.5	0.7	7.2	11.0
6/9/97	56.6	5.7	16.7	3.6	54.9	92.4	7.1	6.4	1.9	0.7	-1.7	9.9
6/11/97	58.0	5.7	13.5	3.6	59.5	87.9	6.5	4.8	2.3	0.7	1.5	7.2
6/12/97	57.8	5.7	16.8	3.6	58.8	85.3	6.3	4.6	1.9	0.7	1.0	1.5
6/13/97	55.3	5.7	17.1	3.6	55.6	95.0	6.2	10.3	5.4	0.7	0.3	13.4
6/14/97	52.6	5.7	15.9	3.6	54.3	80.2	6.1	7.1	1.6	0.7	1.7	2.5
6/17/97	57.3	5.7	17.2	3.6	58.8	94.4	5.1	8.4	1.7	0.7	1.5	10.6
6/18/97	59.1	5.7	17.5	3.6	67.2	93.7	5.5	7.1	1.1	0.7	8.1	7.9
6/19/97	59.4	5.7	17.6	3.6	56.9	95.0	5.5	7.1	1.0	0.7	-2.5	8.8
6/21/97	54.6	5.7	18.1	3.6	54.9	84.7	5.1	7.1	1.4	0.7	0.4	2.8
6/22/97	53.7	5.7	17.2	3.6	56.2	83.4	4.9	7.1	0.7	0.7	2.5	3.3

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Appendix C Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman WRP	Burbank WRP	LAG WRP	Groundw ater	LA River @ Tujnuga (F300)	LA River @ W'dlow (F319)	West Burb Chan (F285)	Verd Wash (F252)	Rio Hondo (F45)	Comp Creek (F37)	Total Est Runoff at Tuj	Total Est Runoff at W'dlow
6/23/97	57.2	5.7	18.4	3.6	49.8	90.5	4.9	7.1	0.8	0.7	-7.4	5.8
6/24/97	58.9	5.7	18.1	3.6	54.9	87.9	5.5	7.1	1.3	0.7	-4.0	1.7
6/25/97	58.5	5.7	17.6	3.6	54.3	87.9	5.1	3.9	0.7	0.7	-4.2	2.6
6/26/97	57.6	5.7	16.8	3.6	54.9	85.3	4.8	2.2	1.2	0.7	-2.6	1.7
6/28/97	53.8	5.7	18.1	3.6	58.2	85.3	4.8	2.1	0.7	0.7	4.4	4.2
6/29/97	53.1	5.7	17.4	3.6	58.2	87.3	4.7	2.0	0.6	0.7	5.1	7.5
6/30/97	54.9	5.7	17.3	3.6	55.6	87.3	4.4	2.0	1.0	0.7	0.7	5.9
7/1/97	55.1	5.0	17.7	3.6	55.6	88.6	5.7	2.0	1.4	0.6	0.5	7.2
7/2/97	54.3	5.0	17.0	3.6	53.7	84.0	5.5	1.9	1.6	0.6	-0.6	4.2
7/3/97	53.4	5.0	13.3	3.6	53.0	78.9	5.5	1.8	2.1	0.6	-0.4	3.6
7/6/97	52.6	5.0	15.3	3.6	56.9	84.0	5.5	1.9	1.9	0.6	4.3	7.5
7/9/97	54.4	5.0	15.4	3.6	53.7	85.3	5.4	1.7	4.1	0.6	-0.7	7.0
7/10/97	55.6	5.0	11.5	3.6	55.6	82.1	5.6	1.8	3.5	0.6	0.0	6.4
7/12/97	55.6	5.0	15.5	3.6	60.1	90.5	5.3	1.8	1.7	0.6	4.5	10.8
7/13/97	54.0	5.0	16.6	3.6	58.2	91.8	5.2	1.7	1.6	0.6	4.1	12.5
7/14/97	55.7	5.0	16.8	3.6	59.5	89.9	6.5	1.6	2.3	0.6	3.8	8.8
7/15/97	55.5	5.0	17.5	3.6	60.1	91.8	6.1	2.1	2.1	0.6	4.7	10.3
7/16/97	55.4	5.0	16.8	3.6	62.1	86.0	5.9	2.3	2.4	0.6	6.6	5.2
7/17/97	55.7	5.0	17.0	3.6	57.5	92.4	6.1	2.2	2.1	0.6	1.9	11.2
7/18/97	56.0	5.0	16.3	3.6	58.8	87.3	5.9	1.8	2.6	0.6	2.9	6.4
7/19/97	55.0	5.0	16.2	3.6	54.9	90.5	6.1	1.7	1.7	0.6	-0.1	10.6
7/20/97	54.6	5.0	16.8	3.6	53.7	87.3	5.2	2.1	2.7	0.6	-0.9	7.3
7/22/97	55.3	5.0	17.3	3.6	60.1	94.4	5.3	2.7	2.6	0.6	4.8	13.2
7/23/97	56.9	5.0	17.2	3.6	56.9	93.1	5.7	2.3	2.1	0.6	-0.1	10.4
7/24/97	55.6	5.0	16.5	3.6	57.5	89.9	5.6	2.4	1.8	0.6	1.9	9.2
7/25/97	56.5	5.0	17.2	3.6	58.2	91.1	6.3	2.1	1.8	0.6	1.7	8.9
7/26/97	53.3	5.0	16.4	3.6	57.5	90.5	6.4	2.5	1.6	0.6	4.3	12.2
7/27/97	52.8	5.0	15.8	3.6	56.2	89.2	6.5	2.4	1.6	0.6	3.5	12.1
7/28/97	55.7	5.0	17.3	3.6	60.1	84.0	5.9	2.7	1.6	0.6	4.4	2.4
7/29/97	54.5	5.0	18.0	3.6	55.6	91.8	6.5	3.2	1.6	0.6	1.1	10.8
7/30/97	55.0	5.0	16.8	3.6	57.5	85.3	6.5	2.5	1.7	0.6	2.5	4.9

Integrated Resources Plan

Appendix C

Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman WRP	Burbank WRP	LAG WRP	Groundw ater	LA River @ Tujnuga (F300)	LA River @ W'dlow (F319)	West Burb Chan (F285)	Verd Wash (F252)	Rio Hondo (F45)	Comp Creek (F37)	Total Est Runoff at Tuj	Total Est Runoff at W'dlow
8/1/97	54.8	5.0	17.9	3.6	56.2	95.7	6.3	2.5	1.6	0.6	1.4	14.4
8/2/97	53.8	5.0	17.1	3.6	56.9	93.1	5.8	2.7	1.4	0.6	3.1	13.7
8/3/97	53.8	5.0	17.9	3.6	47.2	91.1	6.1	2.2	1.7	0.6	-6.6	11.0
8/5/97	56.5	5.0	17.3	3.6	59.5	86.0	6.1	2.4	2.8	0.6	2.9	3.6
8/10/97	54.8	5.0	17.6	3.6	57.5	87.3	7.1	3.2	0.6	0.6	2.7	6.3
8/11/97	58.3	5.0	18.4	3.6	56.9	89.2	5.9	2.1	0.3	0.6	-1.4	4.0
8/12/97	57.5	5.0	17.7	3.6	52.4	86.0	6.5	1.2	1.0	0.6	-5.1	2.2
8/17/97	55.2	5.0	17.6	3.6	58.2	87.3	6.3	3.2	0.1	0.7	3.0	5.9
8/18/97	58.0	5.0	18.4	3.6	59.5	86.0	5.9	3.2	0.1	0.7	1.4	1.0
8/19/97	58.9	5.0	17.0	3.6	53.0	86.0	5.7	3.7	0.1	0.7	-5.9	1.5
8/22/97	58.5	5.0	17.3	3.6	56.9	87.3	5.7	3.5	0.5	0.7	-1.7	2.9
8/24/97	56.9	5.0	16.9	3.6	61.4	89.2	5.7	3.8	0.1	0.7	4.5	6.9
8/25/97	58.4	5.0	17.0	3.6	59.5	86.6	6.1	3.6	0.1	0.7	1.1	2.6
8/26/97	50.3	5.0	17.0	3.6	54.3	87.3	6.0	3.4	0.2	0.7	4.0	11.4
8/27/97	45.5	5.0	16.8	3.6	40.1	81.4	5.9	3.1	0.2	0.7	-5.5	10.6
8/31/97	51.8	5.0	16.4	3.6	54.3	87.3	8.4	3.2	0.1	0.7	2.5	10.5
10/1/97	58.0	5.0	18.2	3.6	51.7	87.3	6.5	4.0	0.3	0.7	-6.3	2.4
10/2/97	58.3	5.0	16.8	3.6	54.9	87.9	7.1	4.0	0.1	0.7	-3.3	4.3
10/3/97	57.2	5.0	17.9	3.6	58.2	96.3	6.5	4.0	0.1	0.7	1.0	12.7
10/4/97	56.6	5.0	17.8	3.6	60.8	97.6	6.5	4.0	0.1	0.7	4.2	14.6
10/5/97	55.6	5.0	18.2	3.6	57.5	100.2	6.5	4.0	0.1	0.7	1.9	17.8
10/6/97	57.8	5.0	17.4	3.6	51.7	101.5	7.1	4.0	0.1	0.6	-6.1	17.7
10/7/97	56.7	5.0	18.8	3.6	51.1	100.2	6.5	3.8	0.1	0.6	-5.6	16.1
10/8/97	56.3	5.0	17.7	3.6	58.8	102.8	6.3	3.4	0.0	0.6	2.5	20.2
10/9/97	56.0	5.0	18.4	3.6	54.3	100.2	6.3	3.4	0.1	0.6	-1.7	17.2
10/10/97	56.3	5.0	17.4	3.6	57.5	99.5	6.5	3.5	0.2	0.6	1.2	17.2
10/11/97	54.7	5.0	17.1	3.6	51.1	100.2	6.5	3.2	0.0	0.6	-3.7	19.8
10/12/97	54.2	5.0	18.0	3.6	52.4	94.4	7.1	3.1	0.0	0.6	-1.8	13.5
10/13/97	56.9	5.0	19.2	3.6	55.6	98.9	7.1	3.4	0.0	0.6	-1.3	14.2
10/14/97	56.1	5.0	16.5	3.6	50.4	100.2	6.3	3.6	0.4	0.6	-5.6	19.0
10/15/97	47.8	5.0	14.0	3.6	50.4	93.7	6.3	4.0	0.1	0.6	2.6	23.3

Integrated Resources Plan

Appendix C

Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman	Burbank		Groundw	LA River	LA River	West	Verd	Rio	Comp	Total Est	Total Est
	WRP	WRP	LAG WRP	ater	@ Tujnuga	@ W'dlow	Burb	Wash	Hondo	Creek	Runoff at	Runoff at
					(F300)	(F319)	(F285)	(F252)	(F45)	(F37)	Tuj	W'dlow
10/16/97	49.3	5.0	17.0	3.6	40.7	84.0	6.5	3.5	0.0	0.6	-8.6	9.1
10/30/97	57.2	5.0	14.1	3.6	49.1	81.4	7.1	2.8	0.0	0.6	-8.1	1.5
8/1/00	58.5	5.8	13.8	2.7	56.2	131.2	7.1	2.1 *	0.4	0.7	-2.3	50.4
8/2/00	55.8	5.8	14.9	2.7	57.5	115.1	7.8	2.1 *	0.4	0.7	1.8	35.9
8/3/00	55.9	5.8	14.7	2.7	38.8	133.8	8.4	2.0 *	0.4	0.7	-17.1	54.7
8/4/00	60.6	5.8	14.4	2.7	58.2	109.2	7.8	2.0 *	0.4	0.7	-2.5	25.7
8/5/00	61.0	5.8	14.4	2.7	58.2	131.9	8.4	2.0 *	0.4	0.7	-2.8	48.0
8/6/00	59.5	5.8	14.2	2.7	56.9	106.7	7.8	2.0 *	0.4	0.7	-2.6	24.4
8/7/00	60.9	5.8	14.3	2.7	59.5	140.3	7.8	2.2 *	0.4	0.7	-1.4	56.6
8/8/00	60.0	5.8	14.0	2.7	58.8	123.5	7.8	2.1 *	0.4	0.7	-1.2	41.1
8/9/00	59.6	5.8	14.8	2.7	57.5	146.1	9.0	3.7 *	0.4	0.7	-2.1	63.2
8/10/00	60.3	5.8	15.2	2.7	57.5	130.6	8.4	6.0 *	0.4	0.7	-2.7	46.7
8/11/00	60.7	5.8	13.6	2.7	59.5	139.0	8.4	4.4 *	0.4	0.7	-1.2	56.2
8/12/00	60.9	5.8	14.6	2.7	60.1	118.9	7.8	2.0 *	0.4	0.7	-0.8	35.0
8/13/00	56.0	5.8	13.8	2.7	53.7	137.0	8.4	1.9 *	0.4	0.7	-2.4	58.7
8/14/00	62.1	5.8	13.7	2.7	57.5	131.9	8.4	4.6 *	0.4	0.7	-4.6	47.6
8/15/00	62.8	5.8	13.7	2.7	57.5	140.9	8.4	5.6 *	0.4	0.7	-5.3	56.0
8/16/00	62.1	5.8	14.3	2.7	59.5	136.4	9.0	2.9 *	0.4	0.7	-2.6	51.6
8/17/00	61.0	5.8	15.5	2.7	58.8	133.2	7.1	2.3 *	0.4	0.7	-2.2	48.2
8/18/00	59.4	5.8	13.9	2.7	57.5	124.8	7.8	2.1 *	0.4	0.7	-1.9	43.0
8/19/00	60.7	5.8	14.9	2.7	53.0	122.2	7.1	2.1 *	0.4	0.7	-7.7	38.1
8/20/00	55.7	5.8	16.3	2.7	51.7	118.3	7.8	1.9 *	0.4	0.7	-3.9	37.9
8/21/00	63.0	5.8	13.4	2.7	59.5	128.6	7.8	2.1 *	0.4	0.7	-3.5	43.7
8/22/00	61.2	5.8	15.0	2.7	61.4	136.4	7.8	2.1 *	0.4	0.7	0.2	51.8
8/23/00	59.3	5.8	13.8	2.7	58.2	131.9	8.4	2.0 *	0.4	0.7	-1.2	50.3
8/24/00	64.3	5.8	14.0	2.7	60.8	129.9	8.4	2.2 *	0.4	0.7	-3.6	43.1
8/25/00	58.5	5.8	14.2	2.7	54.9	137.0	7.8	2.2 *	0.4	0.7	-3.6	55.9
8/26/00	61.5	5.8	14.2	2.7	57.5	135.1	8.4	2.3 *	0.4	0.7	-4.0	50.9
8/27/00	56.1	5.8	14.9	2.7	53.0	133.8	8.4	2.0 *	0.4	0.7	-3.1	54.3
8/28/00	61.7	5.8	13.8	2.7	58.2	131.9	7.8	2.1 *	0.4	0.7	-3.5	48.0
8/30/00	62.7	5.8	14.8	2.7	62.7	140.3	9.0	2.5 *	0.4	0.7	0.0	54.3

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Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman	Burbank		Groundw	LA River	LA River	West	Verd	Rio	Comp	Total Est	Total Est
	WRP	WRP	LAG WRP	ater	@ Tujnuga	@ W'dlow	Burb	Wash	Hondo	Creek	Runoff at	Runoff at
					(F300)	(F319)	Chan	(F252)	(F45)	(F37)	Tuj	W'dlow
8/31/00	62.0	5.8	14.8	2.7	58.2	122.2	8.4	2.5 *	0.4	0.7	-3.9	36.8
9/1/00	61.2	5.6	13.5	2.7	56.9	122.2	8.4	2.3 *	0.4	0.7	-4.3	39.2
9/2/00	59.9	5.6	14.3	2.7	54.3	118.9	7.8	2.3 *	0.4	0.7	-5.6	36.5
9/3/00	56.4	5.6	14.4	2.7	53.0	113.1	7.8	2.4 *	0.4	0.7	-3.4	34.1
9/4/00	59.9	5.6	12.7	2.7	53.7	109.2	8.4	2.1 *	0.4	0.7	-6.3	28.4
9/5/00	61.6	5.6	14.5	2.7	56.2	106.7	7.8	2.3 *	0.4	0.7	-5.3	22.4
9/6/00	62.9	5.6	12.3	2.7	58.2	108.6	9.0	1.9 *	0.4	0.7	-4.7	25.1
9/7/00	60.8	5.6	15.1	2.7	56.9	107.3	7.8	2.0 *	0.4	0.7	-3.9	23.1
9/8/00	61.6	5.6	13.9	2.7	54.9	106.7	7.8	2.0 *	0.4	0.7	-6.6	22.9
9/9/00	62.9	5.6	13.6	2.7	57.5	106.0	7.8	1.9 *	0.4	0.7	-5.4	21.2
9/10/00	62.1	5.6	14.8	2.7	56.9	106.0	7.8	1.9 *	0.4	0.7	-5.2	20.8
9/11/00	62.5	5.6	13.5	2.7	58.2	115.1	7.1	2.5 *	0.4	0.7	-4.3	30.7
9/12/00	64.0	5.6	11.6	2.7	56.2	140.9	7.1	4.0 *	0.4	0.7	-7.8	57.0
9/13/00	63.2	5.6	14.0	2.7	49.1	145.4	7.8	5.0 *	0.4	0.7	-14.1	60.0
9/14/00	64.6	5.6	15.3	2.7	38.8	142.9	7.8	4.3 *	0.4	0.7	-25.8	54.7
9/15/00	62.3	5.6	11.1	2.7	45.2	155.8	7.8	2.2 *	0.4	0.7	-17.1	74.1
9/16/00	54.1	5.6	14.4	2.7	45.9	156.4	7.1	2.2 *	0.4	0.7	-8.2	79.7
9/17/00	54.8	5.6	14.6	2.7	58.8	142.2	7.8	2.3 *	0.4	0.7	4.0	64.5
9/18/00	58.0	5.6	12.8	2.7	59.5	133.8	7.8	2.1 *	0.4	0.7	1.5	54.7
9/19/00	60.9	5.6	15.0	2.7	62.7	119.6	7.8	2.3 *	0.4	0.7	1.8	35.4
9/20/00	59.2	5.6	16.4	2.7	65.9	123.5	7.8	2.4 *	0.4	0.7	6.7	39.6
9/21/00	56.8	5.6	17.2	2.7	52.4	120.9	8.4	3.9 *	0.4	0.7	-4.5	38.6
9/22/00	62.1	5.6	12.5	2.7	68.5	125.4	12.9	7.1 *	0.4	0.7	6.5	42.6
9/24/00	60.7	5.6	13.6	2.7	62.1	129.3	8.4	2.3 *	0.4	0.7	1.4	46.7
9/25/00	62.2	5.6	14.1	2.7	61.4	122.2	7.8	2.3 *	0.4	0.7	-0.8	37.5
9/26/00	60.1	5.6	16.7	2.7	55.6	120.9	7.8	2.1 *	0.4	0.7	-4.5	35.8
9/27/00	62.1	5.6	15.6	2.7	55.6	117.6	7.8	2.1 *	0.4	0.7	-6.5	31.7
9/28/00	56.2	5.6	14.4	2.7	48.5	118.9	7.8	2.3 *	0.4	0.7	-7.8	40.0
9/29/00	62.0	5.6	14.2	2.7	64.0	116.4	7.8	2.4 *	0.4	0.7	2.0	31.8
9/30/00	61.6	5.6	14.1	2.7	61.4	116.4	7.8	2.2 *	0.4	0.7	-0.2	32.4
11/1/00	66.2	5.8	17.2	2.7	59.5	111.8	7.8	2.8 *	0.4	0.7	-6.7	20.0

