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1.0 Introduction

1.1 Overview

The City of Rancho Palos Verdes owns the sewer collection system within the city limits.

The State Water Resources Control Board, through the 2006 Waste Discharge Requirements (WDRs) requires monitoring and reporting for sanitary sewer systems to eliminate sanitary sewer overflows (SSOs). One of the State's requirements are that owner/operators of sewer systems (one mile or longer) must develop and implement a Sewer System Management Plan (SSMP) specific to the sanitary sewer system. This update to the 2004 Sewer Master Plan will include physical changes that have been made to the system since 2004 and provide information needed to comply with the State's Waste Discharge Requirements in addition to identifying areas where improvements in the operations and maintenance of the system can be considered.

The collection system consists of privately owned laterals that extend from individual properties to the City owned collection system located in the street, right of way or easements. Private property owners with the exception of the Abalone Cove landslide area are responsible for the operations and maintenance of their individual service laterals.

Los Angles County collects a fee from property owners in Rancho Palos Verdes for the maintenance and repair of the sewer system excluding the Abalone Cove area. Maintenance and repair activities that the Los Angeles County Department of Public Works, Consolidated Sewer Maintenance District (LACSMD) perform, include video inspections, line cleaning, repairing structurally deficient segments of pipe, unplugging blockages and cleaning up after overflows. The City is responsible for the continuing operations of sewer collection system and to identify and correct pipeline capacity related problems found within the system.

The Abalone Cove Sewer System is currently owned, operated and maintained by the City of Rancho Palos Verdes. The city collects a fee from property owners through the Abalone Cove Sewer Fee. The City is responsible for all aspects of operating and maintaining the system. Maintenance activities for this system include line cleaning and video inspecting, lift station repair and maintenance, grinder pump and lateral line repair and maintenance. ~~The fees do not currently cover the costs of these services and have required annual subsidies.~~The scope of work for this study did not include an extensive evaluation of the new system. However a preliminary evaluation of the Abalone Cove Sewer System was performed. It was determined that the full operational costs associated with the system should be further evaluated.

1.2 Authorization and Scope

To improve the management of the collection system assets, Dudek was contracted to prepare a Sanitary Sewer Master Plan Update (SMPU 2009). The primary need for the update comes from the additional sewers that have been constructed and changes in the regulations governing sewer collection system that have occurred since the original 2004 Sewer Master Plan. The focus of the SMPU 2009 was to update the basis of the original master plan and to comply with the State's Waste Discharge Requirements (WDRs). Council authorized this project at their session held on August 19, 2008 (Appendix B)

The scope of work included the following items:

- Update the existing sewer GIS – adding Abalone Cover Sewer System and any new developments, making changes accordingly
- Measuring the current sewer system flow at key locations*
- Update the hydraulic model from the GIS
- Recalibrate the model with current flow measurements
- Update the future land use to reflect any changes in General or Specific Plans
- Analyze the current and future capacity of the system
- Update Capacity related project descriptions and costs
- Define revised priority factors (proximity to storm drains, etc.)
- Prepare prioritized Collection System Capital Improvements Program
- Coordinate with City/County to determine the current physical condition assessments
- Recommend System Evaluation programs (CCTV, Smoke Testing and Physical Inspection) for SSMP compliance
- Revise the Sewer Master Plan to reflect new findings and to meet the requirements of the SSMP

The updated GIS and the hydraulic model represent tools that are available for improved management of the collection system asset. The analyses performed for this study also yield valuable insight into the overall physical condition and operations of the system. This report highlights the findings and makes specific recommendations related to improving and maintaining the collection system.

To further clarify, in 2006, the State and Regional Water Quality Board adopted the Waste Discharge Requirements that require the preparation of a Sewer System Management Plan (SSMP) by all owners/operators of wastewater collection systems. The City owns the wastewater collection system while the County Sewer Maintenance District (SMD) operates and maintains the collection system except for the Abalone Cove system. The SMD has prepared a general SSMP for its client cities that addresses some of the requirements of the

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WDRs. The City is also responsible for preparing its own SSMP which includes elements not specifically addressed in the County's SSMP. This document addresses specific elements of the System Evaluation and Capacity Assurance Planning (SECAP) not included in the LACSMD SSMP. These elements will be included by reference in the City's SSMP being prepared by John Hunter and Associates, Inc.

The SMPU is organized by discussing the primary findings and recommendations in the Executive Summary, followed by the detailed descriptions of the collection system characteristics, capacity and system conditions, improvements required and the estimated costs for these facility improvements.

1.3 Study Area

The City of Rancho Palos Verdes City Limits served as the logical boundary of the Study Area. Certain homes located within the City of Rolling Hills Estates flow into the City of Rancho Palos Verdes. As a result these areas are included in the hydraulic model. The Rancho Palos Verdes City Limits / Study Area are shown in Figure 1-1.

Figure 1-1 City of Rancho Palos Verdes Study Area

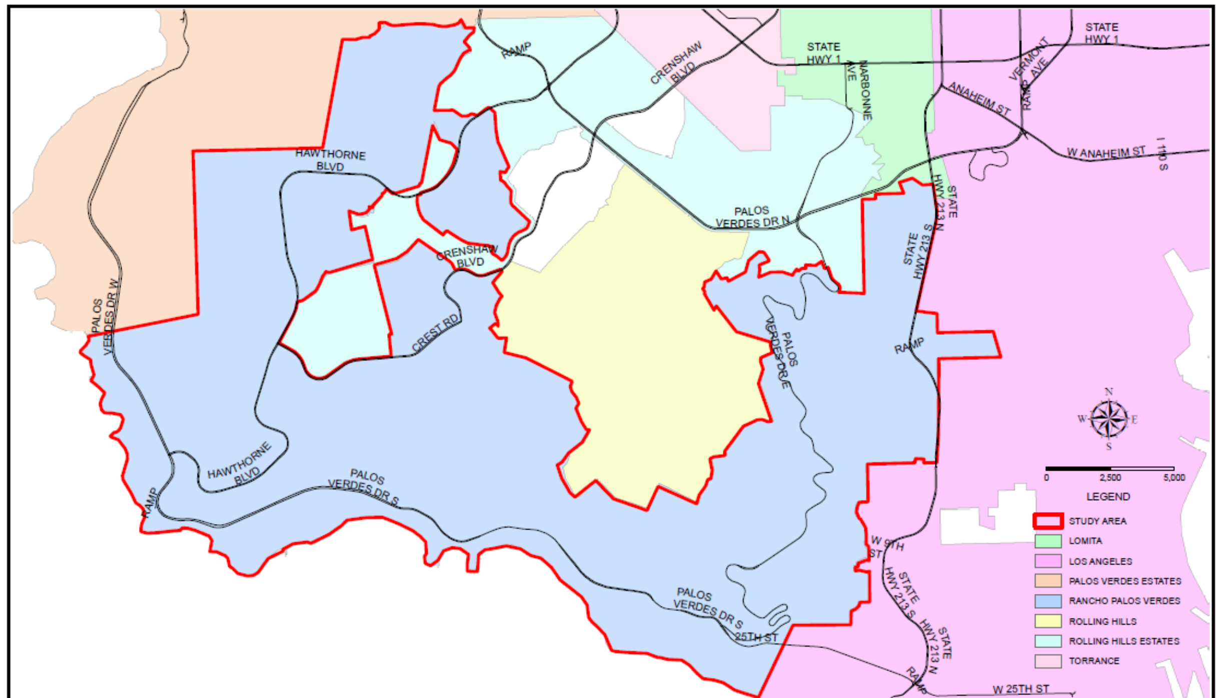

FIGURE 1-1
CITY OF RANCHO PALOS VERDES STUDY AREA

2.0 Executive Summary

2.1 Overview of Collection Systems Activities

Most cities' sewer collection system are owned and operated by the City. Business activities associated with the collection system would be management and operations and maintenance activities. Operations and maintenance functions for the Rancho Palos Verdes sewer collection system are performed through an ongoing contract with the Los Angeles County Sewer Maintenance District (LACSMD or SMD). Routine maintenance activities include cleaning, closed circuit television (CCTV), repairs and replacements.

