City of Los Angeles

Integrated Resources Plan

Facilities Plan

Volume 1: Wastewater Management

July 2004

(Revised November 2005)

Prepared For:

City of Los Angeles

Department of Public Works

Bureau of Sanitation

and

Department of Water and Power

Prepared By:

CH:CDM, A Joint Venture

Final Report

November 2005 Revisions

Section 4 (Wastewater Flow Projections)

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Section 6 (Collection System Options)

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Section 7 (Existing Treatment Facilities)

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Section 8 (Treatment Options)

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Section 10 (Alternatives Analysis)

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Facilities Plan
Wastewater Management Volume
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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 sought 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/recycle 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

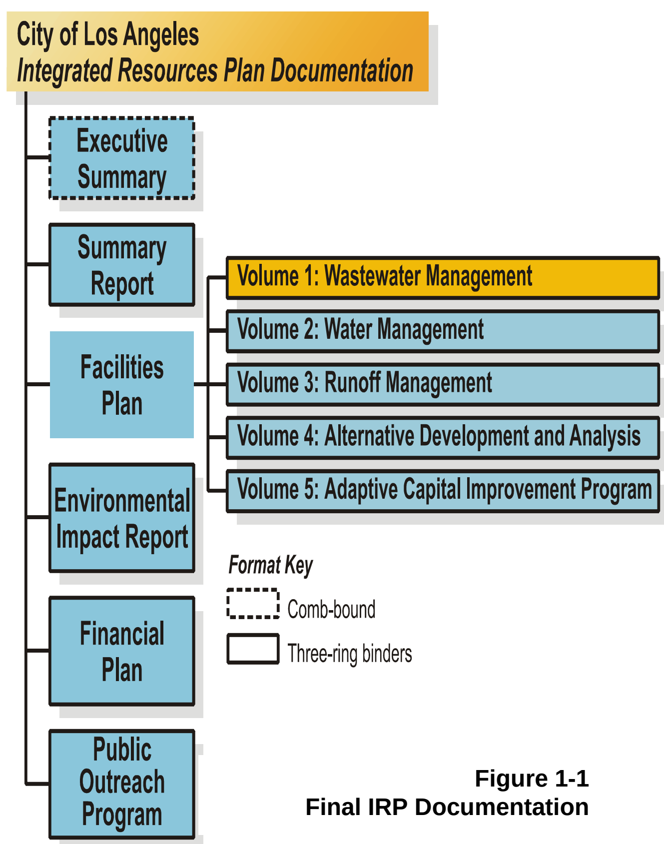


Figure 1-1
Final IRP Documentation

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

Facilities Plan Volume 1: Wastewater Management focuses on the wastewater service areas of the project, specifically the collection system, treatment facilities, and biosolids treatment and disposal. Table 1-1 provides a description of each of the sections of this document.

Table 1-1 **Volume 1: Wastewater Management**	
Section	**Description**
1 – Introduction	Study objectives and background.
2 – Approach	Study approach.
3 – Planning Parameters	Summary of planning year, wastewater service area, population and employment projections, regulatory requirements, and guiding principles.
4 – Wastewater Projections	Summary of dry weather flow, wet weather flow and wastewater constituent loading.
5 – Existing Collection System	Description of current collection system facilities.
6 – Collection System Options	Discussion of future collection system needs and options to handle these needs.
7 – Existing Treatment Facilities	Description of the current wastewater treatment facilities and their process limitations.
8 – Treatment Options	Discussion of future treatment needs and options to handle these needs.
9 – Biosolids Management	Discussion of current and future facilities for biosolids treatment, and options for disposal and reuse.
10 – Alternatives Analysis	Discussion of the integration of collection system, treatment and biosolids options into wastewater alternatives, and ultimate integration with water and runoff alternatives.
References	Summarizes the sources of data, information, and contributions of others.
Appendices	Supporting Documentation

Section 2
Approach

2.1 Introduction

The IRP approach is to involve those who have a stake in the outcome of the program (i.e., "stakeholders") in developing the objectives and focus of the program, and to involve technical staff in developing feasible alternatives to meet the objectives in the planning year 2020.

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 [IRP]): Focuses on the more detailed planning required to develop a facilities plan, environmental impact report and financial plan.

- Projects (Implementation) (2006 and beyond): Will include future concept reports, studies, and design and construction projects to implement the 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. This information is documented in *Volume 4: Alternatives Development and Analysis.*

- 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.

- Refining alternatives using detailed models and developing hybrid alternatives.

- Evaluating and screening hybrid alternatives; searching recommended draft alternatives.

- Preparing a 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.

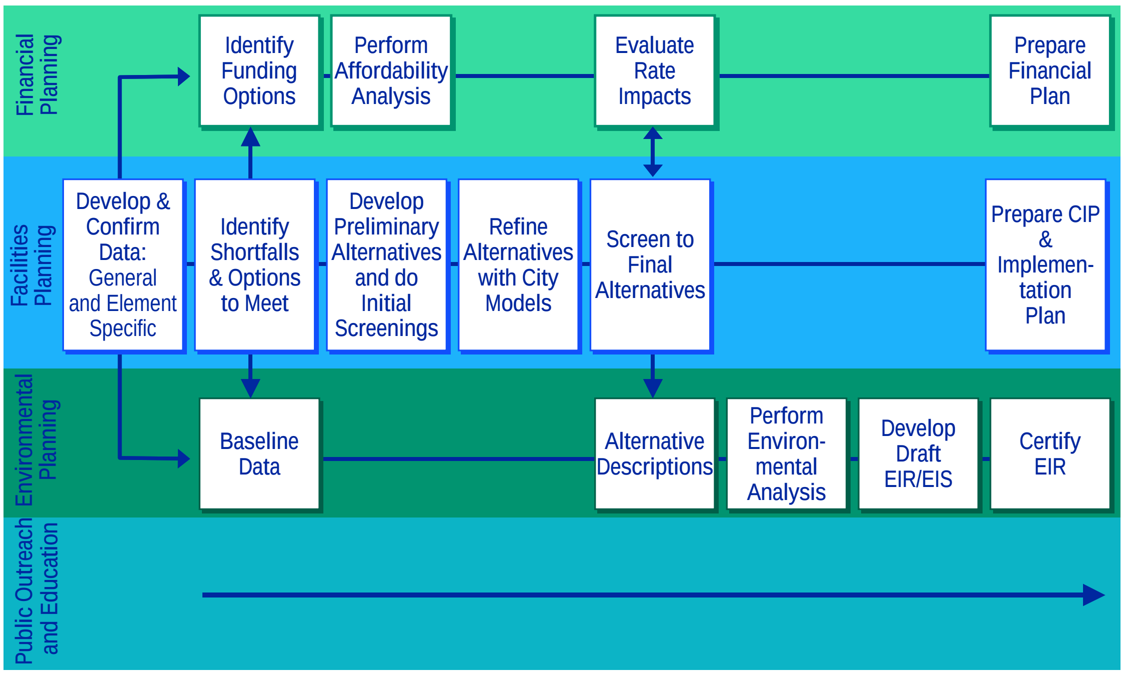


Figure 2-1
Overall IRP Approach

2.3 Wastewater Management

The Los Angeles Department of Public Works (LADPW) provides the services for the City's wastewater, stormwater and solid waste program needs. Within the LADPW, the Bureau of Sanitation (Bureau) is responsible for managing and operating the wastewater, stormwater and solid waste programs. The Bureau's mission is:

> *To protect the public and environment through legal, efficient, and effective collection, treatment, reuse, and disposal of liquid and solid wastes while enhancing relationships with the community, co-workers, elected and appointed officials, and business.*

The wastewater management component of the IRP focuses on the following elements:

- Projecting wastewater flow quantities and constituent concentrations.

- Identifying current and projecting future regulatory requirements.

- Determining the current capacity of existing collection and treatment facilities.
- Identifying the "gaps" between the projected flows and the current system capacities.
- Developing options to address the identified gaps for each system.
- Combining these options to form wastewater alternatives for collection and treatment.
- Integrating the wastewater alternatives with the recycled water needs/demands and runoff needs/demands.

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 wastewater management analysis of the IRP. Discussion of land use data is included in *Volume 3: Runoff Management*.

3.2 Planning Year

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

> Facilities planning will demonstrate the need for facilities and, by a systematic evaluation of feasible alternatives, will also demonstrate that the proposed measures represent the most cost-effective means of meeting established effluent and water quality goals while recognizing environmental and social considerations.

Facilities plans are typically developed with a 20 year planning window and 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 recycled water and urban runoff system needs. The IRP will use year 2020 as the planning year for evaluating the existing water system 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 CIP.

3.3 Wastewater Service Area

The City's wastewater service area consists of two distinct drainage basin areas: the Hyperion Service Area (HSA) and the Terminal Island Service Area (TISA). Figure 3-1 shows the overall service areas.

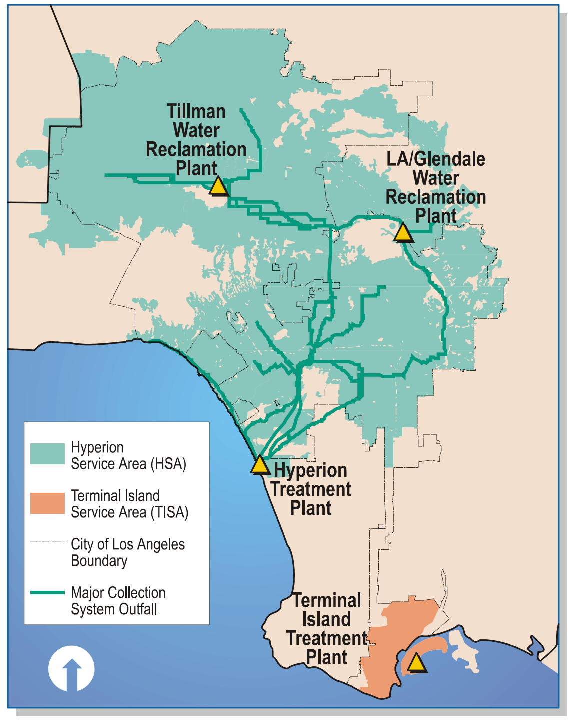


Figure 3-1
Wastewater Service Area

The HSA covers approximately 515 mi^2 and serves the majority of the Los Angeles population. In addition, the service area includes non-City agencies that contract with the City for wastewater service as shown in Figure 3-2. Table 3-1 provides a summary of these "contract agencies."

The TISA is approximately 18 mi^2 and serves the Los Angeles Harbor area. The two service areas are connected geographically by a shoestring strip of land that extends from South Central Los Angeles to the City boundary in the harbor area. The Los Angeles County Sanitation District (LACSD) provides wastewater service to the shoestring portion of the City.

The City owns and operates four major wastewater treatment facilities: Hyperion Treatment Plant (HTP) in Playa del Rey, the Donald C. Tillman Water Reclamation Plant (TWRP) in the Sepulveda Basin, Los Angeles-Glendale Water Reclamation Plant (LAGWRP) across the freeway from Griffith Park, and the Terminal Island Treatment Plant (TITP) in the vicinity of the Los Angeles Harbor.

Wastewater is conveyed to these treatment facilities through a collection system comprised of a network of underground pipes that extend throughout the City. The wastewater collection system's physical structure includes over 6,500 miles of major interceptors and mainline sewers, 46 pumping plants, and various diversion structures and other support facilities, such as corporation yards.

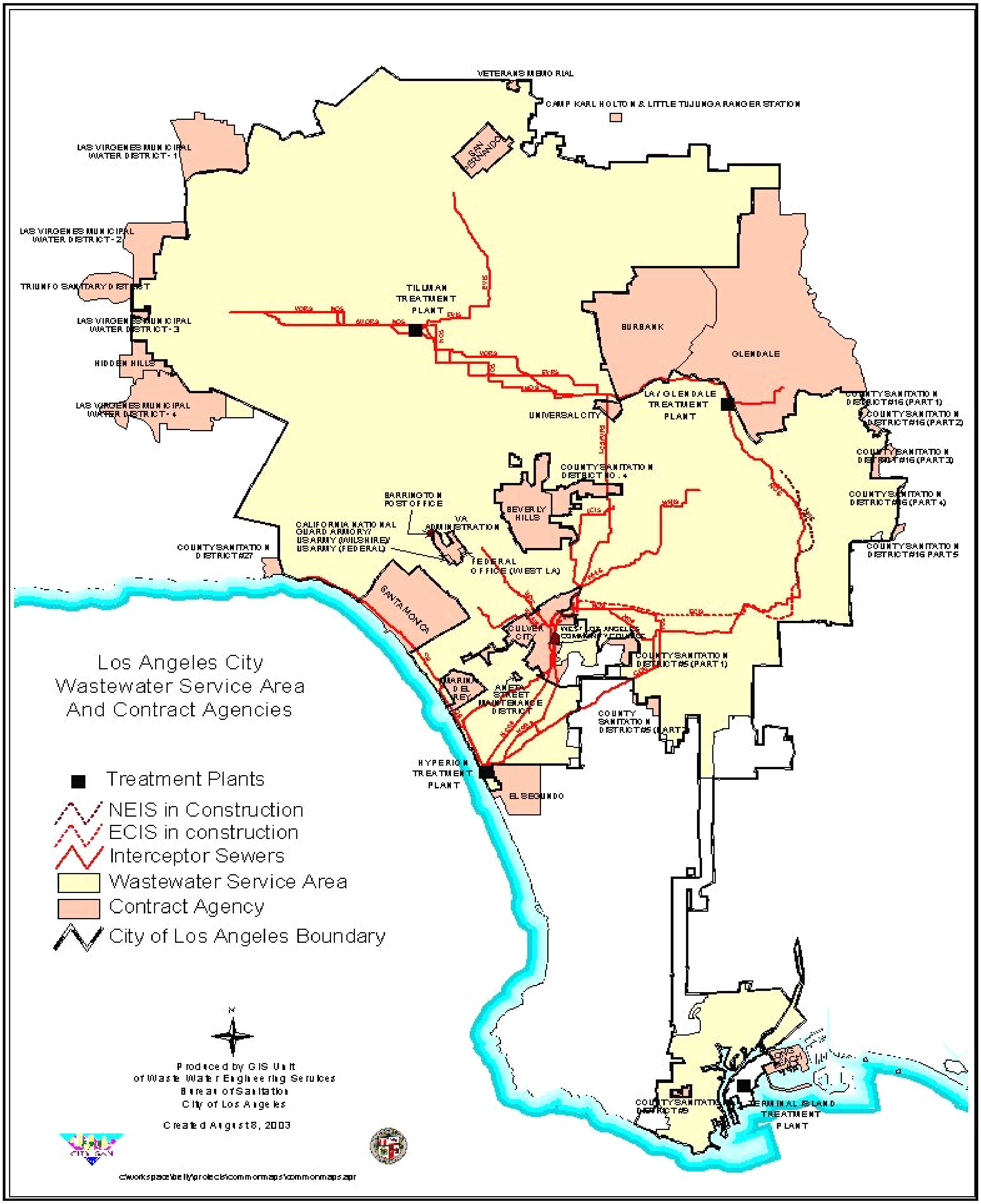


Figure 3-2
Los Angeles Service Area and Contract Agencies

Table 3-1
Summary of Agencies and Businesses that Contract with the City of Los Angeles for Wastewater Service

Per attached map	*Others listed in IPWP document*
1. Aneta Street Sewer Maintenance District	1. County Sanitation District #5
2. City of Beverly Hills	2. County Sanitation District #9
3. City of Burbank	3. County Sanitation District #11
4. County Sanitation District #1	4. County Sanitation District #16
5. County Sanitation District #4	*Others listed in Air Quality Master Plan*
6. County Sanitation District #6	
7. County Sanitation District #8	1. Barrington Post Office
8. County Sanitation District #18	2. California National Guard
9. County Sanitation District #27	3. County Sanitation District #5
10. Crescenta Valley Water District	4. County Sanitation District #9
11. Culver City	5. County Sanitation District #11
12. City of El Segundo	6. Federal Office Building
13. City of Glendale	7. Karl Hoton Camp
14. City of Hidden Hills	8. U.S. Army Reserve Center
15. City of Long Beach	9. U.S. Army Reserve Training Center
16. City of Marina Del Rey	10. Veterans Memorial Park
17. City of San Fernando	11. West Los Angeles Community College
18. City of Santa Monica	
19. Federal Facilities	
20. Las Virgenes Municipal Water District – 1, 2, 3, and 4	
21. Topanga Sewer Maintenance District	
22. Triunfo County Sanitation District	
23. Universal City	
24. US Naval Base	
25. VA Hospital	

For the IRP, the wastewater service area will be separated into seven tributary areas, or "sewersheds." As shown in Figure 3-3, these sewersheds include:

- Hyperion-Coastal Sewershed
- Hyperion-Metro Sewershed
- Los-Angeles-Glendale Sewershed

- Valley Spring Lane/Foreman Avenue (VSL/FA) Sewershed
- Tillman Sewershed
- Terminal Island Sewershed
- Tunnel Sewershed

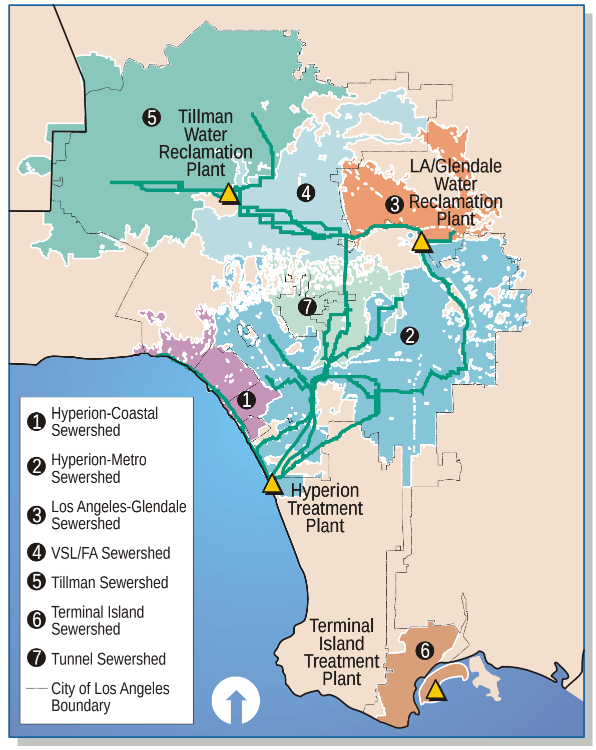


Figure 3-3
Wastewater Sewersheds for the IRP

3.4 Population and Employment Projections

Estimating the current and projecting future population projections between now and the year 2020 is an essential part of the IRP process because these projections will be used to project future wastewater flows and potable water demands.

Because there are different service areas for the water system, runoff system and wastewater system, the population data is presented for two areas: (1) the City of Los Angeles, appropriate for water and runoff planning; and (2) the wastewater service area, appropriate for wastewater planning. The wastewater service area includes the City of Los Angeles and contract agency boundaries.

3.4.1 Data Sources

The following data sources were used to estimate current and projected population:

- United States Census Bureau
- Southern California Associations of Governments (SCAG)
- City of Los Angeles Department of City Planning
- State of California Department of Finance

3.4.1.1 United States Census

Every 10 years, the United States Census Bureau releases population and housing counts. These census numbers are based on survey forms and direct counts at the census tract level, which are then aggregated up to cities, metropolitan areas, counties and states. Census numbers are used for political redistricting, allocation of federal dollars for education and transportation, as well as the basis for state and regional projections. The 2000 Census, which is the population count as of April 1, 2000, was fully released in early 2002. The Census is considered to be the best estimate of population, and is the base from which most demographic projections are made.

3.4.1.2 Southern California Associations of Governments

The SCAG is a council of governments and a regional planning agency that provides population and employment forecasting for six counties in Southern California including Los Angeles County. The federal government has identified SCAG as the Metropolitan Planning Agency (MPA) and mandates SCAG to research and develop plans for transportation, growth management, hazardous waste management, and air quality for the region. Using a single official projection source ensures continuity to the planning processes. For this reason, the EPA requires that agencies use the designated MPA as the source for demographic information.

To achieve its mission, SCAG regularly develops a coordinated, long-range transportation plan that addresses the needs of the vast metropolitan area. Through the development of the regional transportation plans, SCAG develops long-term demographic projections (population, housing and employment). The Regional Council leads the SCAG's organization and is comprised of representatives from all of the counties and local jurisdictions within SCAG's boundaries. In April 1998, the council adopted the *1998 Regional Transportation Plan*, which included demographic projections through year 2020. This data source was used in the IPWP to develop wastewater flow projections. This source was also used by the Department of Water and Power (DWP) to prepare potable water demand projections in their *2000 Urban Water Management Plan*.

In 2001, SCAG released its *2001 Regional Transportation Plan*, which had significantly lower projections for population. Developing the growth forecast for the 2001 transportation plan involved collaboration between regional agencies, sub-regions, and local jurisdictions. Each sub-region received funding for the development of growth forecasts at the local level. Integration of the regional and local forecasts was achieved through the joint efforts of a variety of groups. In developing this plan, SCAG involved 184 cities, hundreds of local, county, regional and state officials, the business community, environmental groups, non-profit organizations and a broad-based public outreach effort. SCAG's demographic projections also factor in national economic models and growth trends.

Both the 1998 and 2001 SCAG demographic projections were based on the 1990 Census. Currently, SCAG is updating its demographic projections which will be based on the 2000 Census counts. It is anticipated that this projection will be approved in the spring of 2004. A plan to track and accommodate revised SCAG projections is presented in *Facilities Plan Volume 5: Adaptive Capital Improvement Program.*

3.4.1.3 City of Los Angeles Department of City Planning

The City of Los Angeles Department of City Planning prepares an estimate of the City population as of October 1, every two years. The Demographic Research Unit calculates population estimates using a New Housing Method (Smith 1980) in which the change in the number of housing units at the census tract level is used to distribute the citywide population to census tract areas. The major components of this method include total housing units from the Census Bureau, estimated residential construction units from building permit data compiled by the Department of Building and Safety, occupancy rates by housing types, and school enrollment data from the Los Angeles Unified School District (LAUSD). A summary of this methodology is published in the Department of City Planning's website: http://cityplanning.lacity.org.

The City also prepares long-term projections of population as part of the SCAG collaborative effort. These internal City projections are not released, but are incorporated into the SCAG *Regional Transportation Plan*. They last prepared an estimate in October 1999.

3.4.1.4 State of California Department of Finance

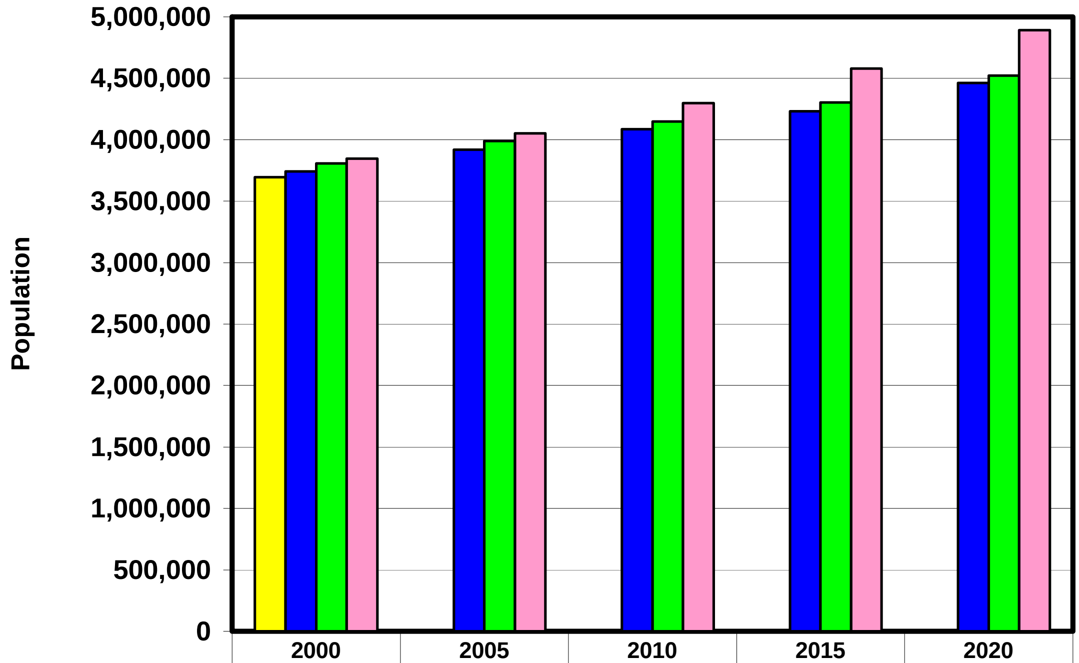
The State of California Department of Finance (DOF) prepares City and County population and housing estimates every year. These are based on the Census counts and are modified annually based on school enrollment, housing permits, automobile registration and other factors. DOF also prepares population projections at the county level through year 2020. Although countywide population projections are not detailed enough for the IRP, they do indicate annual growth trends for Los Angeles County. By taking these annual growth trends for Los Angeles County and applying them to the 2000 Census for the City of Los Angeles, an alternative projection can be developed for comparison purposes.

3.4.2 Comparison of Population Estimates and Projections

3.4.2.1 Comparison of Population for City of Los Angeles

To help determine the appropriate demographic projections for the IRP, a comparison was made between the SCAG and DOF projections. As shown in Figure 3-4, the DOF estimates for year 2000 are greater than the actual 2000 Census. This difference is due to the fact that the DOF views that the Census Bureau's 2000 census undercounted the population in California by approximately 530,000. Based on a total estimated statewide California population of 34,480,300, this "undercount" amounts to around 1.5 percent of the total estimate; for the City, the DOF views that the undercount is around 48,500, or 1.3 percent, based on the SCAG/Census Bureau's estimate of 3.69 million.

The SCAG 2001 population estimate for year 2000 is approximately 113,000 greater than the 2000 census count. The SCAG 2001 population projection was based on 1990 Census data. When SCAG releases its 2003 projections, the year 2000 population will match the 2000 Census. The 1998 SCAG population projection is the highest, showing 2020 population being almost 4.9 million. The SCAG 2001 projection significantly lowered the 2020 population projection to just over 4.5 million. By comparison, the DOF-based projection is also about 4.5 million. Also, as shown in Figure 3-4, the SCAG-01 projection shows an anticipated 18.7 percent growth in population in the City of Los Angeles between year 2000 and year 2020. This projection is less than the 27.2 percent growth projected in SCAG's *1998 Regional Transportation Plan* and used for the IPWP.



	2000	2005	2010	2015	2020
Census 2000 (1)	3,694,820				
California Department of Finance (2)	3,743,293	3,917,859	4,085,876	4,231,778	4,463,287
SCAG 2001 (3)	3,807,860	3,990,068	4,146,556	4,304,677	4,521,432
SCAG 1998 (4)	3,845,300	4,051,200	4,298,900	4,578,700	4,890,900

References/Notes:
(1) United States Census Bureau, Census Counts 2000.
(2) DOF City/County Population Estimates for 2000, and County Population Projections. Los Angeles County growth rates used to estimate City-level projections.
(3) SCAG 2001 Regional Transportation Plan Projections. These were generated prior to Census 2000 figures.
(4) SCAG 1998 Regional Transportation Plan Projections. These were generated prior to Census 2000 figures.

Figure 3-4
Comparison of Population for City of Los Angeles

3.4.2.2 Uncertainties in Population Projections

As with any projections there are uncertainties. Although the best statistical models are used to develop these projections, predicting long-term growth for 20 years is not an exact science. One source of uncertainty associated with estimating population in Los Angeles is referred to as "population undercount." In the 1990 Census, it was determined that a significant amount of the population was not counted. Much of this undercount had to do with transients and illegal immigration. Most of the undercount in 1990 was contained in the larger cities of New York, Chicago, Detroit, and Los Angeles. As discussed above, the DOF believes that the 2000 Census has an undercount for California. Most of this undercount is estimated to be in the SCAG region. Another source of uncertainty with population projections relates to how strong the nation is in terms of economic growth. History has shown that the stronger the economic growth for the nation, the more population growth there is for California. This is due to the fact that Los Angeles is a port city and has a regional economy greater than many industrialized nations. Therefore, national economic trends, which are complex and difficult to forecast, have a significant impact on population projections for Los Angeles.

Given the levels of uncertainties in planning, it is wise to conduct a risk analysis of those factors that are most significant in order to determine the sensitivities of timing and sizing of facilities.

3.4.3 Recommended Population Projections

Based on the analysis of population projections and uncertainties associated with them, the following recommendations are being made for the IRP:

- The SCAG 2001 population projection is the best single source of data to use for the IRP. This data source has population projections through year 2020 for the City and its wastewater contract agencies.
- Sources of uncertainty in population projections will be used in a risk analysis to determine the sensitivity of that varying levels of population have on facilities timing and sizing.
- When SCAG releases its 2004 population projections, they will be used in this risk analysis.

The use of SCAG data is also consistent with the City's planning process and is in compliance with the requirements of the EPA.

The population projection within each wastewater service area for years 2000, 2005, 2010, 2015, and 2020 is presented in Tables 3-2 through 3-6.