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Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman	Burbank		Groundw	LA River	LA River	West	Verd	Rio	Comp	Total Est	Total Est
	WRP	WRP	LAG WRP	ater	@ Tujnuga	@ W'dlow	Burb	Wash	Hondo	Creek	Runoff at	Runoff at
					(F300)	(F319)	Chan	(F252)	(F45)	(F37)	Tuj	W'dlow
11/2/00	54.4	5.8	15.7	2.7	52.4	110.5	8.4	3.4 *	0.4	0.7	-2.1	31.9
11/3/00	65.5	5.8	15.2	2.7	60.8	110.5	8.4	3.3 *	0.4	0.7	-4.8	21.3
11/4/00	66.6	5.8	12.1	2.7	58.8	109.9	8.4	3.4 *	0.4	0.7	-7.7	22.8
11/5/00	61.9	5.8	9.6	2.7	60.1	107.3	8.4	3.5 *	0.4	0.7	-1.7	27.3
11/6/00	62.9	5.8	13.0	2.7	60.1	107.3	8.4	3.4 *	0.4	0.7	-2.8	22.9
11/7/00	65.4	5.8	13.6	2.7	60.1	108.0	7.8	3.3 *	0.4	0.7	-5.2	20.5
11/8/00	66.1	5.8	14.6	2.7	64.6	105.4	8.4	3.2 *	0.4	0.7	-1.5	16.2
11/9/00	65.2	5.8	13.4	2.7	63.3	112.5	7.8	3.6 *	0.4	0.7	-1.8	25.4
11/10/00	65.7	5.8	15.0	2.7	64.6	106.0	7.8	3.6 *	0.4	0.7	-1.1	16.8
11/11/00	67.8	5.8	14.5	2.7	60.1	110.5	7.1	3.5 *	0.4	0.7	-7.7	19.8
11/12/00	69.1	5.8	14.0	2.7	56.2	102.8	7.8	3.4 *	0.4	0.7	-12.8	11.3
11/13/00	69.0	5.8	14.0	2.7	59.5	98.3	7.8	3.0 *	0.4	0.7	-9.5	6.8
11/14/00	69.1	5.8	14.5	2.7	53.0	95.7	7.1	3.0 *	0.4	0.7	-16.1	3.6
11/15/00	61.0	5.8	14.4	2.7	47.8	86.0	7.1	3.2 *	0.4	0.7	-13.2	2.1
11/17/00	62.5	5.8	14.9	2.7	58.2	101.5	7.1	3.4 *	0.4	0.7	-4.3	15.6
11/18/00	67.3	5.8	14.7	2.7	56.2	99.5	7.8	3.0 *	0.4	0.7	-11.1	9.0
11/19/00	66.3	5.8	14.3	2.7	52.4	95.0	7.8	3.0 *	0.4	0.7	-14.0	5.9
11/20/00	65.6	5.8	14.6	2.7	54.9	91.8	7.8	3.3 *	0.4	0.7	-10.7	3.1
11/21/00	63.1	5.8	14.9	2.7	56.2	94.4	7.8	3.4 *	0.4	0.7	-6.9	7.9
11/22/00	62.5	5.8	14.9	2.7	51.1	112.5	7.8	3.4 *	0.4	0.7	-11.4	26.7
11/23/00	63.7	5.8	14.4	2.7	49.8	104.7	7.1	3.5 *	0.4	0.7	-13.9	18.2
11/24/00	62.6	5.8	14.9	2.7	49.8	100.8	6.5	3.3 *	0.4	0.7	-12.9	14.8
11/25/00	64.0	5.8	13.5	2.7	53.7	98.9	6.5	3.3 *	0.4	0.7	-10.4	12.9
11/26/00	62.8	5.8	14.4	2.7	54.9	106.7	6.5	3.2 *	0.4	0.7	-7.9	21.0
11/27/00	67.3	5.8	15.6	2.7	57.5	107.3	7.1	3.5 *	0.4	0.7	-9.7	16.0
11/28/00	63.6	5.8	15.7	2.7	55.6	112.5	7.1	3.5 *	0.4	0.7	-8.0	24.7
11/29/00	67.6	5.8	15.0	2.7	56.2	110.5	7.1	3.5 *	0.4	0.7	-11.4	19.4
11/30/00	66.5	5.8	16.1	2.7	57.5	110.5	7.8	3.5 *	0.4	0.7	-9.0	19.5
12/1/00	65.8	4.7	13.6	2.7	55.6	115.1	7.1	3.5 *	0.4	0.7	-10.2	28.3
12/2/00	65.3	4.7	14.9	2.7	56.2	111.2	7.8	3.5 *	0.4	0.7	-9.1	23.6
12/3/00	64.8	4.7	13.3	2.7	55.6	109.2	7.8	3.5 *	0.4	0.7	-9.2	23.8

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Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman	Burbank		Groundw	LA River	LA River	West	Verd	Rio	Comp	Total Est	Total Est
	WRP	WRP	LAG WRP	ater	@ Tujnuga	@ W'dlow	Burb	Wash	Hondo	Creek	Runoff at	Runoff at
					(F300)	(F319)	Chan	(F252)	(F45)	(F37)	Tuj	W'dlow
12/4/00	66.1	4.7	13.3	2.7	56.2	110.5	7.1	3.4 *	0.4	0.7	-9.9	23.7
12/5/00	66.6	4.7	11.7	2.7	54.9	109.9	6.5	3.5 *	0.4	0.7	-11.7	24.2
12/6/00	67.8	4.7	11.8	2.7	55.6	108.0	5.8	3.5 *	0.4	0.7	-12.2	20.9
12/7/00	65.3	4.7	11.9	2.7	54.3	109.2	7.1	3.5 *	0.4	0.7	-11.0	24.7
12/8/00	64.4	4.7	14.9	2.7	55.6	109.2	6.3	3.8 *	0.4	0.7	-8.8	22.6
12/9/00	65.2	4.7	13.5	2.7	56.2	115.7	5.7	3.5 *	0.4	0.7	-9.0	29.6
12/10/00	63.8	4.7	14.0	2.7	54.9	112.5	5.1	3.5 *	0.4	0.7	-8.9	27.3
12/11/00	65.7	4.7	14.2	2.7	54.9	111.2	4.3	3.5 *	0.4	0.7	-10.8	23.9
12/12/00	66.4	4.7	14.6	2.7	58.8	109.2	5.4	3.5 *	0.4	0.7	-7.6	20.9
12/13/00	61.2	4.7	12.6	2.7	60.8	112.5	6.1	3.5 *	0.4	0.7	-0.4	31.4
12/14/00	58.3	4.7	13.2	2.7	59.5	110.5	7.1	3.5 *	0.4	0.7	1.1	31.6
12/15/00	57.7	4.7	14.0	2.7	57.5	113.1	5.4	3.5 *	0.4	0.7	-0.2	34.0
12/16/00	56.0	4.7	12.6	2.7	54.9	108.0	5.3	3.5 *	0.4	0.7	-1.1	32.0
12/17/00	53.9	4.7	12.2	2.7	51.7	104.1	5.9	3.4 *	0.4	0.7	-2.2	30.6
12/18/00	57.3	4.7	12.4	2.7	53.0	102.1	6.3	3.0 *	0.4	0.7	-4.3	25.0
12/19/00	57.5	4.7	12.7	2.7	56.2	102.8	6.5	3.3 *	0.4	0.7	-1.3	25.1
12/20/00	57.6	4.7	13.1	2.7	56.2	109.2	6.5	3.5 *	0.4	0.7	-1.4	31.2
12/21/00	56.3	4.7	13.5	2.7	53.7	113.1	7.1	3.5 *	0.4	0.7	-2.7	36.0
12/22/00	58.8	4.7	13.7	2.7	58.2	113.1	7.1	3.5 *	0.4	0.7	-0.7	33.3
12/23/00	56.9	4.7	13.6	2.7	54.3	115.7	7.1	3.5 *	0.4	0.7	-2.6	37.9
12/24/00	55.7	4.7	13.4	2.7	55.6	113.1	7.1	3.5 *	0.4	0.7	-0.1	36.6
12/25/00	53.0	4.7	12.4	2.7	52.4	112.5	6.1	3.4 *	0.4	0.7	-0.7	39.6
12/26/00	55.4	4.7	12.3	2.7	49.1	106.0	7.1	3.3 *	0.4	0.7	-6.3	30.9
12/27/00	57.8	4.7	13.5	2.7	53.7	108.0	6.5	3.5 *	0.4	0.7	-4.2	29.2
12/28/00	57.4	4.7	12.2	2.7	56.9	109.9	7.1	3.4 *	0.4	0.7	-0.5	33.0
12/29/00	55.7	4.7	14.6	2.7	53.7	112.5	6.5	3.1 *	0.4	0.7	-2.0	34.8
12/30/00	56.6	4.7	14.2	2.7	53.0	110.5	7.1	3.3 *	0.4	0.7	-3.6	32.4
12/31/00	53.9	4.7	13.6	2.7	50.4	108.6	7.1	3.3 *	0.4	0.7	-3.5	33.8
5/7/01	52.3	5.6	13.9	2.7	58.8	168.7	8.4	3.4 *	0.4	0.7	6.5	94.2
5/8/01	55.5	5.6	14.3	2.7	59.5	165.5	8.4	3.6 *	0.4	0.7	4.0	87.4
5/9/01	51.8	5.6	14.7	2.7	52.4	165.5	7.8	3.4 *	0.4	0.7	0.6	90.8

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Appendix C Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman	Burbank		Groundw	LA River	LA River	West	Verd	Rio	Comp	Total Est	Total Est
	WRP	WRP	LAG WRP	ater	@ Tujnuga	@ W'dlow	Burb	Wash	Hondo	Creek	Runoff at	Runoff at
					(F300)	(F319)	Chan	(F252)	(F45)	(F37)	Tuj	W'dlow
5/10/01	47.6	5.6	10.5	2.7	47.2	156.4	8.4	3.0 *	0.4	0.7	-0.4	90.0
5/11/01	48.2	5.6	15.4	2.7	49.1	155.1	8.4	3.0 *	0.4	0.7	0.9	83.3
5/12/01	47.7	5.6	15.0	2.7	49.1	151.3	9.0	3.0 *	0.4	0.7	1.4	80.3
5/13/01	48.4	5.6	13.9	2.7	45.9	157.7	8.4	2.8 *	0.4	0.7	-2.6	87.1
5/14/01	43.0	5.6	15.3	2.7	49.1	157.1	8.4	2.5 *	0.4	0.7	6.1	90.5
5/15/01	43.0	5.6	15.3	2.7	46.5	161.6	8.4	2.5 *	0.4	0.7	3.6	95.0
5/16/01	42.1	5.6	15.0	2.7	42.7	157.7	8.4	2.5 *	0.4	0.7	0.6	92.3
5/17/01	42.9	5.6	15.0	2.7	42.7	146.7	8.4	2.5 *	0.4	0.7	-0.2	80.6
5/18/01	40.1	5.6	16.2	2.7	39.4	144.1	8.4	2.1 *	0.4	0.7	-0.6	79.6
5/19/01	39.5	5.6	16.1	2.7	41.4	137.7	8.4	2.1 *	0.4	0.7	1.8	73.7
5/20/01	38.4	5.6	15.6	2.7	42.0	146.7	6.4	2.2 *	0.4	0.7	3.6	84.4
5/21/01	41.2	5.6	16.6	2.7	42.7	142.9	7.1	2.3 *	0.4	0.7	1.5	76.8
5/22/01	37.5	5.6	17.0	2.7	40.1	138.3	8.4	2.7 *	0.4	0.7	2.6	75.5
5/23/01	39.2	5.6	15.7	2.7	41.4	137.7	7.8	3.0 *	0.4	0.7	2.2	74.5
5/24/01	37.7	5.6	13.1	2.7	39.4	143.5	8.4	3.0 *	0.4	0.7	1.7	84.3
5/25/01	37.7	5.6	15.4	2.7	39.4	142.9	8.4	3.0 *	0.4	0.7	1.8	81.5
5/26/01	37.3	5.6	14.9	2.7	39.4	148.0	8.4	3.4 *	0.4	0.7	2.2	87.6
5/27/01	33.5	5.6	13.7	2.7	37.5	148.0	8.4	3.5 *	0.4	0.7	4.0	92.5
5/28/01	35.8	5.6	15.1	2.7	34.9	148.0	8.4	3.5 *	0.4	0.7	-0.9	88.9
5/29/01	37.9	5.6	14.7	2.7	38.1	150.6	9.0	3.5 *	0.4	0.7	0.3	89.7
5/30/01	39.4	5.6	12.9	2.7	39.4	144.8	8.4	3.6 *	0.4	0.7	0.0	84.2
5/31/01	39.8	5.6	15.0	2.7	40.7	142.2	8.4	3.8 *	0.4	0.7	0.9	79.1
6/1/01	35.8	6.1	15.5	2.7	39.4	136.4	8.4	3.5 *	0.4	0.7	3.7	76.4
6/2/01	37.3	6.1	15.0	2.7	40.1	136.4	9.0	3.1 *	0.4	0.7	2.8	75.3
6/3/01	38.9	6.1	15.0	2.7	40.7	133.8	9.0	3.0 *	0.4	0.7	1.8	71.1
6/4/01	38.8	6.1	13.9	2.7	42.0	139.6	27.1	2.9 *	0.4	0.7	3.2	78.2
6/5/01	39.9	6.1	16.0	2.7	42.0	142.2	9.0	2.5 *	0.4	0.7	2.2	77.6
6/6/01	40.2	6.1	15.3	2.7	39.4	145.4	9.7	2.5 *	0.4	0.7	-0.8	81.1
6/7/01	39.7	6.1	15.0	2.7	39.4	140.9	9.7	2.5 *	0.4	0.7	-0.3	77.4
6/8/01	39.6	6.1	15.3	2.7	36.2	137.0	9.7	2.5 *	0.4	0.7	-3.4	73.4
6/9/01	38.0	6.1	15.3	2.7	38.1	137.7	9.0	2.5 *	0.4	0.7	0.1	75.6