The city provides the bulk of the management of the system through the preparation of budgets and reporting of sanitary sewer overflows (SSOs). Typical management functions include the planning, budgeting and funding programs required to insure the health of the sewer collection system. To facilitate these activities the City has invested in the creation of the Sewer Geographic Information System (GIS) and periodic master planning activities. The master planning process (1) identifies areas of inadequate capacity or of poor physical conditions (2) develops candidate projects to address the deficiencies (3) estimates costs associated with the projects and schedules the projects. The use of GIS in the City's collection system has greatly facilitated the analysis of the collection system to determine the need and priority of system improvements. Maps are readily created and used to discover the overall character of the system, map known overflow locations, cleaning schedules and to identify emerging trends discovered through the City or County televised inspection program (CCTV). The master plan update addresses the questions of (1) Where is the collection system? (2) What are the physical characteristics of the system? And (3) what needs to be done to bring the system into good conditions? The two primary aspects of concern are the physical condition and hydraulic capacity which are addressed through the system evaluation and hydraulic modeling respectively. The following section describes briefly the findings of the 2009 master plan update.

2.2 ~~System Evaluation~~Condition Assessment ~~and Capacity Analysis Findings~~

In the following sections, the system's physical condition is described through the findings of the CCTV results and the SSO database maintained by the State. The hydraulic capacity of the system is described through the modeling results.

2.2.1 CCTV Results

In 2004, Houston Harris and Associates, CCTV inspected 47,000 feet of pipeline or 6.1 % of the sewer collection system. The inspection results indicated that approximately 75% of the lines inspected were in fair or better condition. The remaining 25% was observed to have cracks and/or fats, roots, oil and grease accumulations. Based on these findings and the recommendations of the Sewer Master Plan, the City staff began to work more closely with the LACSMD to escalate the maintenance of the system. The County also accelerated the CCTV inspection schedule to comply with the WDRs. This should result in the CCTV inspection of the complete system within 10 years.

In the first year of the County CCTV inspection program (2005-2006) 76,591 feet of sewer or just over 10% of the system was inspected. The results indicate that over 88.8% of the system is in fair or better condition structurally and 79.1 % of the system is in fair or better condition from a maintenance perspective. This indicates that approximately 12% of the system is structurally deficient (cracked pipe) and 20% of the system is subject to blockage from fats, roots, oil and grease accumulation. The County has stated that they plan to address problems found through cleaning and repair as appropriate.

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The previous Sewer Master Plan indicated that the physical conditions observed in the CCTV inspection program show that in general the condition of the piping is fair. Root intrusion and cracked pipe dominate the defects observed in the field inspections. Pipeline capacity is not limited by their physical size. 20% of the pipe segments in the system are estimated to be in poor condition which could result in an increase in overflows. Table 5-6 confirms the above statement that 79.1% of the city's (county maintained) system that was CCTV inspected in 2006 is in fair or better maintenance condition.

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Photos of the 2006 study by the county were unavailable and the following photos show the conditions observed in the 2004 CCTV study. It is important to realize that these types of defects are typical and occur in approximately 20% of the observed system. This means that most of the system (80%) is in fair or better condition

Figure 2-1 Typical TV Observation of Normal of Roots at Ungasketed Joint (2004)

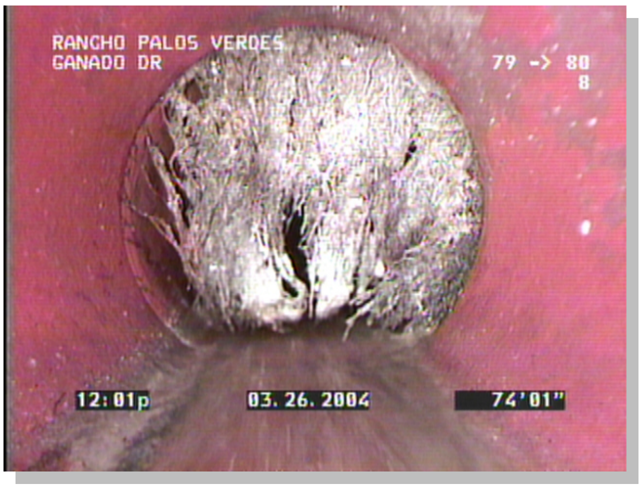

Figure 2-2 Fats, Oils and Grease (2004)

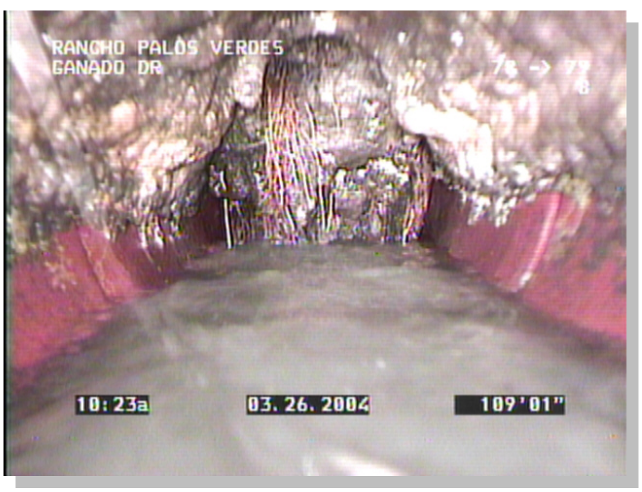

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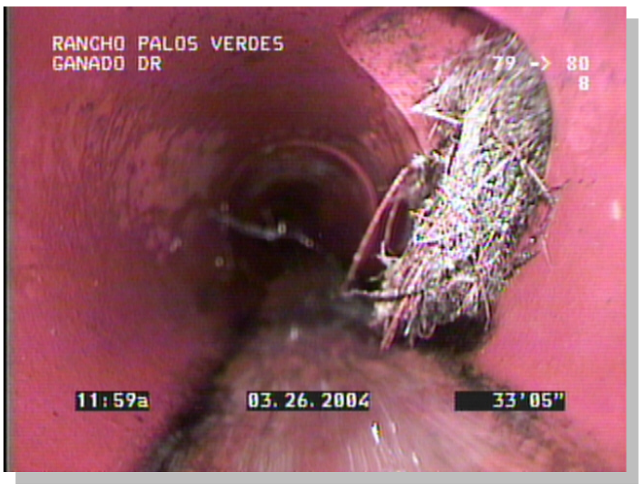
Figure 2-3 Roots from Service Connection (2004)



The previous photos are shown as a representative example of undesirable pipeline conditions. Note that these types of defects are found in 20% of the system inspected. The City should attain all inspection records including the photographs for inclusion in the City's GIS. This will enhance the overall management function and provide documentation of changing conditions in the system. For instance, the property owner of the lateral connection shown in Figure 2-3 should be contacted and advised of the extensive root intrusion in the lateral. Staff recognizes that this practice is not without risk as cleaning the private lateral may result in pushing roots into the city system and creating a downstream blockage.

2.2.2 California Integrated Water Quality System (CIWQS)

The CWIQS is a reporting system created during the WDR development that provides a clearing house for agency overflow reporting. To benchmark the performance of collection system the database stores information related to the number of overflows (SSOs), the number of SSOs per 100 miles of pipe and the SSO volume. Using this information, the following table of SSO characteristics for the five highest ranking systems was developed for the reporting period 2007-2009. The comparison only includes facilities that are maintained by the LACSMD. Three of the five top ranked facilities are located near Rancho Palos Verdes.

Table 2-1 SSO Characteristics SMD Clients

2007-2009	SSOs	SSO Vol.	Recover	To Surface	Length	Frequency	Volume to surface waters
Responsible Agency	(count)	(Gallons)	(Gallons)	(Gallons)	(Miles)	(SSO/100 mi.)	(gallons/100 mi.)
West Hollywood	20	8,800	3,210	4,650	39.4	50.7	11,802.00
Palos Verdes Estates	37	8,465	2,161	3,475	76.4	47.8	4,495.40
Rancho Palos Verdes	38	13,425	3,140	8,025	138.8	27.0	5,707.60
Rolling Hills Estates	7	1,285	245	50	32.4	21.4	152.9
Hawaiian Gardens	3	601	101	500	15.7	19.1	3,184.70

This table indicates that the City has more SSOs than any other agency maintained by the LACSMD. When normalized to consider the length of the system, the City ranks third of the highest five ranked systems. The SSO frequency is a further indicator of the physical condition of the system.

The following table shows the same comparisons for the highest frequency (SSO/100 mi.) for all agencies in Los Angeles County.