Table 3-2 Year 2000 Population Estimate for the IRP		
Tributary Area	**2000 Estimate[1]**	
Hyperion Service Area (HSA)	**Total**	**Percent of Total**
TWRP Shed	854,996	20%
Valley Spring Lane / Forman Avenue Shed	480,463	11%
LAGWRP Shed	294,126	7%
Tunnel Shed	358,041	9%
Coastal Interceptor Sewer Shed	205,968	5%
Metro Shed	1,944,973	45%
Total HSA	4,138,567	97%
Terminal Island Service Area (TISA)	139,589	3%
Total (HSA + TISA)	4,278,156	100%
[1]Based upon SCAG-01 projections		

Table 3-3 Year 2005 Population Projection for the IRP		
Tributary Area	**2005 Projection[1]**	
Hyperion Service Area (HSA)	**Total**	**Percent of Total**
TWRP Shed	899,598	20%
Valley Spring Lane / Forman Avenue Shed	502,186	11%
LAGWRP Shed	308,613	7%
Tunnel Shed	371,294	9%
Coastal Interceptor Sewer Shed	214,822	5%
Metro Shed	2,034,596	45%
Total HSA	4,331,109	97%
Terminal Island Service Area (TISA)	147,567	3%
Total (HSA + TISA)	4,478,676	100%
[1]Based upon SCAG-01 projections		

Table 3-4 Year 2010 Population Projection for the IRP		
Tributary Area	**2010 Projection[1]**	
Hyperion Service Area (HSA)	**Total**	**Percent of Total**
WRP Shed	938,655	20%
Valley Spring Lane / Forman Avenue Shed	526,405	11%
LAGWRP Shed	316,396	7%
Tunnel Shed	385,233	9%
Coastal Interceptor Sewer Shed	219,283	5%
Metro Shed	2,099,082	45%
Total HSA	4,485,054	97%
Terminal Island Service Area (TISA)	154,227	3%
Total (HSA + TISA)	4,639,281	100%
[1]Based upon SCAG-01 projections		

Table 3-5 Year 2015 Population Projection for the IRP		
	2015 Projection[1]	
Tributary Area		
Hyperion Service Area (HSA)	**Total**	**Percent of Total**
WRP Shed	980,451	20%
Valley Spring Lane / Forman Avenue Shed	547,805	11%
LAGWRP Shed	324,033	7%
Tunnel Shed	399,202	9%
Coastal Interceptor Sewer Shed	224,090	5%
Metro Shed	2,166,347	45%
Total HSA	4,641,928	97%
Terminal Island Service Area (TISA)	160,144	3%
Total (HSA + TISA)	4,802,072	100%

[1]Based upon SCAG-01 projections

Table 3-6 Year 2020 Population Projection for the IRP		
	2020 Projection[1]	
Tributary Area		
Hyperion Service Area (HSA)	**Total**	**Percent of Total**
TWRP Shed	1,033,535	21%
Valley Spring Lane / Forman Avenue Shed	575,987	11%
LAGWRP Shed	334,194	7%
Tunnel Shed	419,120	8%
Coastal Interceptor Sewer Shed	231,428	5%
Metro Shed	2,260,219	45%
Total HSA	4,854,483	97%
Terminal Island Service Area (TISA)	170,504	3%
Total (HSA + TISA)	5,024,987	100%

[1]Based upon SCAG-01 projections

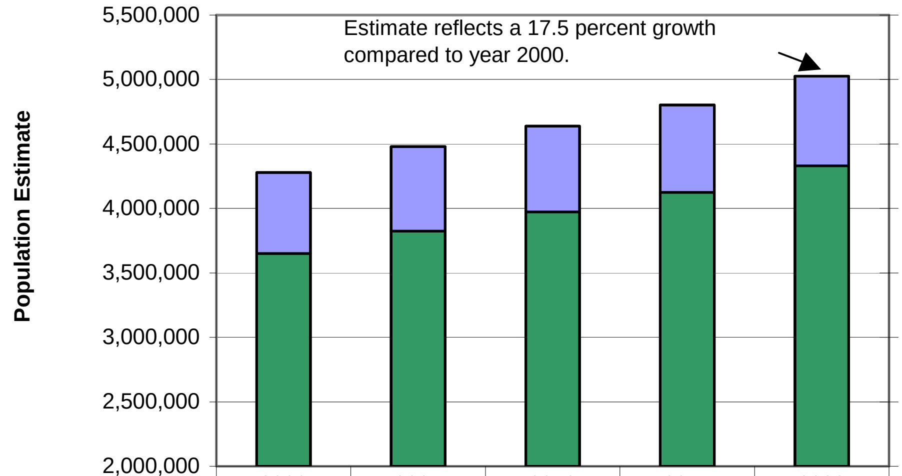
Table 3-7 on the following page, presents a summary of the wastewater service area population projections for years 2000, 2005, 2010, 2015, and 2020; and a summary of the percent increase of these projections, compared to year 2000.

Table 3-7
Summary of Population Projections and Percent Increase Compared to 2000

Tributary Area	Population Projection for IRP[1]				
Hyperion Service Area (HSA)	**2000**	**2005**	**2010**	**2015**	**2020**
TWRP Shed	854,996	899,598	938,655	980,451	1,033,535
Valley Spring Lane / Forman Avenue Shed	480,463	502,186	526,405	547,805	575,987
LAGWRP Shed	294,126	308,613	316,396	324,033	334,194
Tunnel shed	358,041	371,294	385,233	399,202	419,120
Coastal Interceptor Sewer Shed	205,968	214,822	219,283	224,090	231,428
Metro Shed	1,944,973	2,034,596	2,099,082	2,166,347	2,260,219
Total HSA	4,138,567	4,331,109	4,485,054	4,641,928	4,854,483
Terminal Island Service Area (TISA)	139,589	147,567	154,227	160,144	170,504
Total (HSA + TISA)	4,278,156	4,478,676	4,639,281	4,802,072	5,024,987
Tributary Area	**Estimated Percent Increase In Population Compared to Year 2000**				
Hyperion Service Area (HSA)	**2000**	**2005**	**2010**	**2015**	**2020**
TWRP Shed	--	5%	10%	15%	21%
Valley Spring Lane / Forman Avenue Shed	--	5%	10%	14%	20%
LAGWRP Shed	--	5%	8%	10%	14%
Tunnel Shed	--	4%	8%	11%	17%
Coastal Interceptor Sewer Shed	--	4%	6%	9%	12%
Metro Shed	--	5%	8%	11%	16%
Total HSA	--	5%	8%	12%	17%
Terminal Island Service Area (TISA)	--	6%	10%	15%	22%
Total (HSA + TISA)	--	5%	8%	12%	17%

1Based upon SCAG-02 projections

Figure 3-5 presents a summary of the total wastewater service area population projections for years 2000, 2005, 2010, 2015, and 2020.



	2000	2005	2010	2015	2020
Contract Agency	626,962	653,884	665,668	677,399	693,959
City of Los Angeles	3,651,194	3,824,792	3,973,613	4,124,673	4,331,028
Total Wastewater Service Area	4,278,156	4,478,676	4,639,281	4,802,072	5,024,987

Notes:
Estimates are based upon SCAG-01 projections as documented in *2001 Regional Transportation Plan* .
The City population estimate excludes small portions of the City that are served by other wastewater agencies.
The Contract Agency estimate includes the estimated population within the Hyperion Service Area and the Terminal Island Service Area.

Figure 3-5
Summary of Population Projections for Years 2000 through 2020

3.4.4 Recommended Employment Projections

Estimating employment is also an important component for wastewater planning. Employment is a factor used to estimate the wastewater contribution from commercial businesses.

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

The projected employment within each wastewater service area for years 2000, 2005, 2010, 2015, and 2020 is presented in Tables 3-8 through 3-12.

Table 3-8 **Year 2000 Employment Estimate for the IRP**		
Tributary Area	**2000 Estimate[1]**	
Hyperion Service Area (HSA)	**Total**	**Percent of Total**
TWRP Shed	374,583	16%
Valley Spring Lane / Forman Avenue Shed	169,128	7%
LAGWRP Shed	181,279	8%
Tunnel Shed	229,989	10%
Coastal Interceptor Sewer Shed	108,890	5%
Metro Shed	1,220,257	52%
Total HAS	2,284,126	98%
Terminal Island Service Area (TISA)	45,383	2%
Total (HSA + TISA)	2,329,509	100%
[1]Based upon SCAG-01 projections		

Table 3-9 **Year 2005 Employment Projection for the IRP**		
Tributary Area	**2005 Projection[1]**	
Hyperion Service Area (HSA)	**Total**	**Percent of Total**
TWRP Shed	390,243	16%
Valley Spring Lane / Forman Avenue Shed	175,294	7%
LAGWRP Shed	195,156	8%
Tunnel Shed	239,315	10%
Coastal Interceptor Sewer Shed	113,521	5%
Metro Shed	1,268,471	52%
Total HSA	2,382,000	98%
Terminal Island Service Area (TISA)	47,691	2%
Total (HSA + TISA)	2,429,691	100 %
[1]Based upon SCAG-01 projections		

Table 3-10 **Year 2010 Employment Projection for the IRP**		
Tributary Area	**2010 Projection[1]**	
Hyperion Service Area (HSA)	**Total**	**Percent of Total**
TWRP Shed	405,910	16%
Valley Spring Lane / Forman Avenue Shed	182,744	7%
LAGWRP Shed	208,415	8%
Tunnel Shed	247,395	10%
Coastal Interceptor Sewer Shed	119,075	5%
Metro Shed	1,311,912	52%
Total HSA	2,475,451	98%
Terminal Island Service Area (TISA)	49,728	2%
Total (HSA + TISA)	2,525,179	100%
[1]Based upon SCAG-01 projections		

Table 3-11 Year 2015 Employment Projection for the IRP		
	2015 Projection[1]	
Tributary Area		
Hyperion Service Area (HSA)	**Total**	**Percent of Total**
TWRP shed	417,037	16%
Valley Spring Lane / Forman Avenue Shed	186,690	7%
LAGWRP Shed	216,902	8%
Tunnel Shed	253,404	10%
Coastal Interceptor Sewer Shed	121,869	5%
Metro Shed	1,342,449	52%
Total HSA	2,538,351	98%
Terminal Island Service Area (TISA)	51,092	2%
Total (HSA + TISA)	2,589,443	100%
[1]Based upon SCAG-01 projections		

Table 3-12 Year 2020 Employment Projection for the IRP		
	2020 Projection[1]	
Tributary Area		
Hyperion Service Area (HSA)	**Total**	**Percent of Total**
TWRP Shed	424,465	16%
Valley Spring Lane / Forman Avenue Shed	189,752	7%
LAGWRP Shed	223,862	8%
Tunnel Shed	257,646	10%
Coastal Interceptor Sewer Shed	123,911	5%
Metro Shed	1,364,867	52%
Total HSA	2,584,503	98%
Terminal Island Service Area (TISA)	51,995	2%
Total (HSA + TISA)	2,636,498	100%
[1]Based upon SCAG-01 projections		

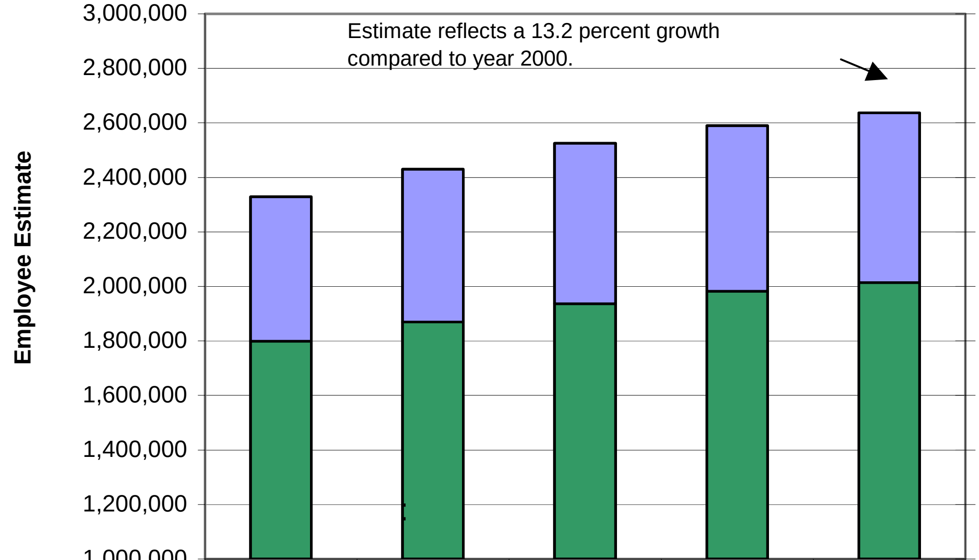
Table 3-13 presents a summary of the wastewater service area employment projections for years 2000, 2005, 2010, 2015, and 2020; and a summary of the percent increase of these projections, compared to year 2000.

Table 3-13
Summary of Employment Projections and Percent Increase Compared to 2000

Tributary Area	**Employment Projection for IRP**[1]				
Hyperion Service Area (HSA)	**2000**	**2005**	**2010**	**2015**	**2020**
TWRP Shed	374,583	390,243	405,910	417,037	424,465
Valley Spring Lane / Forman Avenue Shed	169,128	175,294	182,744	186,690	189,752
LAGWRP Shed	181,279	195,156	208,415	216,902	223,862
Tunnel Shed	229,989	239,315	247,395	253,404	257,646
Coastal Interceptor Sewer Shed	108,890	113,521	119,075	121,869	123,911
Metro Shed	1,220,257	1,268,471	1,311,912	1,342,449	1,364,867
Total HSA	2,284,126	2,382,000	2,475,451	2,538,351	2,584,503
Terminal Island Service Area (TISA)	45,383	47,691	49,728	51,092	51,995
Total (HSA + TISA)	2,329,509	2,429,691	2,525,179	2,589,443	2,636,498
Tributary Area	**Estimated Percent Increase In Employment Compared to Year 2000**				
Hyperion Service Area (HSA)	**2000**	**2005**	**2010**	**2015**	**2020**
TWRP Shed	--	4%	8%	11%	13%
Valley Spring Lane / Forman Avenue Shed	--	4%	8%	10%	12%
LAGWRP Shed	--	8%	15%	20%	23%
Tunnel Shed	--	4%	8%	10%	12%
Coastal Interceptor Sewer Shed	--	4%	9%	12%	14%
Metro Shed	--	4%	8%	10%	12%
Total HSA	--	4%	8%	11%	13%
Terminal Island Service Area (TISA)	--	5%	10%	13%	15%
Total (HSA + TISA)	--	4%	8%	11%	13%

[1]Based upon SCAG-02 projections

Figure 3-6 presents a summary of the total wastewater service area employment projections for years 2000, 2005, 2010, 2015, and 2020.



	2000	2005	2010	2015	2020
Contract Agency	530,048	560,424	588,860	607,493	622,254
City of Los Angeles	1,799,461	1,869,267	1,936,319	1,981,950	2,014,244
Total Wastewater Service Area	2,329,509	2,429,691	2,525,179	2,589,443	2,636,498

Notes:
Estimates are based upon SCAG-02 projections as documented in 2002 Regional Transportation Plan.
The City employee estimate excludes small portions of the City that are served by other wastewater agencies.
The Contract Agency estimate includes the estimated employees within the Hyperion Service Area and Terminal Island Service Area.

Figure 3-6
Summary of Employment Projections for Years 2000 through 2020

3.4.5 Reasons for Population Growth

An interesting component of demographic planning is understanding the reason for growth. SCAG reports that regional population growth is caused by changes in three major components: natural increase, international migration, and domestic (interstate) migration.

3.4.5.1 Background

Based on the 2001 SCAG Regional Transportation Plant (2001 RTP) Socioeconomic Forecast, SCAG's regional population is projected to increase to 22.6 million in 2025, a 6.5 million increase from the 1997 population estimates. Population growth at an annual rate of 1.4 percent is projected to add 232,000 people to the region per year.

SCAG uses a standard demographic cohort-component model to project population at the regional level. This model computes the population at a future point in time by adding to the existing population the number of births and persons moving into the region during a time interval, and by subtracting the number of deaths and the number of persons moving out of the area. Projections are derived for 18 age cohorts in five year intervals for the projection timeline. Fertility, mortality and migration rates are projected in 5 year intervals for each age group, for four mutually exclusive ethnic groups: Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Asian, and Hispanic; by these population classes: residents, domestic migrants and international migrants.

3.4.5.2 Natural Increase

SCAG attributes natural increase (i.e., births) is the most prominent source of growth in the region and accounts for about 80 percent of regional population growth. Of the estimated 6.5 million population growth, 5.23 million is projected to be due to natural increase. This increase reflects a recent decreasing trend of natural increase. SCAG region increases averaged 185,000 annually during the 1994-1997 period, which was 35,000 lower than the previous assumption of natural increase for the 1998 RTP.

3.4.5.3 Migration

Net international migration is the second major contributor to regional growth due to the unique cultural mix, job opportunities, and the geographic location of the SCAG region. The projected net international immigration (including both legal and illegal immigrants) is 3.4 million or 52 percent of the regional population growth.

Domestic migration measures the net change of the inflow of population from other regions to the SCAG region and the outflow of population from the SCAG region to other regions. Based on the SCAG's projections, the region is projected to experience a net domestic migration loss of 2.15 million by 2025. The total net migration of 1.25 million (3.4 million minus 2.15 million) contributes to approximate 20 percent of the regional population growth.

3.5 Regulatory Requirements

Understanding the regulatory forecast and developing appropriate environmental quality goals are essential steps in the facilities planning process. For the IRP, a Technical Memorandum (TM) 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.

Table 3-14 provides a summary of the resulting priority issues identified for the IRP at the time of alternative development (Spring 2003). The IRP team recognizes that these issues continue to change in status and priority. The "Regulatory Forecast Technical Memorandum" in Appendix A provides detailed discussion of these issues. This section will discuss the findings of this technical memorandum with respect to wastewater treatment and the resulting environmental goals for the IRP.

Table 3-14
Summary of Priority Regulations and Key Policy Issues for the Wastewater Program

Priority Issues[1]	Revised Phase of Program	Timing of Issue
Beneficial use designations for all water bodies and narrative standards in the Basin Plan	Current	As National Pollutant Discharge Elimination System (NPDES) Permits are Renewed
Clean Water Act 303(d) listings for all water bodies (including urban lakes)	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	Current and Proposed	Per Consent Decree – with a proposal to bundle different pollutant TMDLs for the same watershed and as NPDES Permits are Renewed
Clean Water Enforcement and Pollution Prevention Act of 1999, as amended in 2000 by SB2165	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 Surfaces Waters and the Enclosed Bays and Estuaries of California	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	Current/Emerging	1 to10 years
Prohibition of bypass of the headworks for sanitary sewage and promulgation of Sanitary Sewer Overflow regulation for management of sanitary collection systems	Current and Proposed	New Regulation ~18 months
Sanitary System Management Plans in NPDES Permits	Emerging	As NPDES Permits are Renewed
Enforcement of Pretreatment requirements and standards on satellite systems	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	Proposed/ Crystal Ball	With Adoption of SSO Rule early in 2005
VOCs & Ammonia from Biosolids Composting Facilities (Rule 1133) consistent with AB 1450	Current/Emerging	1-5 years
Odor as a result of VOCs & H2S from treatment plants and collection systems General Order # 034 from AQMD and potential for requirements from LARWQCB in NPDES permits	Current/ Crystal Ball	2-20 years

[1]See Appendix A for detailed discussion of these priority issues

3.5.1 Hyperion Treatment Plant (HTP)

All treated wastewater at HTP is discharged to the ocean via a five mile long outfall into the Santa Monica Bay. The current regulations that impact the discharge requirements of the flow to the outfall includes (see Regulatory Forecast Technical Memorandum for more information):

- The National Pollution Discharge Elimination System (NPDES) Permit (CA0109991).
- Clean Water Enforcement and Pollution Prevention Act of 1999 (SB 709) (Revised).
- The State Ocean Plan.

The existing discharge permit, which expired in 1999, is currently undergoing renewal. The new permit is not anticipated to significantly change current discharge limits. In addition to the regulations, there are requirements stated within the agreement with the West Basin Municipal Water District, which uses effluent from HTP for groundwater replenishment and advanced treatment uses.

To meet existing requirements, HTP currently provides full secondary treatment. While there are proposed and emerging regulations which would require higher levels of treatment, the IRP assumed that these would not affect HTP treatment requirements by the year 2020. Therefore, the current permit limits and level of secondary treatment are assumed as the environmental goal.

Changes to the regulations and permits pertaining to the collection system or treatment system requirements can occur in the future. A plan to track and accommodate these changes is presented in *Facilities Plan Volume 5: Adaptive Capital Improvement Program.*

3.5.2 Upstream Facilities

TWRP and the Los Angeles-Glendale Water Reclamation Plant (LAGWRP) currently produce recycled water as well as provide relief for the collection system and HTP. Each of the facilities have two primary discharges: recycled water and the Los Angeles River (LA River).

The recycled water produced at these facilities is primarily used for landscaping with some industrial use. This recycled water meets the current Title 22 requirements. For the IRP, it is assumed that current Title 22 requirements will not change significantly prior to the year 2020. Therefore, the Environmental Goal for recycled water discharge is the current Title 22 Requirements.

There are many current and emerging regulations concerning the Los Angeles River (LA River) discharge. Some of these include: expired NPDES permit, 1998 NPDES Permit (stayed), 40 CFR Part 131 [California Toxics Rule (CTR)], and Total Maximum Daily Load (TMDL) in the LA River. See the Regulatory Forecast Technical Memorandum for more information and the complete list.

Since the majority of these regulations listed are new or emerging, the specific requirements and limits are not known or can vary significantly. The challenge for the IRP team is to develop environmental goals for the facilities which will meet the impending requirements without being overly conservative.

A range was developed for many constituents of concern from the estimated and known limits of the regulations and permits listed above (see Table 3-15). While this does not show the full spectrum of constituents, analysis of the range indicated that advanced treatment would be required to meet this range.

A list of the current and emerging technologies which could provide treatment to meet these limits as well as those for other constituents is presented in Table 3-16. Reverse osmosis is the prevailing current technology to treat this broad range of constituents.

Another table was then developed to show the percent of river discharge, which would require reverse osmosis (RO) treatment to meet the estimated and known limits for the primary constituents of concern (see Table 3-17). It is very important to note that the results shown in this table are preliminary and rough estimates at best. The reason for this is that much of the data on the current effluent and influent concentrations of these constituents is not consistent. Also, some of these limits have issues concerning detection limits. In these cases best judgement was used.

Table 3-15
Estimated Range of NPDES Permit Limits for the Primary Constituents of Concern for the Upstream Plants

Constituent	Monthly Average		Daily Max	
	TWRP	**LAGWRP**	**TWRP**	**LAGWRP**
bis-2-(ethylhexyl) phthalate	4 – 5.9 ug/l	4 – 5.9 ug/l	4 – 12 ug/l	4 – 12 ug/l
copper	11 – 31 ug/l	11 – 31 ug/l	17 – 52 ug/l	17 – 52 ug/l
cyanide	3.5 – 5.2 ug/l	3.9 – 5.2 ug/l	8.4 – 22 ug/l	8.4 – 22 ug/l
dieldrin	0.0019 ug/l – no limit	unknown	2.5 ug/l – no limit	unknown
heptachlor epoxide	0.00011 ug/l – no limit	unknown	0.00022 ug/l – no limit	unknown
Lead	2.5 – 50 ug/l	2.5 – 50 ug/l	15 – 30.5 ug/l	15 – 17.1 ug/l
mercury	0.012 – 0.051 ug/l	unknown	0.1 – 2.1 ug/l	unknown
thallium	2 ug/l – no limit	unknown	No limit	unknown
2,3,7,8–TCDD (dioxin)	$1.4x10^{-8}$ – no limit	$1.4x10^{-8}$ – no limit	$2.8x10^{-8}$ – no limit	$2.8x10^{-8}$ – no limit

Table 3-16
Current and Emerging Technologies for Treatment of the Primary Constituents of Concern

Constituent	Current Technology	Emerging Technology
BOD	Secondary Treatment	
TSS	Tertiary/ Filtration	
nitrogen	NdN, Multi-pass RO, Treatment Wetlands	
bis-2-(ethylhexyl) phthalate	MF/RO, GAC	MBR/RO
copper	MF/RO, CP, IE	MBR/RO, ED
cyanide	MF/RO, GAC	MBR/RO, CO
DDT	MF/RO, GAC	MBR/RO, CO
dieldrin	MF/RO, GAC	MBR/RO, CO
endrin	MF/RO, GAC	MBR/RO, CO
heptachlor epoxide	MF/RO, GAC	MBR/RO
lead	MF/RO, CP, IE	MBR/RO, ED
mercury	MF/RO, CP, GAC	MBR/RO
PCBs	MF/RO, GAC	MBR/RO, CO/UV Combination
thallium	MF/RO, GAC	MBR/RO
toxaphene	MF/RO, GAC	MBR/RO, CO
2,3,7,8–TCDD (dioxin)	MF/RO, GAC	MBR/RO, CO/UV Combination

NdN: Biological Nitrification/ Denitrification
MF: Microfiltration Membrane Filters
RO: Reverse Osmosis Membrane Filters
MBR: Membrane Bioreactors
GAC: Granular Activated Carbon Media Filters
ED: Electrodialysis Membrane Filters
CO: Chemical Oxidation
UV: Ultra-Violet Disinfection
CP: Chemical Precipitation
IE: Ion Exchange

Table 3-17
Environmental Goal Permit Summary for the Upstream Plants

Constituent	1995 NPDES Permit[1]		1998 NPDES Permit[2]		Estimated CTR Limits[3]	
	TWRP	LAGWRP	TWRP	LAGWRP	TWRP	LAGWRP
BOD	Secondary	Secondary	Secondary	Secondary	Secondary	Secondary
TSS	Tertiary/ Filtration	Tertiary/ Filtration	Tertiary/ Filtration	Tertiary/ Filtration	Tertiary/ Filtration	Tertiary/ Filtration
nitrogen	NA	NA	NdN	NdN	NdN	NdN
bis-2-(ethylhexyl) phthalate	NA	NA	50% RO	50% RO	50% RO	50% RO
copper	NA	NA	75% RO	75% RO	75% RO	75% RO
cyanide	NA	NA	75% RO	75% RO	100% RO	100% RO
DDT	NA	NA	100% RO	100% RO	100% RO	100% RO
dieldrin	NA	NA	100% RO	100% RO	100% RO	100% RO
endrin	NA	NA	100% RO	100% RO	NA	NA
heptachlor epoxide	NA	NA	NA	NA	100% RO	100% RO
lead	NA	NA	50% RO	50% RO	0% RO	50% RO
mercury	NA	NA	100% RO	NA	100% RO	NA
PCBs	NA	NA	100% RO	100% RO	NA	NA
thallium	NA	NA	NA	NA	75% RO	100% RO
toxaphene	NA	NA	100% RO	100% RO	NA	NA
2,3,7,8–TCDD (dioxin)	NA	NA	NA	NA	100% RO	100% RO

NdN: Biological Nitrification/ Denitrification
RO: Reverse Osmosis Membrane Filters

1. Receiving water limitation for the LA River at Tillman contained in Order No. 91-102 NPDES No. CA0056227 Revised September 5, 1991.
2. Waste Discharge Requirements for the City of LA (Tillman) Order No. 98-046 NPDES No. CA0056227 Revised June 15, 1998. On September 17, 1998 revisions to an order for issuance of a time schedule were presented. The primary deviation between these two documents is the elevation of the nitrite level to provide the City with treatment flexibility while conducting pilot studies and implementation of projects to reduce nitrogen compounds in the effluent. Subsequently, Order 98-046 has been suspended (stayed). Nitrite limit if 2 mg/L is an interim limit. The time schedule order also includes interim limits for problem constituents such as copper, cyanide, dieldrin, DDT, methylene cloride, detergents, bis-2 ethylhexl phthalate, lindane, etc.
3. In April, 2000 the EPA promulgated the California Toxics Rule which set numeric water quality criteria, based on reasonable potential analysis, for Priority Toxic Pollutants for California Inland Surface Waters, Enclosed Bays and Estuaries. This is expected to be integrated in the next round of NPDES Permits.

This information was then presented to the Technical Advisory Committee and the Management Advisory Committee (TAC and MAC) for their guidance on how these environmental goals should be approached. The consensus of the groups was the following:

- Given the uncertainty of the current regulations and limits, the use of a range is better.
- Of the list of current and emerging technologies for advanced treatment, the City should choose ones that provide the greatest flexibility to meet new regulations and provide a modular installation. It was agreed that one or a combination of the membrane technologies would best meet these requirements.
- Source control should be used to help determine if there are ways to reduce the amount of the primary constituents of concern from entering the collection system.

The results of this effort is that the ranges listed in Table 3-15 will provide the basis for the environmental goal for TWRP, LAGWRP, and any new upstream wastewater treatment facilities which will have a discharge to the LA River. For the IRP, we are assuming any discharges to the LA River will require advanced treatment. In terms of application of these limits, the IRP will primarily focus on the use of membrane technologies for its analysis of upgrades to advanced treatment.

3.5.3 Collection System

As with other information that has been presented regarding the regulatory issues effecting the City's wastewater facilities, this information is organized by *current regulations, emerging regulations, proposed regulations,* and *crystal ball regulations. Current* regulations are those that are in permits or are enforceable through some legal mechanism at this time. *Emerging* regulations may have already been adopted or promulgated, but, until they actually are enforceable, they would not be considered *current. Proposed* regulations are under development and not yet adopted. *Crystal ball* regulations have the potential for becoming regulations in the future.

3.5.3.1 Current Regulations

The major regulatory requirement for wastewater collection systems is contained in Part 40 of the Code of Federal Regulations, Section 122.41.(m) which prohibits bypassing of treatment facilities. This prohibition of bypassing the headworks or the treatment facilities within the Publicly-Owned Treatment Works (POTW) has been interpreted in almost every NPDES permit across the country as a narrative requirement in the permit. In the case of the HTP permit (Order No 94-CA019991), which regulates the Hyperion Treatment System *consisting of about 6,000 miles of sewage collection system…*, this prohibition is in Section IV Provisions and is stated as:

> *Any discharge of wastes at any point other than specifically described in this order and permit is prohibited, and constitute a violation thereof.*

Under this provision, any sanitary sewer overflow from the collection system is prohibited. It is important to note that narrative requirements are not subject to the mandatory enforcement and penalties under the Clean Water Enforcement and Pollution Prevention Act of 1999 (a.k.a. SB 709). Under this law, only effluent requirement in permits, those that establish numerical water quality objectives for a POTW discharge, would carry mandatory penalties and enforcement.

In 1986, the Los Angeles Regional Water Quality Control Board (LARWQCB) issued a Cease and Desist Order (CDO 86-2) to the City because dry weather sanitary sewer overflows (SSOs) were occurring into Ballona Creek. The CDO required the City to eliminate dry weather SSOs by undertaking preventive and corrective actions under specific time schedules. They were also required to minimize, if not eliminate, wet weather SSOs through increased capacity upstream of the treatment plants and cleaning of the NOS by April 1, 1994. This work was completed. This CDO is illustrative of the regulatory authority over the collection system and how it can be exercised by the LARWQCB.

During the 1998 El Nino rains, the City's wastewater collection system experienced an extraordinary number of wet weather SSOs. As a result of these overflows, the LARWQCB issued a CDO on September 14, 1998. The order has a stipulated schedule for completing specific projects by November 30, 2005 to prevent the recurrence of SSOs. These tasks include: dewatering feasibility study in the Eagle Rock area, the revision of the City's spill response and reporting procedures, and the immediate construction of three relief sewers in the Eagle Rock area. Until these tasks and others required by the CDO are completed and approved as completed by the LARWQCB, the CDO requirements are in effect as strong as any regulation or permit.

The Southern California Air Quality Management District (SCAQMD), regulates nuisance odors under existing air quality rules. Odor releases from the collection system could result in complaints to the SCAQMD and a requirement that the odor be eliminated. In addition, any odor from the collection system can cause negative public perceptions and complaints which are harmful to the credibility and prestige of the City.

Changes to these regulations can occur in the future. A plan to track and accommodate these changes is presented in *Facilities Plan Volume 5: Adaptive Capital Improvement Program.*

3.5.3.2 Emerging Regulations

There are no emerging regulation that effect the sewage collection system as of this writing.