Integrated Resources Plan

Appendix C

Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman WRP	Burbank WRP	LAG WRP	Groundw ater	LA River @ Tujnuga (F300)	LA River @ W'dlow (F319)	West Burb Chan (F285)	Verd Wash (F252)	Rio Hondo (F45)	Comp Creek (F37)	Total Est Runoff at Tuj	Total Est Runoff at W'dlow
6/10/01	39.6	6.1	15.9	2.7	40.1	135.1	7.8	2.5 *	0.4	0.7	0.5	70.8
6/11/01	39.9	6.1	15.3	2.7	39.4	137.0	8.4	2.5 *	0.4	0.7	-0.5	73.0
6/12/01	38.7	6.1	15.8	2.7	38.1	127.3	9.0	2.5 *	0.4	0.7	-0.6	64.0
6/13/01	38.1	6.1	16.0	2.7	38.8	126.1	8.4	2.5 *	0.4	0.7	0.7	63.2
6/14/01	39.6	6.1	15.8	2.7	38.8	125.4	8.4	2.5 *	0.4	0.7	-0.8	61.3
6/15/01	39.1	6.1	14.9	2.7	37.5	127.3	8.4	2.5 *	0.4	0.7	-1.6	64.6
6/16/01	38.7	6.1	15.3	2.7	40.1	121.5	8.4	2.5 *	0.4	0.7	1.4	58.8
6/17/01	38.3	6.1	15.8	2.7	36.2	124.1	9.0	2.5 *	0.4	0.7	-2.1	61.3
6/18/01	39.4	6.1	15.0	2.7	37.5	124.8	8.4	2.5 *	0.4	0.7	-1.9	61.6
6/19/01	39.7	6.1	15.6	2.7	37.5	120.2	9.0	5.9 *	0.4	0.7	-2.2	56.1
6/20/01	39.3	6.1	16.1	2.7	36.8	126.7	9.7	9.7 *	0.4	0.7	-2.5	62.5
6/21/01	39.2	6.1	15.3	2.7	36.2	128.0	9.0	9.7 *	0.4	0.7	-3.0	64.7
6/22/01	38.1	6.1	14.8	2.7	34.9	129.3	8.4	9.7 *	0.4	0.7	-3.2	67.6
6/23/01	38.4	6.1	15.8	2.7	36.8	122.8	9.7	9.7 *	0.4	0.7	-1.5	59.9
6/24/01	37.6	6.1	15.5	2.7	34.9	125.4	9.7	9.7 *	0.4	0.7	-2.7	63.6
6/25/01	37.8	6.1	15.0	2.7	34.9	128.6	9.0	9.7 *	0.4	0.7	-2.9	67.0
6/26/01	38.3	6.1	15.5	2.7	35.6	124.8	9.0	9.7 *	0.4	0.7	-2.7	62.2
6/27/01	38.4	6.1	15.5	2.7	36.2	124.1	8.4	9.7 *	0.4	0.7	-2.2	61.4
6/28/01	37.9	6.1	17.0	2.7	36.2	119.6	8.4	9.7 *	0.4	0.7	-1.7	55.9
6/29/01	38.6	6.1	15.7	2.7	36.8	113.8	9.0	9.7 *	0.4	0.7	-1.8	50.6
6/30/01	38.0	6.1	14.9	2.7	35.6	110.5	9.7	9.7 *	0.4	0.7	-2.5	48.8
7/1/01	37.3	5.8	15.7	2.7	34.9	104.1	9.7	9.7 *	0.4	0.7	-2.4	42.6
7/2/01	37.9	5.8	14.8	2.7	37.5	101.5	9.0	10.3 *	0.4	0.7	-0.4	40.3
7/3/01	37.5	5.8	11.5	2.7	36.8	101.5	8.4	9.0 *	0.4	0.7	-0.6	44.0
7/4/01	36.3	5.8	13.7	2.7	35.6	102.1	8.4	8.4 *	0.4	0.7	-0.8	43.7
7/5/01	37.8	5.8	14.9	2.7	37.5	97.0	8.4	9.0 *	0.4	0.7	-0.3	35.8
7/6/01	36.7	5.8	15.9	2.7	37.5	102.1	8.4	9.7 *	0.4	0.7	0.8	41.0
7/7/01	37.3	5.8	15.0	2.7	38.8	103.4	8.4	9.7 *	0.4	0.7	1.5	42.7
7/8/01	36.6	5.8	16.2	2.7	35.6	95.7	8.4	9.0 *	0.4	0.7	-1.1	34.3
7/9/01	37.3	5.8	12.7	2.7	38.1	94.4	8.4	8.4 *	0.4	0.7	0.9	35.9
7/10/01	37.6	5.8	15.8	2.7	38.1	96.3	7.8	7.8 *	0.4	0.7	0.6	34.4

Appendix C
Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman	Burbank		Groundw	LA River	LA River	West	Verd	Rio	Comp	Total Est	Total Est
	WRP	WRP	LAG WRP	ater	@ Tujnuga	@ W'dlow	Burb	Wash	Hondo	Creek	Runoff at	Runoff at
					(F300)	(F319)	Chan	(F252)	(F45)	(F37)	Tuj	W'dlow
7/11/01	37.5	5.8	15.5	2.7	38.8	100.2	8.4	7.8 *	0.4	0.7	1.2	38.7
7/12/01	36.4	5.8	15.2	2.7	37.5	101.5	8.4	7.8 *	0.4	0.7	1.1	41.4
7/13/01	37.0	5.8	14.5	2.7	38.1	99.5	7.8	7.8 *	0.4	0.7	1.1	39.5
7/14/01	37.3	5.8	15.3	2.7	35.6	101.5	8.4	8.4 *	0.4	0.7	-1.7	40.5
7/15/01	36.1	5.8	15.4	2.7	34.3	104.1	8.4	7.8 *	0.4	0.7	-1.9	44.0
7/16/01	37.3	5.8	15.7	2.7	39.4	105.4	8.4	7.1 *	0.4	0.7	2.1	43.9
7/17/01	37.8	5.8	12.0	2.7	37.5	109.2	9.0	7.1 *	0.4	0.7	-0.3	50.9
7/18/01	37.4	5.8	12.0	2.7	36.2	110.5	9.0	7.1 *	0.4	0.7	-1.2	52.6
7/19/01	37.4	5.8	15.0	2.7	35.6	110.5	9.0	6.5 *	0.4	0.7	-1.9	49.6
7/20/01	37.6	5.8	13.8	2.7	36.8	114.4	7.8	6.4 *	0.4	0.7	-0.8	54.5
7/21/01	38.1	5.8	14.5	2.7	36.2	114.4	8.4	6.4 *	0.4	0.7	-1.9	53.3
7/22/01	37.0	5.8	15.1	2.7	35.6	116.4	8.4	6.4 *	0.4	0.7	-1.4	55.8
7/23/01	36.9	5.8	15.7	2.7	38.1	115.1	7.1	6.4 *	0.4	0.7	1.3	54.1
7/24/01	37.3	5.8	15.0	2.7	40.1	118.9	7.1	6.4 *	0.4	0.7	2.8	58.2
7/25/01	37.2	5.8	15.5	2.7	38.8	115.1	7.8	6.4 *	0.4	0.7	1.6	53.9
7/26/01	37.3	5.8	15.2	2.7	38.8	119.6	7.8	6.4 *	0.4	0.7	1.5	58.6
7/27/01	37.0	5.8	15.4	2.7	36.8	123.5	7.1	6.4 *	0.4	0.7	-0.1	62.6
7/28/01	37.6	5.8	14.5	2.7	38.8	118.3	7.1	6.4 *	0.4	0.7	1.2	57.6
7/29/01	36.6	5.8	14.7	2.7	38.8	112.5	7.1	6.4 *	0.4	0.7	2.2	52.7
7/30/01	36.9	5.8	15.2	2.7	36.8	118.9	7.1	6.4 *	0.4	0.7	-0.1	58.3
7/31/01	36.8	5.8	15.5	2.7	36.2	111.2	6.5	6.4 *	0.4	0.7	-0.6	50.3
8/1/01	37.5	6.4	15.3	2.7	39.4	113.1	6.5	6.4 *	0.4	0.7	2.0	51.3
8/2/01	37.4	6.4	15.9	2.7	37.5	115.1	7.1	6.4 *	0.4	0.7	0.1	52.6
8/3/01	36.3	6.4	14.3	2.7	35.6	115.7	7.1	6.4 *	0.4	0.7	-0.7	56.0
8/4/01	36.0	6.4	15.5	2.7	35.6	109.2	7.1	6.4 *	0.4	0.7	-0.5	48.7
8/5/01	34.7	6.4	15.6	2.7	34.3	108.0	7.1	6.4 *	0.4	0.7	-0.5	48.6
8/6/01	36.4	6.4	16.8	2.7	34.3	103.4	6.5	6.4 *	0.4	0.7	-2.2	41.1
8/7/01	37.6	6.4	15.0	2.7	35.6	109.2	6.5	6.4 *	0.4	0.7	-2.1	47.5
8/8/01	37.4	6.4	16.4	2.7	34.9	109.9	6.5	6.4 *	0.4	0.7	-2.5	47.0
8/9/01	34.4	6.4	15.7	2.7	34.9	108.0	7.1	6.4 *	0.4	0.7	0.5	48.8
8/10/01	35.0	6.4	16.1	2.7	33.6	106.7	6.5	6.4 *	0.4	0.7	-1.4	46.5

Integrated Resources Plan

Appendix C

Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman WRP	Burbank WRP	LAG WRP	Groundw ater	LA River @ Tujnuga (F300)	LA River @ W'dlow (F319)	West Burb Chan (F285)	Verd Wash (F252)	Rio Hondo (F45)	Comp Creek (F37)	Total Est Runoff at Tuj	Total Est Runoff at W'dlow
8/11/01	34.4	6.4	14.8	2.7	34.3	93.1	7.1	6.4 *	0.4	0.7	-0.2	34.8
8/12/01	33.9	6.4	16.1	2.7	33.6	93.1	7.1	6.4 *	0.4	0.7	-0.3	34.0
8/13/01	34.7	6.4	15.9	2.7	33.6	89.9	7.1	5.9 *	0.4	0.7	-1.1	30.2
8/14/01	36.0	6.4	15.0	2.7	35.6	82.1	7.1	5.8 *	0.4	0.7	-0.5	22.0
8/15/01	37.0	6.4	16.0	2.7	37.5	80.8	6.5	5.8 *	0.4	0.7	0.5	18.7
8/16/01	36.8	6.4	16.5	2.7	34.9	80.2	7.1	5.8 *	0.4	0.7	-1.9	17.8
8/17/01	37.2	6.4	15.1	2.7	36.2	75.6	7.1	5.8 *	0.4	0.7	-1.0	14.2
8/18/01	37.2	6.4	15.5	2.7	35.6	75.0	7.8	5.8 *	0.4	0.7	-1.7	13.3
8/19/01	36.2	6.4	16.1	2.7	34.9	76.9	7.8	5.8 *	0.4	0.7	-1.3	15.6
8/20/01	37.0	6.4	14.8	2.7	37.5	79.5	8.4	5.8 *	0.4	0.7	0.5	18.7
8/21/01	36.8	6.4	13.9	2.7	38.1	84.7	7.8	5.8 *	0.4	0.7	1.3	25.0
8/22/01	36.2	6.4	18.4	2.7	36.2	86.0	7.1	5.8 *	0.4	0.7	0.0	22.4
8/23/01	37.5	6.4	16.0	2.7	35.6	86.0	7.8	5.8 *	0.4	0.7	-2.0	23.4
8/24/01	37.6	6.4	15.4	2.7	36.8	89.2	7.8	5.8 *	0.4	0.7	-0.8	27.1
8/25/01	37.0	6.4	15.4	2.7	36.2	91.8	7.8	5.8 *	0.4	0.7	-0.8	30.3
8/26/01	36.2	6.4	16.2	2.7	36.8	89.9	7.8	5.8 *	0.4	0.7	0.7	28.4
8/27/01	37.9	6.4	15.4	2.7	38.1	89.2	7.8	5.8 *	0.4	0.7	0.2	26.9
8/28/01	37.3	6.4	15.9	2.7	34.3	80.8	7.8	5.8 *	0.4	0.7	-3.0	18.6
8/29/01	34.9	6.4	16.5	2.7	31.7	80.8	7.1	5.5 *	0.4	0.7	-3.2	20.4
8/30/01	34.6	6.4	15.6	2.7	31.7	82.1	7.8	6.0 *	0.4	0.7	-2.9	22.9
8/31/01	34.3	6.4	15.8	2.7	33.6	79.5	7.8	7.1 *	0.4	0.7	-0.7	20.4
9/1/01	31.7	6.8	15.7	2.7	34.9	78.2	7.8	7.8 *	0.4	0.7	3.2	21.4
9/2/01	32.5	6.8	15.0	2.7	35.6	80.2	7.8	7.8 *	0.4	0.7	3.1	23.3
9/3/01	32.2	6.8	15.1	2.7	29.7	81.4	7.8	7.8 *	0.4	0.7	-2.5	24.7
9/4/01	33.4	6.8	17.0	2.7	31.7	78.9	8.4	6.5 *	0.4	0.7	-1.7	19.1
9/5/01	34.0	6.8	15.3	2.7	33.0	84.7	7.8	4.0 *	0.4	0.7	-1.0	25.9
9/6/01	35.1	6.8	16.4	2.7	34.9	86.0	8.4	4.5 *	0.4	0.7	-0.2	25.1
9/7/01	34.5	6.8	15.8	2.7	36.8	85.3	8.4	4.6 *	0.4	0.7	2.3	25.6
9/8/01	32.8	6.8	17.6	2.7	33.6	88.6	8.4	4.3 *	0.4	0.7	0.8	28.8
9/9/01	32.1	6.8	16.8	2.7	33.0	85.3	8.4	4.0 *	0.4	0.7	0.9	27.1
9/10/01	32.8	6.8	15.6	2.7	31.0	90.5	8.4	3.8 *	0.4	0.7	-1.8	32.6

Integrated Resources Plan

Appendix C Metered Flow Data Used in Urban Dry Weather Runoff Calculation for the Los Angeles River WM

	Tillman	Burbank		Groundw	LA River	LA River	West	Verd	Rio	Comp	Total Est	Total Est
	WRP	WRP	LAG WRP	ater	@ Tujnuga	@ W'dlow	Burb	Wash	Hondo	Creek	Runoff at	Runoff at
					(F300)	(F319)	Chan	(F252)	(F45)	(F37)	Tuj	W'dlow
9/11/01	31.9	6.8	17.0	2.7	31.7	87.9	8.4	3.0 *	0.4	0.7	-0.3	29.6
9/12/01	33.1	6.8	16.4	2.7	31.7	88.6	8.4	3.0 *	0.4	0.7	-1.4	29.6
9/13/01	34.0	6.8	14.5	2.7	31.7	90.5	7.8	3.0 *	0.4	0.7	-2.4	32.5
9/14/01	33.8	6.8	15.2	2.7	29.7	91.8	7.8	3.0 *	0.4	0.7	-4.1	33.4
9/15/01	33.3	6.8	15.2	2.7	31.7	89.2	7.8	3.0 *	0.4	0.7	-1.6	31.3
9/16/01	33.1	6.8	15.9	2.7	30.4	92.4	7.8	3.0 *	0.4	0.7	-2.7	34.0
9/17/01	33.5	6.8	15.9	2.7	29.1	88.6	7.8	3.0 *	0.4	0.7	-4.4	29.8
9/18/01	34.3	6.8	16.2	2.7	31.7	84.7	7.1	3.0 *	0.4	0.7	-2.6	24.8
9/19/01	34.0	6.8	15.1	2.7	32.3	86.6	6.5	3.0 *	0.4	0.7	-1.7	28.1
9/20/01	33.4	6.8	15.9	2.7	31.7	86.6	6.5	3.0 *	0.4	0.7	-1.8	27.8
9/21/01	33.1	6.8	16.6	2.7	31.0	91.8	6.5	3.0 *	0.4	0.7	-2.1	32.7
9/22/01	13.6	6.8	16.3	2.7	16.8	94.4	7.1	3.0 *	0.4	0.7	3.2	55.0
9/23/01	32.4	6.8	15.7	2.7	29.1	82.1	7.1	3.0 *	0.4	0.7	-3.3	24.5
9/24/01	34.2	6.8	15.4	2.7	28.4	90.5	6.5	3.0 *	0.4	0.7	-5.8	31.4
9/25/01	33.6	6.8	16.0	2.7	33.0	86.0	7.1	3.0 *	0.4	0.7	-0.6	27.0
9/26/01	33.6	6.8	15.1	2.7	33.0	90.5	7.1	3.0 *	0.4	0.7	-0.7	32.4
9/27/01	33.8	6.8	16.1	2.7	32.3	93.1	7.1	3.0 *	0.4	0.7	-1.4	33.8
9/28/01	33.8	6.8	16.0	2.7	31.0	96.3	7.1	3.6 *	0.4	0.7	-2.8	37.1
9/29/01	32.0	6.8	16.9	2.7	31.0	91.8	7.1	4.0 *	0.4	0.7	-0.9	33.5
9/30/01	33.4	6.8	16.6	2.7	32.3	91.1	7.8	4.0 *	0.4	0.7	-1.1	31.7

* The data for meters F45B-R and F57C-R was supplemented at these dates.

Appendix D
Metered Flow Data Used in Urban Dry
Weather Runoff Calculation for the Ballona
Creek WMA

Integrated Resources Plan

Appendix D Metered Flow Used in Urban Dry Weather Calculation for the Ballona Creek WMA

Count	875
Min	5.0 mgd
50th percentile	11.0 mgd
90th percentile	21.3 mgd
95th percentile	25.9 mgd
Max	35.6 mgd
Average	13.1 mgd

*Notes:

- Dry month is month where there was <0.25" of rainfall
- Flows exceeding 35 mgd were removed from calcs because they were considered too large to accurately represent dry weather runoff in Ballona Creek.