Table 2-2 Top 10 SSO Frequency LA County

2007-2009	SSOs	SSO Vol.	Recovered	To Surface	Length	Frequency	Volume to surface waters
Responsible Agency	**(count)**	**(Gallons)**	**(Gallons)**	**(Gallons)**	**(Miles)**	**(SSO/100 mi.)**	**(gallons/100 mi.)**
CSU Dominguez Hills	37	113,674	6,174	0	3.0	284.6	-
UC Los Angeles	4	17,340	1,300	15,940	2.0	133.3	**531,333**
Los Angeles Cnty DPW	2	400	250	0	2.9	51.2	-
West Hollywood	20	8,800	3,210	4,650	39.4	50.7	**11,802**
Palos Verdes Estates	37	8,465	2,161	3,475	76.4	47.8	**4,495**
Whittier City	75	15,352	985	445	214.0	35.0	**208**
Beverly Hills	31	6,032	2,960	1,409	98.0	31.6	**1,438**
LA County Sanitation Districts	5	3,750	0	1,700	14.6	28.9	**9,827**
Rancho Palos Verdes City	38	13,425	3,140	8,025	138.8	27.0	**5,708**
LA County Sanitation Districts	4	275	75	0	15.3	25.9	-

Note that in Table 2-1 three of the top five communities are located on "the hill." This seems to indicate that a shared physical characteristic contributes to the frequency and amount of overflows. Factors that are likely to create this situation are the dominant construction material and techniques and the steep slopes. The steep slopes would result in a downward stress on the pipe joints which could enlarge the gap at the joint. This pulling apart could result in more root intrusion and structural cracking. The following table shows the Pipeline Assessment and Certification Program (PACP) rating (1=Excellent – 5 = Worst), slope and length of pipe.

Table 2-3 Pipe Rating and Slope

	Slope										
PACP Rating	**0-0.5%**	**0.5-1%**	**1-2%**	**2-3%**	**3-4%**	**4-5%**	**5-6%**	**6-7%**	**7-8%**	**8-9%**	**>9%**
	Pipe Length (ft)										
1 - Excellent	8,075	2,076	5,142	2,165	2,569	1,810	2,577	2,021	2,204	2,631	9,366
2 - Good	414	254	199	857	639	718	1,529	254	0	0	1,150
3 - Fair	3,010	1,079	2,324	1,414	2,344	1,188	1,702	2,158	2,105	1,021	2,315
4 - Poor	1,081	0	1,090	0	0	0	468	182	647	216	986
5 – Immediate Attention	368	142	622	218	121	685	889	143	136	0	1,127

2.2.3 GIS Analysis of Age and Materials

A system evaluation was performed through further analysis of the age and materials used in the collection system. The GIS data captured included the installation date and the material for a majority of the pipes. This data was used to prepare the following summary tables of age and materials.

Table 2-4 Pipe Age Distribution

Decade Constructed	Length of Gravity Pipe (feet)	Percent Cumulative	Length of Forcemain (feet)	Percent Cumulative
1950-1959	145,449	19.54%	0	0.00%
1960-1969	400,868	73.38%	1,550	5.27%
1970-1979	119,735	89.47%	855	8.18%
1980-1989	29,059	93.37%	481	9.81%
1990-1999	23,616	96.54%	20,426	79.28%
2000-2009	16,478	98.76%	2,221	86.83%
Unknown	9,265	100.00%	3,872	100.00%
Total	744,470		29,405	

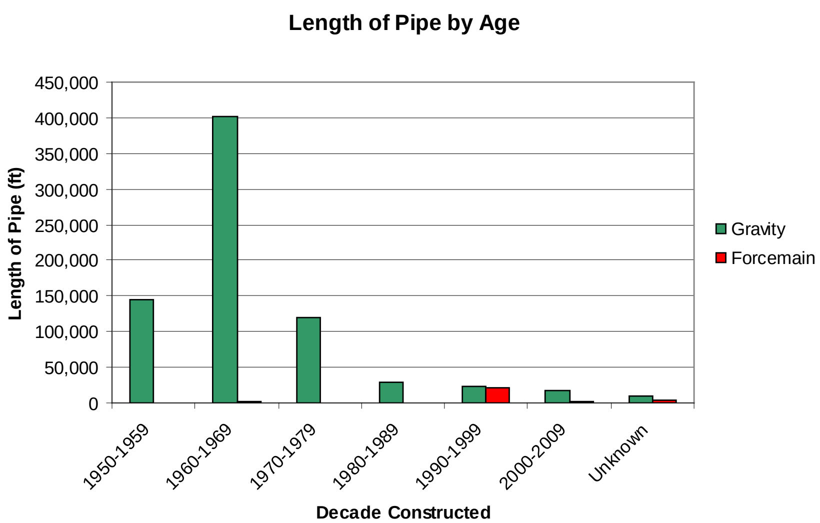
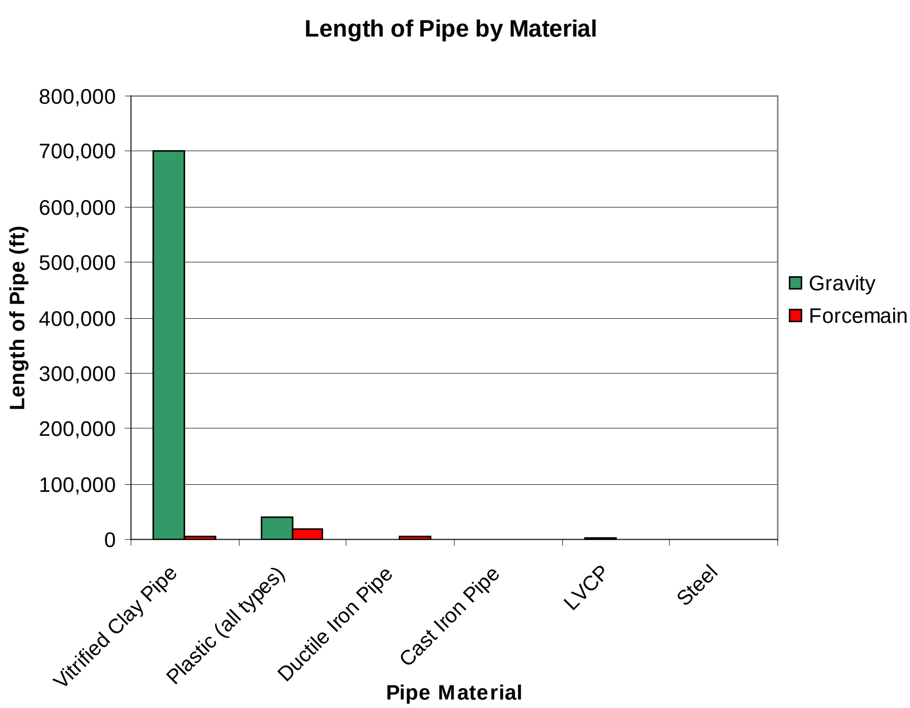


Table 2-5 Pipe Material Distribution

Material	Length of Gravity Pipe (feet)	Percent Cumulative	Length of Forcemain (feet)	Percent Cumulative
Vitrified Clay Pipe	700,270	94.06%	5,135	17.46%
Plastic (all types)	41,422	99.63%	18,931	81.84%
Ductile Iron Pipe	110	99.64%	4,817	98.22%
Cast Iron Pipe	521	99.71%	522	100.00%
LVCP	1,823	99.96%		
Steel	324	100.00%		
Total	744,470		29,405	



As shown in these tables the dominant material used in the system is Vitrified Clay Pipe (VCP) at just over 94%. Prior to the 1970s it was common practice to install VCP pipe sections without gaskets. This practice was based on the theory that additional groundwater flowing into the pipe was beneficial in cleaning and flushing the pipe. This practice resulted in easy entry of roots from surrounding trees and hedges into the pipes. In the mid 70's it became common practice to use mortar to "seal" the joints. This rigid seal would be easily cracked and would dissolve from hydrogen sulfide attack over time. Over 80% of the system was installed before gasketed joints became common.

The majority of the system (over 73%) is now more than 40 years old and made of VCP. The average service life for VCP pipe is generally accepted as 100 years with breakage beginning at approximately 20 years. As a result there will be an increasing trend in pipe structural failures with time.

~~2.2.4~~2.2.4 *Capacity Analysis*

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A hydraulic model was used to determine the systems theoretical capability to convey the flows under existing and future, dry and wet conditions. The capacity analysis uses the measurement of depth/diameter ratio to determine the capacity of the collection system. Gravity pipes flowing at less than d/D = 0.9 are considered adequate and not recommended for replacement. As shown, the steep slopes in the majority of the system provide excellent hydraulic capacity. The following table shows the number of capacity deficient segments for each of the hydraulic scenarios. As shown even with future population increases and a generous allowance for inflow and infiltration, approximately 98% of the system has adequate capacity.