3.5.3.3 Proposed Regulations

The most significant proposed regulation is the Federal proposal to regulate SSOs. From 1994 to 1999 EPA sponsored a Federal Advisory Committee that negotiated the need for, and the potential content of, a national rule regulating SSOs. The advisory committee specifically discussed effective sewer operations and maintenance principles, public notification of SSOs, prohibitions, and affirmative defense and record keeping issues. In January 2000, a Federal Register Notice was issued proposing a new rule. The notice was withdrawn when the current Bush Administration took office in order to completely review the proposed rule before Federal Register reissuance. It is unclear when this rule will be reproposed, but it will likely include:

- Prohibition of SSOs with either some kind of affirmative defense or some definition of what is considered an "unpreventable" SSO.
- Record keeping, reporting, and public notification requirements.
- Capacity assurance, management and operations and maintenance (CMOM) requirements.

Note that for the City, this proposed rule would only be a new requirement if it better defines what is an allowable overflow and on what to base the capacity assurance program. Otherwise, all other aspects of this program have already been required of the City by permits or CDOs.

3.5.3.4 Crystal Ball Regulations

In Orange and San Diego Counties the Regional Boards have required Sanitary Sewer Management Plans, which are, in effect, the same as a CMOM plan. These plans could be included in future NPDES permits for the City and could be required to be renewed and updated with each permit cycle. Although the City already has a CMOM program in place, there are several facets of CMOM that have the potential to lead to significant changes to the program. These include the requirement for a public process during CMOM program development, program approval by the LARWQCB or their staff, inclusion of CMOM in permits and specific program requirements that could be identified in this process, and required periodic updates with each permit cycle.

EPA has been studying the potential for, and impacts of, volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) from sewage collection systems. The EPA Office of Air has released a new version of its emission model called WATER9. The Association of Metropolitan Sewerage Agencies (AMSA) is currently reviewing this model in order to prepare comments for the EPA Office of Air. In the previous version of the model (WATER8), it was concluded that the HTP and TITP emissions were considerably less than was considered a public health threat. However, with an emphasis on collection systems and the fact that the City has more than 6,500 miles of collection sewers and numerous pump stations within the air basin, the newer model could conclude that regulation is advisable.

Over the last few years both the City and the Orange County Sanitation District have collected dry weather urban runoff and directed it to the treatment plants for treatment and discharge. The intention of this is to protect the beaches from low-flow, dry weather urban runoff from the storm drain system that has the potential to carry pollutants that can cause beach postings or other impairments in the water body. With bacteria TMDLs underway for Marina del Rey, Ballona Creek, and the Santa Monica Bay beaches, it is probable that the collection and treatment of wet weather runoff will be required in the future for specific watersheds or subwatershed. Such requirements will be in the form of implementation plans for TMDLs, which will probably contain specific numeric and programmatic requirements in NPDES permits.

Because sanitary sewage mixing with runoff and vice-a-versa impacts both systems, it is possible that an inflow and infiltration (I/I) requirement focused on private property will be developed and included in future NPDES permits. This future regulation may require inspections of private roof downspouts and drain connections (presumably only large roofs as opposed to residential roofs) to ensure that they are connected to the storm water system and not the sewage collection system in order to prevent SSOs.

Conversely, it is also possible that a program would be put into place to meet runoff receiving water requirements determined by TMDLs which would require that such roof drainage is connected to the sewage collection system rather than the storm sewer (drainage) system. Should this happen, it would have to be modeled to be consistent with capacity assurance requirements of CMOM (Sanitary Sewer Management Plans) to ensure that such connections would not cause additional and undesirable SSOs. This would likely require substantial investment in additional sewer capacity, treatment and private investment in runoff holding tanks and control systems, and replumbing of roof drains.

Either way, such a new program would most likely require a local ordinance to give the City authority to inspect, require and enforce specific connections.

3.6 Guiding Principles Affecting Wastewater Management

In the first phase of the IRP the Steering Group created six primary objectives for the program (Figure 3-7).

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 Phase I guiding principles.

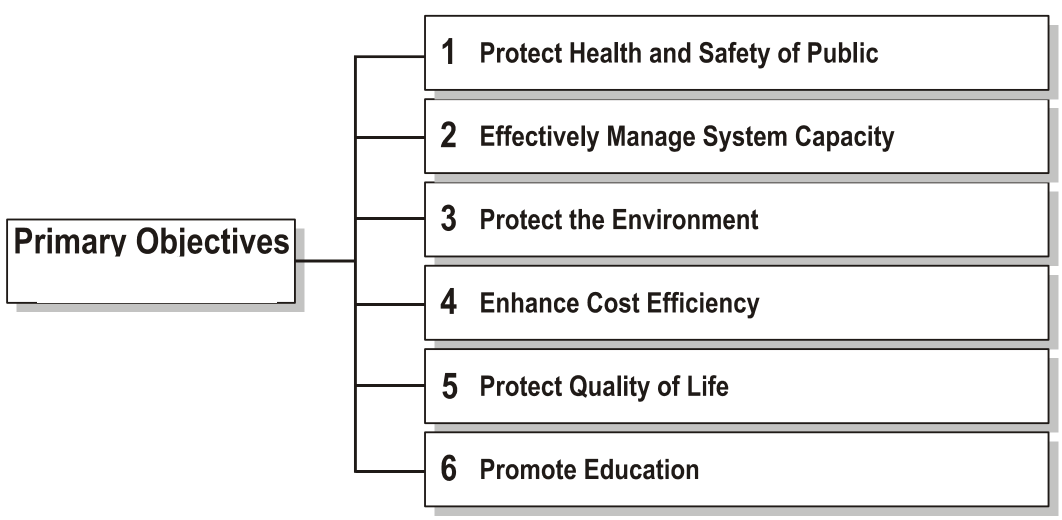


Figure 3-7
IRP Objectives

The guiding principles are essential planning parameters 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 Steering Group Recommendations for Integrated Resources Planning Policy Development* (Summary Statement) and is found in Appendix B of this Volume.

Several of the guiding principles are specific to wastewater management. These guiding principles include 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 (See Figure 3-8) 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. Because there are adequate solids treatment processes downstream at the HTP and TITP, it was assumed that these new upstream treatment facilities would not include solids treatment processes.

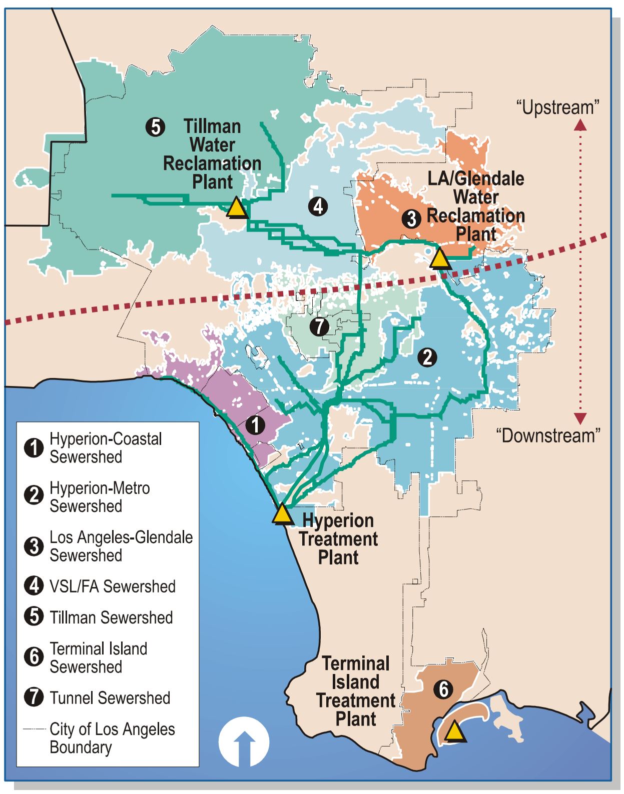


Figure 3-8
New Upstream Facilities will Offer Greater System Operational Flexibility

- **Producing and using as much recycled water as possible from the existing and planned facilities**
  Because of our location in Southern California, the need to maximize opportunities to responsibly use recycled water should be recognized. Recycled water can be used for irrigation, industrial uses, environmental enhancement and groundwater recharge. Based on public input, irrigation and industrial uses for recycled water were most preferred, followed by environmental enhancement. The use of recycled water for groundwater recharge must be approached thoughtfully and with a very open, public process that addresses public health concerns and participatory decision-making. A key element in this approach is a public education program that considers the benefits and risks associated with using recycled water in comparison with other alternatives.

- **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 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. Therefore, the reduction in inflow and infiltration should be pursued. However, the program must address issues associated with potential work on private property.

- **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 City recognizes the benefits to the community of the beneficial reuse of this important resource. The City recommends the continued beneficial reuse of biosolids. Where possible, biosolids should be beneficially reused locally (within Los Angeles County).

- **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 Phase I process. In fact, individual economic preferences were considered in selecting the 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 Steering Group supported the use of lower cost solutions where they are available within the framework of the other policy elements.

Section 4
Wastewater Flow Projections

4.1 Introduction

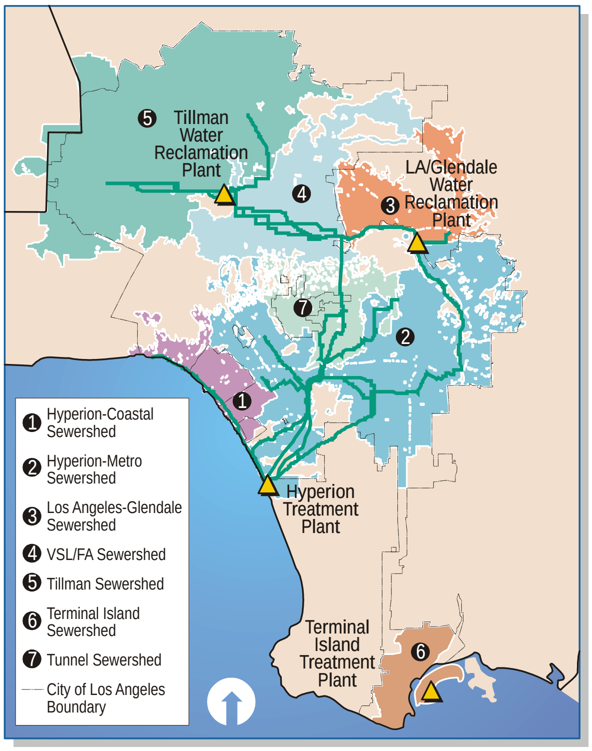


Figure 4-1
Wastewater Sewersheds for the IRP

To plan for future wastewater conveyance and treatment needs, it is necessary to estimate the amount of wastewater that will be generated. This section describes the wastewater flow projections considered for the City's IRP. The average dry weather flows, peak dry weather flows and peak wet weather flows used for planning efforts are discussed. Through the IRP, wastewater facilities will be planned for the City's service area needs that will develop through the year 2020. For this facilities plan, five-year interval planning horizons were used: year 2000 (calibration year), 2005, 2010, 2015, and 2020.

The wastewater system of the City is divided into two major service areas: the HSA and the TISA. Flows generated in the HSA are treated by the City's two upstream water reclamation plants (WRPs), the TWRP and the LAGWRP, as well as the Burbank Water Reclamation Plant (BWRP). Wastewater flows exceeding the capacities of these plants continue through the collection system and are treated at the HTP. The HSA has been subdivided into six smaller tributary areas or sewersheds for the purpose of analysis during Phase 1 of the IRP, or IPWP. The TISA is served by the TITP.

These seven total tributary areas are shown in Figure 4-1:

- Hyperion-Coastal Sewershed
- Hyperion-Metro Sewershed
- Los Angeles-Glendale Sewershed
- Valley Spring Lane/Forman Avenue (VSL/FA Sewershed)
- Tillman Sewershed

- Terminal Island Sewershed
- Tunnel Sewershed

In developing wastewater flow estimates, the IRP considers three distinct categories of wastewater flow. Their definitions, and how they are used in the IRP, are as follows:

- Average Dry Weather Flow (ADWF) – ADWF represents the estimated annual average flows for residential and commercial sanitary flows, average groundwater infiltration (GWI), and industrial flows. ADWFs are estimated using the City's Sewer Flow Estimating Model (SFEM). The ADWF will be used to evaluate treatment plant process capacities.
- Peak Dry Weather Flow (PDWF) – PDWF represents the diurnal flow patterns typically found in wastewater collection systems. PDWF is the basis for selecting pipe size in the IRP planning studies when increased conveyance capacity is needed. These sizes should be refined in more detailed studies and designs.
- Peak Wet Weather Flow (PWWF) – PWWF is the sum of the PDWF and the rainfall-dependent infiltration and inflow (RDI/I), which occurs during storm events. A 10-year storm and an estimate of the magnitude of RDI/I into the system are used for estimating future PWWFs. RDI/I includes two components: stormwater inflow (SWI) and rainfall dependent infiltration (RDI). PWWF will be used for the analysis of collection system and treatment plant hydraulic capacities.

In the following section, projections for each of these wastewater flow categories is developed and summarized.

4.2 Average Dry Weather Flow

This section discusses flow components and how those flows were projected individually and then aggregated.

4.2.1 Flow Components

ADWF includes residential and commercial sanitary flows, average GWI and industrial flows as shown in Figure 4-2. To estimate the ADWF, the IRP team used the GIS-based SFEM developed by the City to calculate future flows in the HSA and TISA. The SFEM consists of a set of flow estimation tools for defining tributary service areas. Within each service area, estimates of sanitary flows, GWI, and industrial waste contributions are developed using census data, and other planning-related data for flow projections. The resultant flows generated are ADWF and are accumulated to downstream nodes (maintenance holes) using a static accumulation module.

The ADWF will be used to evaluate treatment plant capacities. The SFEM calculated the total average dry weather wastewater flow using the following formula:

ADWF =	Residential Flow + Commercial Flow + Average GWI + Industrial Flow
Residential Flow =	Population projection x residential per capita flow rate
Commercial Flow =	Employment projection x employment per employee flow rate
Average GWI Flow =	Average GWI flows based upon I/I basin boundaries and infiltration rates established in the *Infiltration/Inflow Reduction Plan* (CH2M HILL, 1992)
Industrial Flow =	Permitted industrial flows (point sources with permitted flow greater than 10,000 gpd

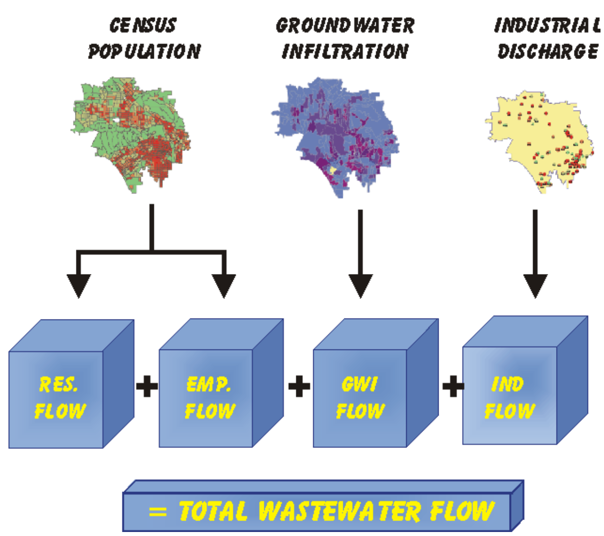


Figure 4-2
ADWF Components

4.2.2 Residential and Commercial Wastewater Flows

Residential and commercial wastewater flows were based on census data for year *1990* and SCAG *2001 Regional Transportation Plan* population projections for subsequent years (discussed previously in Section 3.4) to which unit flow rates were applied.

Unit rates for residential and commercial wastewater flows were based on treatment plant historical information and were applied uniformly across the entire service area.

4.2.2.1 Historical Per Capita Flow Rates

Per capita wastewater flows vary from area to area and can be estimated from flow measurement and census data. As described in Section 4.2.1, residential and employment per capita flow rates and demographic projections were used to estimate the residential flow and commercial flow components of the ADWF.

Planning-level residential and employment per capita flow rates have been widely debated over the years and have ranged from 78 to 90 gpd per person and from 24 to 30 gpd per employee. A discussion of residential and employment per capita flow rates is provided in the *Integrated Plan for the Wastewater Program (IPWP), Baseline Needs Technical Memorandum* (CDM and CH2M HILL, April 2000) and is summarized below.

- In the *Advanced Planning Report, Technical Memorandum-5E-Future Wastewater Flows and Distribution* (City of Los Angeles, 1989), the flow rates were developed by applying a calculated wastewater-to-potable water ratio of 70 percent to the projected per capita potable water usage rates. This resulted in a per capita wastewater flow rate of 120 gallons per capita per day (gpcd). The 120 gpcd flow rate was then broken down into two components: a 90 gpcd residential flow rate and a 30 gallons per employee per day (gped) commercial flow rate, using actual residential flows measured from 1982 to 1984 (per the *CH2M Hill Infiltration/Inflow Reduction Plan*). This approach was accomplished by first determining the GWI for each sub-basin using flows monitored in the early morning hours, when residential wastewater flow was minimal. For each basin, the residential flow rate was determined by subtracting the GWI fraction from flow measured over a full 24-hour period and then dividing the remaining portion by the population in the area tributary to the monitor. The residential flow rate of 90 gpcd and employment flow rate of 30 gped do not represent the impacts of water conservation.

- During the development of the *Draft Wastewater Facilities Plan (*City 1994*)* the residential and employment per capita flow rates were determined using a "flow calibration" model, which was based on the measured wastewater flows into the HSA from 1987 to 1994. This time period represented both normal and drought years. Because it was a drought year, 1990 was selected as the calibration year, and the residential and employment per capita flow rates of 86.7 gpcd and 24 gped, respectively, were determined. The employment per capita flow rate of 24 gped was based on the results of a 1990 study done on commercial high-rise buildings with no landscape irrigation, *Water Use Survey Commercial Buildings in Downtown Los Angeles* (City of Los Angeles, 1990).

- In the IPWP, the 87 gpcd for residential and 24 gped for employment flows derived in the 1994 *Draft Facilities Plan* as described above were used as a starting point to determine the current and year 2020 baseline residential and employment flows. An estimate of the impact of water conservation programs was then conducted to derive revised per capita flow rates. In 1990, DWP initiated a water conservation program. Since not all of these programs impact the "indoor" water usage, which in turn, impacts primarily residential wastewater volume, an analysis of the impact of conservation on potable demand and residential wastewater generation rates was conducted during the IPWP. It was found that for year 2000, potable water demand savings due to indoor water conservation programs was comparable to the total wastewater production savings. A revised residential per capita flow rate of 81 gpcd was derived by reducing the five-year average total wastewater flow in year 2000 by the commercial, industrial, and GWI flows, and dividing the remaining residential flow by the year 2000 HSA population. (See the IPWP *Baseline Needs Technical Memorandum*, Section 4, *f*or additional discussion.)

For the IRP, wastewater flow rates of 81 gpcd for residential flows and 24 gped for commercial flows were used in the SFEM to determine current and future flows for the calibration year and four planning horizons. The SFEM calibration results based on year 2000 estimates are documented in Appendix C. Year 2000 was selected as the calibration year rather than the IRP's defined "current" year of 2002 (per Section 3.2) because the most current population data available is for the year 2000. The SFEM estimated flows for the HSA were within 4 percent of the measured flows.

The use of these residential and commercial flow rates were selected during the IPWP and account for planned levels of water conservation. Although population growth has exhibited steady increases over the past years, near-term wastewater flows to the treatment facilities have decreased during certain years, in part due to water conservation measures by DWP, the effects of industries and commercial establishments either cutting back or closing altogether, as well as lower GWI in drought years.

4.2.2.2 Future Residential and Commercial Wastewater Flows

Future residential and commercial flows were projected for the six tributary basins in the HSA and the one tributary basin in the TISA using the demographic projections discussed in Section 3.4 and the per capita flow rates discussed above. Tables 4-1 through 4-6 summarizes the estimated residential and commercial flows for years 2000, 2005, 2010, 2015, and 2020.

Table 4-1
2000 Average Residential and Commercial Wastewater Flow Projections

Tributary Area	Residential Population[1]	Residential Flow[2] (mgd)	Employees Population[1]	Commercial Flow[3] (mgd)
Hyperion Service Area (HSA)				
TWRP Shed	854,996	69.3	374,583	9.0
Valley Spring Lane / Forman Avenue Shed	480,463	38.9	169,128	4.1
LAGWRP Shed	294,126	23.8	181,279	4.3
Tunnel Shed	358,041	29.0	229,898	5.5
Coastal Interceptor Sewer Shed	205,968	16.7	108,890	2.6
Metro Shed	1,944,973	157.5	1,220,257	29.3
Total HSA	4,138,567	335.2	2,284,126	54.8
Terminal Island Service Area (TISA)	139,589	11.3	45,383	1.1
Total (HSA + TISA)	4,278,156	346.5	2,329,509	55.9

Notes:
[1] Includes contract agencies. Source: SCAG 2001 *Regional Transportation Plan*
[2] Residential flow = population x 81 gpcd / 1,000,000 gal/MG
[3] Commercial flow = employees x 24 gped / 1,000,000 gal/MG

Table 4-2
2005 Average Residential and Commercial Wastewater Flow Projections

Tributary Area	Residential Population[1]	Residential Flow[2] (mgd)	Employees Population[1]	Commercial Flow[3] (mgd)
Hyperion Service Area (HSA)				
TWRP Shed	899,598	72.9	390,243	9.4
Valley Spring Lane / Forman Avenue Shed	502,186	40.7	175,294	4.2
LAGWRP Shed	308,613	25.0	195,156	4.7
Tunnel Shed	371,294	30.1	239,315	5.7
Coastal Interceptor Sewer Shed	214,822	17.4	113,521	2.7
Metro Shed	2,034,596	164.8	1,268,471	30.4
Total HSA	4,331,109	350.8	2,382,000	57.2
Terminal Island Service Area (TISA)	147,567	12.0	47,691	1.1
Total (HSA + TISA)	4,478,676	362.8	2,429,691	58.3

Notes:
[1] Includes contract agencies. Source: SCAG 2001 *Regional Transportation Plan Projections*
[2] Residential flow = population x 81 gpcd / 1,000,000 gal/MG
[3] Commercial flow = employees x 24 gped / 1,000,000 gal/MG

Table 4-3
2010 Average Residential and Commercial Wastewater Flow Projections

Tributary Area	Residential Population[1]	Residential Flow[2] (mgd)	Employees Population[1]	Commercial Flow[3] (mgd)
Hyperion Service Area (HSA)				
TWRP Shed	938,655	76.0	405,910	9.7
Valley Spring Lane / Forman Avenue Shed	526,405	42.6	182,744	4.4
LAGWRPShed	316,396	25.6	208,415	5.0
Tunnel Shed	385,233	31.2	247,395	5.9
Coastal Interceptor Sewer Shed	219,283	17.8	119,075	2.9
Metro Shed	2,099,082	170.0	1,311,912	31.5
Total HSA	4,485,054	363.3	2,475,451	59.4
Terminal Island Service Area (TISA)	154,227	12.5	49,728	1.2
Total (HSA + TISA)	4,639,281	375.8	2,525,179	60.6

Notes:
[1] Includes contract agencies. Source: SCAG 2001 *Regional Transportation Plan Projections*
[2] Residential flow = population x 81 gpcd / 1,000,000 gal/MG
[3] Commercial flow = employees x 24 gped / 1,000,000 gal/MG

Table 4-4
2015 Average Residential and Commercial Wastewater Flow Projections

Tributary Area	Residential Population[1]	Residential Flow[2] (mgd)	Employees Population[1]	Commercial Flow[3] (mgd)
Hyperion Service Area (HSA)				
TWRP Shed	980,451	79.4	417,037	10.0
Valley Spring Lane / Forman Avenue Shed	547,805	44.4	186,690	4.5
LAGWRP Shed	324,033	26.2	216,902	5.2
Tunnel Shed	399,202	32.3	253,404	6.1
Coastal Interceptor Sewer Shed	224,090	18.2	121,869	2.9
Metro Shed	2,166,347	175.5	1,342,449	32.2
Total HSA	4,641,928	376.0	2,538,351	60.9
Terminal Island Service Area (TISA)	160,144	13.0	51,092	1.2
Total (HSA + TISA)	4,802,072	389.0	2,589,443	62.1

Notes:
[1] Includes contract agencies. Source: SCAG 2001 *Regional Transportation Plan Projections*
[2] Residential flow = population x 81 gpcd / 1,000,000 gal/MG
[3] Commercial flow = employees x 24 gped / 1,000,000 gal/MG

Table 4-5
2020 Average Residential and Commercial Wastewater Flow Projections

Tributary Area	Residential Population[1]	Residential Flow[2] (mgd)	Employees Population[1]	Commercial Flow[3] (mgd)
Hyperion Service Area (HSA)				
TWRP Shed	1,033,535	83.7	424,465	10.2
Valley Spring Lane / Forman Avenue Shed	575,987	46.7	189,752	4.5
LAGWRP Shed	334,194	27.1	223,862	5.4
Tunnel Shed	419,120	33.9	257,646	6.2
Coastal Interceptor Sewer Shed	231,428	18.7	123,911	3.0
Metro Shed	2,260,219	183.1	1,364,867	32.8
Total HSA	4,854,483	393.2	2,584,503	62.1
Terminal Island Service Area (TISA)	170,504	13.8	51,995	1.2
Total (HSA + TISA)	5,024,987	407.0	2,636,498	63.3

Notes:
[1] Includes contract agencies. Source: SCAG 2001 *Regional Transportation Plan Projections.*
[2] Residential flow = population x 81 gpcd / 1,000,000 gal/MG
[3] Commercial flow = employees x 24 gped / 1,000,000 gal/MG

Table 4-6
2020 Average Residential and Commercial Wastewater Flow Projections

Tributary Area	Residential Flow[1] (mgd)	Percent of Total (HSA + TISA)	Commercial Flow[2] (mgd)	Percent of Total (HSA + TISA)
Hyperion Service Area (HSA)				
TWRP Shed	83.7	21%	10.2	16%
Valley Spring Lane / Forman Avenue Shed	46.7	11%	4.6	7%
LAGWRP Shed	27.1	7%	5.4	8%
Tunnel Shed	33.9	8%	6.2	10%
Coastal Interceptor Sewer Shed	18.7	5%	3.0	5%
Metro Shed	183.1	45%	32.8	52%
Total HSA	393.2	97%	62.0	98%
Terminal Island Service Area (TISA)	13.8	3%	1.2	2%
Total (HSA + TISA)	407.0	100%	63.2	100%

Notes:
[1] Residential flow = population x 81 gpcd / 1,000,000 gal/MG
[2] Commercial flow = employees x 24 gped / 1,000,000 gal/MG

4.2.3 Groundwater Infiltration (GWI)

GWI enters the sanitary sewer system through pipeline and maintenance hole defects located below the ground surface. In some areas, GWI can be a large local component particularly near the coast, but is not a significant portion of the ADWF generated in most areas within the HSA and the TISA. Because GWI can vary cyclically based on extended periods of wet or dry years, an average rate of GWI was included in the ADWF projections.

The average GWI represents the estimated GWI during dry wintertime conditions. Dry weather hydrographs were generated for individual sub-basins using monitored flows of the collection system during a dry period in the winter of January 1983 to April 1983. The portion of hydrographs representing sanitary flows was subtracted from these values. The remaining flow is defined as the average GWI.

To determine average GWI flows, the IRP used different approaches for each of the two service areas. GWI flows for HSA used basin boundaries and GWI rates that were established in the *I/I Reduction Plan* (CH2M HILL, 1992). For HSA, GWI was determined for each of the 213 monitoring basins using flows monitored in the early morning hours between 2:00 and 4:00 a.m. when the residential wastewater flow was minimal. Since *the I/I Reduction Plan* did not include TISA, a different approach for estimating GWI was used for TISA. For TISA, the GWI flow was estimated using actual TITP influent flows monitored during dry weather and subtracting the residential, commercial and industrial flow elements.

For the IRP, the *I/I Reduction Plan* estimated the average GWI for year 2010. The IRP used this average GWI value for 2010 and then scaled it up to 2020 (or back to 2000) by 0.5 percent per year to account for increased aging, growth and deterioration of pipelines. The 0.5 percent per year assumes that the City continues to commit significant resources to continue its collection system maintenance and rehabilitation program.

Table 4-7 summarizes the average GWI contribution in years 2000, 2005, 2010, 2015, and 2020 for the six tributary basins in the HSA and the one tributary basin in the TISA. For further discussion of the historical generation of GWI rates for each drainage basin, see the IPWP *Baseline Needs Technical Memorandum,* April 2000, Section 4.

Table 4-7
Summary of Average Groundwater Infiltration (GWI) Projections

Tributary Area	Average GWI (mgd)				
	2000	2005	2010	2015	2020
Hyperion Service Area (HSA)					
TWRP Shed	3.5	3.6	3.6	3.7	3.8
Valley Spring Lane / Forman Avenue Shed	3.4	3.5	3.6	3.7	3.8
LAGWRP Shed	1.3	1.4	1.4	1.4	1.5
Tunnel Shed	5.2	5.3	5.5	5.6	5.7
Coastal Interceptor Sewer Shed	3.3	3.4	3.4	3.5	3.6
Metro Shed	13.2	13.5	13.8	14.2	14.5
Total HSA	29.9	30.6	31.4	32.2	33.0
Terminal Island Service Area (TISA)	1.5	1.5	1.6	1.6	1.6
Total (HSA + TISA)	31.4	32.1	33.0	33.8	34.6

4.2.4 Industrial Wastewater Flows

Industrial flows were estimated based on current permitted industrial discharges. These industrial flows are major point dischargers from institutional, commercial and industrial establishments with average daily flows of at least 10,000 gpd. The City maintains a list of all industrial dischargers through its permit process.

As of October 2002, approximately 562 of the 5,307 industrial dischargers permitted within HSA, and 26 of the 240 industrial dischargers within TISA, have flows greater than 10,000 gpd. The combined flow of these "high flow" dischargers is approximately 23 mgd in the HSA, which represents about 73 percent of the total flow from all of the active, permitted, industrial dischargers; the remaining 27 percent of industrial contribution are accounted for in the commercial per capita flow rates. Industrial flows are assumed to remain relatively constant in the future, so the IRP will use the current industrial flows for future industrial wastewater projections. It is expected that wet industries are unlikely to move to Southern California due to water limitations. Any increase in the number of local dry industries will be reflected in the commercial flow projections. However, if a significant industrial user of water does arrive, projected industrial flows should be re-evaluated.

Table 4-8 summarizes the industrial flow contributions for the six tributary basins in the HSA and the one tributary basin in the TISA. Figure 4-3 shows the location of the major industrial dischargers considered for the IRP.