RAW DATA:

Date	mgd	Date	mgd	Date	mgd
02/01/97	15.5	03/05/97	16.2	04/04/97	15.5
02/02/97	14.9	03/06/97	11.6	04/05/97	16.2
02/03/97	15.5	03/07/97	10.3	04/06/97	20.0
02/04/97	16.2	03/08/97	9.7	04/07/97	23.3
02/05/97	16.2	03/09/97	9.7	04/08/97	21.3
02/06/97	15.5	03/10/97	11.0	04/09/97	14.2
02/07/97	15.5	03/11/97	10.3	04/10/97	13.6
02/08/97	14.9	03/12/97	10.3	04/11/97	12.3
02/09/97	14.9	03/13/97	10.3	04/12/97	11.6
02/11/97	19.4	03/14/97	11.0	04/13/97	10.3
02/12/97	16.2	03/15/97	11.0	04/14/97	9.7
02/13/97	15.5	03/16/97	10.3	04/15/97	9.0
02/14/97	15.5	03/17/97	11.0	04/16/97	10.3
02/15/97	14.9	03/18/97	9.7	04/17/97	9.0
02/16/97	14.9	03/19/97	10.3	04/18/97	8.4
02/18/97	16.2	03/20/97	11.0	04/19/97	8.4
02/19/97	14.2	03/21/97	11.6	04/20/97	9.0
02/20/97	14.2	03/22/97	11.6	04/21/97	9.0
02/21/97	14.9	03/23/97	12.3	04/22/97	10.3
02/22/97	14.2	03/24/97	11.0	04/23/97	10.3
02/23/97	14.2	03/25/97	10.3	04/24/97	9.7
02/24/97	14.9	03/26/97	9.7	04/25/97	9.7
02/25/97	14.9	03/27/97	9.7	04/26/97	11.0
02/26/97	16.2	03/28/97	10.3	04/27/97	11.0
02/27/97	15.5	03/29/97	9.7	04/28/97	11.6
02/28/97	14.9	03/30/97	10.3	04/29/97	11.6
03/01/97	14.9	03/31/97	10.3	04/30/97	12.3
03/02/97	14.9	04/01/97	11.0	05/01/97	11.6
03/03/97	15.5	04/02/97	12.9	05/02/97	12.3
03/04/97	16.2	04/03/97	16.2	05/03/97	11.6

Appendix D

Metered Flow Used in Urban Dry Weather Calculation for the Ballona Creek WMA

Date	mgd	Date	mgd	Date	mgd
05/04/97	12.3	06/22/97	10.3	08/10/97	8.4
05/05/97	13.6	06/23/97	10.3	08/11/97	7.8
05/06/97	13.6	06/24/97	9.7	08/12/97	7.1
05/07/97	9.7	06/25/97	10.3	08/13/97	7.8
05/08/97	10.3	06/26/97	10.3	08/14/97	7.8
05/09/97	9.7	06/27/97	10.3	08/15/97	8.4
05/10/97	9.7	06/28/97	11.0	08/16/97	8.4
05/11/97	9.7	06/29/97	12.3	08/17/97	9.0
05/12/97	9.0	06/30/97	11.6	08/18/97	9.0
05/13/97	9.7	07/01/97	9.7	08/19/97	8.4
05/14/97	9.7	07/02/97	9.7	08/20/97	7.8
05/15/97	9.7	07/03/97	11.0	08/21/97	7.1
05/16/97	9.7	07/04/97	9.7	08/22/97	7.1
05/17/97	11.6	07/05/97	9.7	08/23/97	7.1
05/18/97	9.0	07/06/97	9.7	08/24/97	7.1
05/19/97	10.3	07/07/97	10.3	08/25/97	7.8
05/20/97	9.7	07/08/97	8.4	08/26/97	7.1
05/21/97	9.0	07/09/97	6.4	08/27/97	7.8
05/22/97	10.3	07/10/97	6.3	08/28/97	6.5
05/23/97	8.4	07/11/97	6.5	08/29/97	7.1
05/24/97	7.8	07/12/97	6.5	08/30/97	7.1
05/25/97	7.8	07/13/97	6.4	08/31/97	7.8
05/26/97	7.8	07/14/97	7.8	10/01/97	7.8
05/27/97	7.1	07/15/97	7.8	10/02/97	7.8
05/28/97	7.1	07/16/97	7.8	10/03/97	7.8
05/29/97	7.1	07/17/97	7.8	10/04/97	7.8
05/30/97	7.8	07/18/97	7.8	10/05/97	7.8
05/31/97	7.8	07/19/97	7.1	10/06/97	8.4
06/01/97	7.8	07/20/97	7.8	10/07/97	8.4
06/02/97	7.8	07/21/97	7.8	10/08/97	7.8
06/03/97	7.8	07/22/97	7.8	10/09/97	8.4
06/04/97	9.0	07/23/97	8.4	10/10/97	8.4
06/05/97	8.4	07/24/97	8.4	10/11/97	7.8
06/06/97	8.4	07/25/97	7.8	10/12/97	7.8
06/07/97	8.4	07/26/97	8.4	10/13/97	7.8
06/08/97	7.8	07/27/97	8.4	10/14/97	8.4
06/09/97	8.4	07/28/97	9.0	10/15/97	9.7
06/10/97	8.4	07/29/97	8.4	10/16/97	7.8
06/11/97	8.4	07/30/97	9.0	10/17/97	7.8
06/12/97	8.4	07/31/97	9.7	10/18/97	7.8
06/13/97	9.0	08/01/97	9.7	10/19/97	7.8
06/14/97	9.0	08/02/97	9.7	10/20/97	8.4
06/15/97	9.7	08/03/97	10.3	10/21/97	8.4
06/16/97	9.0	08/04/97	12.9	10/22/97	9.0
06/17/97	9.7	08/05/97	11.0	10/23/97	9.0
06/18/97	9.7	08/06/97	10.3	10/24/97	9.0
06/19/97	9.7	08/07/97	9.0	10/25/97	8.4
06/20/97	9.7	08/08/97	9.0	10/26/97	9.0

Appendix D

Metered Flow Used in Urban Dry Weather Calculation for the Ballona Creek WMA

Date	mgd	Date	mgd	Date	mgd
06/21/97	10.3	08/09/97	7.8	10/27/97	10.3
10/28/97	10.3	07/16/98	8.4	09/03/98	7.8
10/29/97	12.9	07/17/98	8.4	09/04/98	7.8
10/30/97	12.3	07/18/98	9.0	09/05/98	7.1
10/31/97	12.3	07/19/98	8.4	09/06/98	7.8
06/01/98	16.8	07/20/98	10.3	09/07/98	7.8
06/02/98	15.5	07/21/98	12.9	09/08/98	8.4
06/03/98	17.5	07/22/98	9.7	09/09/98	9.0
06/04/98	18.1	07/23/98	11.6	09/10/98	7.1
06/05/98	17.5	07/24/98	12.3	09/11/98	7.1
06/06/98	16.8	07/25/98	13.6	09/12/98	6.5
06/07/98	18.1	07/26/98	15.5	09/13/98	7.1
06/08/98	20.0	07/27/98	16.2	09/14/98	7.8
06/09/98	20.7	07/28/98	14.2	09/15/98	9.7
06/10/98	25.9	07/29/98	15.5	09/16/98	9.0
06/11/98	28.4	07/30/98	16.2	09/17/98	9.0
06/12/98	20.7	07/31/98	16.8	09/18/98	9.7
06/13/98	16.2	08/01/98	18.1	09/19/98	10.3
06/14/98	17.5	08/02/98	18.7	09/20/98	7.1
06/15/98	16.8	08/03/98	18.1	09/21/98	7.8
06/16/98	13.6	08/04/98	16.2	09/22/98	7.1
06/17/98	12.3	08/05/98	9.0	09/23/98	7.1
06/18/98	13.6	08/06/98	7.1	09/24/98	7.1
06/19/98	14.2	08/07/98	7.1	09/25/98	7.1
06/20/98	13.6	08/08/98	6.5	09/26/98	7.1
06/21/98	14.2	08/09/98	7.1	09/27/98	7.1
06/22/98	16.2	08/10/98	6.5	09/28/98	7.8
06/23/98	15.5	08/11/98	5.8	09/29/98	9.0
06/24/98	15.5	08/12/98	5.9	09/30/98	8.4
06/25/98	14.9	08/13/98	5.9	10/01/98	16.2
06/26/98	13.6	08/14/98	6.3	10/02/98	16.8
06/27/98	15.5	08/15/98	5.4	10/03/98	17.5
06/28/98	13.6	08/16/98	5.8	10/04/98	20.7
06/29/98	13.6	08/17/98	6.4	10/05/98	20.7
06/30/98	15.5	08/18/98	6.0	10/06/98	20.0
07/01/98	17.5	08/19/98	5.5	10/07/98	19.4
07/02/98	18.7	08/20/98	6.0	10/08/98	18.7
07/03/98	18.1	08/21/98	6.2	10/09/98	20.7
07/04/98	16.8	08/22/98	6.4	10/10/98	23.9
07/05/98	18.1	08/23/98	6.3	10/11/98	26.5
07/06/98	16.2	08/24/98	7.1	10/12/98	29.1
07/07/98	16.2	08/25/98	6.5	10/13/98	27.1
07/08/98	16.2	08/26/98	6.5	10/14/98	22.0
07/09/98	15.5	08/27/98	6.5	10/15/98	24.6
07/10/98	14.2	08/28/98	7.1	10/16/98	25.2
07/11/98	12.3	08/29/98	7.1	10/17/98	24.6
07/12/98	11.0	08/30/98	7.1	10/18/98	23.9
07/13/98	9.0	08/31/98	7.1	10/19/98	23.3

Integrated Resources Plan

Appendix D

Metered Flow Used in Urban Dry Weather Calculation for the Ballona Creek WMA

Date	mgd	Date	mgd	Date	mgd
07/14/98	7.8	09/01/98	7.8	10/20/98	16.8
07/15/98	7.8	09/02/98	7.1	10/21/98	13.6
10/22/98	14.9	07/10/99	7.8	08/28/99	11.6
10/23/98	16.8	07/11/99	15.5	08/29/99	11.6
10/24/98	14.9	07/12/99	9.0	08/30/99	12.3
10/25/98	12.9	07/13/99	8.4	08/31/99	11.6
10/26/98	12.9	07/14/99	9.0	09/01/99	11.0
10/27/98	13.6	07/15/99	9.7	09/02/99	11.6
10/28/98	13.6	07/16/99	11.6	09/03/99	11.0
10/29/98	12.9	07/17/99	12.9	09/04/99	10.3
10/30/98	16.8	07/18/99	12.3	09/05/99	9.7
10/31/98	11.0	07/19/99	14.2	09/06/99	9.7
05/01/99	12.3	07/20/99	11.0	09/07/99	10.3
05/02/99	12.3	07/21/99	11.0	09/08/99	11.6
05/03/99	13.6	07/22/99	11.6	09/09/99	11.6
05/04/99	15.5	07/23/99	11.6	09/10/99	11.6
05/05/99	17.5	07/24/99	11.6	09/11/99	11.6
05/06/99	19.4	07/25/99	11.6	09/12/99	11.6
05/07/99	21.3	07/26/99	12.3	09/13/99	12.3
05/08/99	26.5	07/27/99	12.3	09/14/99	12.3
05/09/99	27.8	07/28/99	12.9	09/15/99	10.3
05/10/99	30.4	07/29/99	12.9	09/16/99	8.4
05/11/99	32.3	07/30/99	12.9	09/17/99	8.4
05/12/99	35.6	07/31/99	12.9	09/18/99	7.8
05/14/99	33.0	08/01/99	12.9	09/19/99	7.8
05/15/99	29.7	08/02/99	13.6	09/20/99	7.1
05/16/99	34.3	08/03/99	12.9	09/21/99	7.8
05/17/99	29.1	08/04/99	12.9	09/22/99	7.8
05/18/99	33.0	08/05/99	12.9	09/24/99	7.1
05/19/99	28.4	08/06/99	12.3	09/25/99	7.1
05/20/99	31.7	08/07/99	11.6	09/26/99	6.5
05/21/99	34.9	08/08/99	11.0	09/27/99	6.5
05/22/99	24.6	08/09/99	12.3	09/28/99	7.1
05/23/99	20.7	08/10/99	11.6	09/29/99	9.0
05/24/99	20.0	08/11/99	11.0	09/30/99	7.8
05/25/99	18.1	08/12/99	8.4	10/01/99	5.4
05/26/99	17.5	08/13/99	8.4	10/02/99	5.3
05/27/99	18.1	08/14/99	7.8	10/03/99	5.0
05/28/99	16.8	08/15/99	7.8	10/04/99	5.4
05/29/99	15.5	08/16/99	9.0	10/05/99	7.8
05/30/99	18.1	08/17/99	9.0	10/06/99	8.4
05/31/99	21.3	08/18/99	9.0	10/07/99	9.0
07/01/99	14.2	08/19/99	9.7	10/08/99	8.4
07/02/99	12.3	08/20/99	9.0	10/09/99	9.0
07/03/99	9.0	08/21/99	7.8	10/10/99	9.0
07/04/99	7.1	08/22/99	8.4	10/11/99	9.0
07/05/99	7.8	08/23/99	9.7	10/12/99	9.7
07/06/99	7.8	08/24/99	9.7	10/13/99	9.7

Integrated Resources Plan

Appendix D

Metered Flow Used in Urban Dry Weather Calculation for the Ballona Creek WMA

Date	mgd	Date	mgd	Date	mgd
07/07/99	7.1	08/25/99	10.3	10/14/99	9.7
07/08/99	9.0	08/26/99	11.0	10/15/99	10.3
07/09/99	9.0	08/27/99	11.6	10/16/99	9.7
10/17/99	9.0	05/05/00	25.2	07/10/00	14.2
10/18/99	9.7	05/06/00	23.3	07/11/00	11.6
10/19/99	9.7	05/07/00	18.1	07/12/00	11.0
10/20/99	10.3	05/08/00	22.0	07/13/00	9.7
10/21/99	10.3	05/09/00	23.3	07/14/00	11.0
10/22/99	11.0	05/10/00	23.9	07/15/00	9.0
10/23/99	10.3	05/11/00	26.5	07/16/00	10.3
10/24/99	9.7	05/12/00	30.4	07/17/00	11.0
10/25/99	11.6	05/13/00	34.3	07/18/00	9.0
10/26/99	11.6	05/31/00	31.0	07/19/00	9.0
10/27/99	12.3	06/01/00	17.5	07/20/00	8.4
10/28/99	12.9	06/02/00	12.3	07/21/00	6.3
10/29/99	13.6	06/03/00	12.3	07/22/00	10.3
10/30/99	14.9	06/04/00	18.1	07/23/00	10.3
10/31/99	13.6	06/05/00	25.2	07/24/00	11.6
12/01/99	12.9	06/06/00	24.6	07/25/00	10.3
12/02/99	12.9	06/07/00	17.5	07/26/00	10.3
12/03/99	11.6	06/08/00	9.0	07/27/00	9.7
12/04/99	9.7	06/09/00	7.8	07/28/00	7.8
12/05/99	9.7	06/10/00	9.0	07/29/00	5.7
12/06/99	11.0	06/11/00	9.7	07/30/00	6.1
12/07/99	11.6	06/12/00	9.7	07/31/00	6.1
12/08/99	12.9	06/13/00	9.7	08/01/00	6.1
12/09/99	12.9	06/14/00	10.3	08/02/00	6.3
12/10/99	12.3	06/15/00	9.7	08/03/00	7.1
12/11/99	12.3	06/16/00	10.3	08/04/00	7.1
12/12/99	12.3	06/17/00	10.3	08/05/00	7.1
12/13/99	13.6	06/18/00	11.0	08/06/00	6.5
12/14/99	11.6	06/19/00	13.6	08/07/00	7.8
12/15/99	11.6	06/20/00	14.2	08/08/00	7.8
12/16/99	14.9	06/21/00	15.5	08/09/00	8.4
12/17/99	12.9	06/22/00	16.8	08/10/00	8.4
12/18/99	12.9	06/23/00	18.1	08/11/00	7.1
12/19/99	12.3	06/24/00	20.7	08/12/00	7.8
12/20/99	12.9	06/25/00	20.7	08/13/00	7.8
12/21/99	14.2	06/26/00	22.6	08/14/00	7.1
12/22/99	14.2	06/27/00	22.0	08/15/00	7.1
12/23/99	12.3	06/28/00	13.6	08/16/00	9.7
12/24/99	12.3	06/29/00	11.0	08/17/00	9.7
12/25/99	14.2	06/30/00	10.3	08/18/00	9.7
12/26/99	21.3	07/01/00	9.7	08/19/00	9.7
12/27/99	19.4	07/02/00	9.7	08/20/00	11.0
12/28/99	11.0	07/03/00	9.7	08/21/00	12.9
12/29/99	12.3	07/04/00	7.1	08/22/00	15.5
12/30/99	10.3	07/05/00	9.0	08/23/00	22.0

Integrated Resources Plan

Appendix D

Metered Flow Used in Urban Dry Weather Calculation for the Ballona Creek WMA

Date	mgd	Date	mgd	Date	mgd
05/01/00	22.6	07/06/00	10.3	08/24/00	22.0
05/02/00	25.9	07/07/00	11.6	08/25/00	21.3
05/03/00	23.9	07/08/00	11.0	08/26/00	22.0
05/04/00	23.9	07/09/00	12.3	08/27/00	23.9
08/28/00	25.2	11/19/00	11.6	05/14/01	11.0
08/30/00	17.5	11/20/00	9.7	05/15/01	11.6
08/31/00	17.5	11/21/00	9.7	05/16/01	17.5
09/01/00	17.5	11/22/00	9.0	05/17/01	16.2
09/02/00	16.2	11/23/00	7.8	05/18/01	14.2
09/03/00	15.5	11/24/00	8.4	05/19/01	15.5
09/04/00	15.5	11/25/00	9.0	05/20/01	16.2
09/05/00	17.5	11/26/00	9.0	05/21/01	18.1
09/06/00	15.5	11/27/00	9.7	05/22/01	18.1
09/07/00	16.8	11/28/00	9.7	05/23/01	20.0
09/08/00	18.1	11/29/00	9.7	05/24/01	20.7
09/09/00	16.8	11/30/00	9.7	05/25/01	24.6
09/10/00	16.8	12/01/00	11.0	05/26/01	26.5
09/11/00	17.5	12/02/00	15.5	05/27/01	28.4
09/12/00	16.8	12/03/00	12.3	05/28/01	31.0
09/13/00	15.5	12/04/00	11.0	05/30/01	27.1
09/14/00	18.7	12/05/00	11.0	05/31/01	25.9
09/15/00	22.6	12/06/00	11.0	06/01/01	27.1
09/16/00	19.4	12/07/00	12.3	06/02/01	33.0
09/17/00	17.5	12/08/00	14.9	06/04/01	21.3
09/18/00	20.7	12/09/00	14.9	06/05/01	12.9
09/19/00	16.8	12/10/00	16.8	06/06/01	15.5
09/20/00	16.2	12/11/00	18.7	06/07/01	16.2
09/21/00	20.7	12/12/00	20.7	06/08/01	16.2
09/24/00	11.6	12/13/00	25.2	06/09/01	16.2
09/25/00	11.6	12/14/00	23.9	06/10/01	22.0
09/26/00	11.0	12/15/00	29.7	06/11/01	25.2
09/27/00	11.6	12/16/00	33.0	06/12/01	18.7
09/28/00	12.3	12/18/00	31.7	06/13/01	19.4
09/29/00	12.9	12/19/00	25.2	06/14/01	18.7
09/30/00	12.3	12/20/00	23.9	06/15/01	20.0
11/01/00	9.0	12/21/00	25.2	06/16/01	15.5
11/02/00	9.7	12/22/00	25.9	06/17/01	11.0
11/03/00	9.0	12/23/00	28.4	06/18/01	14.2
11/04/00	9.0	12/24/00	29.1	06/19/01	12.9
11/05/00	9.7	12/25/00	32.3	06/20/01	14.9
11/06/00	9.7	05/01/01	13.6	06/21/01	16.8
11/07/00	9.7	05/02/01	12.9	06/22/01	17.5
11/08/00	9.7	05/03/01	9.0	06/23/01	17.5
11/09/00	11.0	05/04/01	9.0	06/24/01	24.6
11/10/00	10.3	05/05/01	8.4	06/25/01	27.1
11/11/00	11.0	05/06/01	9.0	06/26/01	23.3
11/12/00	10.3	05/07/01	9.0	06/27/01	13.6
11/13/00	11.6	05/08/01	9.7	06/28/01	12.3