Table 2-6 - Capacity Analysis Results

Flow Scenario	Total	0.5-0.75	0.75-0.90	>0.90	>0.90
Existing	3192	70	10	7	0.2%
Future	3192	71	12	11	0.3%
Future Wet (2.5X)	3192	195	23	81	2.1%

As a result of the Capacity Analysis, seven potential projects have been identified and prioritized. The details of the process are discussed in Chapter 7. The candidate projects and their approximate scheduling are shown below. The pipes included in the Miscellaneous category were single or double pipe segments that have capacity problems but do not necessarily fall into a project category. The Miscellaneous category is for a new pipe size of 12 inches, based on the hydraulic model recommendations.

The Abalone Cove area is served primarily by grinder pumps, lift stations and force mains. The criterion for capacity revolves around pump ratings and pipeline velocities where each individual home is served by a pump and a series of force mains. Since the system is predominately pressurized it is not subject to the wet weather effects seen in the gravity portions of the system. The number of homes in the Abalone Cove service area is expected to double as a result of recent litigation. This increase in homes Is NOT anticipated to create a capacity problem as the original plan anticipated. The increase in assessment district customers may provide an opportunity for the reassessment of all users and the elimination of the City subsidy for the area.

Table 2-7 Capacity Related Projects

Project Name	Planning Period	
	2010	2020
Ironwood Street	$202,275.00	
PV Drive South, Conqueror to Schooner	$516,997.50	
PVDrive S., Sea Cove to Abalone Cove Shoreline Pk.	$162,690.00	
Basswood Avenue		$98,136.00
Parallel to Basswood Avenue		$334,950.00
West General Street		$97,400.00
Ginger Root Lane		$165,648.00
Miscellaneous, 12 inch		$339,474.00
Total 10 Year Program	**$881,962.50**	**$1,035,608.00**
Average Annual Cost	**$88,196.25**	**$103,560.80**

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~~2.2.5~~ *Recommendations*

The City has improved the management of the collection system through closer coordination and collaboration with the County Sewer Maintenance District. The preparation of the SSMP and the City's direction to the LACSMD will also facilitate improved management of the collection system. This document will be incorporated by reference in the SSMP which will become the business plan for the collection system. The sources of funding for the noted condition and capacity related projects needs to be identified through significant coordination with the County.

The LACSMD has proposed the following schedule for CCTV inspection of the system and system cleaning of segments with critical maintenance issues. As of June 2009, results for the 2006-2007 inspection program have not been provided. The City should coordinate with the County to attain this data for planning purposes.

Table 2-8 CCTV Project Schedule[1]

Fiscal Year	Project Name	Length (feet)
2005-2006	Y0TV0506F	76,591
2006-2007	Y0TV607D	131,329
2008-2009	4_18	31,410
2009-2010	4_19	266,674
2011-2012	4_16	100,727
2011-2012	4_17	124,667
2012-2013	1_5	850

The City should approach the management of the collection system to address three primary areas of concern. These are:

(1) Determine the actual physical condition of the system by augmenting the County's CCTV efforts
(2) Perform a detailed Advanced Asset Management Study of the Abalone Cove sewer system to determine the true costs of a sustainable system.
(3) Address the capacity problems identified and scheduled in the CIP.

Commented [RD6]: Noah, these three points are good, but you need to tie these points to the three sections below. It is confusing and took me some time to associate the Physical Condition Assessment with item (1) and so on.

[1] Consolidated Sewer Maintenance District Condition Assessment Program Report

The approximate costs and scheduling for the near term projects are shown in.

Recommendations -

~~2.3~~Physical Condition Assessment

- To aid in augmenting the County's maintenance efforts, c~~C~~ontinue the public awareness campaign to educate citizens about the condition of the sewers and what they can do to help
- Work with LA County to insure that:
  - Increase routine maintenance is performed to improve the PACP Maintenance scores
  - Accelerate the CCTV Inspection program to insure complete inspection of the system is conducted within 5 years
  - Track lines identified by the County as structurally compromised through to replacement of the lines.~~Replace the lines identified as structurally compromised~~
- Conduct a thorough assessment of the fiscal requirements for the operation of the Abalone Cove Special District
- Secure funding sources through establishment of rates that are based on the EPAs Enhanced Asset Management Strategy for Sustainability
- Incorporate suggested improvement to the Collection System CIP into the City's budget

~~2.4~~Recommendations - Abalone Cove Sewer System

The current rates address a minimally compliant system. Longer term sustainability of the system has not been fully addressed in this report. ~~currently collected from the Abalone Cover sewer system are inadequate to maintain or sustain the system. The City provides a subsidy to supplement property owner's fees that covers maintenance only.~~ A complete and thorough review of the fiscal requirements for the operations of the Abalone Cove Sewer System should be completed. Sustainability of this system requires detailed analysis of the life expectancy of all of the components of the system which is beyond the scope of this update to the Sewer System Management Plan. Additionally the risk analysis would include a rational assessment of the consequences of failure of these systems. The outcome of this detailed operational analysis would be the preparation of a proactive preventative maintenance and replacement schedule for the facilities.

The results of recent legal decisions are likely to provide an opportunity to revisit the ownership and operation of the Abalone Cove system. As discussed in the introduction, it is unusual for the City to own, operate and maintain facilities located on private property and serving only one single family residence. Individual ownership, operations and maintenance of these facilities is more consistent with the other properties in the City.

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It is recommended that both the city and County continue to investigate and document the physical condition of the system. Detailed information related to the physical condition should be evaluated with a Risk Management approach to prioritize which portions of the system are repaired first. The City will need to take a proactive role in the management of the system ~~while continuing to rely on the County for the Operations and Maintenance~~. Opportunities for private cleaning and maintenance of sewer lateral systems should be considered.

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~~2.5~~Recommendations - Capacity Projects

The capacity analysis reveals a need to set aside money to fund just over $1.5 Million dollars worth of capacity increasing projects over the next 20 years. An additional $340,000 dollars is identified for miscellaneous replacements that are scattered throughout the City. Funding for these locations should be set aside and expended through the replacement or repair of other capital facilities.

Table 2-9 Near Term CIP

Rancho Palos Verdes Collection System CIP				Near Term				
Category		Total Cost	Years	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015
Administrative								
	Abalone Cove Analysis	$ 50,000	1	$ 50,000				
	CCTV Program Management	$ 93,132	5	$ 18,626	$ 18,626	$ 18,626	$ 18,626	$ 18,626
System Evaluation								
	CCTV-Cleaning	$ 465,659	5	$ 93,132	$ 93,132	$ 93,132	$ 93,132	$ 93,132
General Projects								
	Abalone Cove Upgrades	$ 150,000	3		$ 50,000	$ 50,000	$ 50,000	
Capacity Projects								
Ironwood Street		$ 202,275	3	$ 67,425	$ 67,425	$ 67,425		
PV Drive S. ,Conqueror to Schooner		$ 516,998	3		$ 172,333	$ 172,333	$ 172,333	
PV Drive S., Sea Cove to Abalone Cove $		$ 162,690	3			$ 54,230	$ 54,230	$ 54,230
Basswood Avenue		$ 98,136	3					
Parallel to Basswood Avenue		$ 334,950	3					
West General Street		$ 97,400	3					
Ginger Root Lane		$ 165,648	3					
Miscellaneous 12"		$ 339,474	10	$ 33,947	$ 33,947	$ 33,947	$ 33,947	$ 33,947
	Total	$ 2,676,361	**Period Total**	$ 263,131	$ 435,463	$ 489,693	$ 422,268	$ 199,936

The complete recommended CIP is shown in Table 7-3.

3.0 Existing System

3.1 General

The City of Rancho Palos Verdes is located in the western most portion of Los Angeles County. It is bounded on the north by Palos Verdes Estates, on the east by Rolling Hills Estates and the City of Lomita, on the south by the City of San Pedro and unincorporated county areas, and on the west by the Pacific Ocean.

Figure 3-1 Rancho Palos Verdes Views

The city boundaries contain approximately 13.6 square miles of area and 7.5 miles of coastline. The reported population in 2000 was 41,145 capita and this is estimated to have increased to 42,800 capita in 2009. [2] The population is not expected to increase dramatically and the few vacant areas remain for development and the developments that do occur will have limited impact on the overall population. The City is currently revising its General Plan and there is a strong community feeling that the semi-rural nature of the community should be preserved.

The climate of the City is Mediterranean with average annual rainfall of 13.17 inches. The majority of this rainfall occurs during January, February and March. The steep terrain of the City allows most of the rainfall to drain quickly with little observed surface flooding. The average temperature varies from 67° F in the winter to 80° F in the summer.