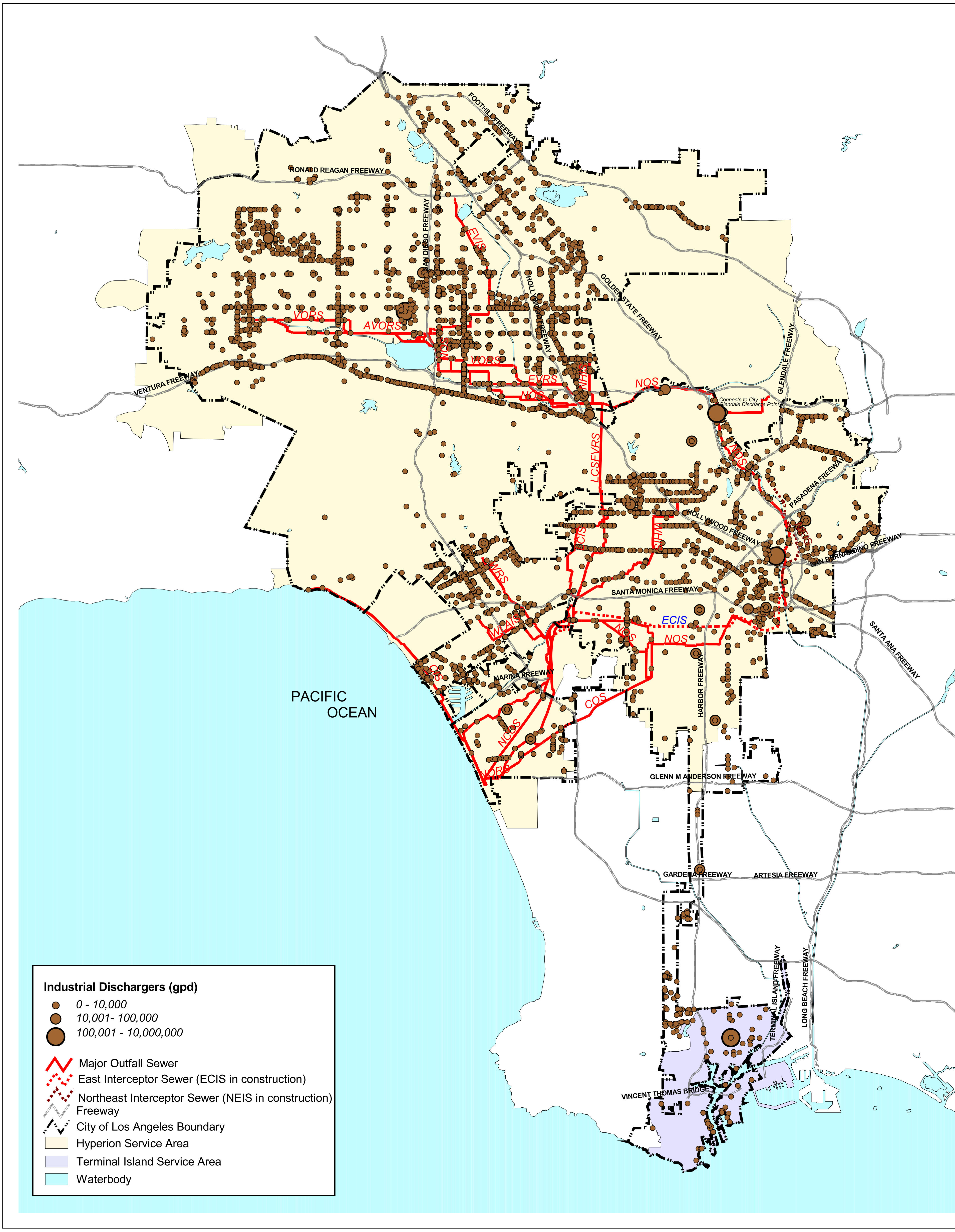


FIGURE 4-3

INTEGRATED RESOURCES PLAN

MAJOR INDUSTRIAL DISCHARGERS

WASTEWATER ENGINEERING SERVICES DIVISION
BUREAU OF SANITATION
DEPARTMENT OF PUBLIC WORKS
CITY OF LOS ANGELES

N

0 1 2 3 4 5 Miles

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Produced by GIS Unit

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Table 4-8
Industrial Wastewater Flow Projections

Tributary Area	Industrial Flow[1] (mgd) 2000 to 2020
Hyperion Service Area (HSA)	
TWRP Shed	6.6
Valley Spring Lane / Forman Avenue Shed	1.1
LAGWRP Shed	0.8
Tunnel Shed	1.9
Coastal Interceptor Sewer Shed	0.2
Metro Shed	12.6
Total HSA	*23.2*
Terminal Island Service Area (TISA)	3.2
Total (HSA+TISA)	26.4

Notes:
[1] From permitted active Significant Industrial Users with flows greater than 10,000 gpd. Excludes 10 MGD discharge from LAG

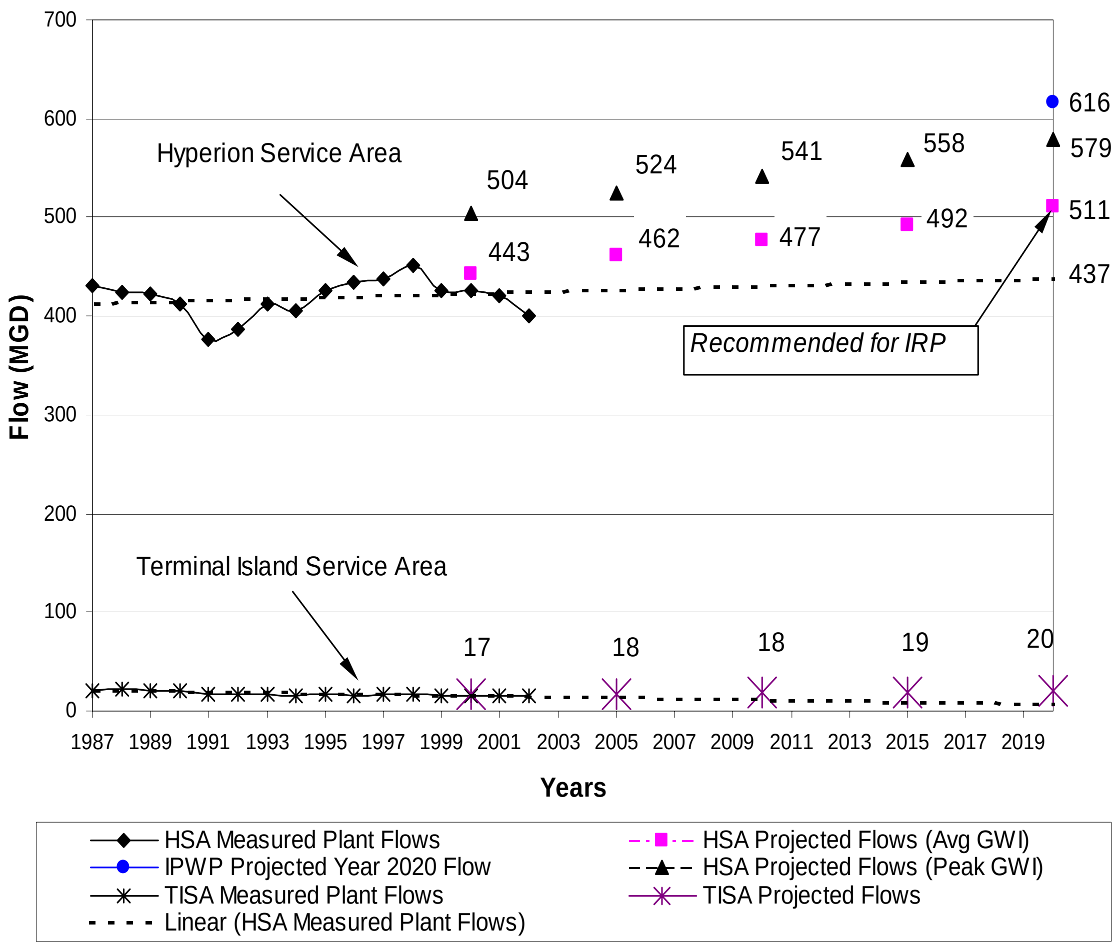
4.2.5 Comparison of Projected Flows to Historical Flows

Historical flow data from the City's wastewater treatment plants were reviewed and evaluated to identify the trend of flow rates over time. Figure 4-4 shows HSA and TISA historical and projected ADWFs.

For the year 2000, HSA shows a theoretical flow of about 443 mgd using the per capita rates of 81 gpcd for residential flows and 24 gped for commercial flows. The 443 includes industrial flow and a GWI flow component in addition to the residential and commercial flows. Comparing this to a measured annual average flow of 426 mgd, there is a four percent difference between the theoretical and annual average flows, which is a reasonable and acceptable error for calibration.

Figure 4-4 shows that ADWF including average GWI flows follows the trend of HSA historical flows. The projected year 2020 ADWF for the HSA is 511 mgd, and that of the TISA is 20 mgd, for a total of 531 mgd projected for both service areas.

ADWFs were also calculated using peak GWI to account for the effects extended periods of wet years. These flows are also indicated in Figure 4-4, and represent an upper range of analysis for planning purposes. A linear projection of historical annual average flows is also shown, and indicates a lower limit for planning.



*Note: Current IRP projected year 2020 flow is lower than IPWP projected year 2020 flow due to use of average GWI instead of peak GWI and reductions in populations from 1998 to 2001 SCAG releases.

Figure 4-4
Historical and Projected Average Dry Weather Flows

4.2.6 Summary of ADWFs

Projected ADWF flows were estimated for years 2000, 2005, 2010, 2015, and 2020 using residential and employment per capita flow rates of 81 and 24 gpd, respectively, average GWI and industrial discharges greater than 10,000 gpd. Tables 4-9 through 4-14 summarize the various ADWF components for these years assuming planned levels of water conservation.

Existing and planned low flow stormwater runoff diversions from the storm drain system to the wastewater system are not included in these flow projections. They are addressed in the *IRP Facilities Plan Volume 3: Runoff Management*..

The certainty of achieving projected flows could vary due to inherent uncertainties of projecting flows for a 20-year planning period, assumed population projections, assumed impacts of planned level of water conservation, and assumed levels of collection system maintenance and rehabilitation. Flow rate changes will be monitored and tracked to assess the differences in projected versus actual flow rates and their impacts on the implementation of planned wastewater facilities.

Table 4-9
Summary of 2000 Average Dry Weather Flow Estimates

Tributary Area	Residential Flows[1,2] (mgd)	Commercial Flows[1,2] (mgd)	Industrial Flows (mgd)	Avg. GWI (mgd)	Total[3] (mgd)	Percent of Total (HSA + TISA)
Hyperion Service Area (HSA)						
TWRP Shed	69.3	9.0	6.6	3.5	88.4	19%
Valley Spring Lane/Forman Avenue Shed	38.9	4.1	1.1	3.4	47.5	10%
LAGWRP Shed	23.8	4.3	0.8	1.3	30.3	7%
Tunnel Shed	29.0	5.5	1.9	5.2	41.6	9%
Coastal Interceptor Sewer Shed	16.7	2.6	0.2	3.3	22.7	5%
Metro Shed	157.5	29.3	12.6	13.2	212.6	46%
Total HSA	335.2	54.8	23.2	29.9	443.1	96%
Terminal Island Service Area (TISA)	11.3	1.1	3.2	1.5	17.1	4%
Total (HSA + TISA)	346.5	55.9	26.4	31.4	460.2	100%

Notes:
1 Residential and commercial flows include water conservation impacts at planned levels of conservation program implementation
2 Population and employment projections source: SCAG-2001
3 Total ADWF does not include low flow diversions

Table 4-10
Summary of 2005 Average Dry Weather Flow Projection

Tributary Area	Residential Flows[1,2] (mgd)	Commercial Flows[1,2,] (mgd)	Industrial Flows (mgd)	Avg. GWI (mgd)	Total[3] (mgd)	Percent of Total (HSA + TISA)
Hyperion Service Area (HSA)						
TWRP Shed	72.9	9.4	6.6	3.5	92.4	19%
Valley Spring Lane / Forman Avenue Shed	40.7	4.2	1.1	3.5	49.5	10%
LAGWRP Shed	25.0	4.7	0.8	1.4	31.9	7%
Tunnel Shed	30.1	5.7	1.9	5.3	43.1	9%
Coastal Interceptor Sewer Shed	17.4	2.7	0.2	3.4	23.6	5%
Metro Shed	164.8	30.4	12.6	13.5	221.3	46%
Total HSA	350.8	57.2	23.2	30.6	461.8	96%
Terminal Island Service Area (TISA)	12.0	1.1	3.2	1.5	17.8	4%
Total (HSA + TISA)	362.8	58.3	26.4	32.1	479.6	100%

Notes:
1 Residential and commercial flows include water conservation impacts at planned levels of conservation program implementation
2 Population and employment projections source: SCAG-2001
3 Total ADWF does not include low flow diversions

Table 4-11
Summary of 2010 Average Dry Weather Flow Projection

Tributary Area	Residential Flows[1,2] (mgd)	Commercial Flows[1,2] (mgd)	Industrial Flows (mgd)	Avg. GWI (mgd)	Total[3] (mgd)	Percent of Total (HSA + TISA)
Hyperion Service Area (HSA)						
TWRP Shed	76.0	9.7	6.6	3.6	96.1	19%
Valley Spring Lane / Forman Avenue Shed	42.6	4.4	1.1	3.6	51.7	10%
LAGWRP Shed	25.6	5.0	0.8	1.4	32.9	7%
Tunnel Shed	31.2	5.9	1.9	5.5	44.5	9%
Coastal Interceptor Sewer Shed	17.8	2.9	0.2	3.4	24.2	5%
Metro Shed	170.0	31.5	12.6	13.8	227.9	46%
Total HSA	363.3	59.4	23.2	31.4	477.3	96%
Terminal Island Service Area (TISA)	12.5	1.2	3.2	1.6	18.4	4%
Total (HSA + TISA)	375.8	60.6	26.4	33.0	495.6	100%

Notes:
1 Residential and commercial flows include water conservation impacts at planned levels of conservation program implementation
2 Population and employment projections source: SCAG-2001
3 Total ADWF does not include low flow diversions

Table 4-12
Summary of 2015 Average Dry Weather Flow Projection

Tributary Area	Residential Flows[1,2] (mgd)	Commercial Flows[1,2] (mgd)	Industrial Flows (mgd)	Avg. GWI (mgd)	Total[3] (mgd)	Percent of Total (HSA + TISA)
Hyperion Service Area (HSA)						
TWRP Shed	79.4	10.0	6.6	3.7	99.8	19%
Valley Spring Lane / Forman Avenue Shed	44.4	4.5	1.1	3.7	53.6	10%
LAGWRP Shed	26.2	5.2	0.8	1.4	33.7	7%
Tunnel Shed	32.3	6.1	1.9	5.6	45.9	9%
Coastal Interceptor Sewer Shed	18.2	2.9	0.2	3.5	24.8	5%
Metro Shed	175.5	32.2	12.6	14.2	234.5	46%
Total HSA	376.0	60.9	23.2	32.2	492.3	96%
Terminal Island Service Area (TISA)	13.0	1.2	3.2	1.6	19.0	4%
Total (HSA + TISA)	389.0	62.1	26.4	33.8	511.3	100%

Notes:
[1] Residential and commercial flows include water conservation impacts at planned levels of conservation program implementation
[2] Population and employment projections source: SCAG-2001
[3] Total ADWF does not include low flow diversions

Table 4-13
Summary of 2020 Average Dry Weather Flow Projection

Tributary Area	Residential Flows[1,2] (mgd)	Commercial Flows[1,2] (mgd)	Industrial Flows (mgd)	Avg. GWI (mgd)	Total[3] (mgd)	Percent of Total (HSA + TISA)
Hyperion Service Area (HSA)						
TWRP Shed	83.7	10.2	6.6	3.8	104.4	20%
Valley Spring Lane / Forman Avenue Shed	46.7	4.5	1.1	3.8	56.1	11%
LAGWRP Shed	27.1	5.4	0.8	1.5	34.8	7%
Tunnel Shed	33.9	6.2	1.9	5.7	47.8	9%
Coastal Interceptor Sewer Shed	18.7	3.0	0.2	3.6	25.5	5%
Metro Shed	183.1	32.8	12.6	14.5	243.0	46%
Total HSA	393.2	62.1	23.2	33.0	511.5	96%
Terminal Island Service Area (TISA)	13.8	1.2	3.2	1.6	19.9	4%
Total (HSA + TISA)	407.0	63.2	26.4	34.6	531.4	100%

Notes:
[1] Residential and commercial flows include water conservation impacts at planned levels of conservation program implementation
[2] Population and employment projections source: SCAG-2001
[3] Total ADWF does not include low flow diversions

Table 4-14
Summary of Average Dry Weather Flow (ADWF) Projections ADWF (mgd)

Tributary Area	2000	2005	Percent of Total Flow Increase in 2005[1]	2010	Percent of Total Flow Increase in 2010[1]	2015	Percent of Total Flow Increase in 2015[1]	2020	Percent of Total Flow Increasein 2020[1]
Hyperion Service Area (HSA)									
TWRP Shed	88.3	92.4	21%	96.1	22%	99.8	23%	104.4	23%
Valley Spring Lane / Forman Avenue Shed	47.5	49.5	10%	51.7	12%	53.7	12%	56.1	12%
LAGWRP Shed	30.3	31.9	8%	32.9	7%	33.7	7%	34.8	6%
Tunnel Shed	41.6	43.1	8%	44.5	8%	45.9	8%	47.8	9%
Coastal Interceptor Sewer Shed	22.7	23.6	5%	24.2	4%	24.8	4%	25.5	4%
Metro Shed	212.6	221.3	45%	227.9	43%	234.5	43%	243.0	43%
Total HSA	443.1	461.8	96%	477.3	96%	492.3	96%	511.5	96%
Terminal Island Service Area (TISA)	17.1	17.8	4%	18.4	4%	19.0	4%	19.9	4%
Total (HSA + TISA)	460.2	479.6	100%	495.7	100%	511.3	100%	531.4	100%

Note:
[1] % increase is from year 2000 of Total (HSA + TISA)
Example calculation: [104.4-88.3)/(531.4-460.2)] x 100 = 23%

4.3 Peak Flow Projections

Peak dry weather flows represent the diurnal flow patterns typically found in a wastewater system. These peak flows correspond to high indoor water usage when people are in their residences, such as early morning and early evening household activities. Flows will peak in the collection system at various times, depending on the travel time from the point of initial flow generation to its terminus at the treatment facilities.

Collection systems are designed to convey peak wet weather flows from a design storm. The 10-year, 24-hour, back-loaded, synthetic, intensity duration frequency (IDF) design storm was selected during development of the City's *Advanced Planning Report (APR)* to simulate wet weather condition for the collection system. It was selected as the City's standard design storm after extensive flow measurements, infiltration and inflow studies and through a series of workshops involving engineering, operations and management staff.

Collection system modeling conducted for the APR indicated that this design storm would be accommodated in most sewer basins by a pipeline system designed for peak dry weather flow at a design depth (d) of one-half of the pipe diameter (D), expressed as d/D = 0.5. This design standard was adopted by the City and implemented through Special Order S006-0691 signed by the City Engineer on June 6, 1991. While this design standard is applied to the design of new facilities, much of the existing collection system was designed with a less conservative depth/diameter (d/D) value of 0.75 or higher.

For the IRP, PDWF will thus be used as a surrogate measurement of the available capacity in the major interceptor system for conveyance of PWWFs.

4.3.1 Peak Flow Estimation Using MOUSE

Since peak flows are dynamic function of flow routing, they are estimated and projected using a hydraulic model. The City utilizes Model of Urban Sewer System (MOUSE), a state-of-the-art predictive hydraulic and dynamic flow routing model, for planning and identifying problem areas resulting from current and future flows. The MOUSE model is designed to simulate unsteady flow in pipe networks. The MOUSE model is developed and supported by the Danish Hydraulic Institute (DHI). MOUSE is used as the standard modeling tool for major outfall planning and operational studies for the City. The MOUSE model has been developed for both dry weather and wet weather conditions. The model complements the City's flow monitoring to identify system capacity needs and performance with system modifications.

The MOUSE model includes the City's major interceptor and outfall system, as well as other key components of the primary collection system. Flow is routed through the system based on input in the form of sub-basin hydrographs.

Figure 4-5 represents the outfall network configuration and approximately 350 basin feeding into the MOUSE model network. The model only represents Hyperion Service Area. The Terminal Island Service Area is not modeled using MOUSE. The modeled network extends beyond the major interceptors at various locations primarily to extend to the service areas at larger distance from major outfalls and to increase the accuracy of modeling results. The IRP study is focused on the major interceptors and outfalls, treatment plants and some of the significant diversion structures.

4.3.2 Dry Weather Base Model

As described in Section 4.2.1, dry weather wastewater flow contains four components: residential flow, commercial flow, industrial discharges, and groundwater infiltration. These four flow components are estimated using SFEM for each of the 350 sub-sewersheds in MOUSE. The residential flow is estimated using 81 gpcd and commercial flow is estimated using 24 gped. The industrial flow is estimated based on industries with permitted flow greater then 10,000 gpd. Average rates of GWI are used in the base model setup. The estimated dry weather flow for each sub-sewershed is input to the model. The input flows are applied as diurnal curves representing flow generation patterns relative to time of the day. Approximately twenty-three different diurnal curves are applied to generate the 350 sub-sewershed flow hydrographs in MOUSE.

The MOUSE model has been calibrated for the existing system configuration under dry weather conditions. This calibration is documented in Appendix D (Computer Modeling for the City of Los Angeles Outfall Sewer System), which describes the model configuration, calibration process and results.

PDWFs are developed in MOUSE through the application of diurnal curves at each catchment. PDWFs for each sewer are determined based on the routed, cumulative effect of flows generated according to these hydrographs.

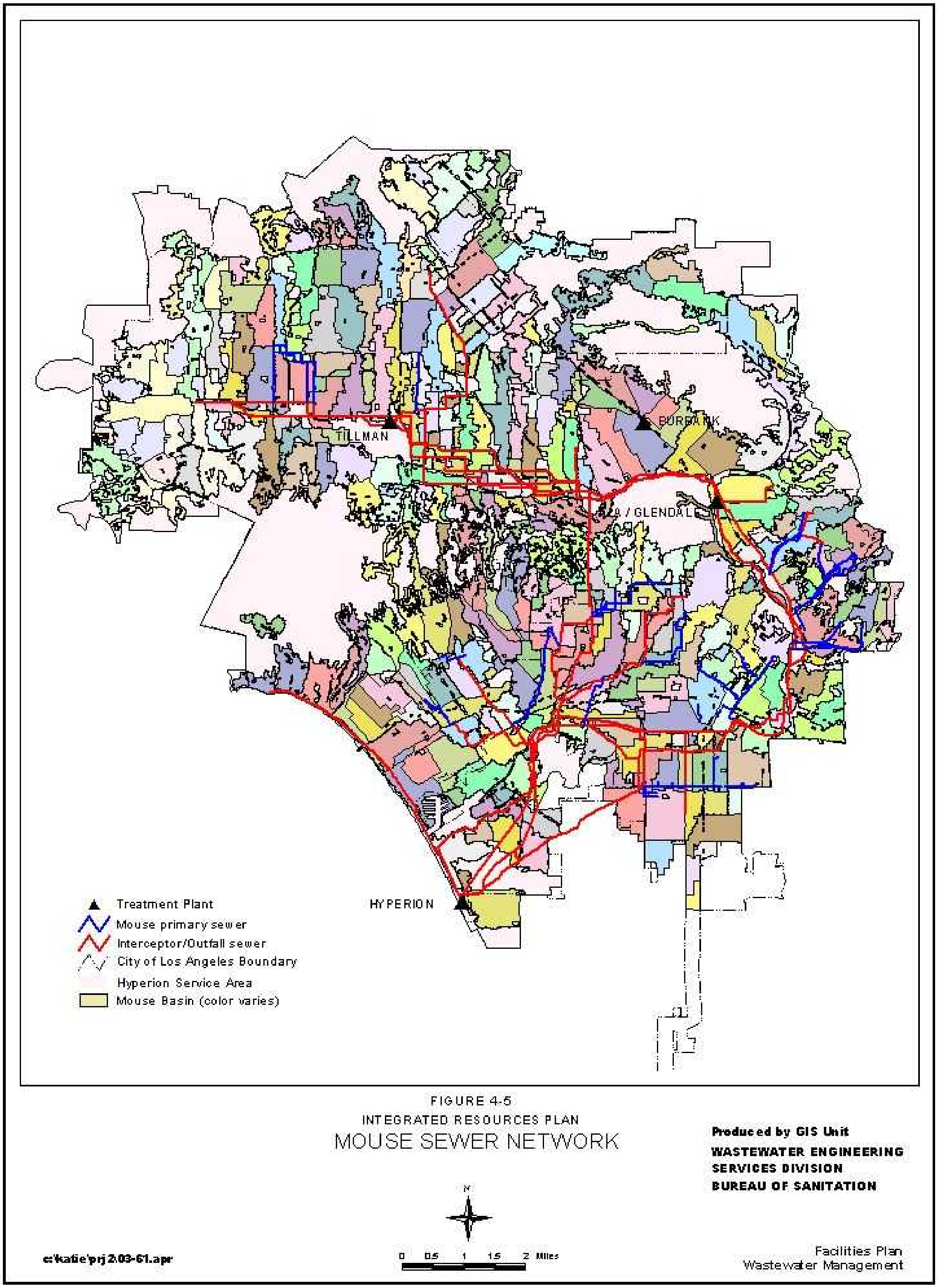


Figure 4-5
MOUSE Model Sewer Network

4.3.3 Wet Weather Base Model

The wet weather flow base model is built upon calibrated dry weather model. The wet weather model used for the IRP study is built using the 10-year design storm hydrographs distributed over the entire service area. These input hydrographs were originally generated during the City's *I/I Reduction Plan* study.

PWWFs are the sum of the PDWFs and the RDI/I which occurs during storm events. Future PWWFs were estimated by using the 10-year, 24-hour design storm and an estimate of the magnitude of RDI/I into the system. For the IRP, PDWF was used to calculate PWWF as shown below:

PWWF= PDWF + RDI/I

where:

RDI/I = Amount of rainfall that enters the collection system, which includes two components: SWI and RDI

SWI = Portion of rainfall that enters the sewer system through direct sources, such as maintenance hole covers, catch basins, downspouts, and area drains

RDI = The rainfall that percolates into the subsurface and enters the collection system through joints, defects, house connections, and other infrastructure defects

During the I/I study, flow monitors recorded continuous flow data, including peak flows, during storm events in each of 213 sewer system drainage sub-basins. The design hydrographs were developed for each of the sub-basins based on flow measurements during storm events and statistical analyses. These hydrographs were compared to actual flow measurements and adjusted for each of the sub-basins. A hydraulic System Analysis Model (SAM) was used to route flow through the interceptor and outfall system using the sub-basin hydrographs for input. Modeled flows were compared to measured flows at specific locations in the interceptor and outfall system and the model further calibrated.

To calculate the design rain-dependent infiltration and inflow (RDI/I) flow that could be expected during the 10-year design storm, a series of computer programs was used to duplicate the hydrograph shape with synthetic characteristics. These characteristics were then used to generate RDI/I hydrographs for the 10-year, 24-hour, design storm event. This methodology is based on the Unit Hydrograph Theory developed for storm water runoff calculations. Additional discussion of this process of wet weather flow modeling can be found in the *IPWP Baseline Needs Technical Memorandum, Section 5*.

PWWFs were developed in MOUSE by adding RDI/I flow hydrographs for the design storm to the dry weather flow hydrographs.

4.3.4 Peak Dry Weather Flow Projections

Modeling of future, year 2020, PDWFs was conducted for a baseline system configuration. This baseline configuration consists of the major interceptor and outfall system network representing current system conditions, and includes projects that will be constructed and operational in the near future. Additionally, flow routing is adjusted for enhanced use of the current infrastructure.

The following are the planned projects and system flow routing adjustments that are considered to be on-line by 2020 for the evaluation of the collection system. These project descriptions are excerpted from the City's current CIP.

1. East Central Interceptor Sewer (ECIS) constructed

The ECIS project is 11 miles long beginning at the northerly terminus of the North Outfall Relief Sewer (NORS) to the vicinity of Whittier Boulevard and Mission Road. ECIS will provide much needed relief for the 76-year old North Outfall Sewer (NOS). Construction is expected to be completed by August 2004.

2. North East Interceptor Sewer (NEIS) constructed

The NEIS project is an approximately 9.5-mile long interceptor sewer extending from the intersection of San Fernando Road and Eagle Rock Boulevard to the intersection of Mission Road and Jesse street. NEIS will relieve the deteriorating NOS and convey the sewage to the ECIS. This sewer will provide an outlet for the future Eagle Rock Interceptor Sewer. Construction is expected to be completed by November 2004.

3. Lower North Outfall Sewer (NOS) rehabilitated

The following are rehabilitation projects to restore the full carrying capacity and structural integrity of NOS:

- Rehabilitation by lining the existing sewer between HTP to the intersection of Riggs Place and Kenwood Court (outlet location of the lower NOS siphon).
- Construction of the NOS-Ziolta Grouting project and maintenance hole rehabilitation/construction . Predesign for this project has just begun.
- Rehabilitation of the 10½ feet of semi-elliptical sewer for a total length of approximately 22,000 linear feet of the NOS upstream of the siphon outlet to Diversion No. 1.
- Rehabilitation of the Centinela Siphon. The siphon outlet and inlet structures will be rehabilitated under a separate project.

4. North Outfall Sewer (NOS)-North Central Outfall Sewer (NCOS) diversion constructed to divert flow from South Los Angeles to the Central Outfall Sewer (COS)

This project will modify the existing diversion structure at Slauson and Van Ness to allow diversion of excess NOS flows into the COS, thereby eliminating the post-ECIS chances of overflow in the Maze[1] area.

5. Flow diverted from West Los Angeles to the lower NOS

This flow optimization process diverts a maximum flow of 130 cfs to take advantage of capacity available in the lower NOS after it is rehabilitated (see item number 3 above). This diversion will provide some relief to the NORS line.

In addition, the 2020 dry weather base scenario assumes the following:

- SCAG projected residential/employment population for year 2020 (2001 SCAG release based on 1990 census data).
- Per capita flow generation rates: 81 gpcd (residential) and 24 gped (employment).
- LAG and TWRP capacities with denitrification
  - TWRP: 64 mgd (20 percent derated based on pilot testing results)
  - LAGWRP: 5 mgd (25 percent derated based on pilot testing results)
- 100 percent of the flow at the VSL/FA Diversion Structure diverted through La Cienega/San Fernando Valley Relief Sewer (Tunnel)
- Eagle Rock/Highland Park Sewer flows intercepted by NEIS

Figure 4-6 presents collection system conditions for the year 2020 dry weather model for the baseline configuration scenario described above. The sewers are color-coded based on their d/D conditions.