Appendix D

Metered Flow Used in Urban Dry Weather Calculation for the Ballona Creek WMA

Date	mgd	Date	mgd	Date	mgd
11/14/00	12.3	05/09/01	9.7	06/29/01	10.3
11/15/00	13.6	05/10/01	11.0	06/30/01	7.8
11/16/00	14.2	05/11/01	9.0	07/01/01	5.7
11/17/00	16.2	05/12/01	9.7	07/02/01	5.1
11/18/00	12.3	05/13/01	9.7	07/03/01	11.0
07/04/01	18.1	09/30/01	10.3		
07/05/01	18.7				
07/06/01	21.3				
07/07/01	18.1				
07/08/01	18.7				
07/09/01	19.4				
07/10/01	16.8				
07/11/01	11.0				
07/12/01	11.0				
07/13/01	11.0				
07/14/01	8.4				
07/15/01	9.7				
07/16/01	10.3				
07/17/01	12.3				
07/18/01	14.2				
07/19/01	13.6				
07/20/01	14.2				
07/21/01	15.5				
07/22/01	18.1				
07/23/01	21.3				
07/24/01	27.8				
07/25/01	31.7				
07/26/01	34.9				
08/07/01	32.3				
08/08/01	25.9				
08/09/01	20.0				
08/10/01	18.1				
08/11/01	16.8				
08/12/01	16.2				
08/13/01	17.5				
08/14/01	16.2				
08/15/01	13.6				
08/16/01	12.9				
08/17/01	12.9				
08/18/01	12.9				
08/19/01	13.6				
08/20/01	15.5				
08/21/01	16.8				
08/22/01	18.1				
08/23/01	23.3				
08/24/01	26.5				
08/25/01	30.4				
08/26/01	32.3				

Appendix D

Metered Flow Used in Urban Dry Weather Calculation for the Ballona Creek WMA

Date	mgd	Date	mgd	Date	mgd
09/21/01	31.7				
09/25/01	28.4				
09/26/01	13.6				
09/27/01	11.6				
09/28/01	11.6				
09/29/01	11.0				

Appendix E

Cistern Assumptions and Calculations

Appendix E

Assumptions used for Cistern and Infiltration Options Analysis

Data from 2000 UWMP (in DWP Service Area)					
	Year				
	2000	2005	2010	2015	2020
Total Population	3,834,089	4,035,305	4,277,206	4,551,189	4,856,887
SFR Households	518,915	530,518	544,687	561,425	589,715
MFR Households	746,133	788,429	870,653	937,182	1,040,173
Total Residential Population	1,265,048	1,318,947	1,415,340	1,498,607	1,629,888
Persons per Household	3.0	3.1	3.0	3.0	3.0
Annual Projected Water Use (AF/Year)					
SFR	226,000	234,000	240,000	249,000	260,000
MFR	196,000	216,000	240,000	260,000	283,000
Daily Water Use/Household					
SFR	389	394	393	396	394
MFR	234	245	246	248	243

Water Usage ¹				
	% Indoor Use	% Outdoor Use	Indoor Use (gal/day)	Outdoor Use (gal/day)
Residential - Single Family - indoor use	65%	35%		136
Residential - Multiple Family - indoor use	80%	20%		47
Breakdown of Usage ²				
Drinking/Used in Kitchen			8	
Car Washing				10
Lawns/Swimming Pools				100
To Sewer System			228	
Total Residential Usage	346 gpd			
Indoor Use of Potable Water	65.90%			
Irrigation				
SFR - 35% of Total Usage				135
MFR (2 to 4 Units) - 20% of Total Usage				50
MFR (5+ Units) - 10% of Total Usage				25

Notes:

1. Vickers. Water Use and Conservation (2001).

2. AWWA. Water Sources (1995).

Current Population and Household Data from California Department of Finance	
For City of Los Angeles:	
Population	
Households	3,612,223
Group Quarters	82,597
Total	3,694,820
Single-Family Residences	
Detached	524,782
Attached	87,775
Total	612,557
Multifamily Residences	
2 to 4 Units/Building	129,066
5+ Units/Building	586,949
Mobile Home Parks	9,082
Total	725,097
Total Residences	1,337,654

Multifamily Residential Irrigation Needs				
	Residences	Assumed #/Building	Buildings	Irrigation Needs (gal/day/res)
2 to 4 Units/Building	129,066	3	43,022	50
5+ Units/Building	586,949	10	58,695	25
Mobile Home Parks	9,082	25	363	25
Total	725,097		102,080	36
		Average		7.1
Total Irrigation Need for MFR (gal/day/building)				252
Use				250

Runoff Coefficient for Single Family Residential Landuse ³				
	Total Area (acres)	Impervious Area (acres)	Impervious Ratio	Runoff Coef ⁴
High Density Single Family Residential	116,588	48,967	0.42	0.44
Low Density Single Family Residential	6,439	1,352	0.21	0.27
Rural Residential Low Density	76	8	0.10	0.18
Total/weighted Average	123,103	50,327	0.41	0.43

Notes:

3. CA DOF Data

4. Runoff Coefficient = .1 + .8 * Impervious Rate

Makeup of the Average Single Family Residence Lot			
Acres of Land Use in the City of Los Angeles	123,103		
Number of Residences	612,557		
SF	8,754		
Acres/SFR Lot	0.20		
Impervious Ratio	0.41		
SF of Impervious Surface	3,579		
This area included the associated street and sidewalk.			
Assume :			
Residential Lots are 85 feet wide.			
Residential Lot is 85 feet deep	7,225 SF	0.17 acres	
Sidewalk and tree lane is 8 feet wide	680 SF	0.02 acres	
Half of street is 10 feet wide	850 SF	0.02 acres	
	8,755 SF	0.20 acres	
Impervious Portions			
			% of total MFR Area
Assume:			
Roof Shadow	2,000 SF		23%
Driveway	400 SF		5%
Sidewalk 4 feet wide	340 SF		4%
Half of street is 10 feet wide	850 SF		10%
	3,590 SF	OK	41%
Pervious Portion	5,165 SF	60' x 85'	59%
Assumes that all of the runoff comes from the hard surfaces and the rainfall on the rest of the property is retained at the site.			
Portion of property where Rainfall can be captured for irrigation:			
Roof Shadow	2,000 SF		
Portion of property where Rainfall can be captured for infiltration/Evaporation:			
Roof Shadow	2,000 SF		
Driveway	400 SF		
Total	2,400 SF		

Runoff Coefficient for Multi Family Residential Landuse ⁵						
			Total Area (acres)	Impervious Area (acres)	Impervious Ratio	Runoff Coef ⁶
Mixed Multifamily Residential			1,098	813	0.74	0.69
Duplexes and Triplexes			541	298	0.55	0.54
Low-Rise Apartments, Condos, and Townhouses			16,139	13,234	0.82	0.76
Medium-Rise Apartments and Condos			1,619	1,392	0.86	0.79
High-Rise Apartments and Condos			245	221	0.90	0.82
Trailer Pks. & Mobile Home Cts., High Densi			673	612	0.91	0.83
Mobile Home Courts & Subdivs., Low Density			2	1	0.42	0.44
Mixed Residential			8,610	5,080	0.59	0.57
			28,928	21,651	0.75	0.70
Notes						
5. Watershed Protection Division, Pollutant Load Model (landuse from SCAG)						
6. Runoff Coefficient = .1 + .8 * Impervious Rate						

Makeup of the Average Multi Family Residence Lot			
SF of Single Family Residence Land Use in the City of Los Angeles	5,362,354,138		
Acres of Land Use in the City of Los Angeles	28,928		
Buildings	102,080		
SF	12,344		
Acres/ MFR Lot	0.28		
Impervious ratio	0.75		
SF of Impervious Surface	9,239		
This area included the associated street and sidewalk.			
Assume:			
MFR Lots are 100 feet wide.			
Lot is 100 feet deep	10,000 SF	0.23 acres	
Sidewalk and tree lane is 8 feet wide	800 SF	0.02 acres	
Half of street is 15 feet wide	1500 SF	0.03 acres	
	12,300 SF	0.28 acres	
Impervious Portions			
Assume			% of total MFR Area
Roof Shadow	5,000 SF		41%
Parking Lot	2,340 SF	23' x 100'	19%
Sidewalk and tree lane is 4 feet wide	400 SF		3%
Half of street is 15 feet wide	1500 SF		12%
	9,240 SF	OK	75%
Pervious Portion	3,060 SF	30' x 105'	25%
Assumes that all of the runoff comes from the hard surfaces and the rainfall on the rest of the property is retained at the site.			
Portion of property where Rainfall can be captured for irrigation:			
Roof Shadow	5,000 SF		
Portion of property where Rainfall can be captured for infiltration/Evaporation:			
Roof Shadow	5,000 SF		
Parking Lot	2,400 SF		
Total	7,400 SF		

Approach for Cistern Analysis.

Used the rainfall data at LAX from January 1990 to December 2001.
 There were 658 rain events during this period.
 Of these events, 375 were very small (0.00 to 0.1 inches of total rainfall). These events were deleted from the database.
 The largest was 3.5 inches on 3 January 1995.
 It was assumed that 90% of the rain falling onto a roof would be captured (per TREE people web site information).
 It was assumed that irrigation would be stopped one day before a storm and could be started 2 days after a storm.

Estimated Costs for Cisterns

		Size (gal)	Materials	Installation	Total
Single Rain Barrel	LID	60	\$ 120	\$ 96	\$ 216
Polyethylene Cistern	LID	165	\$ 160	\$ 400	\$ 560
Fiberglass	LID	350	\$ 660	\$ 500	\$ 1,160
Estimated		1,000			\$ 1,500
Polyethylene Cistern	LID	1,800	\$ 1,100	\$ 1,000	\$ 2,100
Estimated		2,000			\$ 2,500
Fiberglass	LID	5,000	\$ 5,000	\$ 1,500	\$ 6,500
Fiberglass	LID	10,000	\$ 10,000	\$ 2,000	\$ 12,000

Source:

LID - Low Impact Development Center. (www.lowimpactdevelopment.org)

The estimated cost for the 1,000 and 2,000 gallon unit was based on interpolation.

It was assumed that water would be used for irrigation only.

It was assumed that treatment would not be required.

It was assumed that the cisterns would not be emptied other than through irrigation.

Area that sustains infiltration in the San Fernando Valley:

	A (acres)	B (acres)	C (acres)	Total			
Single Family High Density	19,500	7,560	2,116	29,176			
Single Family Low Density	325	280	184	789	29,965	SFR	Single Family 29,965
Multi-Family	1,950	280	92	2,322			Multi-Family 2,322
Commercial	1,625	560	92	2,277			Commercial 2,277
Industrial	650	840	368	1,858			Industrial 1,858
Transportation/Utilities/Mixed	2,600	2,800	276	5,676			Transportation/Utilities/Mixed 5,676
Open Space/Agriculture	5,850	15,680	6,072	27,602			Open Space/Agriculture 27,602
	32,500	28,000	9,200	69,700			Total 69,700

a) LA River Reach 4 and Tujunga Wash

b) Tujunga Wash at Pacoima Wash

c) Burbank Western Channel

From above:

Acres/SFR Lot 0.20

SF/driveway for SFR 400

SF/Sidewalk for SFR 340

SF/half street for SFR 850

Acres/ MFR Lot 0.28

SF/parking lot for MFR 2,340

SF/Sidewalk for MFR 400

SF/half street for MFR 1,500

	No of Lots	Driveway/Parking (Acres)		Runoff MG
		Per Lot	Total	
SFR	149,105	0.009	1,369	15
MFR	8,194	0.054	440	5
			Total	20
	Street/Sidewalks (Acres)			
		Per Lot	Total	Runoff MG
SFR		0.027	4,073	45
MFR		0.044	357	4
			Total	49

Appendix F
Rainfall Data at LAX, November, 1950
through February, 2002

Rainfall Data at LAX, November, 1950 through February 2002

	1950/1951				1951/1952				1952/1953				1953/1954				1954/1955				1955/1956				1956/1957		
	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total
			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth
1	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0
2	11	13	75	0.75	11	19	38	0.38	11	6	2	0.02	11	5	11	0.11	11	10	45	0.45	11	13	15	0.15	12	1	0
3	11	14	5	0.05	11	20	31	0.31	11	8	5	0.05	11	14	105	1.05	11	11	74	0.74	11	14	65	0.65	12	5	49
4	11	18	5	0.05	11	21	2	0.02	11	14	55	0.55	11	20	7	0.07	11	15	4	0.04	11	16	1	0.01	1	1	0
5	11	19	7	0.07	12	1	36	0.36	11	15	143	1.43	12	1	0	0.00	11	29	1	0.01	11	17	11	0.11	1	4	7
6	11	20	1	0.01	12	3	1	0.01	11	16	3	0.03	12	4	6	0.06	12	1	0	0.00	11	21	43	0.43	1	5	16
7	11	21	1	0.01	12	4	29	0.29	11	22	14	0.14	1	1	0	0.00	12	3	37	0.37	12	1	12	0.12	1	7	6
8	12	1	0	0.00	12	5	2	0.02	11	29	45	0.45	1	11	9	0.09	12	4	1	0.01	12	4	30	0.30	1	9	1
9	12	14	1	0.01	12	11	29	0.29	11	30	9	0.09	1	12	121	1.21	12	9	36	0.36	12	5	1	0.01	1	10	5
10	1	1	0	0.00	12	12	7	0.07	12	1	50	0.50	1	17	18	0.18	1	1	53	0.53	12	6	6	0.06	1	12	97
11	1	4	7	0.07	12	19	22	0.22	12	5	3	0.03	1	18	66	0.66	1	6	9	0.09	12	23	12	0.12	1	13	81
12	1	10	81	0.81	12	28	4	0.04	12	7	9	0.09	1	19	137	1.37	1	9	1	0.01	12	24	18	0.18	1	20	32
13	1	11	26	0.26	12	29	284	2.84	12	17	13	0.13	1	20	15	0.15	1	10	87	0.87	12	26	14	0.14	1	23	16
14	1	16	41	0.41	12	30	49	0.49	12	20	70	0.70	1	23	12	0.12	1	15	1	0.01	12	27	1	0.01	1	24	12
15	1	18	11	0.11	1	1	0	0.00	12	27	11	0.11	1	24	83	0.83	1	16	67	0.67	1	1	0	0.00	1	25	9
16	1	19	17	0.17	1	6	13	0.13	12	28	31	0.31	1	25	17	0.17	1	18	98	0.98	1	20	1	0.01	1	26	23
17	1	29	99	0.99	1	7	17	0.17	12	30	41	0.41	2	1	0	0.00	1	19	21	0.21	1	23	8	0.08	1	27	22
18	2	1	0	0.00	1	8	5	0.05	1	1	0	0.00	2	13	328	3.28	1	30	42	0.42	1	25	277	2.77	1	28	12
19	2	11	3	0.03	1	12	75	0.75	1	6	50	0.50	2	14	2	0.02	1	31	33	0.33	1	26	456	4.56	1	29	49
20	2	23	48	0.48	1	13	25	0.25	1	7	8	0.08	2	17	6	0.06	2	1	0	0.00	1	27	11	0.11	2	1	0
21	2	26	30	0.30	1	14	1	0.01	1	8	13	0.13	3	1	0	0.00	2	16	19	0.19	1	30	40	0.40	2	8	1
22	2	27	2	0.02	1	15	161	1.61	1	13	42	0.42	3	16	42	0.42	2	17	19	0.19	1	31	14	0.14	2	22	2
23	2	28	1	0.01	1	16	92	0.92	2	1	0	0.00	3	17	18	0.18	2	26	19	0.19	2	1	0	0.00	2	23	99
24	3	1	32	0.32	1	17	136	1.36	2	23	9	0.09	3	19	8	0.08	2	27	31	0.31	2	22	7	0.07	2	24	2
25	3	5	5	0.05	1	18	120	1.20	2	28	1	0.01	3	20	79	0.79	3	1	0	0.00	2	23	39	0.39	2	28	90
26	3	6	1	0.01	1	24	23	0.23	3	1	14	0.14	3	21	17	0.17	3	10	14	0.14	2	24	5	0.05	3	1	22
27	4	1	0	0.00	1	25	55	0.55	3	19	28	0.28	3	22	13	0.13	3	11	1	0.01	3	1	0	0.00	3	9	18
28	4	3	48	0.48	2	1	0	0.00	3	20	2	0.02	3	24	17	0.17	4	1	0	0.00	4	1	15	0.15	3	16	38
29	4	4	2	0.02	2	29	72	0.72	4	1	0	0.00	3	29	54	0.54	4	21	90	0.90	4	10	2	0.02	3	18	17
30	4	5	8	0.08	3	1	3	0.03	4	19	4	0.04	3	30	12	0.12	4	22	52	0.52	4	11	12	0.12	4	1	0
31	4	25	32	0.32	3	4	2	0.02	4	20	87	0.87	4	1	0	0.00	4	26	18	0.18	4	12	111	1.11	4	17	33
32	4	28	47	0.47	3	6	46	0.46	4	21	4	0.04	4	27	2	0.02	4	30	60	0.60	4	13	41	0.41	4	18	12
33	5	1	0	0.00	3	7	139	1.39	4	27	81	0.81	4	28	9	0.09	5	1	10	0.10	4	18	1	0.01	4	20	75
34	5	13	2	0.02	3	10	11	0.11	4	29	2	0.02	5	1	0	0.00	5	2	1	0.01	4	26	23	0.23	4	21	11
35	6	1	0	0.00	3	12	3	0.03	5	1	0	0.00	5	15	1	0.01	5	6	30	0.30	4	27	2	0.02	4	22	2
36	7	1	0	0.00	3	13	6	0.06	6	1	0	0.00	5	29	1	0.01	5	7	1	0.01	5	1	0	0.00	5	1	0
37	8	1	0	0.00	3	14	5	0.05	7	1	0	0.00	6	1	0	0.00	6	1	0	0.00	5	8	19	0.19	5	10	1
38	8	28	4	0.04	3	15	175	1.75	7	13	2	0.02	6	13	1	0.01	6	14	7	0.07	5	9	37	0.37	5	11	3
39	8	29	2	0.02	3	16	19	0.19	8	1	0	0.00	7	1	0	0.00	7	1	0	0.00	6	1	0	0.00	5	14	3
40	9	1	0	0.00	3	19	24	0.24	9	1	0	0.00	7	24	1	0.01	7	14	1	0.01	7	1	0	0.00	5	18	5
41	10	1	0	0.00	4	1	0	0.00	10	1	0	0.00	8	1	0	0.00	8	1	0	0.00	8	1	0	0.00	5	19	8
42	10	24	4	0.04	4	7	27	0.27					8	3	4	0.04	9	1	0	0.00	9	1	0	0.00	5	20	3
43	10	25	19	0.19	4	50	70	0.70					9	1	0	0.00	10	1	0	0.00	10	1	0	0.00	5	21	4
44					4	19	1	0.01					10	1	0	0.00					10	4	1	0.01	6	1	0
45					4	25	23	0.23																	6	9	5
46					5	1	0	0.00																	6	10	1
47					6	1	0	0.00																	7	1	0
48					7	1	0	0.00																	7	10	3
49					8	1	0	0.00																	8	1	0
50					9	1	0	0.00																	9	1	0
51					9	19	6	0.06																	10	1	0
52					10	1	0	0.00																	10	11	59
53																									10	13	51
54																									10	14	6
55																									10	20	2
56																									10	21	1
57																									10	30	1
58																									10	31	7
59																											
60																											
61																											
62																											
63																											
64																											
65																											
66																											
67																											
68																											
69																											