[2] State of California, Department of Finance, *E-5 Population and Housing Estimates for Cities, Counties and the State, 2001-2009, with 2000 Benchmark. Sacramento, California, May 2009*

The topology of the City is considered one of its best assets rising from a rugged coastline on the south and west to elevations of over 1400 feet above sea level in the area around Marymount College. The areas of Abalone Cove and Portuguese Bend have had major landslide activities. In these areas a new collection system consisting of grinder pumps, low pressure sewer lines, lift stations, and gravity pipes has been installed. The steep terrain and rocky soils have created a sewer system with many interesting features. These would include a wide use of vertical curves and structural retards to prevent the pipelines from shifting down the hillsides.

3.2 Land Use

The land use in the City is 98% residential. There are no known major industrial or commercial contributors to the collection system.

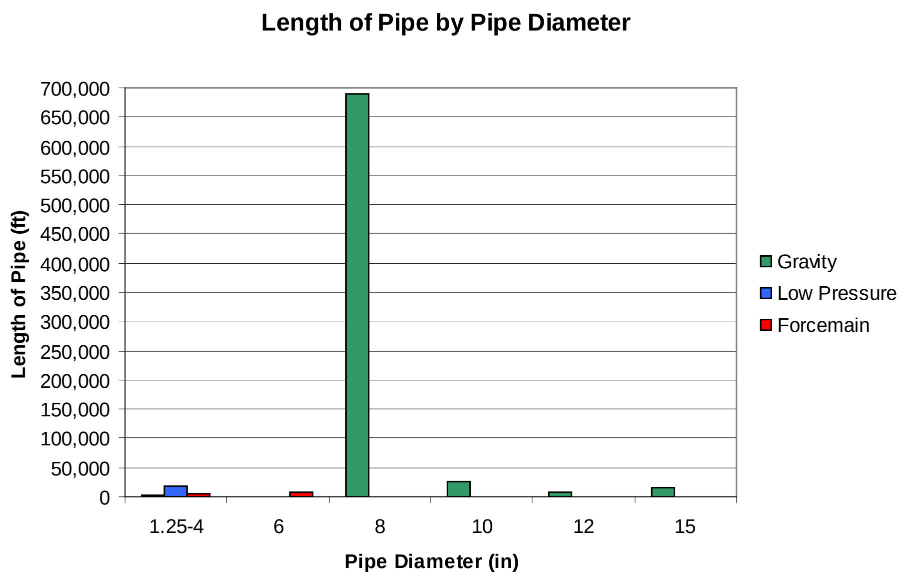
Figure 3-2 Rugged Coastline

3.3 Collection System Description

Located within the City of Rancho Palos Verdes is approximately 790,000 linear feet of wastewater conveyance pipelines, 17 primary lift stations, 44 grinder pumps, and approximately 3,707 manholes. The gravity pipe ranges in size from 8 inches in diameter to 15 inches in diameter. The low pressure sewer pipelines in the Abalone Cove area range from 1.25 inches to 4 inches in diameter.

Table 3-1 Summary of City Conveyance Pipelines, Entire System

Pipe Diameter (inches)	Total Length of Gravity Pipe (feet)	Total Length of Low Pressure Pipe (feet)	Total Length of Forcemain (feet)
1.25-4	1,872	18,549	3,943
6	465	0	6,609
8	690,309	1,065	590
10	25,155	0	0
12	8,837	0	0
15	16,169	0	0



The collection system is further characterized by considering the age and materials used in its construction. The following tables show the distribution of these characteristics.

Table 3-2 Pipe Age Distribution

Decade Constructed	Length of Gravity Pipe (feet)	Percent Cumulative	Length of Forcemain (feet)	Percent Cumulative
1950-1959	145,449	19.54%	0	0.00%
1960-1969	400,868	73.38%	1,550	5.27%
1970-1979	119,735	89.47%	855	8.18%
1980-1989	29,059	93.37%	481	9.81%
1990-1999	23,616	96.54%	20,426	79.28%
2000-2009	16,478	98.76%	2,221	86.83%
Unknown	9,265	100.00%	3,872	100.00%
Total	744,470		29,405	

Table 3-3 Pipe Material Distribution

Material	Length of Gravity Pipe (feet)	Percent Cumulative	Length of Forcemain (feet)	Percent Cumulative
Vitrified Clay Pipe	700,270	94.06%	5,135	17.46%
Plastic (all types)	41,422	99.63%	18,931	81.84%
Ductile Iron Pipe	110	99.64%	4,817	98.22%
Cast Iron Pipe	521	99.71%	522	100.00%
LVCP	1,823	99.96%		
Steel	324	100.00%		
Total	744,470		29,405	

The dominant material used in the system is Vitrified Clay Pipe (VCP) at just over 94%. Prior to the 1970s it was common practice to install VCP pipe sections without gaskets. The prevailing theory was that the additional groundwater that flowed into the pipe was beneficial in cleaning and flushing the pipe. This practice results in easy entry into the pipes of roots from surrounding trees and hedges. Note that over 80% of the system was installed before gasketed joints became common.

The majority of the system (over 73%) is now more than 40 years old and made of VCP. The average service life for VCP pipe is generally accepted as 50 years. This leaves the remaining design service life for most of the system at less than 10 years. As a result there will most likely be an increasing trend in pipe structural failures with time.

3.4 Abalone Cove

The area known as Abalone Cove is of special consideration due to the presence of 44 grinder pumps in the area, with 41 of them serving one residence and 3 duplex grinder pumps serving two or more residences. The three duplex grinder pumps are located on Abalone Cove Shoreline Park, off of West Pomegranate Drive, and off of Vanderlip Road. The system was installed in 2001 to replace septic systems in landslide areas. There are 130 manholes, 1 diversion structure, approximately 19,000 linear feet of gravity pipeline, 19,615 linear feet of low pressure pipe, and 2,505 linear feet of forcemain. A summary of the length of pipe and their associated diameters is provided in Table 3-4.

Table 3-4 Summary of City Conveyance Pipelines, Abalone Cove

Pipe Diameter (inches)	Total Length of Gravity Pipe (feet)	Total Length of Low Pressure Pipe (feet)	Total Length of Forcemain (feet)
1.25-4	0	19,615	1,840
6	0	0	665
8	19,000	0	0
10	0	0	0
12	0	0	0
15	0	0	0

Figure 3-3 Wastewater Collection System

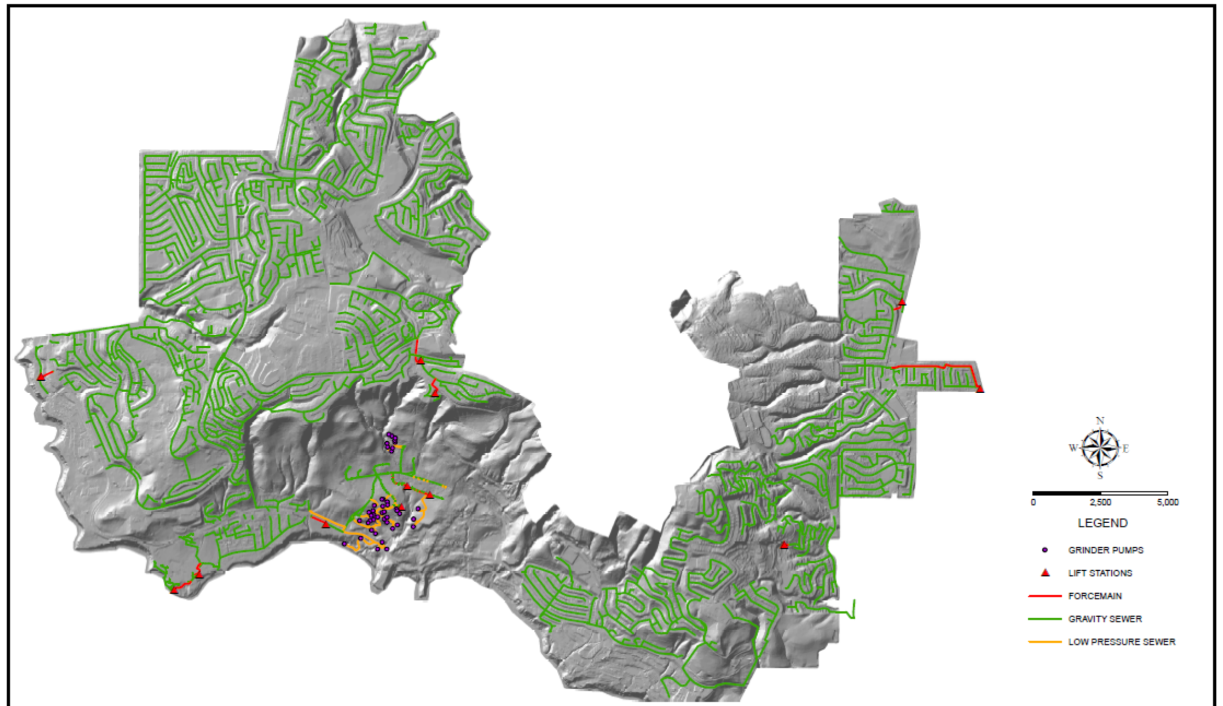


FIGURE 3-3
WASTEWATER COLLECTION SYSTEM

4.0 Basis of Capacity Analysis

Hydraulic modeling is used to determine the hydraulic capacity of each pipe segment in the system. Pipe capacity is compared to the actual or predicted flow loads to determine if sufficient capacity exists. The following sections discuss the various assumptions related to the flow loads to be conveyed and the calculation of pipeline capacity. Of special note is that these calculations are based on the underlying assumption that the pipe is clean and unobstructed.