[1] The "Maze" area is bounded by Rodeo Road in the north (North Branch of the NOS), Van Ness Avenue in the east (COS), and Martin Luther King Jr. Blvd. (West Branch and South Branch of the NOS).

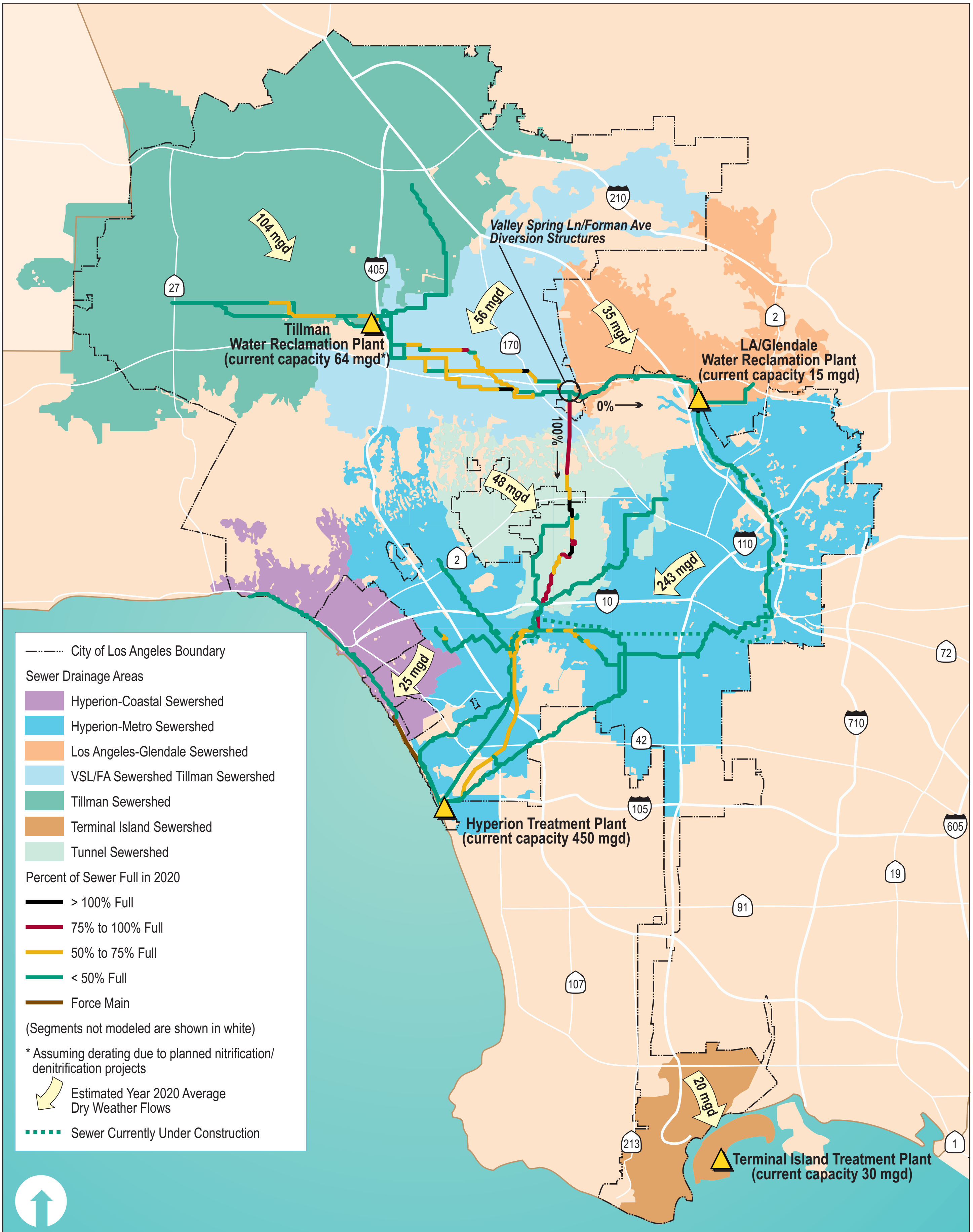


Figure 4-6
Wastewater System Flows and Capacity Gaps in Year 2020

This IRP study defines a collection system need if the sewer is flowing greater than half-full at PDWF. The following sewers were observed to be flowing greater than half-full in year 2020:

- Outfall upstream of TWRP
- Interceptors between the TWRP and VSL/FA diversion structure
- Tunnel interceptor
- North Outfall Relief Sewer (NORS)
- South branch of the NOS in the Maze area

These sewers are candidates for relief. A check of their ability to convey wet weather flow is then conducted to confirm that such system relief is required. Flow conditions during interim years will be evaluated during the IRP alternatives analysis process to determine project phasing requirements.

4.3.5 Peak Wet Weather Flow Projections (PWWF)

Since the true measure of sewer capacity is based on its ability to convey PWWF from the design storm, the collection system needs identified above from the dry weather model results were then checked against a wet weather model run scenario under the same baseline system configuration and operations.

The critical planning parameter for collection system design is to convey flows from the design storm without overflows. Figure 4-7 indicates the results from the wet weather model of the baseline configuration.

The following sewers were observed to show overflow conditions from year 2020 projected wet weather flows:

- Inceptors between the TWRP and VSL/FA diversion structure
- Tunnel interceptor
- South branch of the NOS in the Maze are

Options for addressing collection system needs will be described in Section 6.

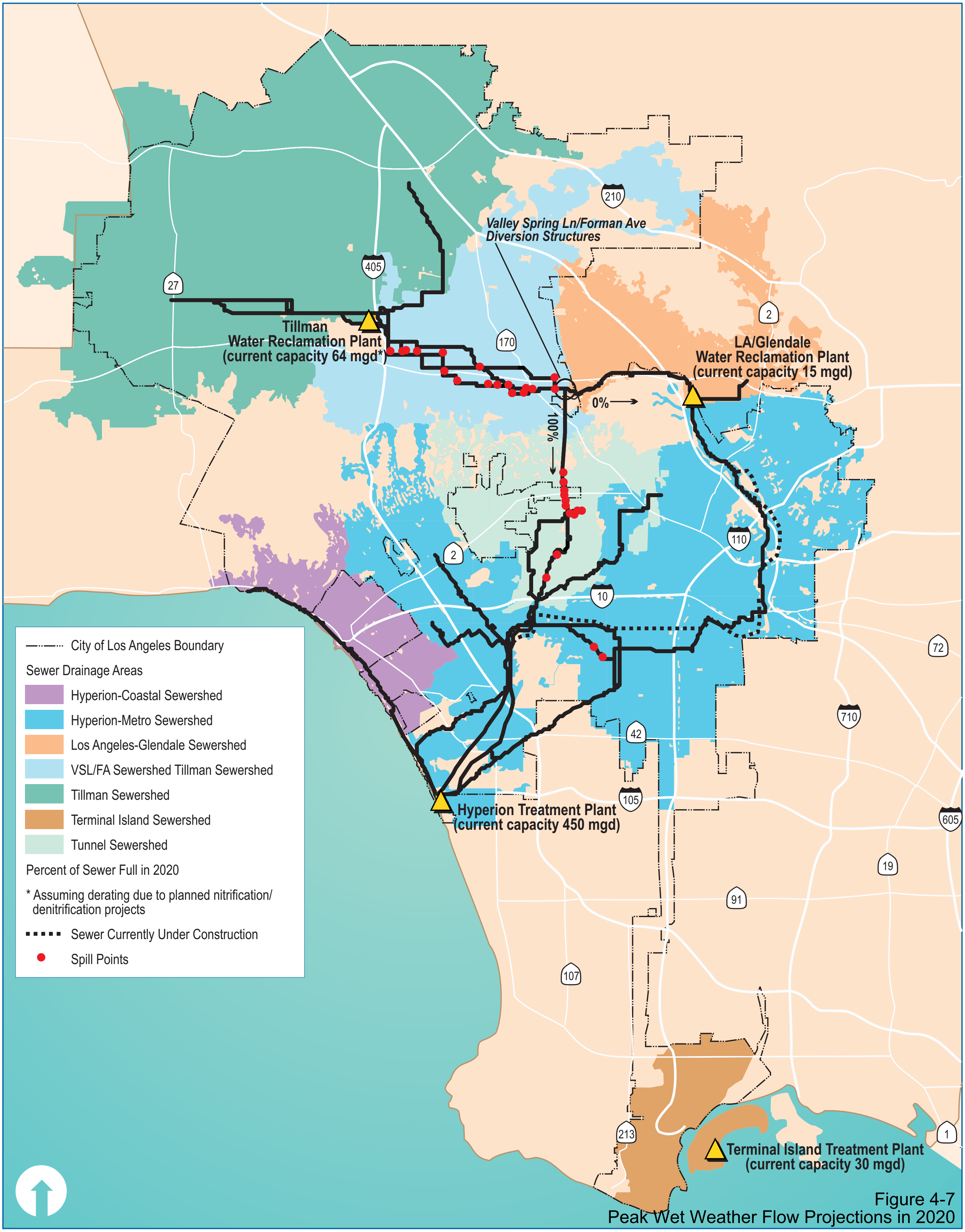


Figure 4-7
Peak Wet Weather Flow Projections in 2020

4.4 Wastewater Loading

In order to help develop and evaluate the future treatment options at each of the treatment facilities, projections of wastewater constituent loadings for the HSA, Tillman Service Area (TSA) and Los Angeles Glendale Service Area (LAGSA) were developed. The specific constituents are total suspended soldids.

Total suspended solids (TSS), biochemical oxygen demand (BOD), and total nitrogen (Total N).

There were two parts to this analysis: Historical data trending and future constituent projections. The historical data trending involved the analysis of historical data to determine the historical average values. These values were then used to project the future constituent values.

Note that these projections were completed prior to the assumption that the City may discharge the waste stream from the advanced treatment at the upstream plants back to the collection system. This does change the projected average concentrations into HTP. A technical memorandum was prepared to investigate this assumption. The memorandum is located in Appendix E.

4.4.1 Background

For the first phase of the IRP (i.e., the IPWP), the team compared the average influent concentrations at each facility to the design concentrations of each facility. The IPWP TAC and MAC supported using the more conservative of these values for planning. Table 4-15 summarizes the IPWP values.

Table 4-15
Wastewater Loading Results from the First Phase of the Integrated Resources Plan

Facility / Service Area	Biochemical Oxygen Demand (BOD, mg/l)	Total Suspended Solids (TSS, mg/l))
Tillman WRP	280	300
Los Angeles-Glendale WRP	330	390
Hyperion Service Area	320	310
Hyperion Treatment Plant	350	365

4.4.2 Data Update

For this more-detailed phase of planning, the team gathered data from the following sources:

- WISARD Downloads (influent concentration and flow)
- IPWP Data (influent concentrations and flows)
- Return Sludge Estimates provided by the City

A period of 10 years of influent data (both flow and constituent concentrations) was collected for the HTP, TWRP, and LGWRP. The duration of 10 years was used for the analysis of TWRP and HTP (1992 to 2002). However, for LAGWRP, the current operating condition is that flows from the TWRP and VSL/FA Sheds are send directly to HTP, bypassing LAGWRP. Since this diversion setting was started in 1997, only the data from 1998 to 2002 was used for the LAGSA analysis.

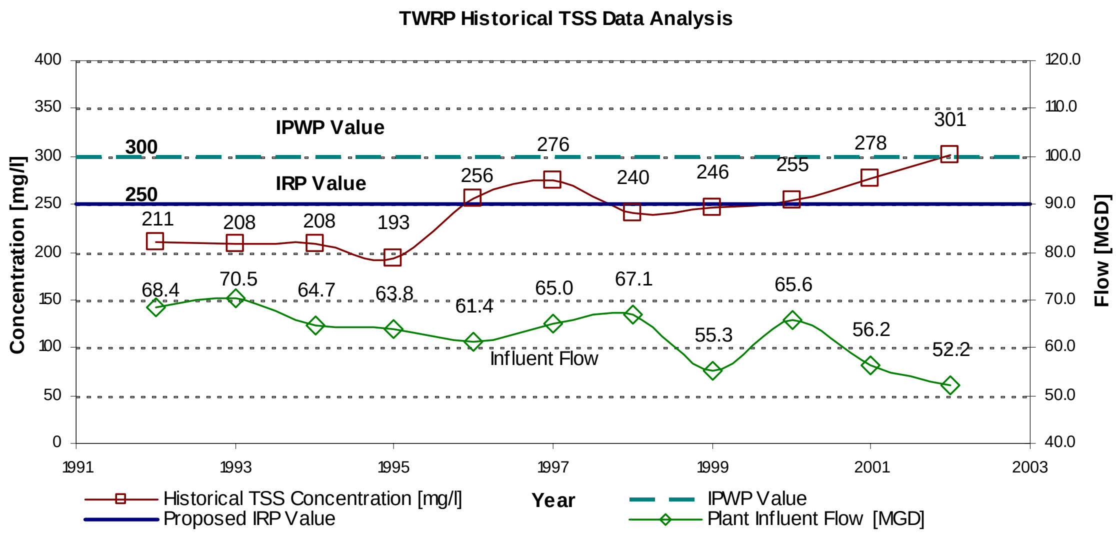
4.4.3 Historical Data Trending

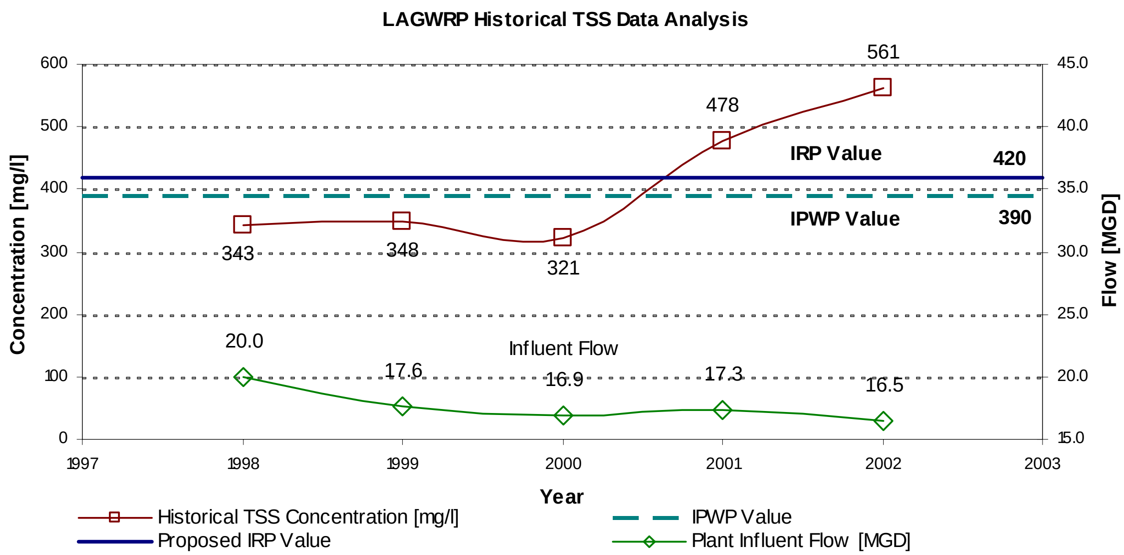
The first step in loading projections was to determine the historical average concentrations of each constituent. The method chosen for this analysis was based on the historical influent and return sludge concentrations and flows at each facility. The average of the historical TSS, BOD and Total N influent and return sludge concentrations were determined for HTP, TWRP and LAGWRP (see Figures 4-8 through 4-10). These values were then rounded up to the nearest 10 mg/l (or next 10mg/l in some cases) for TSS and BOD, and nearest 1 mg/l for Total N. For HSA, these "rounded average" values were used to calculate, through the mass balance descried above, the corresponding TSS, BOD and Total N concentrations (see Figures 4-11)./ The rounded average results as well as the historic averages can be seen in Table 4-16.

In this analysis there is an important distinction between the plant influent and the service area influent. The reason for this is that the upstream plants do not treat the entire flow from their respective sewer sheds. However, for the historical trending, the influent concentrations and flows from each plant were needed, as they present the only source of available data. For the projections (see Section 4.5.4 below), the flows/loadings are based on the entire service areas.

To determine the values for the entire HSA, a two step mass balance was used to calculate the associated concentrations (see Figure 4-11). The steps are as follows:

- For each plant, the influent concentrations were multiplied by the influent flows to determine the mass loadings.
- The flows/mass loadings from each plant were added and the return sludge flows/loads subtracted.





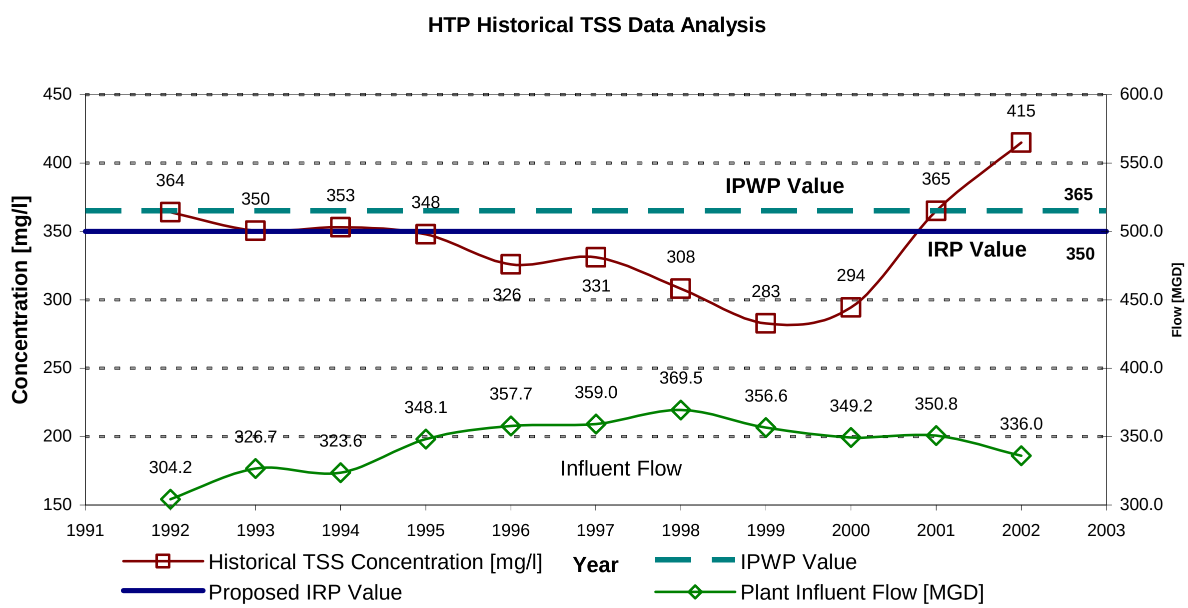
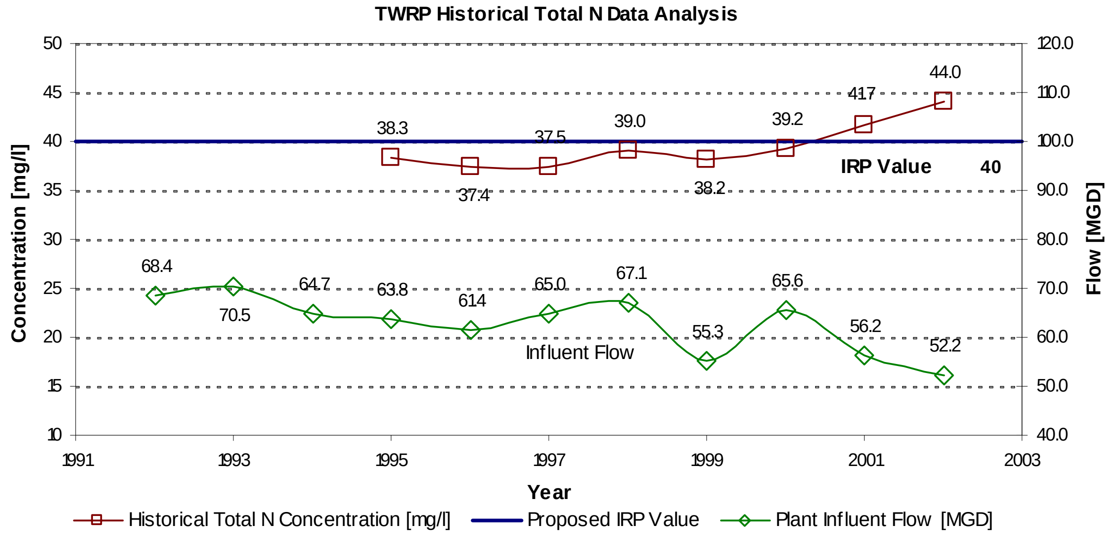
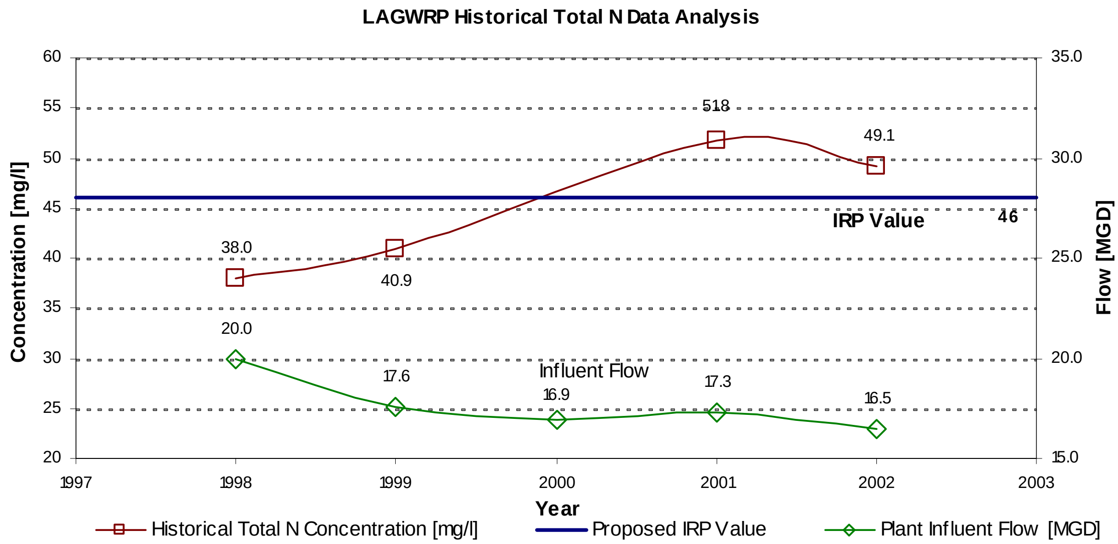


Figure 4-8
Historical TSS Data for Treatment Facilities





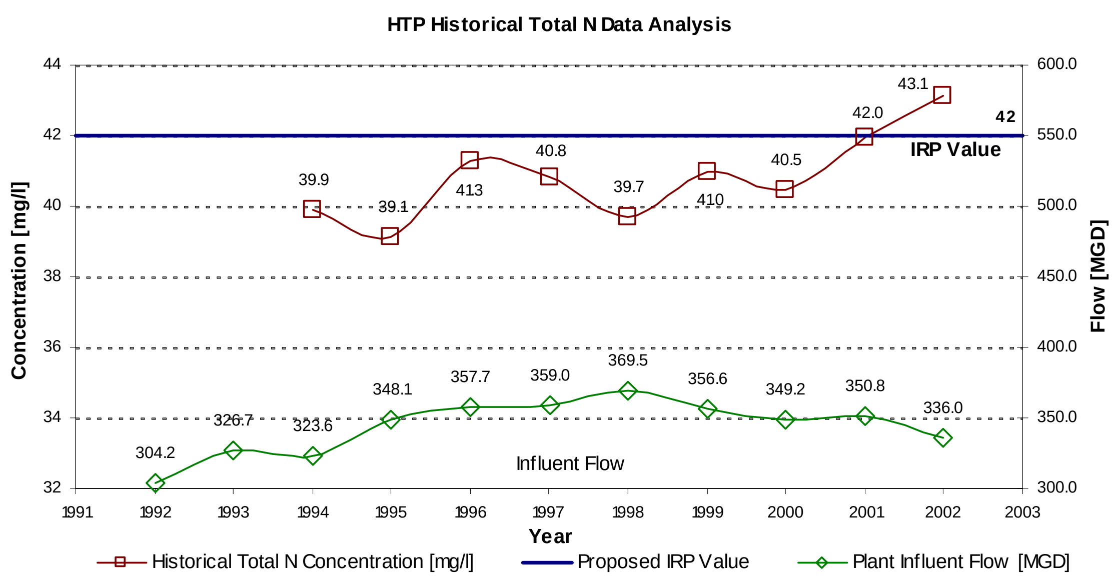
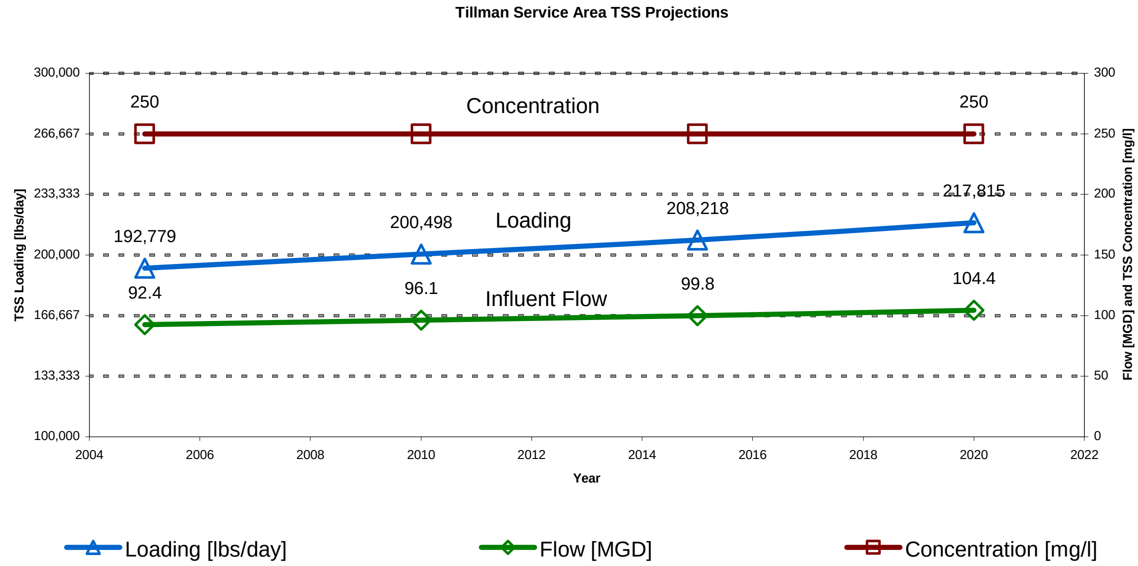
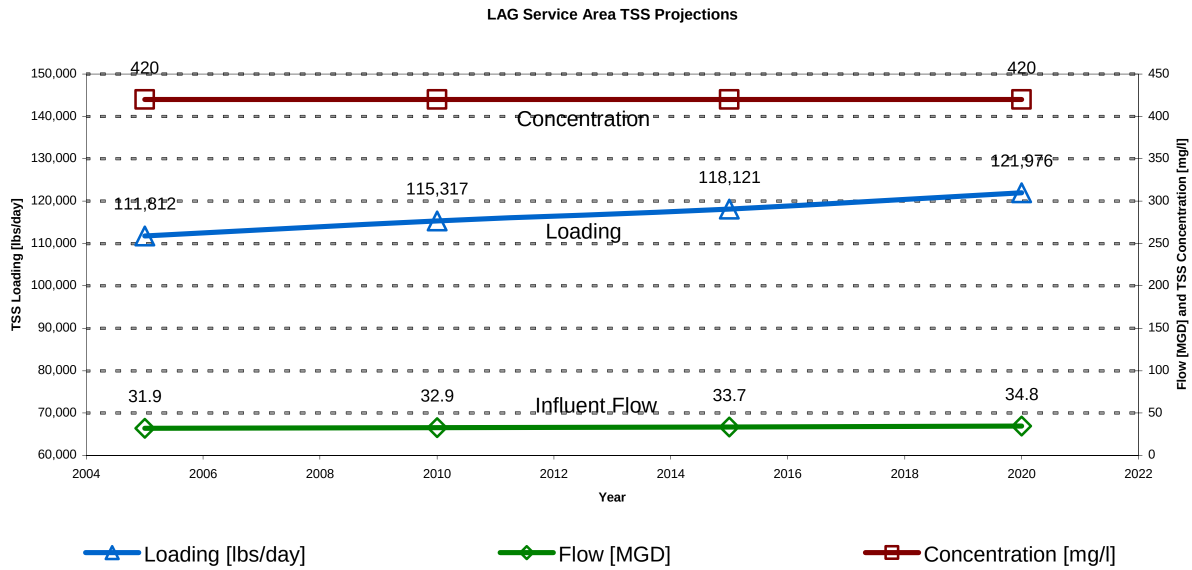