Rainfall Data at LAX, November, 1950 through February 2002

1957/1958					1958/1959				1959/1960				1960/1961				1961/1962				1962/1963				1963/	
total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day
inches			hundredth	inches			hundredths	inches			hundredth	inches			hundredth	inches			hundredths	inches			hundredth	inches		
0.00	11	1	0	0.00	11	1	0	0.00	11	1	4	0.04	11	1	0	0.00	11	1	0	0	11	1	0	0.00	11	1
0.00	11	2	32	0.32	12	1	0	0.00	11	2	2	0.02	11	3	23	0.23	11	20	55	0.55	11	2	2	0.02	11	6
0.49	11	3	6	0.06	12	27	1	0.01	12	1	0	0.00	11	5	67	0.67	11	24	1	0.01	12	1	0	0.00	11	15
0.00	11	5	8	0.08	1	1	0	0.00	12	8	7	0.07	11	6	70	0.70	11	25	96	0.96	12	17	1	0.01	11	19
0.07	12	1	0	0.00	1	5	35	0.35	12	20	7	0.07	11	12	42	0.42	11	26	14	0.14	1	1	0	0.00	11	20
0.16	12	4	18	0.18	1	6	76	0.76	12	21	10	0.10	11	13	5	0.05	11	29	2	0.02	1	9	6	0.06	11	21
0.06	12	5	39	0.39	2	1	0	0.00	12	24	79	0.79	11	26	60	0.60	11	30	20	0.2	1	31	56	0.56	12	1
0.01	12	15	105	1.05	2	7	24	0.24	12	25	8	0.08	12	1	5	0.05	12	1	27	0.27	2	1	17	0.17	1	1
0.05	12	16	35	0.35	2	8	30	0.30	1	1	0	0.00	12	2	1	0.01	12	2	58	0.58	2	9	166	1.66	1	18
0.97	12	17	13	0.13	2	9	4	0.04	1	9	5	0.05	1	1	0	0.00	12	3	5	0.05	2	10	250	2.50	1	20
0.81	1	1	0	0.00	2	10	7	0.07	1	10	90	0.90	1	25	5	0.05	12	14	17	0.17	2	11	5	0.05	1	21
0.32	1	10	7	0.07	2	11	63	0.63	1	11	79	0.79	1	26	122	1.22	1	1	0	0	2	13	5	0.05	1	22
0.16	1	24	22	0.22	2	12	3	0.03	1	12	5	0.05	2	1	0	0.00	1	12	24	0.24	2	14	5	0.05	2	1
0.12	1	25	84	0.84	2	15	20	0.20	1	14	73	0.73	3	1	0	0.00	1	20	114	1.14	2	20	4	0.04	3	1
0.09	1	26	26	0.26	2	16	145	1.45	1	25	31	0.31	3	6	4	0.04	1	21	48	0.48	3	1	0	0.00	3	2
0.23	1	30	8	0.08	2	17	2	0.02	2	1	155	1.55	3	15	36	0.36	1	22	82	0.82	3	14	14	0.14	3	12
0.22	2	1	0	0.00	2	18	3	0.03	2	8	22	0.22	3	24	6	0.06	2	1	0	0	3	15	1	0.01	3	22
0.12	2	2	38	0.38	2	21	71	0.71	2	9	1	0.01	4	1	0	0.00	2	7	70	0.7	3	16	105	1.05	3	23
0.49	2	3	70	0.70	3	1	0	0.00	2	10	24	0.24	4	22	2	0.02	2	8	391	3.91	3	22	8	0.08	3	24
0.00	2	4	56	0.56	4	1	0	0.00	2	28	41	0.41	5	1	0	0.00	2	9	48	0.48	3	23	1	0.01	3	31
0.01	2	8	8	0.08	4	25	36	0.36	2	29	47	0.47	6	1	0	0.00	2	10	153	1.53	3	28	113	1.13	4	1
0.02	2	12	1	0.01	4	26	3	0.03	3	1	0	0.00	7	1	0	0.00	2	11	91	0.91	4	1	0	0.00	4	18
0.99	2	19	349	3.49	5	1	0	0.00	3	27	20	0.20	7	12	1	0.01	2	12	19	0.19	4	7	2	0.02	4	19
0.02	2	25	104	1.04	6	1	0	0.00	3	28	1	0.01	8	1	0	0.00	2	15	154	1.54	4	8	2	0.02	4	28
0.90	3	1	0	0.00	7	1	0	0.00	4	1	0	0.00	8	11	21	0.21	2	16	9	0.09	4	14	41	0.41	5	1
0.22	3	2	8	0.08	8	1	0	0.00	4	26	74	0.74	8	18	9	0.09	2	19	149	1.49	4	20	22	0.22	5	6
0.18	3	6	17	0.17	9	1	0	0.00	4	27	126	1.26	9	1	0	0.00	2	20	15	0.15	4	25	33	0.33	6	1
0.38	3	10	6	0.06	9	12	1	0.01	5	1	0	0.00	9	16	4	0.04	2	21	1	0.01	4	26	41	0.41	6	8
0.17	3	11	13	0.13	9	30	3	0.03	6	1	0	0.00	10	1	0	0.00	2	24	3	0.03	5	1	0	0.00	6	9
0.00	3	12	1	0.01	10	1	0	0.00	7	1	0	0.00					3	1	0	0	5	19	1	0.01	7	1
0.33	3	13	3	0.03	10	26	1	0.01	8	1	0	0.00					3	5	1	0.01	5	28	1	0.01	8	1
0.12	3	14	4	0.04					9	1	0	0.00					3	6	54	0.54	6	1	0	0.00	9	1
0.75	3	15	230	2.30					10	1	0	0.00					3	18	42	0.42	6	3	2	0.02	10	1
0.11	3	16	7	0.07													3	20	5	0.05	6	10	2	0.02	10	27
0.02	3	17	7	0.07													3	22	9	0.09	6	11	20	0.20	10	29
0.00	3	20	84	0.84													4	1	0	0	7	1	0	0.00		
0.01	3	21	73	0.73													5	1	0	0	8	1	0	0.00		
0.03	3	22	1	0.01													5	14	6	0.06	8	8	1	0.01		
0.03	3	27	60	0.60													6	1	0	0	9	1	0	0.00		
0.05	3	30	6	0.06													7	1	0	0	9	4	39	0.39		
0.08	3	31	5	0.05													8	1	0	0	9	17	49	0.49		
0.03	4	1	67	0.67													9	1	0	0	9	19	25	0.25		
0.04	4	2	2	0.02													10	1	0	0	10	1	0	0.00		
0.00	4	3	30	0.30													10	14	3	0.03	10	16	42	0.42		
0.05	4	4	2	0.02													10	18	4	0.04						
0.01	4	6	67	0.67																						
0.00	4	7	36	0.36																						
0.03	5	1	0	0.00																						
0.00	5	11	1	0.01																						
0.00	6	1	0	0.00																						
0.00	7	1	0	0.00																						
0.59	8	1	0	0.00																						
0.51	8	13	2	0.02																						
0.06	9	1	0	0.00																						
0.02	9	23	3	0.03																						
0.01	10	1	0	0.00																						
0.01	10	24	15	0.15																						
0.07	10	25	17	0.17																						

Rainfall Data at LAX, November, 1950 through February 2002

1964	1964/1965				1965/1966				1966/1967				1967/1968				1968/1969				1969/1970					
Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month
hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches	
0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11
81	0.81	11	9	49	0.49	11	14	103	1.03	11	7	244	2.44	11	18	1	0.01	11	3	4	0.04	11	6	126	1.26	11
63	0.63	11	10	21	0.21	11	15	72	0.72	11	20	24	0.24	11	19	82	0.82	11	4	1	0.01	11	7	6	0.06	11
68	0.68	11	11	9	0.09	11	16	137	1.37	11	22	1	0.01	11	20	53	0.53	11	14	4	0.04	11	9	1	0.01	11
63	0.63	11	12	1	0.01	11	17	43	0.43	12	1	0	0.00	11	21	560	5.60	11	15	15	0.15	11	10	3	0.03	11
1	0.01	11	16	6	0.06	11	18	2	0.02	12	2	73	0.73	11	22	1	0.01	12	1	0	0.00	11	15	1	0.01	11
0	0.00	11	17	21	0.21	11	22	212	2.12	12	3	95	0.95	11	30	50	0.50	12	10	2	0.02	12	1	1	0.01	11
0	0.00	12	1	0	0.00	11	23	1	0.01	12	4	21	0.21	12	1	0	0.00	12	11	14	0.14	1	1	0	0.00	11
35	0.35	12	18	4	0.04	11	24	29	0.29	12	5	149	1.49	12	5	10	0.10	12	16	13	0.13	1	9	39	0.39	12
3	0.03	12	19	54	0.54	11	25	39	0.39	12	6	29	0.29	12	7	15	0.15	12	20	9	0.09	1	10	13	0.13	12
52	0.52	12	20	56	0.56	12	1	0	0.00	1	1	0	0.00	12	16	1	0.01	12	25	80	0.80	1	11	13	0.13	12
59	0.59	12	23	1	0.01	12	9	5	0.05	1	21	1	0.01	12	18	54	0.54	12	26	24	0.24	1	14	6	0.06	12
0	0.00	12	26	4	0.04	12	10	65	0.65	1	22	146	1.46	12	19	25	0.25	1	1	0	0.00	1	15	5	0.05	12
0	0.00	12	27	71	0.71	12	11	1	0.01	1	24	100	1.00	1	1	0	0.00	1	13	90	0.90	1	16	67	0.67	12
8	0.08	12	28	5	0.05	12	12	35	0.35	1	30	24	0.24	1	10	13	0.13	1	14	17	0.17	1	24	1	0.01	12
5	0.05	1	1	0	0.00	12	13	1	0.01	2	1	0	0.00	1	11	5	0.05	1	18	71	0.71	2	1	0	0.00	12
60	0.60	1	6	3	0.03	12	16	3	0.03	2	25	5	0.05	1	26	22	0.22	1	19	170	1.70	2	9	24	0.24	12
37	0.37	1	7	10	0.10	12	28	4	0.04	3	1	0	0.00	1	27	24	0.24	1	20	263	2.63	2	10	44	0.44	12
1	0.01	1	24	30	0.30	12	29	196	1.96	3	4	9	0.09	1	30	1	0.01	1	21	25	0.25	2	11	5	0.05	12
9	0.09	2	1	0	0.00	12	30	4	0.04	3	10	2	0.02	1	31	19	0.19	1	22	1	0.01	2	28	66	0.66	1
8	0.08	2	5	20	0.20	12	31	11	0.11	3	11	33	0.33	2	1	0	0.00	1	23	30	0.30	3	1	18	0.18	1
6	0.06	2	6	14	0.14	1	1	0	0.00	3	12	36	0.36	2	9	10	0.10	1	24	153	1.53	3	2	21	0.21	1
5	0.05	3	1	0	0.00	1	19	11	0.11	3	13	23	0.23	2	12	8	0.08	1	25	107	1.07	3	4	89	0.89	1
1	0.01	3	5	1	0.01	1	30	73	0.73	3	14	6	0.06	2	13	5	0.05	1	26	13	0.13	3	30	1	0.01	2
0	0.00	3	6	1	0.01	2	1	36	0.36	3	31	38	0.38	2	16	1	0.01	1	28	20	0.20	4	1	0	0.00	2
1	0.01	3	7	5	0.05	2	6	102	1.02	4	1	33	0.33	2	17	20	0.20	2	1	0	0.00	5	1	0	0.00	2
0	0.00	3	12	22	0.22	2	7	2	0.02	4	4	2	0.02	3	1	0	0.00	2	4	1	0.01	6	1	0	0.00	2
3	0.03	3	13	16	0.16	3	1	0	0.00	4	7	21	0.21	3	7	310	3.10	2	5	26	0.26	6	8	1	0.01	3
26	0.26	3	14	3	0.03	3	2	12	0.12	4	11	39	0.39	3	8	44	0.44	2	6	32	0.32	7	1	0	0.00	3
0	0.00	3	15	12	0.12	3	24	11	0.11	4	18	48	0.48	3	13	12	0.12	2	12	6	0.06	8	1	0	0.00	4
0	0.00	3	31	103	1.03	3	25	26	0.26	4	19	27	0.27	3	16	11	0.11	2	15	26	0.26	9	1	0	0.00	4
0	0.00	4	1	54	0.54	4	1	0	0.00	4	21	78	0.78	4	1	46	0.46	2	18	13	0.13	10	1	0	0.00	4
0	0.00	4	2	62	0.62	4	19	1	0.01	4	22	5	0.05	4	2	3	0.03	2	19	33	0.33	10	3	1	0.01	5
9	0.09	4	3	78	0.78	5	1	0	0.00	4	24	9	0.09	5	1	0	0.00	2	21	53	0.53	10	21	1	0.01	5
21	0.21	4	4	11	0.11	5	9	1	0.01	4	28	6	0.06	6	1	0	0.00	2	22	4	0.04				5	
		4	6	4	0.04	5	10	1	0.01	5	1	0	0.00	7	1	0	0.00	2	23	89	0.89				5	
		4	7	12	0.12	6	1	0	0.00	5	9	3	0.03	7	28	4	0.04	2	24	8	0.08				5	
		4	8	120	1.20	7	1	0	0.00	6	1	0	0.00	8	1	0	0.00	2	25	71	0.71				5	
		4	9	99	0.99	7	30	1	0.01	7	1	0	0.00	9	1	0	0.00	2	26	2	0.02				6	
		4	12	12	0.12	8	1	0	0.00	8	1	0	0.00	10	1	0	0.00	2	28	12	0.12				7	
		5	1	0	0.00	9	1	0	0.00	9	1	0	0.00	10	2	13	0.13	3	1	0	0.00				8	
		6	1	2	0.02	9	18	14	0.14	9	2	1	0.01	10	14	8	0.08	3	10	12	0.12				9	
		6	25	1	0.01	9	28	1	0.01	9	28	41	0.41	10	29	6	0.06	3	13	7	0.07				10	
		7	1	0	0.00	9	29	4	0.04	9	29	2	0.02	10	30	5	0.05	3	21	23	0.23				10	
		8	1	0	0.00	10	1	0	0.00	10	1	0	0.00					4	1	0	0.00				10	
		8	11	12	0.12	10	10	4	0.04									4	2	11	0.11					
		9	1	0	0.00													4	3	3	0.03					
		9	5	2	0.02													4	5	24	0.24					
		9	6	2	0.02													5	1	0	0.00					
		9	18	7	0.07													6	1	0	0.00					
		10	1	0	0.00													7	1	0	0.00					
																		7	11	15	0.15					
																		8	1	0	0.00					
																		9	1	0	0.00					
																		9	6	1	0.01					
																		10	1	0	0.00					
							</																			