4.1 Flow Rates

To determine the operation of the system under a variety of flow conditions, three primary flow scenarios were considered. These are:

(1) Average Dry Weather Flow
(2) Future Dry Weather Flow
(3) Future Wet Weather Flow

The hydraulic model requires the flows to be described as an average daily volume and as an hourly variation. This allows the system capacity to be tested at all flow variations from low to peak. The hourly variation is also called the diurnal curve or shape.

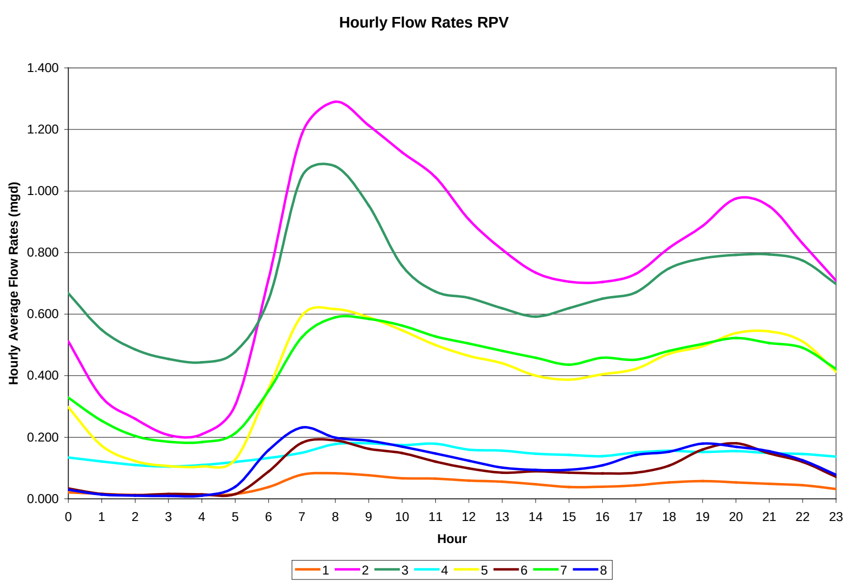
To determine the Average Dry Weather flow, the 2004 flow measurement data was collected and analyzed at eight (8) key locations in the City for a period of one week. The eight locations sampled represent the general character of flow throughout the entire system. Approximately 60% of the piping system was measured through these eight locations.

Table 4-1 Flow Measurement Data (From 7-Day Average)

Meter ID	Flow Rates (mgd)			Peaking Factor
	Maximum	Minimum	Average	
1	0.083	0.011	0.044	1.9
2	1.290	0.208	0.756	1.7
3	1.080	0.444	0.693	1.6
4	0.180	0.105	0.145	1.2
5	0.617	0.105	0.401	1.5
6	0.190	0.012	0.096	2.0
7	0.590	0.184	0.426	1.4
8	0.232	0.009	0.114	2.0

Note that this data is derived from the seven day average. In addition to defining the general characteristics of each basin the flow data is used to determine the hourly variation of flow that is observed in each basin. This is a single characteristic that is analyzed for consistency across the entire set of basins that were measured. The following graph shows how the flow varied throughout the day for each of the sites.

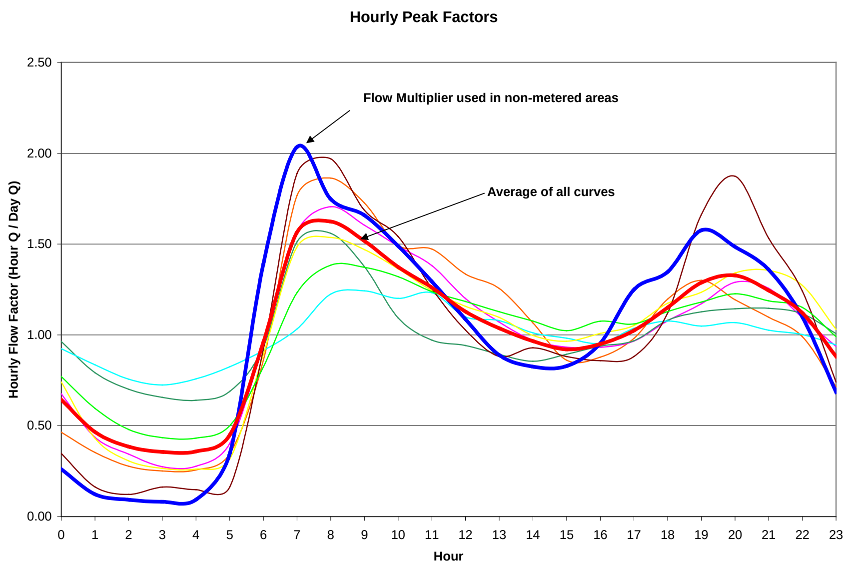
Figure 4-1 Flow Measurement Results



The Y values of the graph are the hourly flow rates measured in millions of gallons per day (mgd); the X axis is the time of day. Due to the wide variation in the actual flow measured at each flow meter the hourly flow factor (HFF) is calculated for each basin.

The hourly peaking factor is calculated by dividing the average hourly flow rate by the average daily rate. In this way, all measured system flow variations can be directly compared. This is done to determine if there is a single diurnal pattern that could be used for all basins. The following graph shows the hourly peaking factors for all sites.

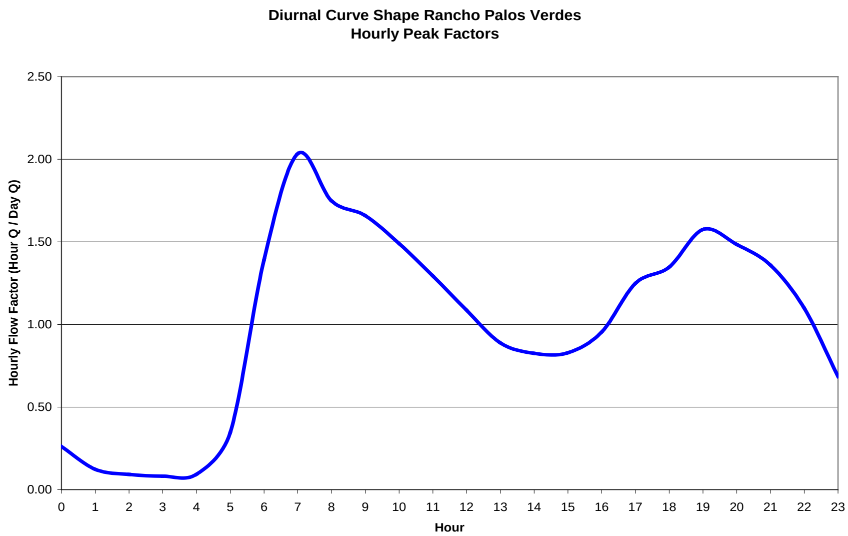
Figure 4-2 Hourly Peaking Factor



The red line is the average of all flow curves. Because of the variability of the measured curves the average of all curves was not used as the default pattern. This would have resulted in a peak factor of 1.62 which is significantly less than the county peaking factor of 2.0.