Figure 4-9
Historical BOD Data for Treatment Facilities





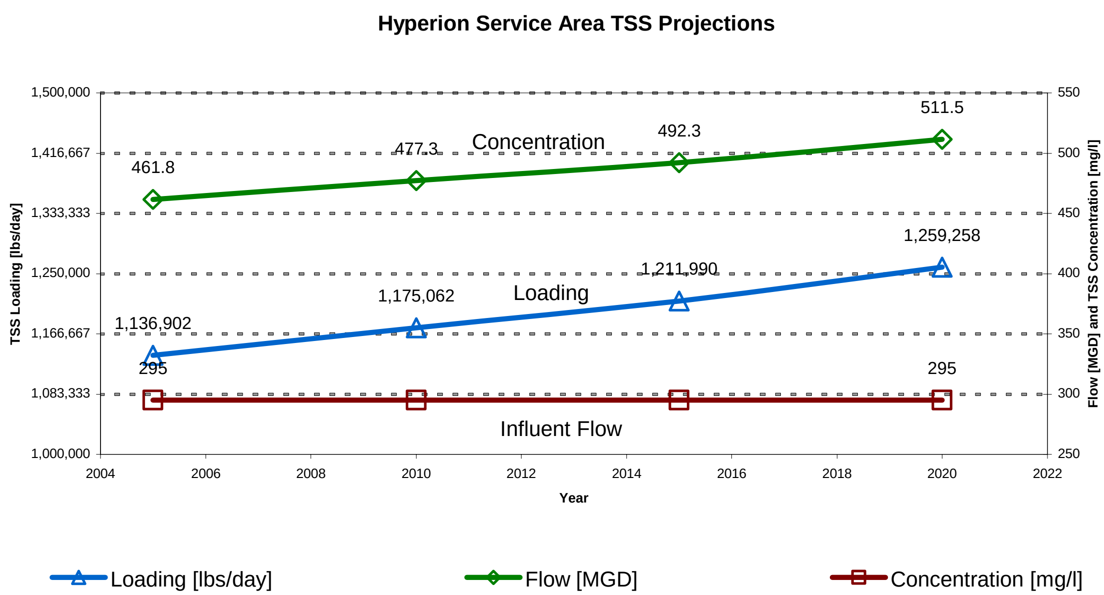
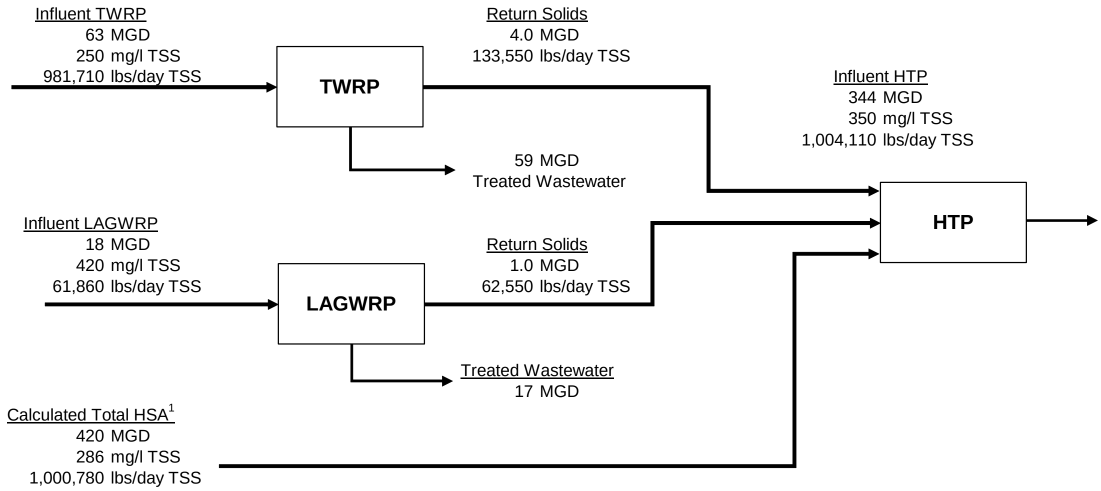


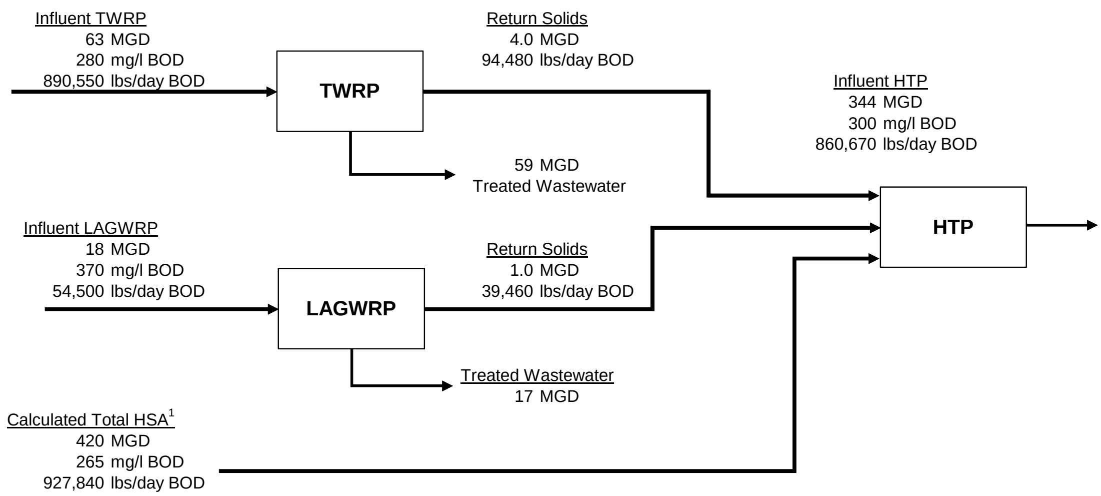
Figure 4-10
Historical Total Nitrogen Data for Treatment Facilities

Mass Balance for TSS



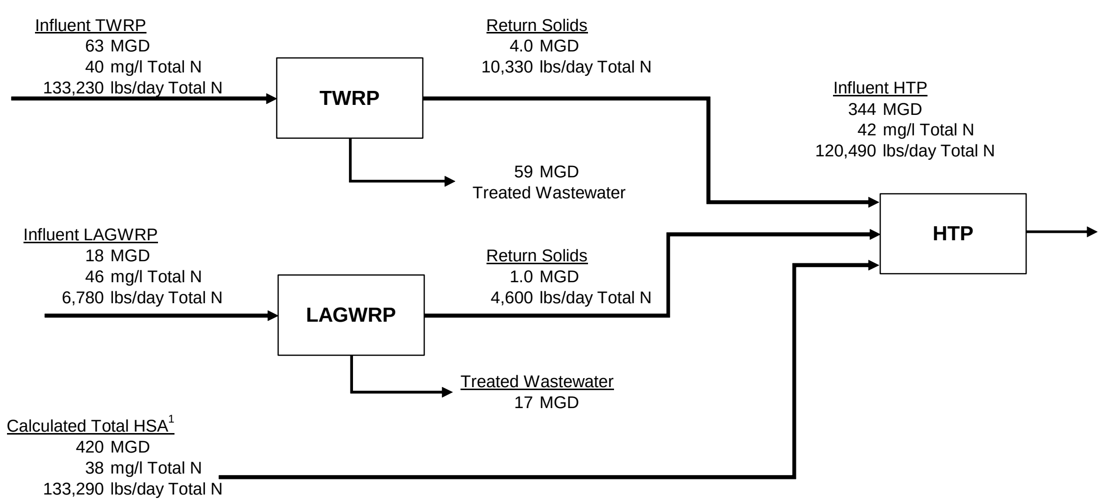
1 - This calculation is from the formula: $HSA_{Total} = HTP_{Influent} + DCTWRP_{Influent} - DCTWRP_{Sludge} + LAGWRP_{Influent} - LAGWRP_{Sludge}$

Mass Balance for BOD



1 - This calculation is from the formula: $HSA_{Total} = HTP_{Influent} + DCTWRP_{Influent} - DCTWRP_{Sludge} + LAGWRP_{Influent} - LAGWRP_{Sludge}$

Mass Balance for Total N



1 - This calculation is from the formula: $HSA_{Total} = HTP_{Influent} + DCTWRP_{Influent} - DCTWRP_{Sludge} + LAGWRP_{Influent} - LAGWRP_{Sludge}$

Figure 4-11
Historical Mass Balance for Hyperion Service Area

Table 4-16
Rounded Historical Wastewater Characteristics

Description		TSS [mg/l]	BOD [mg/l]	Total N [mg/l]	Flow [mgd]
Historical Data Analysis Results					
HTP	Historical Average	343	288	41	344
	Rounded Average	**350**	**300**	**42**	
TWRP	Historical Average	243	274	39	63
	Rounded Average	**250**	**280**	**40**	
TWRP Return Sludge	Historical Average	4,004	2,833	317	4.0 (6.6% of influent)
	Rounded Average	**4,010**	**2,840**	**320**	**6.6% of influent**
LAG[1]	Historical Average	410	361	45	18
	Rounded Average	**420**	**370**	**46**	
LAG Return Sludge	Historical Average	7,336	4,628	511	1.0 (5.8% of influent)
	Rounded Average	**7,340**	**4,630**	**520**	**5.8% of influent**
HSA[2]	Historical Average	278	254	38	420
	Calculated Rounded Average	**286**	**265**	**38**	**419**

Notes:
Based on only 5 years of data.
All values for HSA are calculated based on a mass balance of the solids into the plants subtracting out the return sludge. See the attached mass balance diagrams.
The Historical Average is the average of the yearly mass balance. The Rounded Average is the result of the mass balance for the rounded average values for HTP, TWRP and LAGWRP.

4.4.4 Loading Projection Results

The second step was to use the projected concentrations and the projected flows (see Section 4.2) to determine the mass loading at each facility. The projected total HSA loading along with the projected TSA and LAGSA concentrations (see Figures 4-12 through Figure 4-14) were then used to calculate the influent characteristics at HTP.

The existing capacities for TWRP and LAGWRP and the rounded average results were used as an example to determine the subsequent influent characteristics at HTP (see Figure 4-15). This configuration is actually a baseline for other alternatives to build on as the planning effort continues. The resulting values, along with the values used in the IPWP are listed in the Tables 4-17.

Table 4-17
Rounded Projected Wastewater Characteristics

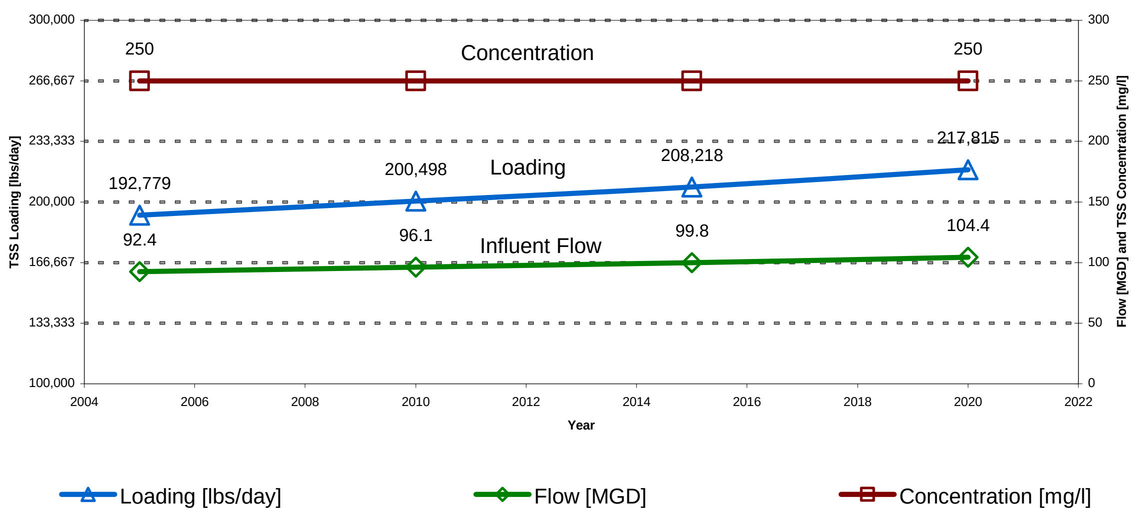
Description		TSS [mg/l]	BOD [mg/l]	Total N [mg/l]	Flow [mgd]
Projected Year 2020					
HSA	**Rounded Average**	**286**	**265**	**38**	**509**
	IPWP Value	310	320		
TSA	**Rounded Average**	**250**	**280**	**40**	**64**[3]
	IPWP Value	300	280		
LAGSA	**Rounded Average**	**420**	**370**	**46**	**15**[3]
	IPWP Value	390	330		
HTP[1]	**Calculated Rounded Average**	**337**	**293**	**41**	**435**
	IPWP Value	365	350		

Note:
[1]These are calculated values based on the current planning capacities (after nitrification/denitrification expansion) at TWRP and LAGWRP as an example only. This value will vary depending on future flows to LAGWRP and TWRP as determined as part of this planning effort.

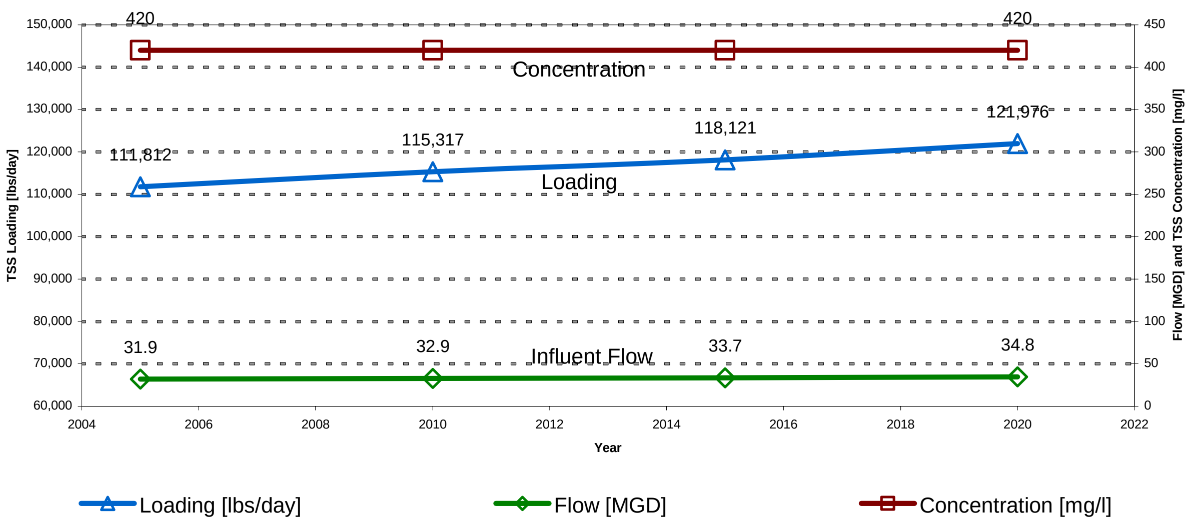
4.4.5 Effects of Water Conservation

One issue that will be part of future discussions is increased water conservation. As the flows within the service are are decreased, the concentration of constituents will increase. In terms of loadings, this decrease in flow is not expected to significantly affect the total mass loading for the services area. Therefore, for all alternatives that include this option, the projected mass loading will be held constant for the service area. The decreased flows will then be used to calculate a new concentration value to be used in the mass balance for the treatment facilities as described above.

Tillman Service Area TSS Projections



LAG Service Area TSS Projections



Hyperion Service Area TSS Projections

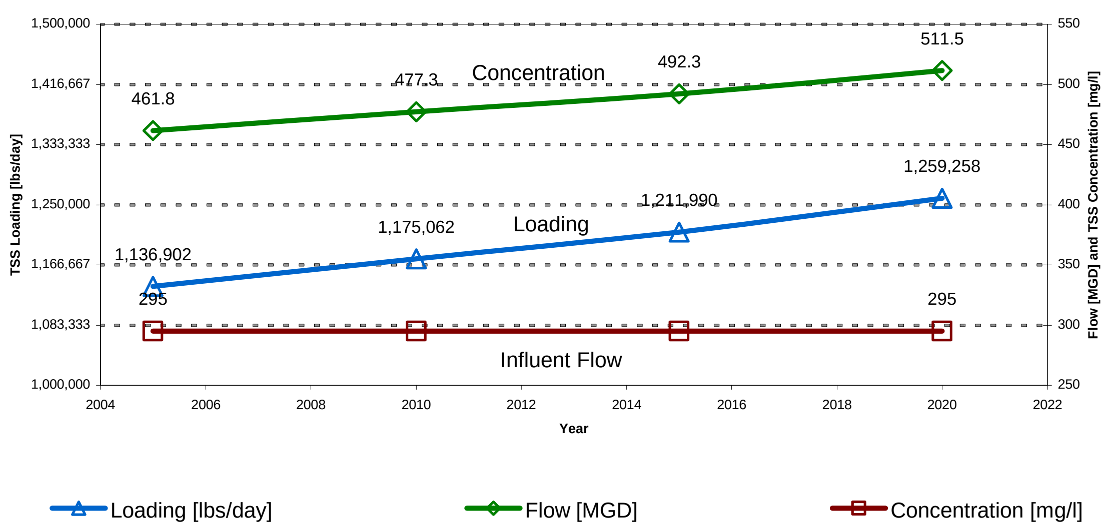
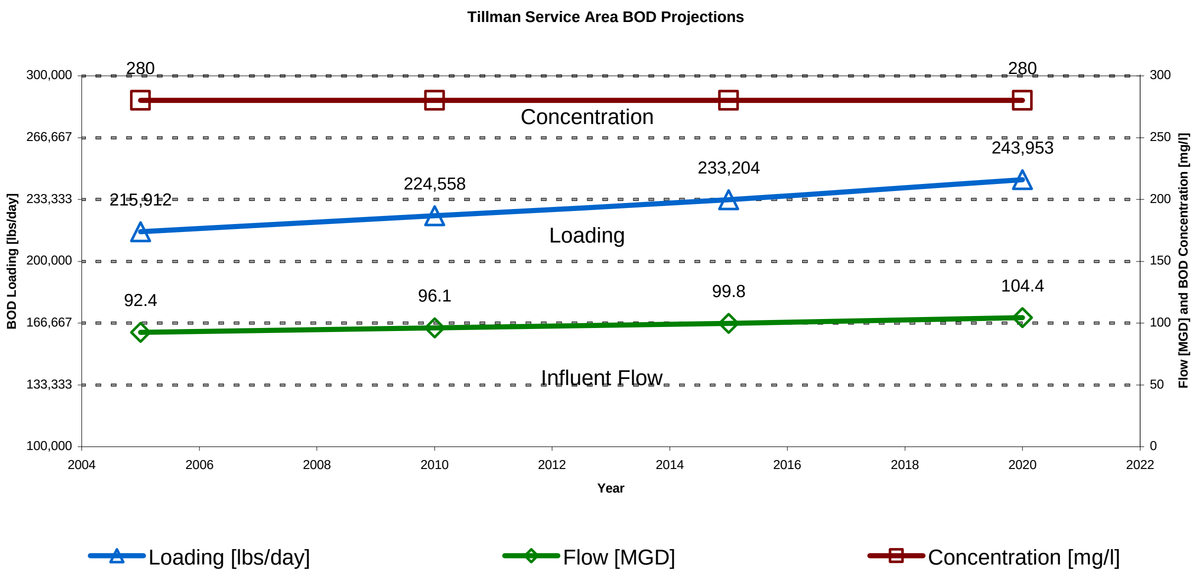
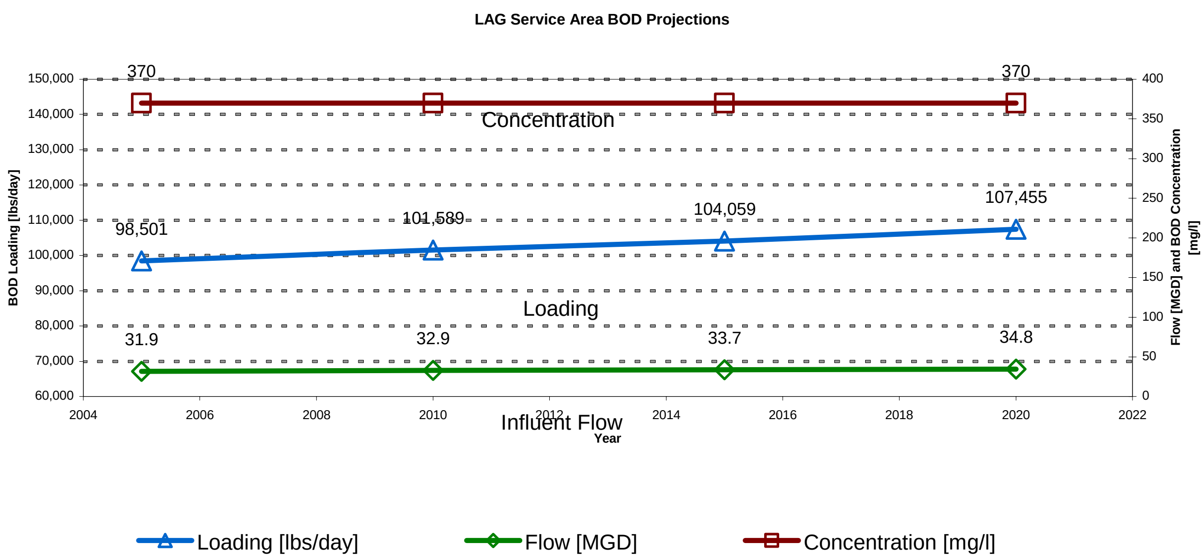


Figure 4-12
Projected TSS Data for Service Areas





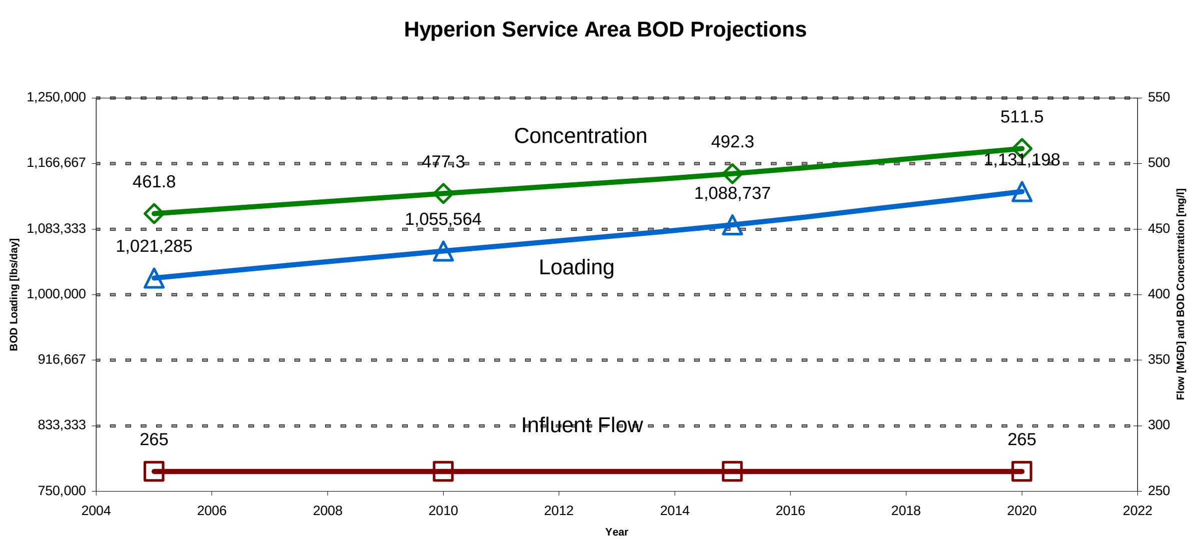
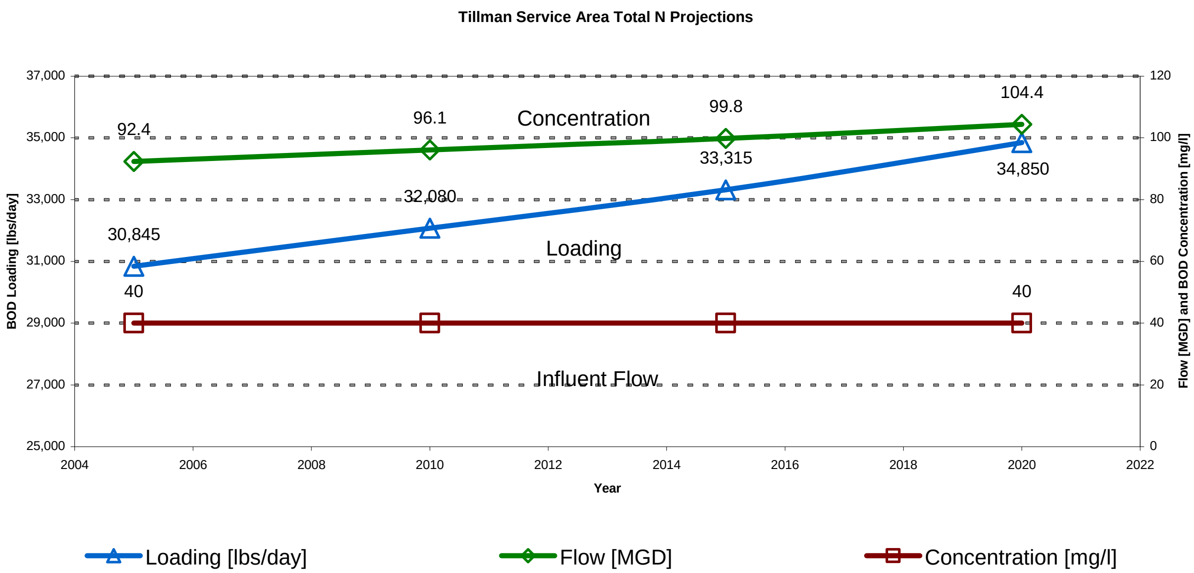
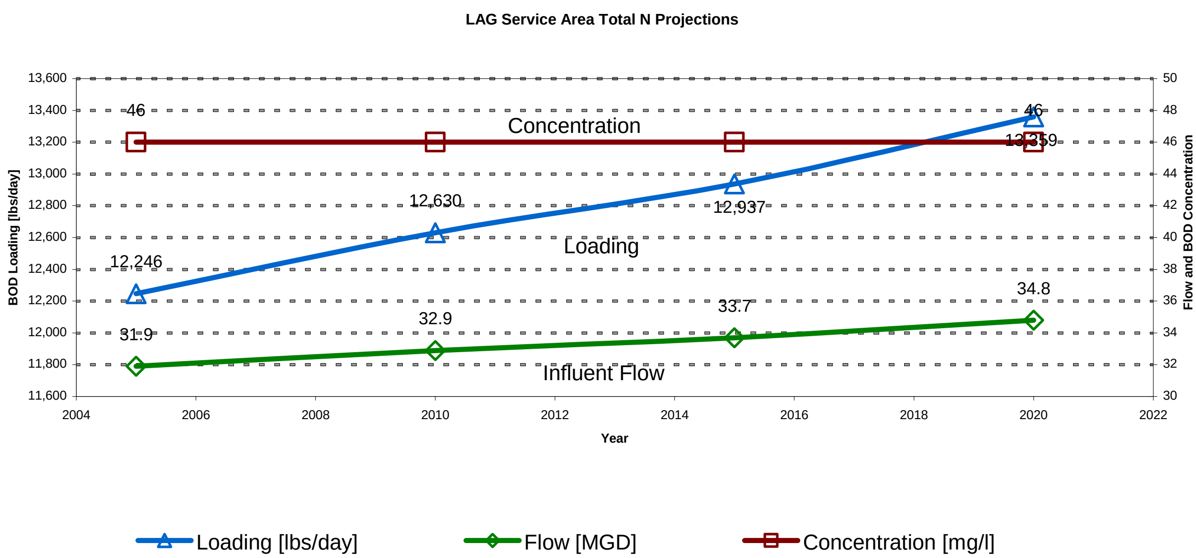


Figure 4-13
Projected BOD Data for Service Areas





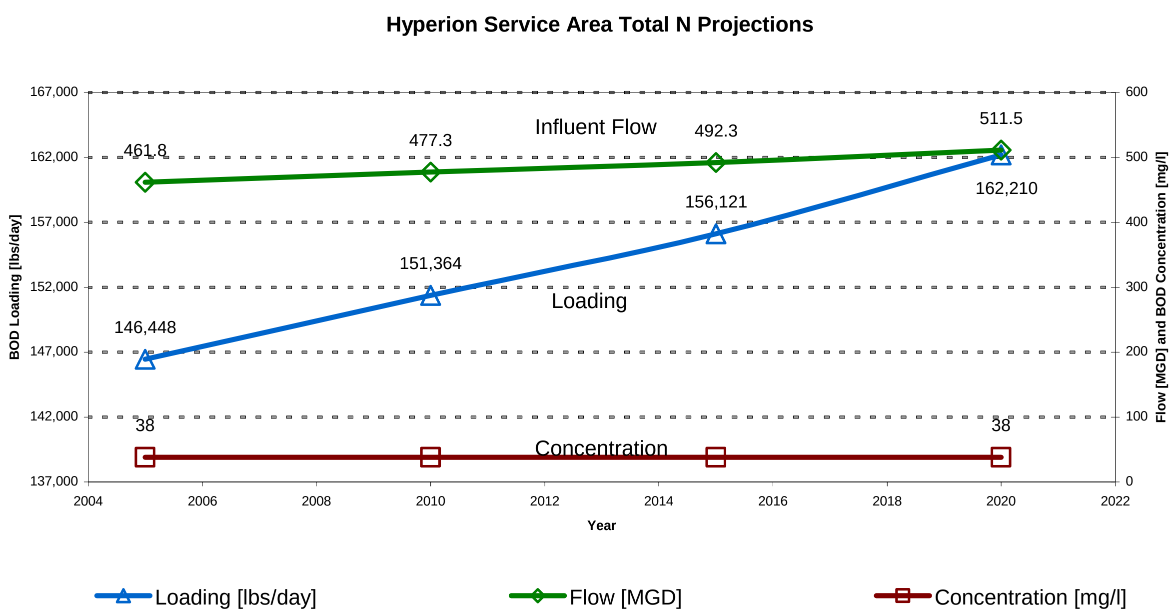
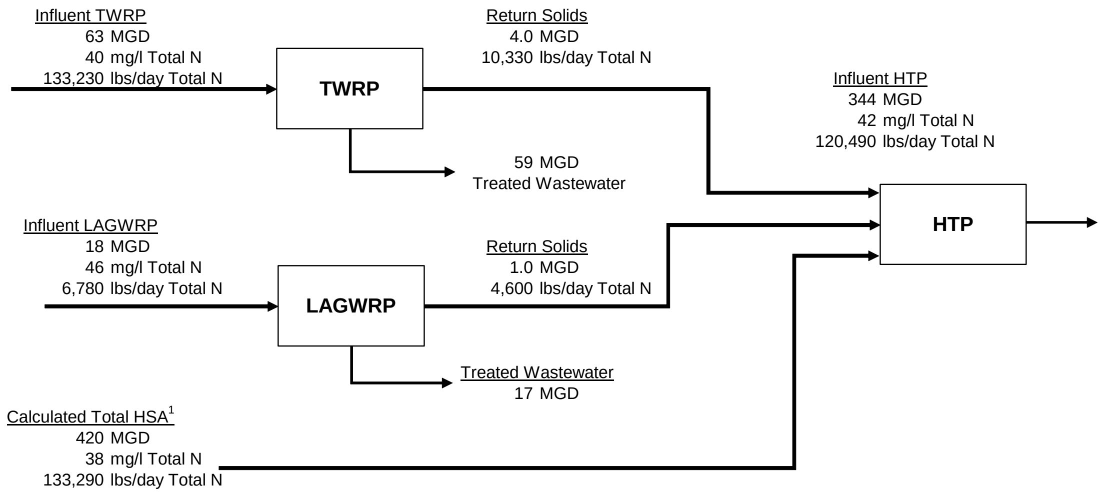