1970/1971				1971/1972				1972/1973				1973/1974				1974/1975				1975/1976				1976/1977			
Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	
	hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches	hundredth
1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	
6	3	0.03	11	11	8	0.08	11	4	1	0.01	11	16	57	0.57	12	1	0	0.00	12	1	0	0.00	11	11	73	0.73	
25	24	0.24	11	12	14	0.14	11	10	14	0.14	11	17	8	0.08	12	3	56	0.56	12	12	10	0.10	11	12	14	0.14	
26	10	0.10	12	1	0	0.00	11	11	34	0.34	11	18	28	0.28	12	4	172	1.72	1	1	0	0.00	12	1	0	0.00	
27	1	0.01	12	2	29	0.29	11	14	127	1.27	11	21	1	0.01	12	27	2	0.02	2	1	0	0.00	12	30	81	0.81	
28	179	1.79	12	3	4	0.04	11	15	4	0.04	11	22	98	0.98	12	28	129	1.29	2	4	14	0.14	12	31	14	0.14	
29	132	1.32	12	12	18	0.18	11	16	110	1.10	12	1	30	0.30	12	29	3	0.03	2	5	21	0.21	1	1	0	0.00	
30	19	0.19	12	13	2	0.02	11	17	23	0.23	12	14	1	0.01	12	30	14	0.14	2	6	45	0.45	1	2	27	0.27	
1	0	0.00	12	21	1	0.01	12	1	0	0.00	12	21	9	0.09	1	1	0	0.00	2	7	19	0.19	1	3	15	0.15	
2	21	0.21	12	22	69	0.69	12	4	73	0.73	12	22	3	0.03	1	8	1	0.01	2	8	36	0.36	1	5	57	0.57	
9	45	0.45	12	23	8	0.08	12	6	32	0.32	12	27	1	0.01	2	1	0	0.00	2	9	75	0.75	1	6	133	1.33	
13	5	0.05	12	24	160	1.60	12	7	50	0.50	12	31	1	0.01	2	2	70	0.70	2	10	3	0.03	1	7	74	0.74	
14	11	0.11	12	25	19	0.19	12	8	33	0.33	1	1	4	0.04	2	3	107	1.07	2	24	2	0.02	1	20	8	0.08	
16	9	0.09	12	26	6	0.06	1	1	0	0.00	1	3	25	0.25	2	4	26	0.26	3	1	22	0.22	1	28	7	0.07	
17	7	0.07	12	27	225	2.25	1	8	3	0.03	1	4	170	1.70	2	8	21	0.21	3	2	49	0.49	2	1	0	0.00	
18	223	2.23	12	28	29	0.29	1	9	30	0.30	1	5	47	0.47	2	9	78	0.78	3	3	1	0.01	2	23	18	0.18	
19	15	0.15	1	1	0	0.00	1	16	170	1.70	1	6	107	1.07	2	10	18	0.18	3	9	10	0.10	2	24	8	0.08	
20	9	0.09	2	1	0	0.00	1	18	53	0.53	1	7	167	1.67	2	13	1	0.01	3	10	1	0.01	3	1	0	0.00	
21	67	0.67	2	5</																							

Rainfall Data at LAX, November, 1950 through February 2002

1977/1978				1978/1979				1979/1980				1980/1981				1981/1982				1982/1983				1983/1984		
Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total
		hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth
11	1	0	0.00	11	1	0	0	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	38
11	5	4	0.04	11	10	10	0.1	11	7	13	0.13	12	1	0	0.00	11	26	25	0.25	11	9	131	1.31	11	11	81
12	1	0	0.00	11	11	26	0.26	11	8	6	0.06	12	3	2	0.02	11	27	156	1.56	11	10	50	0.50	11	12	49
12	17	34	0.34	11	13	32	0.32	11	17	3	0.03	12	4	127	1.27	11	28	82	0.82	11	18	25	0.25	11	17	6
12	18	4	0.04	11	21	40	0.4	12	1	0	0.00	12	7	26	0.26	12	1	0	0.00	11	19	20	0.20	11	20	16
12	21	4	0.04	11	22	12	0.12	12	21	11	0.11	12	8	2	0.02	12	20	2	0.02	11	29	41	0.41	11	24	84
12	25	32	0.32	12	1	1	0.01	12	24	31	0.31	1	1	0	0.00	12	30	150	1.50	11	30	81	0.81	12	1	4
12	26	157	1.57	12	16	6	0.06	1	1	0	0.00	1	11	6	0.06	1	1	87	0.87	12	1	0	0.00	12	3	39
12	27	17	0.17	12	17	10	0.1	1	7	10	0.10	1	23	22	0.22	1	2	13	0.13	12	8	2	0.02	12	9	33
12	28	140	1.40	12	18	61	0.61	1	8	89	0.89	1	28	77	0.77	1	4	8	0.08	12	22	64	0.64	12	11	1
12	29	2	0.02	12	19	5	0.05	1	9	161	1.61	1	29	46	0.46	1	5	26	0.26	1	1	0	0.00	12	24	60
12	30	2	0.02	1	1	0	0	1	10	32	0.32	2	1	0	0.00	1	11	1	0.01	1	19	22	0.22	12	25	70
1	1	0	0.00	1	5	132	1.32	1	11	116	1.16	2	8	44	0.44	1	19	6	0.06	1	22	194	1.94	12	26	3
1	3	21	0.21	1	6	10	0.1	1	12	27	0.27	2	9	32	0.32	1	20	118	1.18	1	23	13	0.13	12	27	1
1	4	76	0.76	1	9	22	0.22	1	13	23	0.23	2	24	4	0.04	1	21	17	0.17	1	24	43	0.43	1	1	0
1	6	102	1.02	1	14	11	0.11	1	14	3	0.03	2	25	53	0.53	1	28	2	0.02	1	27	150	1.50	1	16	39
1	9	145	1.45	1	15	68	0.68	1	15	2	0.02	2	28	25	0.25	2	1	0	0.00	1	28	90	0.90	2	1	0
1	10	109	1.09	1	16	60	0.6	1	16	13	0.13	3	1	70	0.70	2	8	14	0.14	1	29	13	0.13	2	10	1
1	14	151	1.51	1	17	3	0.03	1	17	16	0.16	3	2	93	0.93	2	10	50	0.50	2	1	0	0.00	3	1	0
1	15	13	0.13	1	18	40	0.4	1	18	4	0.04	3	4	33	0.33	2	16	2	0.02	2	2	80	0.80	3	14	14
1	16	109	1.09	1	30	118	1.18	1	27	8	0.08	3	5	45	0.45	3	1	14	0.14	2	5	25	0.25	4	1	0
1	17	2	0.02	1	31	62	0.62	1	28	182	1.82	3	19	76	0.76	3	2	27	0.27	2	6	19	0.19	4	6	87
1	19	20	0.20	2	1	18	0.18	1	29	11	0.11	3	20	7	0.07	3	11	36	0.36	2	7	17	0.17	4	18	4
2	1	0	0.00	2	2	59	0.59	2	1	0	0.00	4	1	0	0.00	3	14	43	0.43	2	8	39	0.39	4	19	10
2	5	142	1.42	2	13	39	0.39	2	13	263	2.63	4	2	2	0.02	3	15	14	0.14	2	13	14	0.14	4	27	15
2	6	5	0.05	2	14	23	0.23	2	14	81	0.81	4	18	20	0.20	3	16	23	0.23	2	18	2	0.02	5	1	0
2	7	89	0.89	2	19	1	0.01	2	15	17	0.17	4	19	24	0.24	3	17	89	0.89	2	24	16	0.16	6	1	0
2	8	70	0.70	2	20	28	0.28	2	16	182	1.82	5	1	0	0.00	3	18	40	0.40	2	25	6	0.06	7	1	0
2	9	92	0.92	2	21	37	0.37	2	17	168	1.68	6	1	0	0.00	3	25	20	0.20	2	26	235	2.35	8	1	0
2	10	82	0.82	2	22	15	0.15	2	18	16	0.16	7	1	0	0.00	3	26	6	0.06	2	27	109	1.09	8	15	29
2	12	75	0.75	2	23	33	0.33	2	19	75	0.75	8	1	0	0.00	3	28	2	0.02	2	28	2	0.02	9	1	0
2	13	23	0.23	3	1	56	0.56	2	20	102	1.02	9	1	0	0.00	3	29	27	0.27	3	1	255	2.55	9	10	2
2	26	20	0.20	3	13	60	0.6	2	21	9	0.09	9	30	5	0.05	4	1	98	0.98	3	2	90	0.90	9	11	2
2	27	7	0.07	3	15	5	0.05	3	1	0	0.00	10	1	36	0.36	4	10	6	0.06	3	3	22	0.22	9	25	5
2	28	161	1.61	3	17	51	0.51	3	2	146	1.46	10	28	4	0.04	4	11	57	0.57	3	5	20	0.20	10	1	0
3	1	148	1.48	3	18	10	0.1	3	3	90	0.90					5	1	0	0.00	3	6	3	0.03	10	16	7
3	2	42	0.42	3	19	35	0.35	3	5	33	0.33					5	4	8	0.08	3	13	12	0.12	10	17	21
3	3	19	0.19	3	20	10	0.1	3	6	27	0.27					5	8	3	0.03	3	16	18	0.18			
3	4	227	2.27	3	26	9	0.09	3	10	1	0.01					6	1	0	0.00	3	17	30	0.30			
3	5	2	0.02	3	27	161	1.61	3	18	24	0.24					6	17	1	0.01	3	18	39	0.39			
3	9	13	0.13	3	28	56	0.56	3	25	25	0.25					7	1	0	0.00	3	20	7	0.07			
3	11	4	0.04	3	29	21	0.21	3	26	23	0.23					8	1	0	0.00	3	21	30	0.30			
3	21	6	0.06	4	1	0	0	4	1	0	0.00					9	1	0	0.00	3	22	34	0.34			
3	22	58	0.58	5	1	0	0	4	22	4	0.04					9	8	15	0.15	3	23	52	0.52			
3	30	28	0.28	6	1	0	0	4	28	13	0.13					9	15	1	0.01	3	24	15	0.15			
3	31	28	0.28	7	1	0	0	5	1	0	0.00					9	16	2	0.02	3	27	2	0.02			
4	1	0	0.00	8	1	0	0	5	10	5	0.05					9	17	24	0.24	3	28	8	0.08			
4	4	23	0.23	9	1	0	0	5	20	2	0.02					9	18	2	0.02	4	1	0	0.00			
4	6	27	0.27	9	29	4	0.04	6	1	0	0.00					9	25	11	0.11	4	5	21	0.21			
4	15	69	0.69	10	1	0	0	7	1	0	0.00					9	26	23	0.23	4	10	1	0.01			
4	25	4	0.04	10	14	5	0.05	8	1	0	0.00					10	1	0	0.00	4	17	33	0.33			
5	1	0	0.00	10	19	4	0.04	9	1	0	0.00					10	26	5	0.05	4	18	65	0.65			
6	1	0	0.00	10	20	22	0.22	10	1	0	0.00					10	30	13	0.13	4	19	11	0.11			
7	1	0	0.00																	4	20	42	0.42			
8	1	0	0.00																	4	21	17	0.17			
9	1	0	0.00																	4	24	10	0.10			
9	4	3	0.03																	4	28	70	0.70			
9	5	36	0.36																	4	29	27	0.27			
10	1	0	0.00																	4	30	21	0.21			
10	20	4	0.04																	5	1	4	0.04			
																				6	1	0	0.00			
																				6	8	1	0.01			
																				6	11	2	0.02			
																				7	1	0	0.00			
																				8	1	0	0.00			
																				8	6	12	0.12			
																				8	7	4	0.04			
																				8	15	9	0.09			

Rainfall Data at LAX, November, 1950 through February 2002

1984/1985					1985/1986				1986/1987				1987/1988				1988/1989				1989/1990				1990/	
total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day
inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches		
0.38	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	14	0.14	11	1	0	0.00	11	1	0	0.00	11	1
0.81	11	8	9	0.09	11	10	10	0.10	11	17	112	1.12	11	3	1	0.01	11	13	8	0.08	11	26	38	0.38	11	19
0.49	11	12	1	0.01	11	11	63	0.63	11	18	2	0.02	11	4	18	0.18	11	14	28	0.28	12	1	0	0.00	11	20
0.06	11	13	15	0.15	11	12	3	0.03	12	1	0	0.00	11	5	23	0.23	11	23	15	0.15	1	1	4	0.04	11	25
0.16	11	18	1	0.01	11	24	169	1.69	12	5	1	0.01	11	17	4	0.04	11	25	22	0.22	1	2	11	0.11	12	1
0.84	11	24	93	0.93	11	25	66	0.66	12	6	29	0.29	12	1	0	0.00	12	1	0	0.00	1	12	4	0.04	12	19
0.04	11	28	5	0.05	11	29	164	1.64	1	1	0	0.00	12	4	65	0.65	12	15	43	0.43	1	13	22	0.22	1	1
0.39	12	1	0	0.00	12	1	0	0.00	1	4	82	0.82	12	5	5	0.05	12	16	26	0.26	1	14	25	0.25	1	3
0.33	12	3	6	0.06	12	2	35	0.35	1	5	3	0.03	12	6	3	0.03	12	18	5	0.05	1	15	5	0.05	1	4
0.01	12	7	64	0.64	12	10	9	0.09	1	6	40	0.40	12	7	5	0.05	12	20	36	0.36	1	16	37	0.37	1	9
0.60	12	8	25	0.25	1	1	0	0.00	1	7	2	0.02	12	16	70	0.70	12	21	26	0.26	1	30	10	0.10	1	21
0.70	12	10	17	0.17	1	3	4	0.04	2	1	0	0.00	12	17	15	0.15	12	22	24	0.24	2	1	0	0.00	2	1
0.03	12	15	28	0.28	1	4	27	0.27	2	9	8	0.08	12	29	16	0.16	12	24	76	0.76	2	4	32	0.32	2	27
0.01	12	16	4	0.04	1	5	24	0.24	2	10	1	0.01	1	1	0	0.00	12	27	2	0.02	2	16	35	0.35	2	28
0.00	12	18	34	0.34	1	29	27	0.27	2	13	30	0.30	1	5	21	0.21	12	31	14	0.14	2	17	188	1.88	3	1
0.39	12	19	162	1.62	1	30	84	0.84	2	15	2	0.02	1	17	140	1.40	1	1	3	0.03	2	18	5	0.05	3	4
0.00	12	26	35	0.35	1	31	65	0.65	2	23	1	0.01	2	1	0	0.00	1	5	52	0.52	3	1	0	0.00	3	10
0.01	12	27	46	0.46	2	1	0	0.00	2	24	22	0.22	2	2	82	0.82	1	23	4	0.04	3	4	2	0.02	3	13
0.00	1	1	0	0.00	2	7	26	0.26	3	1	0	0.00	2	27	12	0.12	2	1	0	0.00	3	10	4	0.04	3	18
0.14	1	7	16	0.16	2	8	2	0.02	3	5	28	0.28	2	28	56	0.56	2	2	2	0.02	3	12	8	0.08	3	19
0.00	1	10	3	0.03	2	12	3	0.03	3	6	7	0.07	2	29	29	0.29	2	3	14	0.14	4	1	0	0.00	3	20
0.87	1	22	1	0.01	2	13	162	1.62	3	14	17	0.17	3	1	4	0.04	2	4	21	0.21	4	4	16	0.16	3	24
0.04	1	28	50	0.50	2	14	266	2.66	3	21	40	0.40	3	2	4	0.04	2	8	18	0.18	4	16	2	0.02	3	25
0.10	2	1	0	0.00	2	15	52	0.52	4	1	0	0.00	4	1	0	0.00	2	9	97	0.97	4	23	4	0.04	3	26
0.15	2	2	43	0.43	2	16	2	0.02	4	3	2	0.02	4	14	40	0.40	2	13	18	0.18	4	30	12	0.12	3	27
0.00	2	8	62	0.62	2	17	2	0.02	5	1	0	0.00	4	15	6	0.06	2	19	2	0.02	5	1	0	0.00	4	1
0.00	2	9	86	0.86	2	19	21	0.21	6	1	0	0.00	4	19	38	0.38	3	1	0	0.00	5	27	6	0.06	5	1
0.00	3	1	0	0.00	3	1	0	0.00	6	5	6	0.06	4	20	24	0.24	3	2	30	0.30	5	28	77	0.77	6	1
0.00	3	7	17	0.17	3	7	2	0.02	6	6	3	0.03	4	23	6	0.06	3	24	6	0.06	6	1	0	0.00	7	1
0.29	3	11	1	0.01	3	8	78	0.78	7	1	0	0.00	5	1	0	0.00	3	25	50	0.50	7	1	0	0.00	7	8
0.00	3	18	16	0.16	3	9	1	0.01	7	16	4	0.04	6	1	0	0.00	4	1	0	0.00	8	1	0	0.00	7	19
0.02	3	27	30	0.30	3	10	122	1.22	7	17	4	0.04	7	1	0	0.00	5	1	0	0.00	8	6	2	0.02	7	31
0.02	3	28	8	0.08	3	12	13	0.13	8	1	0	0.00	8	1	0	0.00	5	15	4	0.04	9	1	0	0.00	8	1
0.05	4	1	0	0.00	3	13	14	0.14	9	1	0	0.00	8	24	2	0.02	6	1	0	0.00	10	1	0	0.00	9	1
0.00	5	1	0	0.00	3	15	70	0.70	9	23	8	0.08	9	1	0	0.00	7	1	0	0.00					9	28
0.07	5	8	9	0.09	3	16	189	1.89	10	1	0	0.00	9	20	7	0.07	8	1	0	0.00					10	1
0.21	5	9	7	0.07	4	1	0	0.00	10	22	51	0.51	10	1	0	0.00	9	1	0	0.00					10	26
	6	1	0	0.00	4	5	12	0.12	10	27	2	0.02					9	16	3	0.03						
	7	1	0	0.00	4	6	18	0.18	10	29	8	0.08					9	19	23	0.23						
	8	1	0	0.00	5	1	0	0.00	10	31	113	1.13					10	1	0	0.00						
	9	1	0	0.00	6	1	0	0.00									10	21	1	0.01						
	9	3	4	0.04	7	1	0	0.00									10	22	30	0.30						
	9	4	5	0.05	7	22	5	0.05									10	23	3	0.03						
	9	5	17	0.17	7	23	4	0.04																		
	9	26	2	0.02	8	1	0	0.00																		
	10	1	0	0.00	9	1	0	0.00																		
	10	5	4	0.04	9	24	144	1.44																		
	10	7	3	0.03	10	1	0	0.00																		
	10	9	1	0.01	10	2	10	0.10																		
	10	21	28	0.28																						
																				</						