The peak flow factor for the Average Dry Weather Flow is then 2.0 for each parcel in the City. To determine the Future Dry Weather Flows census projections were used to describe the increase in population expected over the next 20 years. The population is expected to increase by only 1.07% in this time. To assess the future dry weather performance of the system a peaking factor of 1.017 was multiplied times the existing system flows. This increase is insignificant compared to the impact of simulating wet weather flows. Wet weather flows enter the system through direct or indirect connections with the surface. This is known as inflow and infiltration respectively. Inflow has a significant impact on the system capacity. Since no wet weather flow records are available for the collection system, wet weather conditions were simulated by using a multiplier of 2.5 times the average dry day flow rates. This is a widely accepted multiplier when combined with the hourly peak flow rate. This safety factor simulates each connection in the system at a load of 5.0 times (peak hour multiplier of 2.0 X wet weather multiplier of 2.5) the average dry day flow. The following figure shows the diurnal flow pattern that was used to assess system performance in the Average Dry Day condition.

Figure 4-3 Diurnal Hydrograph for RPV

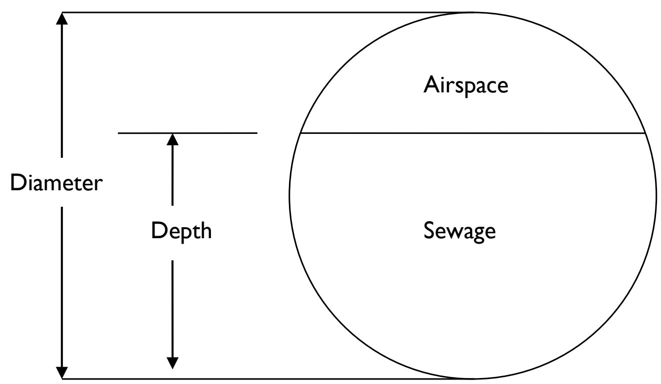


4.2 Pipeline Performance Criteria

Sewer collection systems are designed to use gravity to convey the fluids from homes and businesses to the wastewater treatment plant. Sewer pipelines are designed to operate in free flow conditions which assures that sufficient airspace is provided to maintain oxygen in the system. This airspace also provides an extra buffer for additional flows that may come from rainfall or unanticipated increases in flow. To provide this buffer, sewer pipes are regularly designed to operate at a depth that is less than the diameter of the pipe. The ratio of depth to diameter is used as the primary indicator of gravity pipeline capacity.

The depth is calculated using the Manning's equation for full and partially full pipes. The Los Angeles Bureau of Engineering (BOE) standards require that the depth/diameter ratio must be less than or equal to 0.75 for average dry weather flow in pipes larger than 12 inches and less than or equal to 0.50 for smaller pipes. These are design standards applied to new pipe. Considering existing pipe in place, during the simulated wet weather a pipe depth to diameter ratio of 0.9 is allowed for determining pipe capacity. The following figure shows the depth to diameter ratio used for determining hydraulic capacity.

Figure 4-4 Depth/Diameter Ratio



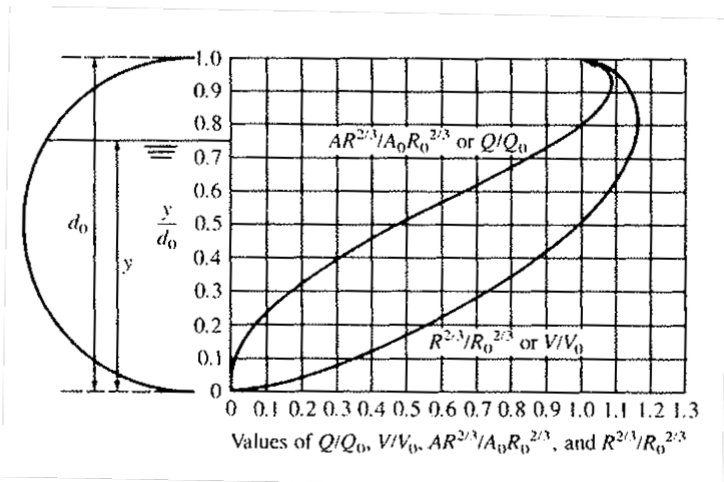
In addition to the depth/diameter criteria for capacity, the standards also require that the flow achieve a velocity of three feet per second (3 fps). This velocity insures that the system is adequately cleaned and that solids are regularly flushed from the system. The overall grade of the Rancho Palos Verdes gives velocities that are generally much higher.

In the measurement of system performance, a capacity analysis was performed based on the average dry weather flow (ADWF) and predicted wet weather flows of 2.5 times the ADWF. For Wet Weather flow scenario, the depth to diameter ratio was raised to 0.9.

As is shown in Figure 4-5, when the depth to diameter ratio is 0.9, the pipe is at a capacity of slightly less than maximum open channel flow and slightly more than full pipe capacity. At full pipe capacity the actual capacity is slightly less due to the additional friction from the top of the pipe. At flow regimes between a d/D of 0.9 and 1.0 flow is inherently unstable, for these reasons the maximum pipe capacity is calculated at d/D = 0.90.

In other words if the hydraulic model predicts a pipe segment d/D of more than 0.9 then the capacity of that pipe segment is deficient. Hydraulic capacity deficiencies are addressed by creating projects of closely grouped pipes into logically constructed projects.

Figure 4-5 Flow Depth Relationships



5.0 Existing Collection System Evaluation

To properly manage a facility, you must understand its operational characteristics. You must know how big it is and how it operates under normal and stressed conditions. The methods employed assure that the City knows more about its collection system asset than ever before. Now that the tools and the datasets have been created, regular maintenance will ensure their accuracy and continual usefulness in proper management.

To build understanding of the hydraulic operations of the system, the original Geographic Information System (GIS) was updated based on the most recent plan sets. These newly digitized features were added to the existing GIS to create a complete representation of the sanitary sewer system. Flows from previous measurements were applied to determine the hydraulic characteristics of the City of Rancho Palos Verdes collection system. Combining these into the hydraulic model allowed testing of the hydraulic capacity of the system under a variety of real and projected conditions. The models reflect the way that the system responds to changes in flows or in piping configurations. The details listed below will provide the user with an understanding of the methods by which the model was developed.

5.1 Updating the GIS

DUDEK previously created a GIS of the sanitary system for the Sanitary Sewer Master Plan in 2004; the main task for this 2009 Master Plan was to update the GIS. Newly provided plans for the areas of Abalone Cove, portions of Tract No. 46422, Tract No. 40640, Tract No. 52666, and Terransea were added to the GIS. Terransea is a site opening in June 2009 that contains approximately 8,500 linear feet of pipeline, 2 pump stations, 43 manholes, and 54 cleanouts.

Although the gravity portion of Abalone Cove was included in the 2004 Master Plan, house laterals and a few pipes have been added to support the inclusion of the grinder pumps. In all there were 41 grinder pumps, 3 duplex grinder pumps serving more than one residence, and approximately 18,500 linear feet of low pressure pipe within the system. There are also 3 larger lift stations and 19,000 feet of force mains. The following table shows the amount of new pipes and nodes that were digitized since the last master plan in 2004:

Table 5-1 Newly Digitized Features

	Number of Features
Low Pressure Pipe (feet)	18,549
Forcemain (feet)	2,232
Gravity Pipe (feet)	28,596
Manholes	97
Grinder Pumps	44
Pump Stations	6

To make the GIS as consistent as possible, the existing attributes from the original sewer pipes and manholes were filled in for the newly digitized sewer lines and nodes. The following table lists the attributes that are stored for each of the pipe segments in the collection system.

Table 5-2 Pipe Data Entities

Attribute	Description
PlanNo	The construction drawing number
SheetNo	The sheet within the construction drawing
RecordNo	Additional information related to location
HotLink	Connection to the as-built, CCTV inspection results
TractNo	Adjacent tract number
StreetName	Street that facility is located in or near
PIPE_LOCN	Whether in easement or roadway
LotNo	Adjacent lot number
UpID	Upstream structureID
UpStation	Upstream structure station
UpInvert	Upstream invert elevation
UpGround	Upstream ground elevation
Type	Gravity, pressure, or low pressure
Diameter	Diameter of pipe in inches
Material	Construction material (PVC, VCP, CI, etc.)
Slope	The calculated slope
DnID	Downstream structure ID
DnStation	Downstream structure station
DnInvert	Downstream invert elevation
DnGround	Downstream ground elevation
YearBuilt	Year of construction
Length	Length of pipe in feet
Curve Data	Used for describing curved pipes
Notes	User notes regarding facility
PipeID	Unique identifier for pipe segment

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Attribute	Description
JUR	Jurisdiction that owns pipe
MMS	LA County Maintenance Record ID
FM_Basin	Flow measurement basin ID
CAP_OV	If the pipe exceeds the recommended capacity
SD	Proximity to stormdrain structures
CCTV_Year	The year the pipe was CCTV inspected
PACP_Rate	Rating assigned during CCTV inspection
Priority	Priority based on condition and capacity
Area	Location in city

This information supports a broad range of decision support requests. For instance, knowing the age and material of all pipes, the inspection, replacement and rehabilitation programs can be directed to the area of greatest need. Prior to having access to this data, there was no logical method of directing these efforts.