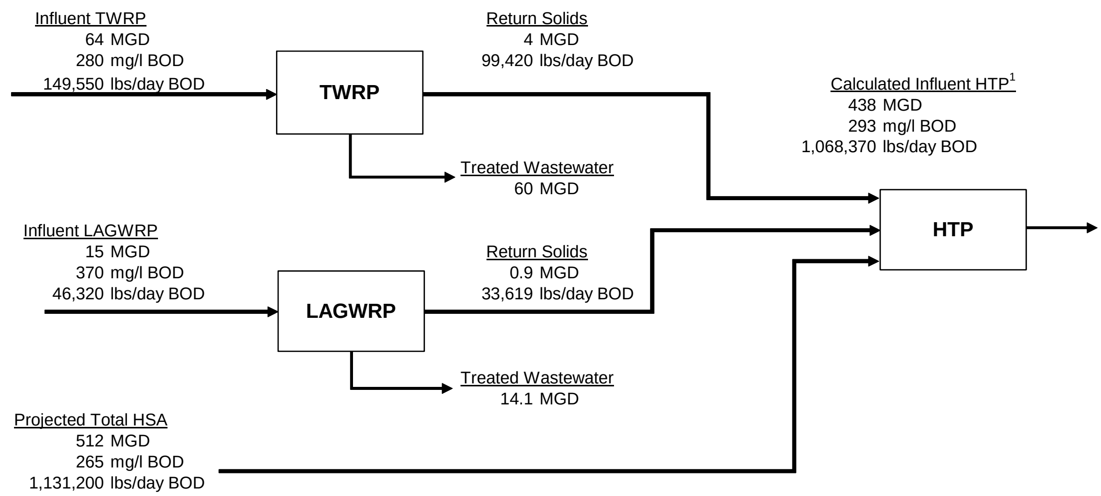
Figure 4-14
Projected Total Nitrogen Data for Service Areas

Mass Balance for TSS



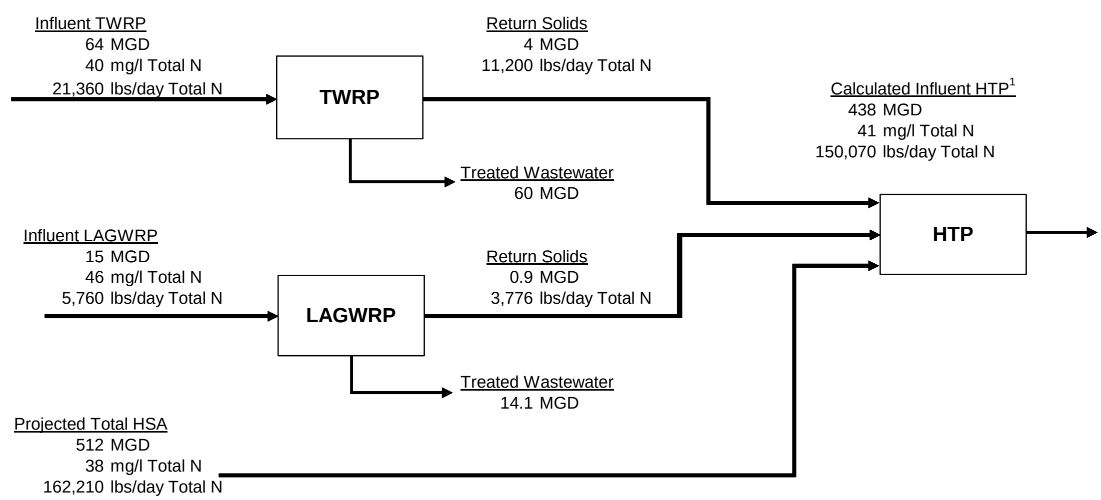
1 - This calculation is from the formula: $HSA_{Total} = HTP_{Influent} + DCTWRP_{Influent} - DCTWRP_{Sludge} + LAGWRP_{Influent} - LAGWRP_{Sludge}$

Mass Balance for BOD



1 - This calculation is from the formula: $HTP_{Influent} = HSA_{Total} - DCTWRP_{Influent} + DCTWRP_{Sludge} - LAGWRP_{Influent} + LAGWRP_{Sludge}$

Mass Balance for Total N



1 - This calculation is from the formula: $HTP_{Influent} = HSA_{Total} - DCTWRP_{Influent} + DCTWRP_{Sludge} - LAGWRP_{Influent} + LAGWRP_{Sludge}$

Figure 4-15
Projected Mass Balance for Hyperion Treatment Plant

Section 5
Existing Collection System

5.1 Overview

The City's wastewater collection system includes approximately 6,500 miles of major interceptors and mainline sewers, 46 pumping plants, and various other support facilities, such as maintenance yards and diversion structures. Approximately 650 miles of the City's sewers are primary sewers, which by definition range in size from 16-inches to over 12½ feet in height or diameter. The rest of the sewers (approximately 5,850 miles) are smaller secondary sewers that by definition range in diameter from 6-inches to 15-inches. The system provides service to about 600,000 connections within the City. The building sewers, which connect to the City's mainline sewers, are privately owned and maintained, and their total length is approximately 11,000 miles.

The City also provides wastewater services for 27 contributing agencies, which include 8 sovereign cities and 19 special sewerage districts. (See Section 3.3 for a listing of these agencies.) The agencies contracting with the City for wastewater disposal operate their own collection systems, which connect to the City's system, and they pay for services on the basis of flow and strength measured at the connection of their system to the City's system. The contracting agencies provide service to a total of about 150,000 connections.

The City has extensive programs to support planning, condition assessment evaluation, and ongoing maintenance of these wastewater facilities. With various programs in place, the City is effectively able to address the issues related to regulatory compliance. The key programs that evaluate the collection system's hydraulic, environmental and structural condition, help effectively plan for future and address any regulatory issues that may come up.

As discussed in Section 3.3 and shown in Figure 5-1, the City collection system is made up of two completely independent service areas called HSA and TISA. Major collection system components of these service areas are described below. Detailed descriptions can be found in Section 3 of the *Integrated Plan for the Wastewater Program, Tools Technical Memorandum*, CH2M HILL and Camp, Dresser and McKee, June 2000.

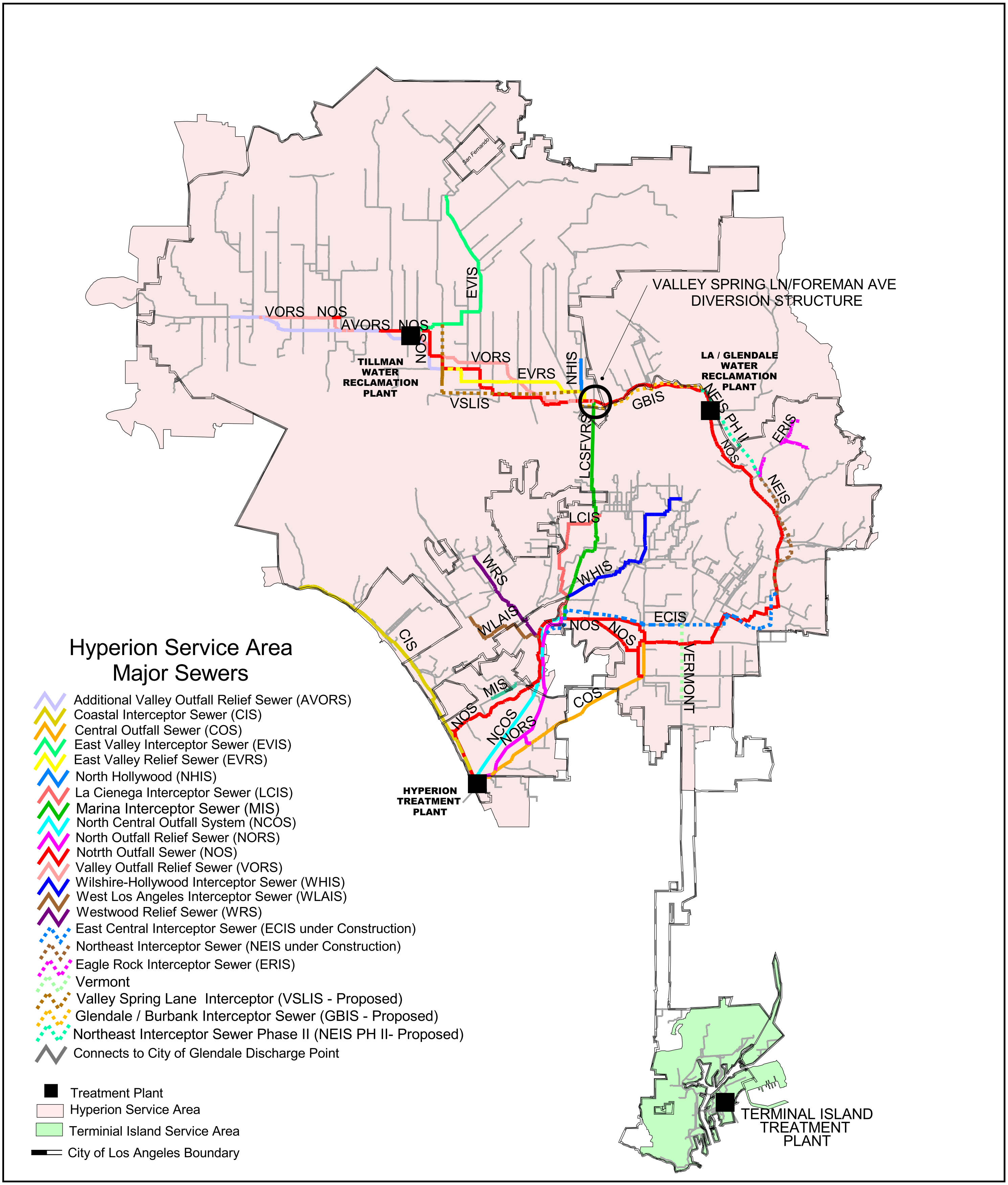
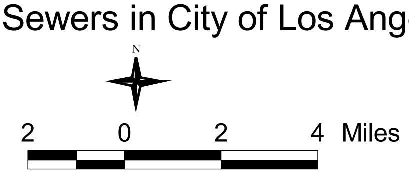


FIGURE 5-1
INTEGRATED RESOURCES PLAN
Interceptor Sewers in City of Los Angeles

Produced by GIS Unit
WASTEWATER ENGINEERING
SERVICES DIVISION
BUREAU OF SANITATION



Facilities Plan
Wastewater Management

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5.1.1 HSA Collection System

The HSA wastewater collection system includes more than 6,000 miles of public sewers, 25 pumping plants and various hydraulic structures such as siphons and diversion structures. Approximately 600 miles are primary sewers, which are larger than 15-inches in diameter, of which about 170 miles are major interceptor and outfall sewers. A major interceptor sewer is one that receives flow from a number of main or trunk sewers and conveys the wastewater to an outfall sewer or treatment plant. An outfall sewer is one that receives wastewater from another sewer or reclamation plant and conveys it to a point of final discharge.

The interceptor and outfall sewers serve as the backbone of the wastewater collection system by collecting wastewater from many drainage areas and conveying it to one or more of the HSA's wastewater treatment and/or water reclamation plants. This backbone system has largely been aligned according to the natural topography of the area so that most of the system flows by gravity.

5.1.1.1 HSA Major Sewers

The focus of this IRP is on the backbone of the City's collection system, comprised of the major interceptor and outfall sewers in the HSA. The following are these major interceptor and outfall sewers1:

- Additional Valley Outfall Relief Sewer (AVORS)
- Coastal Interceptor Sewer (CIS)
- Central Outfall Sewer (COS)
- East Central Interceptor Sewer (ECIS, under construction)
- East Valley Interceptor Sewer (EVIS)
- East Valley Relief Sewer (EVRS)
- La Cienega Interceptor Sewer (LCIS)
- La Cienega-San Fernando Valley Relief Sewer (LCSFVRS)
- North Central Outfall Sewer (NCOS)
- North East Interceptor Sewer - Phase 1 (NEIS-Ph1, under construction)
- North Outfall Relief Sewer (NORS)
- North Outfall Sewer (NOS)

[1] Detailed descriptions of these major interceptors and outfalls can be found in Section 3 of the *Integrated Plan for the Wastewater Program, Tools Technical Memorandum*, CH2M HILL and Camp, Dresser and McKee, June 2000.

- Valley Outfall Relief Sewer (VORS)
- West Los Angeles Interceptor Sewer (WLAIS)
- Westwood Relief Sewer (WRS)
- Wilshire-Hollywood Interceptor Sewer (WHIS)

Table 5-1 summarizes the general characteristics of these major sewers. The capacity ranges are shown in both million gallons per day (mgd) and cubic feet per second (cfs).

5.1.2 TISA Collection System

The existing TISA wastewater collection system includes approximately 270 miles of sewer and 19 pumping plants. All of the wastewater collected in the TISA is pumped to the TITP through seven force mains: 30-inches in diameter, Fries Avenue Force Main; 20-inches in diameter, Terminal Way Force Main; 30-inches in diameter San Pedro Force Main; and four (6- to 20-inches in diameter), U.S. Navy force mains.

5.1.2.1 TISA Major Sewers

There are four interceptor sewer systems in the TISA that conveys the wastewater generated in the Harbor area to the TITP for treatment and disposal. The four interceptor sewer systems are named after the respective force main through which their flow is pumped to the TITP. The four interceptor sewer systems are as follows:

- Fries Avenue Interceptor Sewer System (FISS).
- Terminal Way Interceptor Sewer System (TISS).
- San Pedro Interceptor Sewer System (SPISS).
- United States Department of the Navy (U.S. Navy) Interceptor Sewer System.

Figure 5-2 shows the major interceptor and outfall sewers and treatment/reclamation plants within HSA.

Table 5-1
Summary of Hyperion Service Area
Major Sewers

Sewer	Length (miles)	Diameter[1] (inches)	Capacity Range[2] (mgd)	Capacity Range[2] (cfs)	Material[3]	Year Built
CIS	9.4	24 to 72	14 to 61	22 to 95	VCP, RCP_{PVC}	1950s to 1970s
COS	9.9	57, 69 & 60x73 el	54 to 65	83 to100	Brick, RCP	1907
NOS	57.6	15 to 102 (includes se, bms) & 147x126 se	1 to 268	2 to 414	VCP, $Concrete_{CT}$	1920s to 1930s
NCOS	7.8	96 to 114	232 to 259	359 to 400	RCP_{PVC}	1957
NORS	8.0	96 to 150	251 to 381	388 to 590	RCP_{PVC}	1993
WLAIS	4.0	24 to 60 (includes se) & 48x60 box	14 to 65	21 to 100	Clay, RCP_{CT}	1920s & 1950
WRS	4.5	27 to 60	25 to 84	38 to 130	VCP, RCP_{PVC}	1962
WHIS	8.3	24 to 69	9 to 65	14 to 100	VCP, RCP_{PVC}	1970s
LCIS	6.1	27 to 63 (includes se)	24 to 58	37 to 90	RCP_{CT}	1920s
LCSFVRS	10.7	48 to 99 (includes se) & 99x115 box	112 to 213	174 to 330	RCP_{PVC}	1955
VORS	16.3	24 to 66	8 to 65	12 to 100	RCP_{PVC}	1953 to 1962
AVORS	10.3	48 to 96	39 to 181	61 to 280	VCP, RCP_{PVC}	Late 1960s
EVRS	7.0	39 to 51	45 to 52	69 to 80	VCP, RCP_{PVC}	1980s
EVIS	8.7	36 to 84	33 to 97	51 to 150	VCP, RCP_{PVC}	1987
MIS	1.1	32	18	27	Polymer Concrete	2001
ECIS[4]	11	132	207[6]	320[5]	--	2004
NEIS[5]	10	84 TO 96	72 to 142	112 to 219	--	2004

Notes:
[1] Non-circular sewers are denoted thus – elliptical (el), semi-elliptical (se), and Burns-McDonnell shape (bms)
[2] Maximum full flow capacity (d/D = 1.0)
[3] Abbreviations:
- CT clay tile liner
- PVC polyvinyl chloride liner
- RCP reinforced concrete pipe
- VCP vitrified clay pipe

[4] Sewer under construction
[5] Sewer under construction
[6] Designed for 320 cfs (207 mgd) PDWF; however, the full pipe capacity will be much greater due to the 11-foot diameter and it will depend on the slope

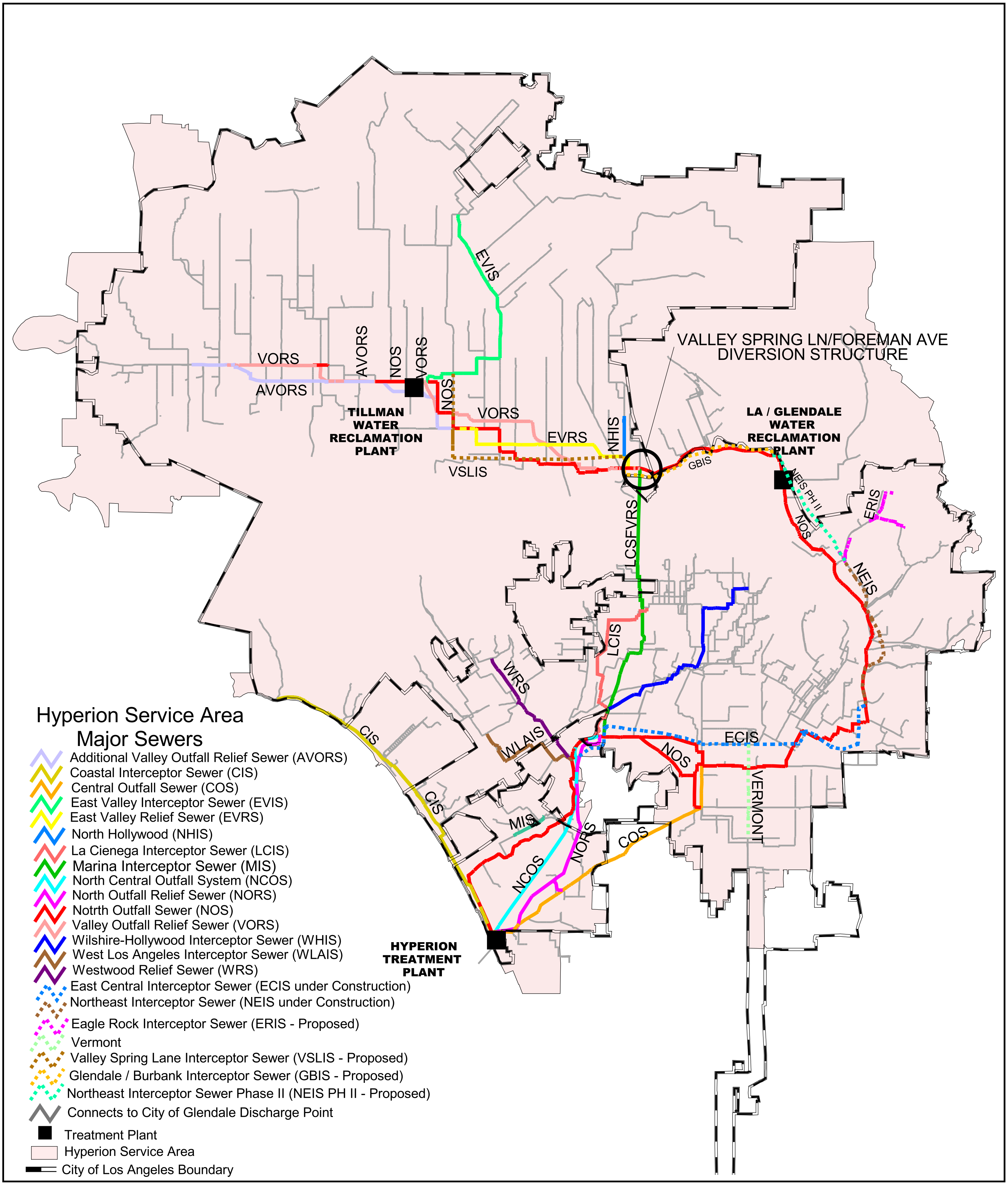

FIGURE 5-2
INTEGRATED RESOURCES PLAN

Interceptor Sewers in City of Los Angeles

Produced by GIS Unit
WASTEWATER ENGINEERING
SERVICES DIVISION
BUREAU OF SANITATION

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Facilities Plan
Wastewater Management

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5.2 Other Key Collection System Facilities

5.2.1 Major Diversion Structures

Diversion structures are used to divert all or part of the flow from one sewer to another. There are approximately 60 major diversion structures in the HSA wastewater collection system. All but one of the diversion structures are operationally passive. That is, physical entry, or access into the structure is necessary to change flow settings. The one exception is one of the structures at VSL/FA Diversion, which has remotely controlled, electronically operated sluice gates. There are four structures at or near the intersection of VSL/FA as shown in Appendix F. These structures allow flow from the NOS to be diverted into the LCSFVRS. Three of the structures have gate slots into which metal diversion plates or wooden stop logs can be manually installed. The fourth structure has electrically-operated sluice gates controlled remotely at the LAGWRP. This fourth structure provides the LAGWRP with active control over flows in the NOS. Currently, all flows are being diverted through the LCSFVRS.

5.2.2 Wet Weather Facilities

The City has one wet weather storage facility within the service area. The North Outfall Treatment Facility (NOTF) is located in Culver City on Jefferson Boulevard north of Overland Avenue. The NOTF can receive flow from the WLAIS, the WRS, and the NOS. It can also receive flow from the LCIS and the LCSFVRS through the NOS depending on upstream diversion settings. The NOTF was designed to provide preliminary and primary treatment and disinfection to excess wastewater, which could not be conveyed by the outfall system, before it was discharged to Ballona Creek. The volume of the NOTF tank is 1 million gallons, which can also be used as off-line storage to eliminate overflows from the sewer system. Appendix F shows how flows are routed into the NOTF. The stored flow can be returned to the NOS for conveyance to the HTP after the peak flow has passed. The NOTF is tributary to the 8-mile downstream section of the NOS called the Lower NOS, which has been out of service since 1994. The NOTF is currently out of service since it cannot be used until the lower NOS is rehabilitated and put back in service.

5.3 Wastewater Collection System Programs

The City has many ongoing programs to address the needs of the wastewater collection system. A summary of several of these key programs is provided in Appendix G.

5.4 Condition Assessments

The City's condition assessment program monitors structural, environmental and hydraulic conditions of the collection system through various programs. The deficiencies identified during these processes are addressed by various planning programs. This section provides a summary of these conditions for the major sewer system. (Further discussion of the City's condition assessment program is provided in Appendix G)

5.4.1 Structural Condition

The structural condition of the collection system is assessed through the City's Closed Circuit Television (CCTV) program. CCTV inspection is an ongoing program, which monitors the condition of the collection system in a step-by-step process of televising, reviewing, ranking and reporting. Figure 5-3 highlights the structural condition of major sewers. As indicated on the map, major parts of the outfall system are ranked as condition A or B, which means they are in good condition - requiring no immediate attention. Parts of the NOS and most of the COS are ranked as condition C or D, requiring rehabilitation or repair.

Rehabilitation of the lower section of the COS has been completed. Projects to repair the other D ranked sections of the COS and the LCIS are planned and underway.

The eastern NOS is undergoing crown spraying to halt deterioration while the ECIS and NEIS interceptors are constructed. Repair of the portions of the NOS will be conducted after these new interceptors come on-line.

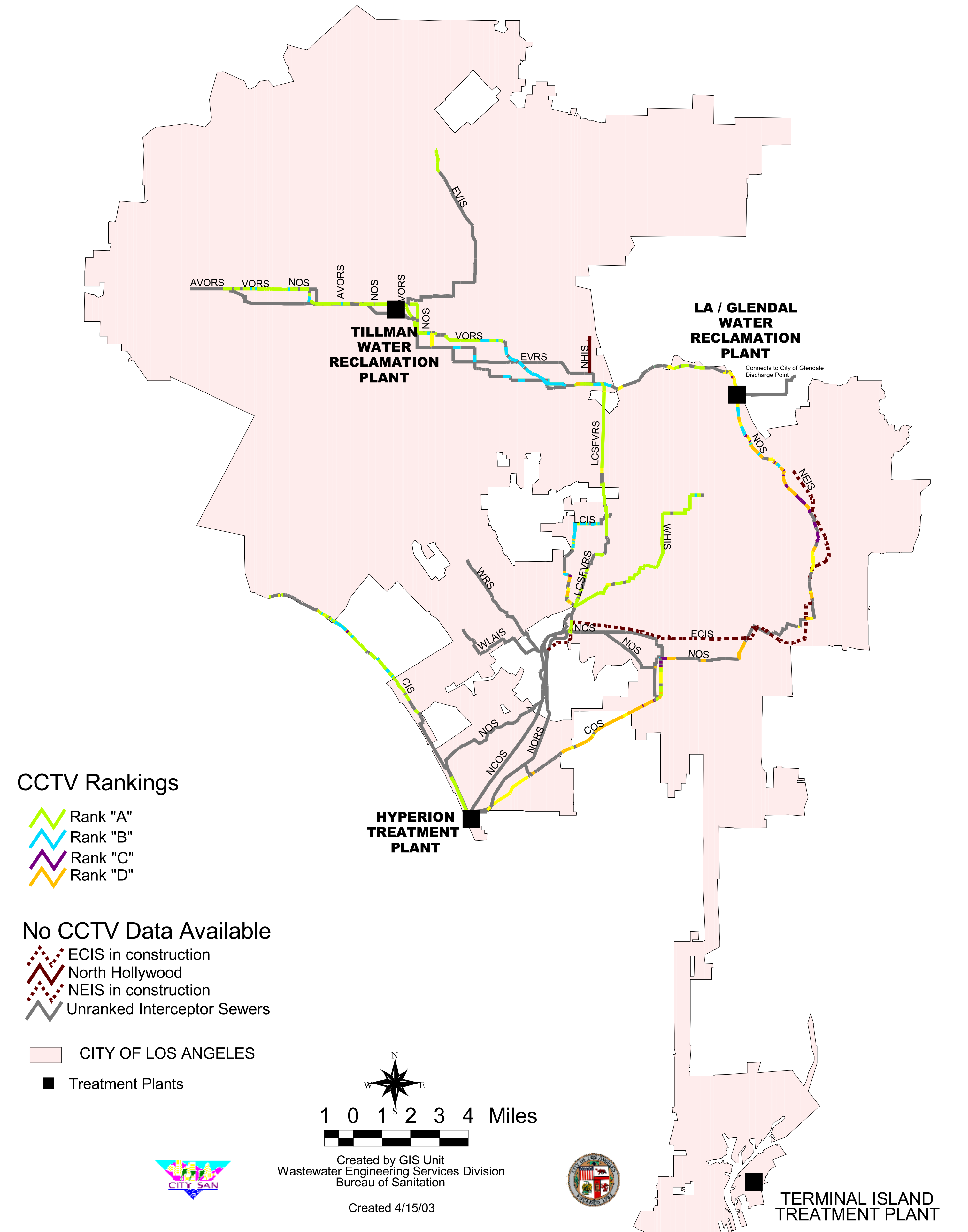

Figure 5-3
Collection System Structural Condition

5.4.2 Environmental Condition

The collection system environmental condition is monitored through odor complaint analysis and air quality sampling and analysis within maintenance holes.

The City maintains an odor complaint database, where all the odor complaints related to the sewer system are recorded into a centralized database, analyzed for frequency of complaints, and correlated to maintenance issues. This analysis helps identify areas of repeated odor complaints (hot spots) as well as areas where solutions employed have resolved odor problems, as indicated by a reduction of odor complaints.

Air quality sampling and analysis programs proactively identify odor-related issues that are then addressed through ongoing odor control programs. Appendix G, Section 2.9, provides summary of various programs adopted by the City to manage odor and corrosion issues in the existing collection system. The odor and corrosion problems in the existing collection system are primarily addressed with chemical injection and crown spraying programs. The City has recently undertaken the development of an Odor Control Master Plan to identify odor control strategies citywide.

5.4.3 Current Hydraulic Capacity Based on Flow Gauging Data

Permanent flow gauging stations in the major outfall system provides continuous flow monitoring of the collection system. Figure 5-4 shows the strategic locations of 33 flow monitoring locations. Data from these locations are continuously recorded and downloaded into a centralized database for further analysis.

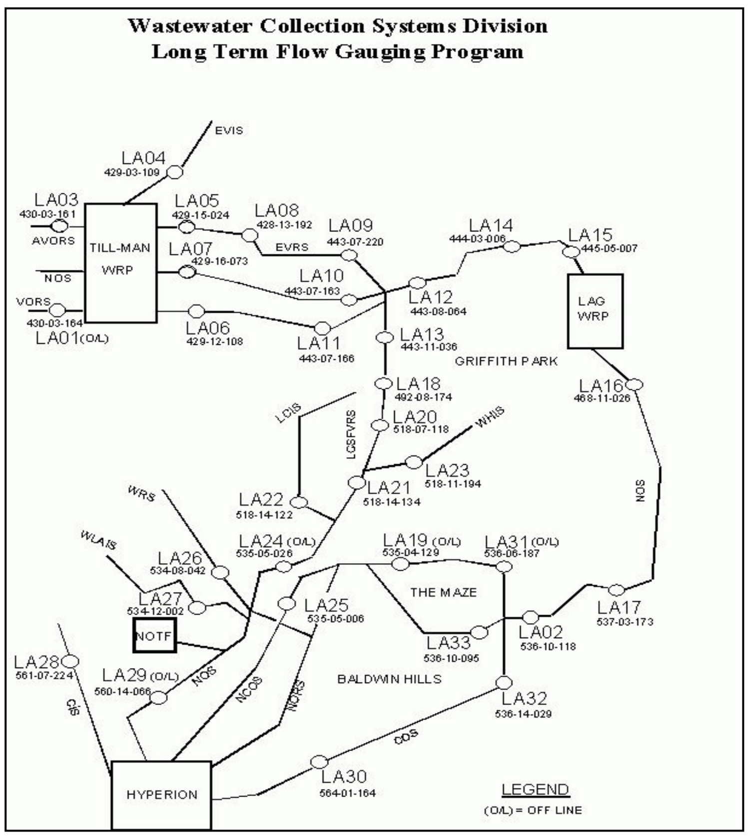

Figure 5-4
Flow Gauging Locations

Figure 5-5 shows depth of flow results, expressed as a ratio of flow depth (d) to sewer diameter (D), or d/D, from recent recordings. Data from January to June, 2002 were summarized to generate hourly hydrographs by taking averages of several recordings. Figure 5-5 depicts the depth of flow results of this analysis, shown as d/D. These results indicate that there are some outfall locations with d/D values greater than 0.5, indicating a potential future capacity need. (The significance of this d/D criterion is discussed in Section 6.3.)

Flow depths in the following general areas indicate potential future collection system capacity needs:

- Interceptor system between TWRP and the VSL/FA diversion structure.
- Portions of the NOS around the Maze area (indicated in Figure 5-5) and upstream of the Maze area.
- Downstream of the LCSFVRS tunnel and prior to its connection to the NOS.
- Lower part of the COS in lower outfall system.