Rainfall Data at LAX, November, 1950 through February 2002

1991	1991/1992				1992/1993				1993/1994				1994/1995				1995/1996				1996/1997					
Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month
hundreth	inches			hundreth	inches			hundreth	inches			hundreth	inches			hundreth	inches			hundreth	inches			hundreth	inches	
0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	10	0.10	11	1	0	0.00	11
3	0.03	12	1	0	0.00	12	1	0	0.00	11	11	24	0.24	11	7	1	0.01	12	1	0	0.00	11	2	0	0.00	11
1	0.01	12	7	5	0.05	12	4	21	0.21	11	22	2	0.02	11	8	19	0.19	12	12	53	0.53	11	17	0	0.00	11
6	0.06	12	8	27	0.27	12	6	64	0.64	11	29	26	0.26	11	10	38	0.38	12	13	82	0.82	11	20	7	0.07	11
0	0.00	12	10	4	0.04	12	7	171	1.71	11	30	41	0.41	11	26	8	0.08	12	22	1	0.01	11	21	144	1.44	11
3	0.03	12	27	84	0.84	12	11	12	0.12	12	1	0	0.00	12	1	0	0.00	12	23	80	0.80	11	22	37	0.37	11
0	0.00	12	28	47	0.47	12	17	18	0.18	12	11	46	0.46	12	12	46	0.46	1	1	0	0.00	12	1	0	0.00	11
66	0.66	12	29	107	1.07	12	27	54	0.54	12	14	38	0.38	12	24	57	0.57	1	16	23	0.23	12	5	7	0.07	11
38	0.38	12	30	12	0.12	12	28	2	0.02	12	18	6	0.06	12	28	2	0.02	1	19	15	0.15	12	6	0	0.00	11
32	0.32	1	1	0	0.00	12	29	74	0.74	12	19	6	0.06	1	1	0	0.00	1	21	18	0.18	12	9	136	1.36	12
2	0.02	1	2	1	0.01	1	1	0	0.00	12	26	1	0.01	1	3	75	0.75	1	27	10	0.10	12	10	79	0.79	12
0	0.00	1	3	39	0.39	1	2	44	0.44	1	1	0	0.00	1	4	350	3.50	1	28	1	0.01	12	11	64	0.64	12
160	1.60	1	5	84	0.84	1	5	1	0.01	1	24	33	0.33	1	7	129	1.29	1	30	2	0.02	12	12	2	0.02	12
93	0.93	1	7	37	0.37	1	6	323	3.23	2	1	0	0.00	1	8	38	0.38	1	31	125	1.25	12	22	17	0.17	12
72	0.72	2	1	0	0.00	1	7	126	1.26	2	3	28	0.28	1	9	2	0.02	2	1	8	0.08	12	26	0	0.00	12
10	0.10	2	5	4	0.04	1	8	2	0.02	2	4	37	0.37	1	10	293	2.93	2	3	29	0.29	12	27	146	1.46	1
2	0.02	2	6	80	0.80	1	9	1	0.01	2	6	12	0.12	1	11	17	0.17	2	19	57	0.57	12	30	0	0.00	1
14	0.14	2	7	51	0.51	1	10	23	0.23	2	7	99	0.99	1	12	37	0.37	2	20	190	1.90	12	31	3	0.03	1
68	0.68	2	9	19	0.19	1	12	73	0.73	2	8	8	0.08	1	14	12	0.12	2	21	78	0.78	1	1	14	0.14	1
23	0.23	2	10	60	0.60	1	13	93	0.93	2	17	126	1.26	1	20	14	0.14	2	25	20	0.20	1	2	43	0.43	1
52	0.52	2	11	57	0.57	1	14	28	0.28	2	18	4	0.04	1	21	2	0.02	2	27	37	0.37	1	3	10	0.10	1
2	0.02	2	12	138	1.38	1	15	118	1.18	2	20	122	1.22	1	22	1	0.01	3	1	0	0.00	1	5	3	0.03	1
48	0.48	2	13	20	0.20	1	16	51	0.51	3	1	0	0.00	1	23	116	1.16	3	4	80	0.80	1	12	120	1.20	1
70	0.70	2	15	38	0.38	1	17	36	0.36	3	5	2	0.02	1	24	104	1.04	3	5	3	0.03	1	13	7	0.07	1
35	0.35	2	16	2	0.02	1	18	103	1.03	3	6	3	0.03	1	25	81	0.81	3	12	26	0.26	1	14	1	0.01	1
0	0.00	2	17	1	0.01	1	30	41	0.41	3	7	4	0.04	2	1	0	0.00	3	13	19	0.19	1	15	79	0.79	1
0	0.00	3	1	10	0.10	2	1	0	0.00	3	19	24	0.24	2	8	12	0.12	3	28	8	0.08	1	20	0	0.00	1
0	0.00	3	2	128	1.28	2	7	242	2.42	3	24	66	0.66	2	9	4	0.04	4	1	7	0.07	1	21	46	0.46	1
0	0.00	3	3	34	0.34	2	8	32	0.32	3	25	2	0.02	2	13	16	0.16	4	16	4	0.04	1	22	23	0.23	2
10	0.10	3	5	2	0.02	2	9	4	0.04	4	1	0	0.00	2	14	26	0.26	4	17	31	0.31	1	23	30	0.30	2
5	0.05	3	6	52	0.52	2	18	129	1.29	4	9	19	0.19	2	24	4	0.04	5	1	0	0.00	1	24	0	0.00	2
2	0.02	3	20	104	1.04	2	19	34	0.34	4	25	18	0.18	3	1	0	0.00	5	16	5	0.05	1	25	92	0.92	2
0	0.00	3	21	23	0.23	2	20	41	0.41	4	26	7	0.07	3	2	16	0.16	6	1	0	0.00	1	26	44	0.44	2
0	0.00	3	22	71	0.71	2	22	9	0.09	5	1	0	0.00	3	3	10	0.10	7	1	0	0.00	1	27	0	0.00	2
9	0.09	3	23	5	0.05	2	23	22	0.22	5	7	1	0.01	3	4	19	0.19	7	3	0	0.00	2	1	0	0.00	2
0	0.00	3	26	10	0.10	2	24	1	0.01	5	8	6	0.06	3	5	189	1.89	7	10	0	0.00	2	10	4	0.04	2
6	0.06	3	27	56	0.56	2	26	34	0.34	5	17	1	0.01	3	9	1	0.01	7	26	0	0.00	2	11	1	0.01	2
		3	31	13	0.13	3	1	0	0.00	6	1	0	0.00	3	10	167	1.67	8	1	0	0.00	2	17	0	0.00	2
		4	1	18	0.18	3	25	104	1.04	7	1	0	0.00	3	11	75	0.75	9	1	0	0.00	3	1	0	0.00	2
		5	1	0	0.00	3	26	30	0.30	8	1	0	0.00	3	12	2	0.02	10	1	0	0.00	3	22	0	0.00	2
		5	5	4	0.04	3	27	30	0.30	9	1	0	0.00	3	21	50	0.50	10	29	0	0.00	3	23	0	0.00	2
		6	1	0	0.00	3	28	19	0.19	10	1	0	0.00	3	23	38	0.38	10	30	144	1.44	4	1	0	0.00	2
		6	30	0	0.00	4	1	0	0.00	10	4	14	0.14	4	1	0	0.00					4	5	0	0.00	2
		7	1	0	0.00	5	1	0	0.00					4	16	69	0.69					4	19	0	0.00	2
		7	7	2	0.02	6	1	0	0.00					4	18	5	0.05					5	1	0	0.00	2
		7	11	2	0.02	6	5	74	0.74					5	1	0	0.00					5	17	0	0.00	3
		7	12	28	0.28	7	1	0	0.00					5	15	61	0.61					6	1	0	0.00	3
		8	1	0	0.00	8	1	0	0.00					6	1	0	0.00					7	1	0	0.00	3
		9	1	0	0.00	9	1	0	0.00					6	15	24	0.24					7	22	0	0.00	3
		10	1	0	0.00	10	1	0	0.00					6	16	36	0.36					7	24	0	0.00	3
		10	21	24	0.24	10	10	6	0.06					7	1	0	0.00					8	1	0	0.00	3
		10	23	5	0.05	10	11	2	0.02					7	16	6	0.06					8	16	0	0.00	3
		10	30	21	0.21	10	16	1	0.01					8	1	0	0.00					8	17	0	0.00	3
														9	1	0	0.00					8	22	0	0.00	3
														10	1	0	0.00					9	1	0	0.00	3
														10	31	1	0.01					9	2	0	0.00	3
															</											

Rainfall Data at LAX, November, 1950 through February 2002

1997/1998			1998/1999				1999/2000				2000/2001				2001/2002			
Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total	Month	Day	Total	total
	hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches			hundredth	inches
1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00	11	1	0	0.00
10	78	0.78	11	7	1	0.01	11	8	27	0.27	12	1	0	0.00	11	4	3	0.03
11	0	0.00	11	8	120	1.20	11	17	1	0.01	12	6	0	0.00	11	10	2	0.02
13	40	0.40	11	11	7	0.07	11	20	0	0.00	12	8	0	0.00	11	11	4	0.04
15	6	0.06	11	27	2	0.02	12	1	0	0.00	1	1	0	0.00	11	12	35	0.35
16	1	0.01	11	28	49	0.49	12	31	0	0.00	1	5	0	0.00	11	24	60	0.60
19	4	0.04	12	1	17	0.17	1	1	0	0.00	1	6	0	0.00	11	29	30	0.30
26	79	0.79	12	3	2	0.02	1	15	0	0.00	1	8	23	0.23	12	1	0	0.00
30	58	0.58	12	4	3	0.03	1	16	1	0.01	1	9	0	0.00	12	2	10	0.10
1	0	0.00	12	5	1	0.01	1	17	1	0.01	1	10	209	2.09	12	3	13	0.13
5	92	0.92	12	6	39	0.39	1	23	0	0.00	1	11	95	0.95	12	9	0	0.00
6	154	1.54	12	19	4	0.04	1	24	1	0.01	1	12	47	0.47	12	14	23	0.23
7	29	0.29	12	20	1	0.01	1	25	61	0.61	1	24	28	0.28	12	20	9	0.09
14	0	0.00	1	1	0	0.00	1	30	18	0.18	1	26	66	0.66	12	21	8	0.08
18	122	1.22	1	3	2	0.02	1	31	2	0.02	2	1	0	0.00	12	28	0	0.00
1	0	0.00	1	19	5	0.05	2	1	0	0.00	2	7	1	0.01	12	29	32	0.32
2	8	0.08	1	20	23	0.23	2	4	0	0.00	2	9	0	0.00	12	30	10	0.10
3	22	0.22	1	24	0	0.00	2	8	0	0.00	2	10	33	0.33	2	1	0	0.00
4	41	0.41	1	25	40	0.40	2	10	31	0.31	2	11	10	0.10	2	17	35	0.35
8	0	0.00	1	26	30	0.30	2	11	5	0.05	2	12	195	1.95				
9	170	1.70	1	30	0	0.00	2	12	51	0.51	2	13	161	1.61				
10	7	0.07	1	31	19	0.19	2	13	39	0.39	2	17	0	0.00				
12	0	0.00	2	1	0	0.00	2	14	17	0.17	2	18	3	0.03				
13	15	0.15	2	4	19	0.19	2	16	54	0.54	2	19	24	0.24				
15	2	0.02	2	5	13	0.13	2	20	66	0.66	2	23	17	0.17				
19	14	0.14	2	7	1	0.01	2	21	118	1.18	2	24	27	0.27				
29	83	0.83	2	9	17	0.17	2	22	0	0.00	2	25	185	1.85				
31	9	0.09	2	27	0	0.00	2	23	73	0.73	2	26	40	0.40				
1	5	0.05	3	1	0	0.00	2	24	0	0.00	2	27	25	0.25				
2	56	0.56	3	3	1	0.01	2	25	0	0.00	2	28	9	0.09				
3	308	3.08	3	7	0	0.00	2	27	17	0.17	3	1	0	0.00				
6	138	1.38	3	9	15	0.15	3	1	0	0.00	3	2	0	0.00				
7	122	1.22	3	11	9	0.09	3	3	29	0.29	3	4	6	0.06				
8	47	0.47	3	15	66	0.66	3	4	1	0.01	3	5	66	0.66				
9	0	0.00	3	16	2	0.02	3	5	114	1.14	3	6	49	0.49				
12	0	0.00	3	20	30	0.30	3	6	4	0.04	3	7	1	0.01				
14	209	2.09	3	23	1	0.01	3	7	0	0.00	3	9	2	0.02				
15	0	0.00	3	25	88	0.88	3	8	88	0.88	3	20	1	0.01				
16	18	0.18	4	1	9	0.09	3	9	3	0.03	4	1	0	0.00				
17	29	0.29	4	3	0	0.00	4	1	0	0.00	4	6	1	0.01				
19	77	0.77	4	6	42	0.42	4	14	0	0.00	4	7	48	0.48				
21	13	0.13	4	7	30	0.30	4	17	132	1.32	4	20	54	0.54				
22	102	1.02	4	8	6	0.06	4	18	56	0.56	4	21	7	0.07				
23	180	1.80	4	11	135	1.35	5	1	0	0.00	5	1	0	0.00				
24	52	0.52	4	12	1	0.01	5	15	0	0.00	5	12	1	0.01				
1	0	0.00	4	23	0	0.00	5	25	0	0.00	5	26	0	0.00				
5	11	0.11	4	28	0	0.00	6	1	0	0.00	6	1	0	0.00				
6	19	0.19	5	1	0	0.00	7	1	0	0.00	6	2	0	0.00				
13	47	0.47	5	13	0	0.00	8	1	0	0.00	7	1	0	0.00				
14	20	0.20	5	23	0	0.00	8	29	3	0.03	7	3	0	0.00				
24	1	0.01	6	1	6	0.06	9	1	0	0.00	7	4	0	0.00				
25	139	1.39	6	2	48	0.48	9	22	3	0.03	7	5	0	0.00				
27	0	0.00	6	3	5	0.05	10	1	0	0.00	7	6	0	0.00				
28	28	0.28	7	1	0	0.00	10	4	3	0.03	8	1	0	0.00				
29	0	0.00	7	8	0	0.00	10	6	3	0.03	9	1	0	0.00				
31	68	0.68	8	1	0	0.00	10	10	0	0.00	10	1	0	0.00				
1	8	0.08	9	1	0	0.00	10	11	11	0.11	10	30	4	0.04				
3	12	0.12	10	1	0	0.00	10	26	17	0.17								
4	6	0.06					10	27	19	0.19								
10	0	0.00					10	29	59	0.59								
11	74	0.74																
13	0	0.00																
1	0	0.00																
2	11	0.11																
3	6	0.06																
4	34	0.34																
5	46	0.46																
6	22	0.22																
9	1	0.01																
12	67	0.67																
13	59	0.59																
14	0	0.00																
1	0	0.00																
11	8	0.08																
12	0	0.00																
16	1	0.01																
21	0	0.00																
1	0	0.00																
1	0	0.00																
10	0	0.00																
1	0	0.00																
3	0	0.00																
4	0	0.00																
21	1	0.01																
22	0	0.00																
23	0	0.00																
27	0	0.00																
1	0	0.00																
31	0	0.00																

Appendix G

Rainbow Chart - Runoff

City of Los Angeles
Integrated Resources Plan

**Facilities Plan
Volume 3: Runoff Management**

July 2004

City of Los Angeles
Department of Public Works
Bureau of Sanitation
and
Department of Water and Power

FINAL



City of Los Angeles
Integrated Resources Plan

**Facilities Plan
Volume 3: Runoff Management**

July 2004

City of Los Angeles
Department of Public Works
Bureau of Sanitation
and
Department of Water and Power

FINAL





Prepared by



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July 2004



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July 2004



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