The results of these gauging data point to potential areas of future hydraulic capacity constraints. MOUSE modeling conducted with future flow projections confirmed that these areas are vulnerable to hydraulic overloading. The results of these modeling scenarios and options identified to address these collection system capacity needs are presented in Section 6.

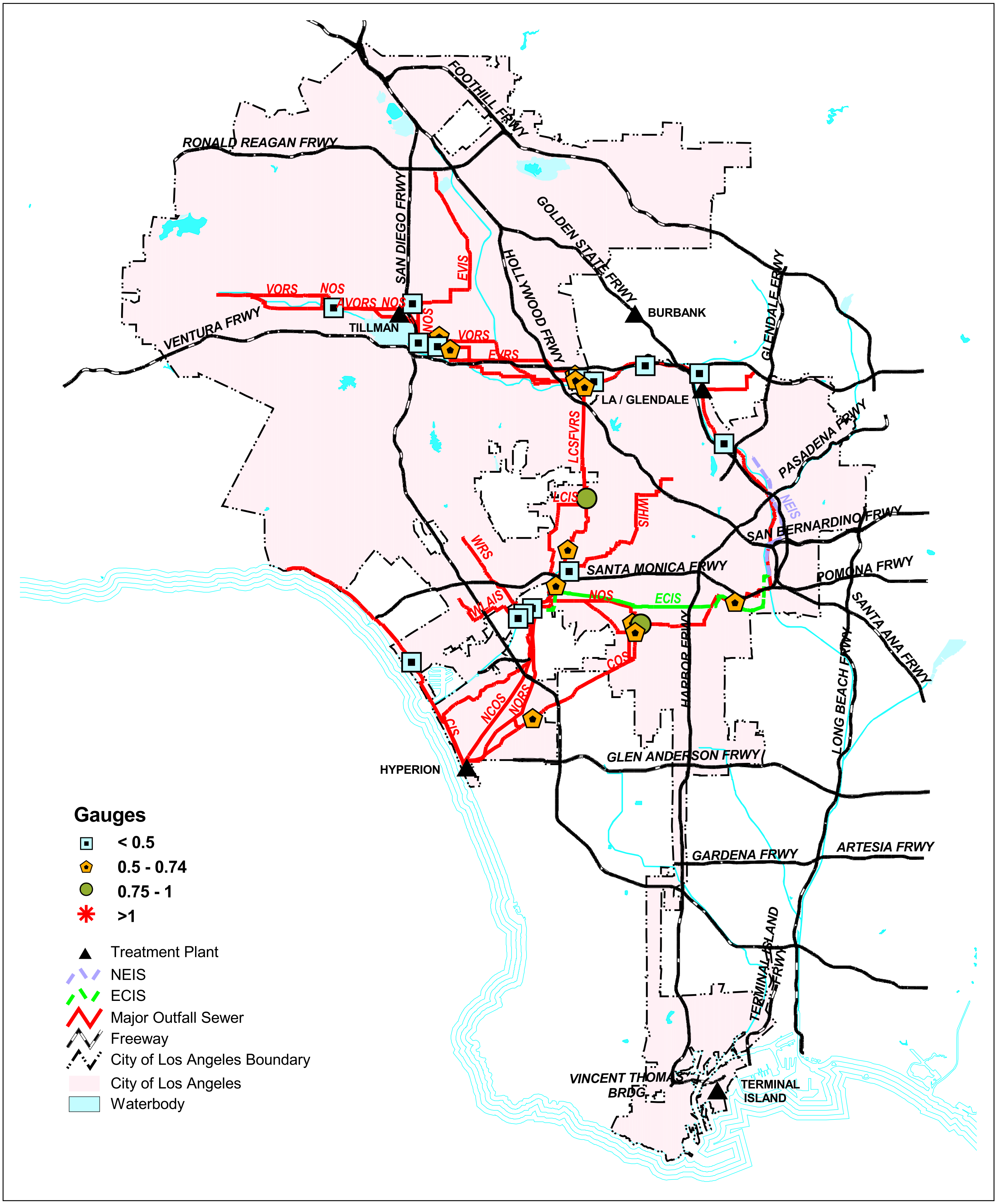

FIGURE 5-5

INTEGRATED RESOURCES PLAN

FLOW GAUGING RESULTS

Produced by GIS Unit

WASTEWATER ENGINEERING SERVICES DIVISION BUREAU OF SANITATION

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Section 6
Collection System Options

6.1 Introduction

Collection system planning for the IRP is focused on the City's major interceptor and outfall sewers within the HSA. The ability of the collection system to convey wastewater flows in the year 2020 is a function of the other hydraulic elements of the system, such as treatment, storage, and flow routing. To determine future system needs and develop options to address these needs, a step-wise approach to evaluating the sewer capacities under various hydraulic scenarios (baseline configurations, discussed previously in Subsection 4.3.4) was conducted. This process and the collection system options generated through this process are described in this section.

6.2 Collection System Options Planning Criteria

The initial identification of collection system needs to accommodate the projected year 2020 PWWFs was based on the City's standard practice of collection system planning as defined Sewer Design Manual, Section F250, stated as follows:

> "Sewers shall be sized so the depth of the PDWF, projected for the design period, shall be no more than one half the pipe diameter (d/D = 0.5). Where upstream treatment and/or storage reservoirs are planned or available, their effect on reducing peak flows shall be considered in sizing downstream sewers."

This practice includes a design criterion for sizing new sewers to allow for the conveyance of wet weather flow to avoid overflows. However, this design criterion was established when wet weather modeling was not available. The primary criterion for adequate sewer capacity remains its ability to convey PWWFs.

As shown in Figure 6-1, this design criterion sets the ratio of flow depth to pipe diameter (d/D) value to 0.5. The remainder of the sewer capacity is reserved to accommodate wet weather flows, since wet weather flows are generally twice the peak of dry weather flows. For the design period of a new sewer, d/D values will range from 0.3 to 0.7 over the life of the sewer (typically 50 to 100 years).

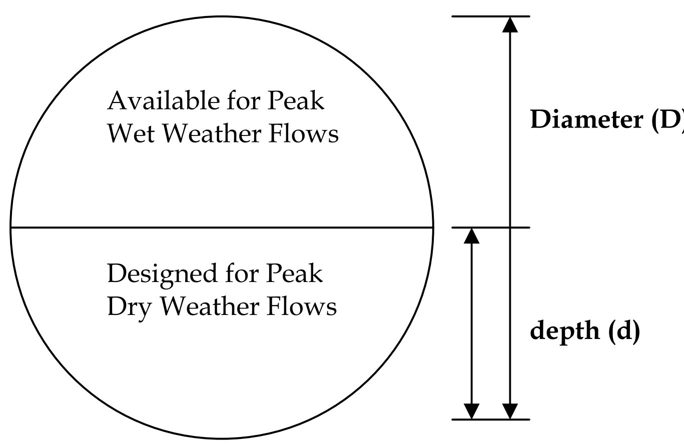

Figure 6-1
Basis for Sewer Design

As indicated by the above excerpt from the City's Sewer Design Manual, this d/D criterion for dry weather flows is not applied exclusively. The presence and size of upstream treatment plants and storage facilities impact the downstream collection system d/D design criterion. For example, where wet weather storage facilities are provided, the downstream collection system should be able to flow at greater than half-full during dry weather, since a portion of the projected wet weather flow will be handled by the storage facilities rather than by the collection system. In this case, d/D values for PDWF of greater than 0.5 are acceptable and would not indicate a potential overflow condition.

Conversely, if there is dry weather flow equalization provided at the treatment plant, the downstream peaks are dampened during dry weather. However, the total amount of wet weather flow that would need to be conveyed remains virtually the same as it would have without the equalization; thus the pipe design basis to convey the PWWFs would correspond to a d/D value of less than 0.5 for PDWF, i.e., pipe flow is shallow during dry weather, but flows full during wet weather. These assumptions are confirmed in the IRP through wet weather modeling, which will be calibrated and refined for the future development of detailed planning documents.

6.3 Options Development and Evaluation Process

Figure 6-2 is a diagram of the collection system options evaluation process. The process involved several MOUSE hydraulic model runs for dry weather and wet weather scenarios for current year and projected year 2020 flow conditions. (Descriptions of the MOUSE model are provided in Subsection 4.3.1.)

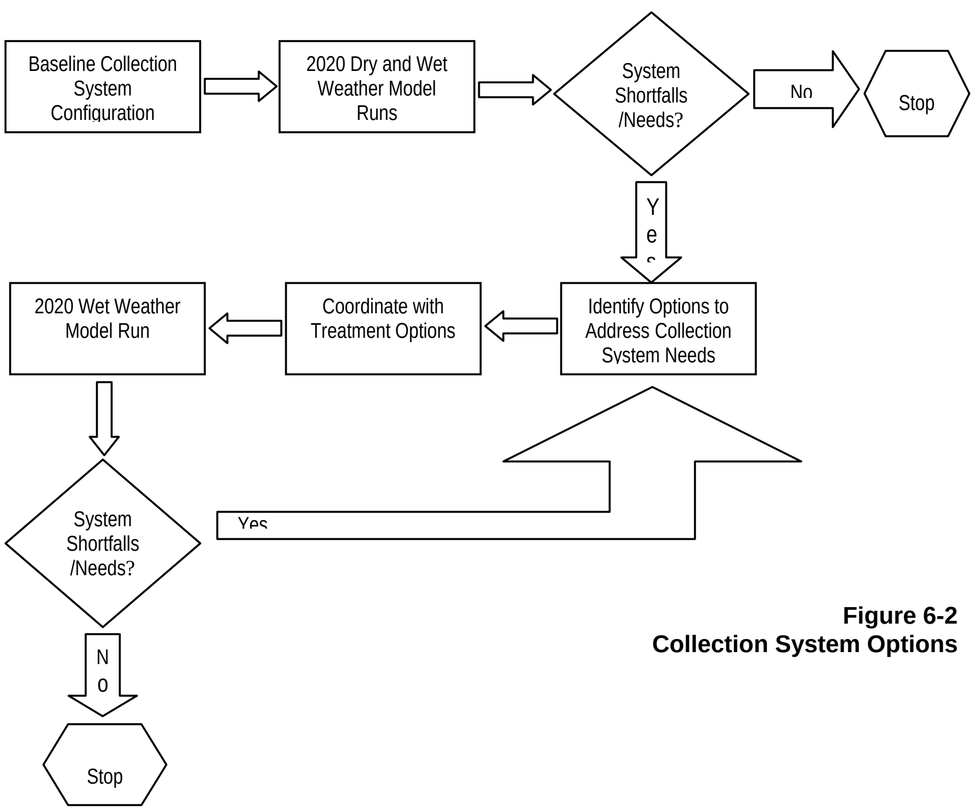

Figure 6-2
Collection System Options

1) **Baseline collection system configuration:** The starting point for analysis of future collection system capacity needs is the baseline system configuration described in Subsection 4.3.4. This configuration is based on the existing system, but also includes several projects that will be constructed by year 2020 as well as system operations optimization to maximum use of the available system capacity with minimal changes to the collection system.

2) **Evaluate system under year 2020 dry and wet weather conditions:** Year 2020 dry and wet weather flows through the baseline configuration were modeled using MOUSE. Dry weather results in the form of d/D values indicated sewers with projected capacity needs based on the City's sewer design criterion, described above in Subsection 6.2, are shown in Subsection 4.3.4, Figure 4-5.

As described in Subsection 4.3.2, the dry weather modeling has been well-calibrated against current monitored flows. However, the modeling of wet weather flows has not yet been calibrated in MOUSE due to a lack of monitoring data specific to this exercise. Therefore, the wet weather model results are used to check the performance of collection system modifications and provide gross estimates of projected wet weather flows to HTP for the design storm. Wet weather results for the collection system were evaluated only for projected overflows.

1) **Identify options to address collection system needs:** Potential collection system modifications were identified to address the system needs identified for the baseline configuration.

2) **Coordinate with treatment options configurations:** Consistent with various treatment options, the MOUSE model was configured to match the range of treatment options identified. These included upstream treatment expansions to existing plants and/or new plants, upstream treatment expansion combined with wet weather storage, and HTP treatment capacity expansion.

3) **Evaluate modified system under 2020 wet weather conditions:** The MOUSE model was then configured to reflect the collection system modifications expected to be needed for the corresponding treatment options. Since the critical condition is during wet weather operations, wet weather model runs were conducted with these system modifications to identify whether the projected overflow conditions were alleviated. If overflows were not eliminated, additional collection system modifications were identified and the modeling was repeated until the collection system was able to fully convey wet weather flows from the design storm.

6.4 Collection System Options

As indicated by the process outlined above, the development of collection system options to accommodate the changes in downstream flow as a function of treatment and/or storage system scenarios is an iterative process. The options described below represent an initial definition of the collection system components that would be needed to accommodate flows under varying treatment options. The size and extent of these components will be refined as more specific alternatives are generated. In addition, these options only consider management of wastewater flows, and do not address the potential impacts of runoff management strategies that could affect the wastewater collection system. These will be developed during the subsequent IRP alternatives analysis process.

6.4.1 Treatment, Storage and Conveyance Scenarios

As noted above, options to address collection system needs are highly dependent on the treatment system size and location. The initial broad categories of collection system options can be described by the following three scenarios:

- **Upstream treatment expansion:** Expand existing or construct new treatment facilities to effectively remove flow to the collection system and provide capacity relief. In this scenario, collection system capacity needs are addressed by providing additional upstream treatment capacity by:

- Expanding Donald C. Tillman Water Reclamation Plant

- Expanding Los Angeles-Glendale (LAG)

- Constructing a new reclamation plant(s)

Additional interceptors are provided where these planned upstream treatment enhancements do not provide adequate collection system relief.

- **Wet weather storage:** Build in-line or off-line storage tanks or pipelines for managing wet weather flows. In this scenario, collection system capacity needs are addressed by providing additional upstream treatment capacity combined with wet weather storage. The storage is provided to remove peak flow during wet weather, flattening the peak and releasing the storage flows gradually during off-peak hours.

Additional interceptors are provided where selected wet weather storage options do not provide adequate collection system relief.

- **Interceptor expansion only:** Build new interceptors parallel to the existing system or connecting to a new treatment plant for conveyance of year 2020 peak wet weather flows from the design storm. In this scenario, collection system capacity needs are addressed without any upstream treatment expansion or wet weather storage facilities. All the additional flows are conveyed through the existing treatment plants downstream to the HTP requiring HTP capacity expansion only.

All collection system options will include recommendations for flow optimization using diversion structures and pump stations and real-time monitoring and control systems. Odor control facilities will also be included with all options.

6.4.2 Collection System Components

Collection system capacity needs identified for the baseline configuration (see Subsection 4, Figure 4-5) are addressed within the three scenarios described in Subsection 6.4.1, above. The collection system modifications to address the collection system needs under these scenarios consist of the component elements described below.

- **Primary sewer modifications upstream of TWRP:** The interceptor system upstream of TWRP was shown to be flowing greater than half-full in the baseline scenario. This hydraulic constraint can be alleviated by modifications to the primary system that are not part of the major interceptor/outfall system. Since planning for these other elements of the primary system lie beyond the focus of the IRP, these modifications are not included under the IRP, but should be noted for more detailed primary system planning. These modifications included rerouting flow from upstream to downstream of TWRP through expansion of one-half mile of primary sewers, and installation of 2.5 miles of new primary sewers. The specific modifications are shown in Appendix H.

- **Valley Spring Lane Interceptor Sewer (VSLIS):** To relieve the hydraulic constraint indicated between TWRP and the VSL/FA diversion structure, a new parallel interceptor is needed (see Figure 6-3). This new gravity sewer will carry the bypass flow from TWRP to the VSL/FA intersection. The

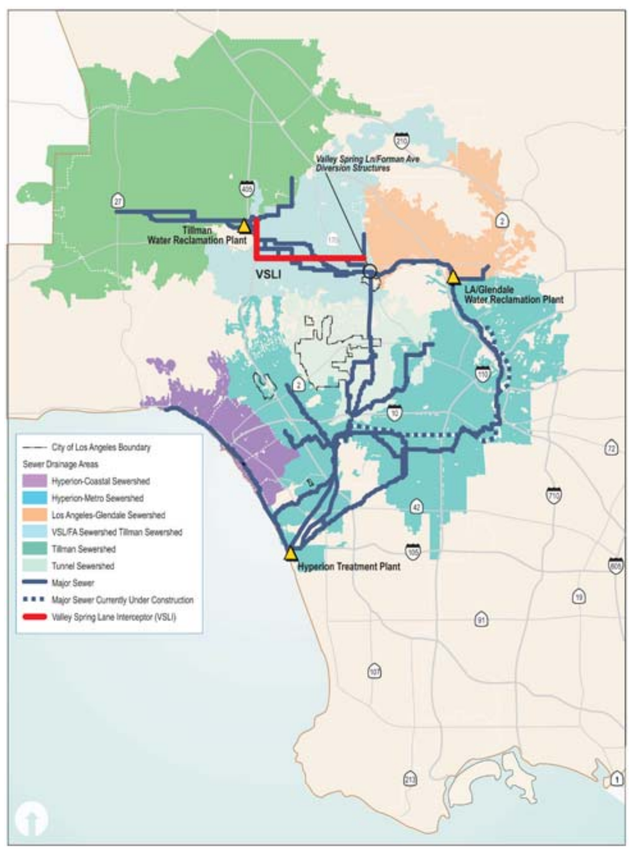

Figure 6-3
Valley Spring Lane Interceptor Sewer

VSLIS is assumed to be a circular pipe 44,600 feet in length, ranging from 84 to 96 inches in diameter.

- **Glendale-Burbank Interceptor Sewer (GBIS):** This sewer is a buried tunnel located between the vicinity of Valley Spring Lane and Forman Avenue and the LAGWRP (see Figure 6-4). The GBIS tunnel will intercept the existing NCOS-NOS near the lower Burbank Gauging Station and divert all flow from the existing NCOS-NOS to the new GBIS. This will allow for the rehabilitation of the existing NCOS-NOS line. The GBIS gravity sewer will consist of 1,300 linear feet of 90-inch pipe, 20,800 linear feet of 78-inch pipe and 2,700 linear feet of 48-inch pipe. This sewer is designed to carry approximately 50 MGD average dry weather flow. For detailed information, see *Final Predesign Report for the Glendale – Burbank Interceptor Sewer,* November 1991.

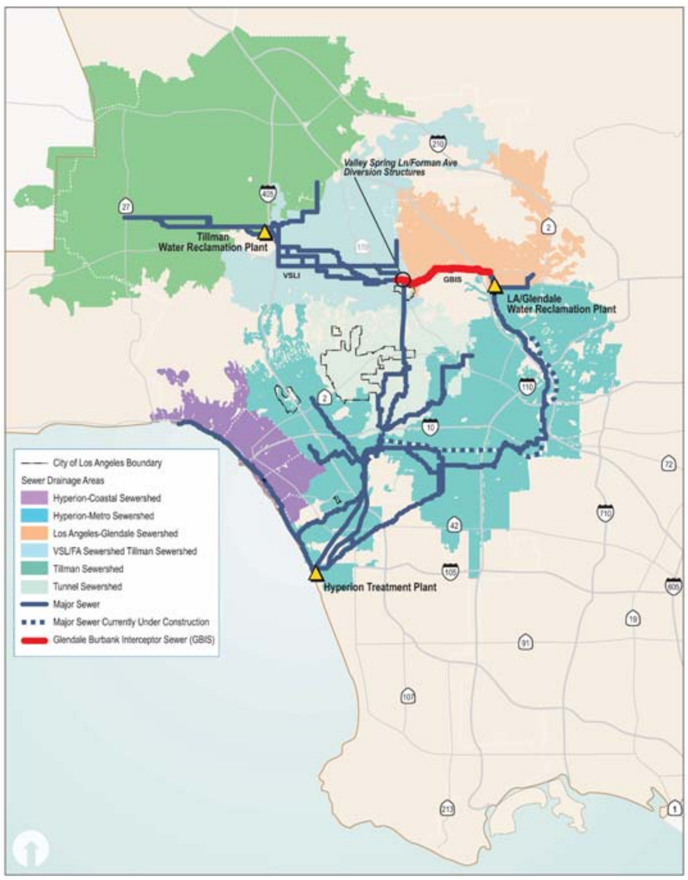

Figure 6-4
Glendale-Burbank Interceptor Sewer (GBIS)

- **Northeast Interceptor Sewer (NEIS) - Phase II:** This segment of the NEIS project consists of 3.5 miles of 96-inch pipe tunneled from the intersection of San Fernando Road and Cazador Street to the LAGWRP in order to relieve the NOS and to convey the sewage through NEIS-Phase I and ECIS and the NORS to the HTP. This sewer will provide an outlet for the future GBIS.

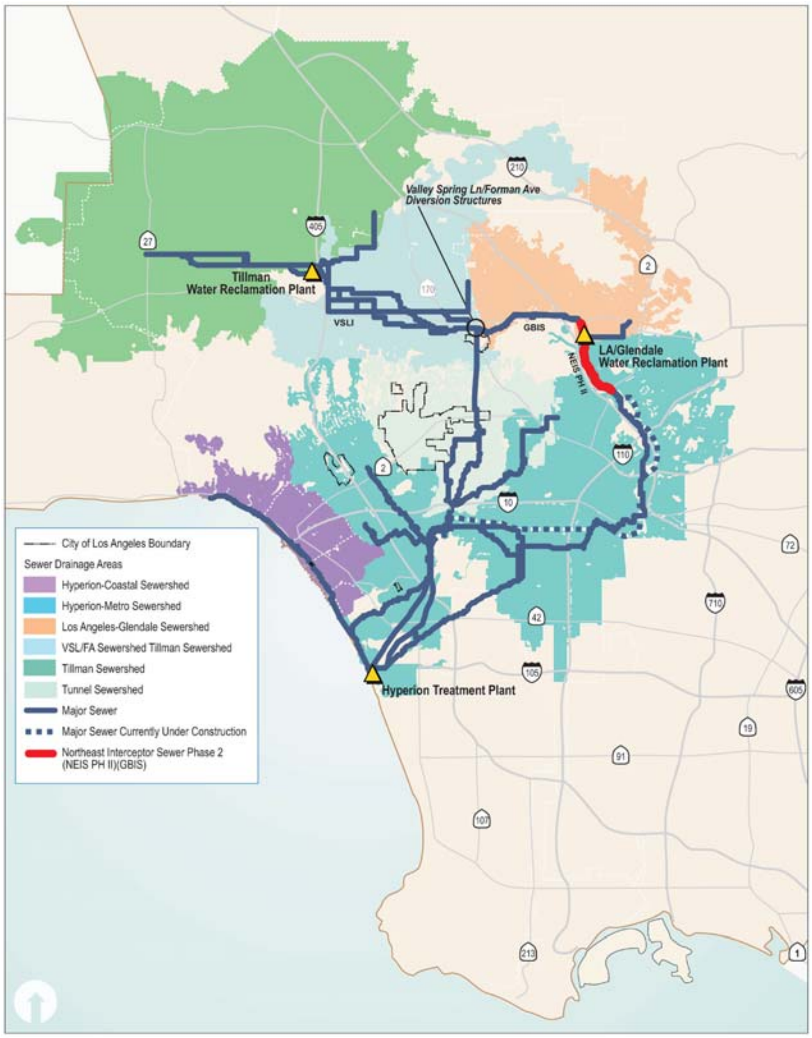

Figure 6-5
Northeast Interceptor Sewer (NEIS)

- **Vermont Avenue Relief Sewer (VARS):** The VARS consists of four segments - Interceptors 2-2, 2-3B, 2-4B, and 2-5B (see Figure 6-6). This sewer will provide capacity relief to the primary sewers west of Vermont Avenue by intercepting flow from the eastern portion of the study area. The Interceptor 2-2 project (rehab of 13,563 feet of 54-inch pipe) begins on Vermont Avenue just north of Manchester Avenue and extends along Vermont Avenue to Florence Avenue where it replaces both the Vermont Avenue West-Side Sewer and the Vermont Avenue East-Side Sewer. From there, Interceptor 2-3B (cut and cover construction of 5,415 feet of 60 and 72-inch pipe) continues north on Vermont Avenue to Slauson Avenue with Interceptor 2-4B (tunneling of 2,650 feet of 84-inch), to 51st Street, then on to Exposition Boulevard where Interceptor 2-5B (tunneling 7,945 feet of 90-inch pipe) connects to ECIS. Design is currently underway for Interceptor 2-5B; design of the other new segments is scheduled for completion by February 2006; design of the rehab section is scheduled for completion by December 2008. Construction of all segments is planned for completion by July 2011. Physically, VARS is not on-line and not included in our baseline configurations in the MOUSE. However, in MOUSE, the major discharge at South branch of the MAZE area was relocated to ECIS. This change is equivalent to VARS.

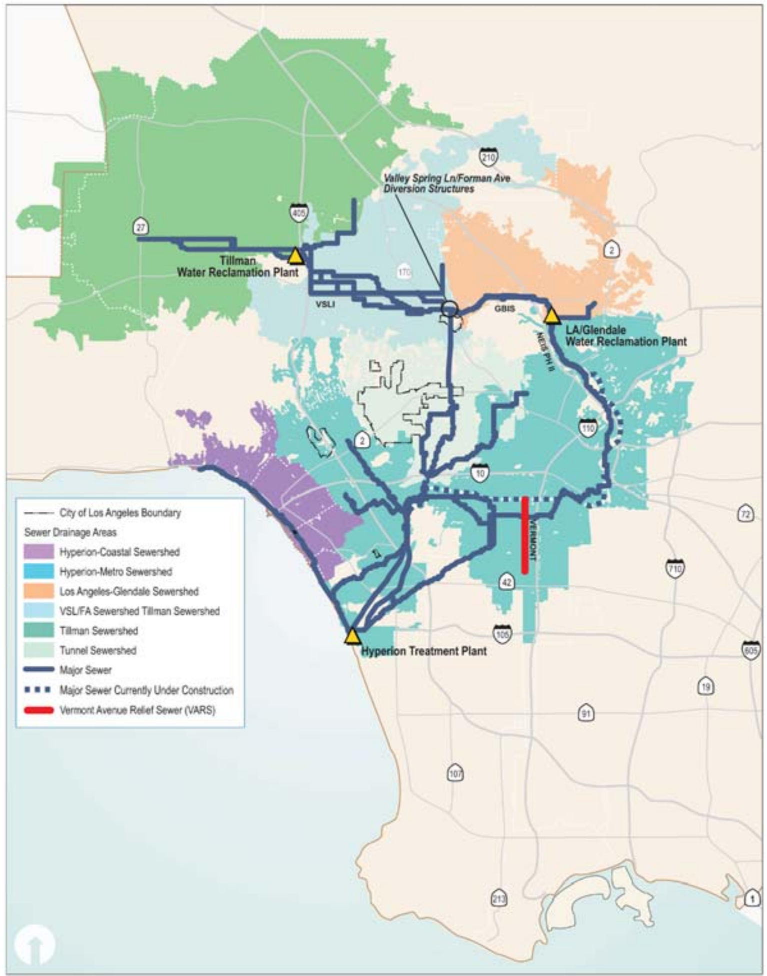

Figure 6-6
Vermont Avenue Relief Sewer (VARS)

- **New Plant Interceptor:** These new interceptors will be gravity or force main sewers, depending upon the site conditions of the new plant location(s). The interceptor is sized to carry the flow equal to proposed treatment plant capacities of either 10, 20, or 30 mgd. The estimated length of proposed new plant interceptor is assumed to be five miles. The length and size of specific new plant interceptors will be determined when these options are more clearly defined.

An alternative relief sewer alignment that would parallel the existing Tunnel Interceptor was considered. However, since this alignment would pass through an area of the City that has recently experienced extensive major sewer improvements (currently ECIS, and previously, NORS), this option will not be further developed or evaluated.

6.4.3 Bookend Configurations

Initial options for addressing year 2020 major collection system needs were developed by modeling "bookends" of potential options using the MOUSE model. Bookend Option 1 reflects a system configuration with the maximum anticipated upstream flow diversions (additional treatment and storage capacity) which would minimize the downstream collection system needs. Bookend Option 2 reflects a system configuration with minimum anticipated upstream flow diversions, where maximum flow is conveyed through the downstream collection system to HTP.

These bookend options provide a starting point for identifying variations of these options to match treatment plant option permutations and are described below:

6.4.3.1 Bookend Option 1 - Wet Weather Storage with Upstream Expansion

For the treatment system scenario with upstream expansion of TWRP and LAG to MF/RO, and wet weather storage at both plants, the collection system modifications were determined through a series of dry and wet weather MOUSE model runs. The resulting plant configurations for this scenario are as follows:

- Tillman: 120 mgd with 6.5 percent sludge return to the downstream collection system and 25 percent MF/RO brine return; 30 million gallons of wet weather storage.
- LAG: 30 mgd with 5.8 percent sludge return and 25 percent MF/RO brine return; 20 million gallons of storage.
- HTP: 450 mgd.

Wet weather treatment and storage at TWRP was sufficient to eliminate the need for the VSLIS. GBIS was assumed to be on-line to convey flows to the expanded LAG and provide relief to the La Cienega San Fernando Valley Relief Sewer (Tunnel) line. However, the treatment and storage provided at LAG was not enough to eliminate the need for NEIS Phase 2 downstream of LAG. The VARS is needed to provide relief to the south branch of the NOS at the Maze area. In summary, the following collection system components would be needed for the treatment scenario with upstream plant expansions and wet weather storage:

- GBIS
- NEIS Phase 2
- VARS

6.4.3.2 Bookend Option 2 - Maximum Conveyance to HTP

For the treatment system scenario that maximizes conveyance to HTP, TWRP is maintained at its existing derated capacity with MF/RO added and LAG is assumed to be operated as a skimming plant. A skimming plant operates during dry weather to produce recycled water for end users. However, during wet weather when end users are likely to be minimal since they are primarily for irrigation, the entire flow must be able to be conveyed back to the downstream collection system. The skimming plant would effectively have no flow diversion capacity during wet weather.

Collection system modifications were determined through a series of dry and wet weather MOUSE model runs. The resulting plant configurations for this scenario are as follows:

- TWRP: 64 mgd with 6.5 percent return sludge and 25 percent brine return
- LAG: 0 mgd
- Hyperion: 550 mgd

For this scenario, collection system capacity from TWRP to LAG would need expansion. The VARS is needed to provide relief to the south branch of the NOS at the Maze area. The following collection system components would be needed for the treatment scenario with conveyance of maximum flows downstream and HTP expansion:

- VSLIS
- GBIS
- NEIS Phase 2
- VARS

Based on the results of these bookend scenarios, key components of collection system improvements will be applied and refined to meet the combined needs of the wastewater treatment and conveyance systems as integrated alternatives are developed under the IRP. The preliminary concepts presented here will be further developed through the IRP process.