5.1.1 GIS Datasets

The GIS contains all information that was available at the beginning of the project plus an additional 20 sets of plans that were later found not to be a part of the previously scanned imagery. These have been scanned and are indexed to the GIS shapefiles. This allows the staff to select a pipe on screen and retrieve the scanned image of the construction drawing for greater detail.

The following set of figures shows the usefulness of the GIS and how it can be used.
Figure 5-1 is the collection system color coded by year constructed
Figure 5-2 is the collection system color coded by pipe diameter
Figure 5-3 is the collection system color coded by pipe material

Figure 5-1 Collection System by Year

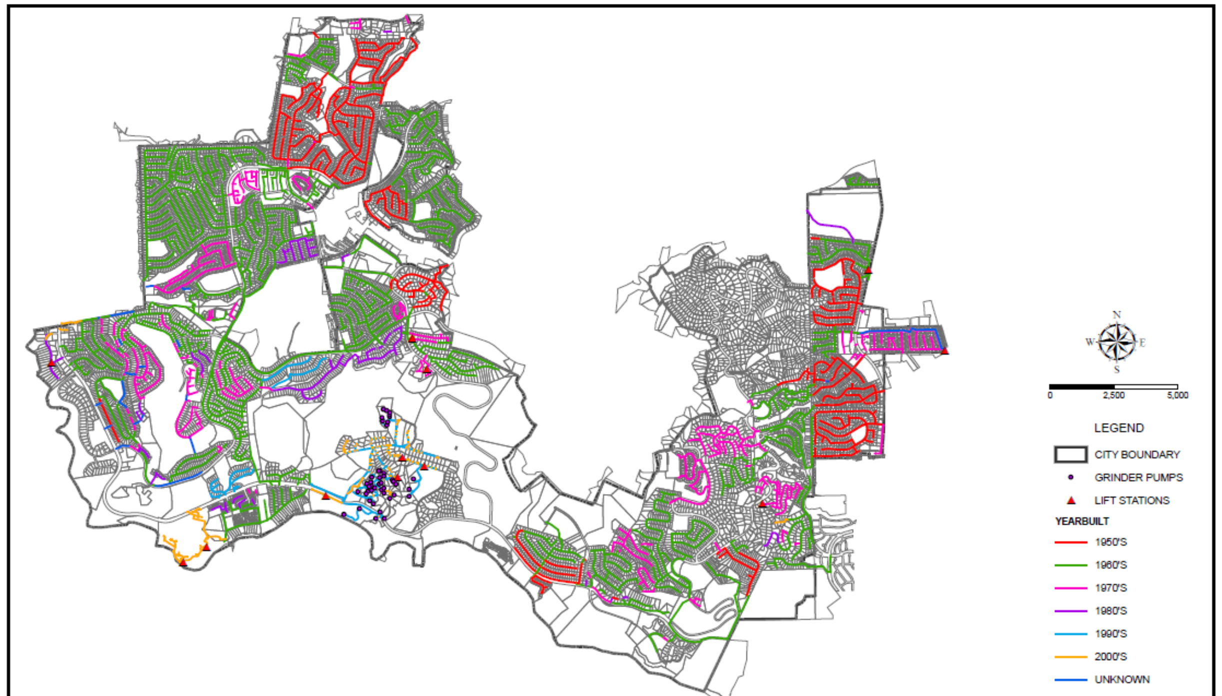


FIGURE 5-1
SANITARY SEWER COLLECTION SYSTEM BY YEAR CONSTRUCTED

Figure 5-2 Collection System by Pipe Diameter

FIGURE 5-2
SANITARY SEWER COLLECTION SYSTEM BY PIPE DIAMETER

Figure 5-3 Collection System by Pipe Material

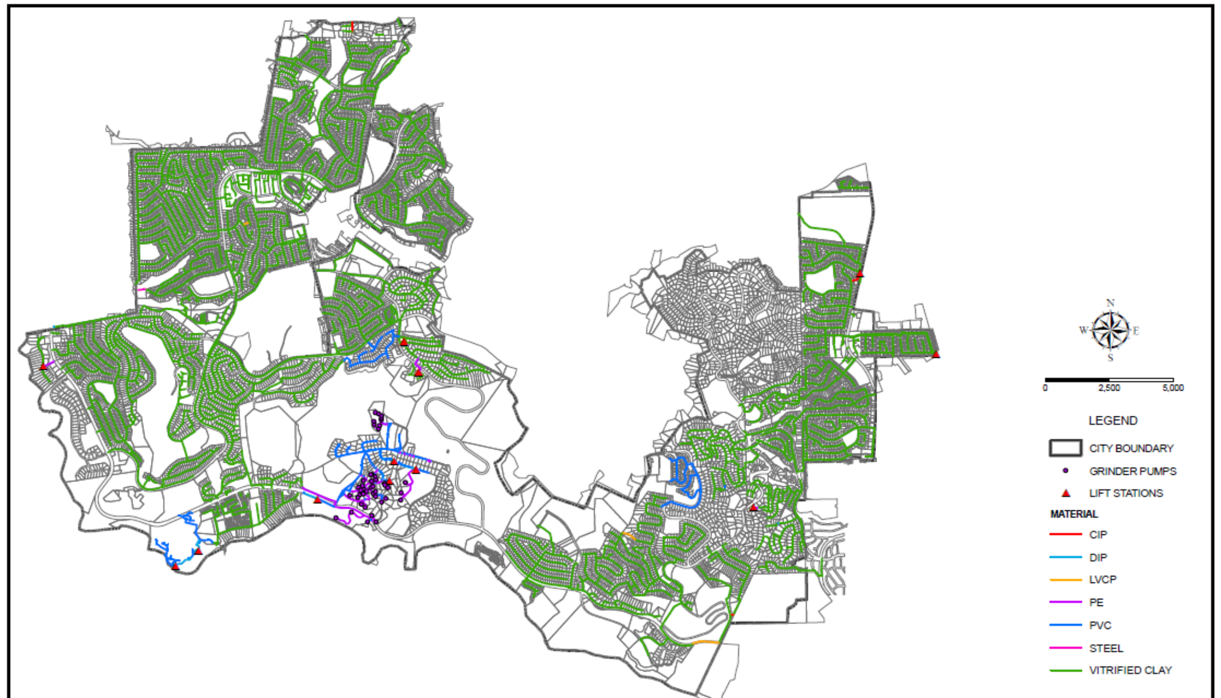


FIGURE 5-3
SANITARY SEWER COLLECTION SYSTEM BY PIPE MATERIAL

5.2 Updating the Hydraulic Model

The GIS data set was used to create a Hydra database and graphic file to perform the hydraulic analysis. All pipes and facilities are included in the model and in the GIS. The modeled features in the system include:

Table 5-3 Modeled Features

Feature	Number
Diversions	16
Pipes	3,812
Manholes	3,828
Outfalls	54
Pumps	56
Split Manholes	16
Total	**7,782**

The primary attributes of the system include:

- Length (Feet) = 790,000 feet
- Length (Miles) = 150 miles
- Number of Pipes = 3,812
- Number of Manholes = 3,914
- Largest Pipe Diameter = 15 inches
- Number of Drainage Basins = 53
- Oldest Pipe Age = 54 years
- Dominant Pipe Material = Clay (87%)
- Primary Lift Stations = 17

5.2.1 Abalone Cove Modeling

The conveyance system in Rancho Palos Verdes contains a large number of grinder pumps and gravity connections in the Abalone Cove Landslide Area. Since Abalone Cove is located on shifting land, that is prone to landslides, grinder pumps have been installed to transport the household flows into the main sewer system. The grinder pumps store the household waste until enough has accumulated to turn the pump on. The pump then grinds the waste into slurry, which is discharged into the main sewer system. These facilities typically serve individual homes and discharge into low pressure sewer systems that are above the ground. As part of this update, a capacity analysis was not performed on the grinder pumps. A detailed grinder pump specific model will be prepared as a part of the complete review of the Abalone Cove area. Approximately 880 linear feet of pipeline is over capacity for the existing flow conditions, and 1,708 linear feet are over capacity for the 2.5 safety factor flow condition.

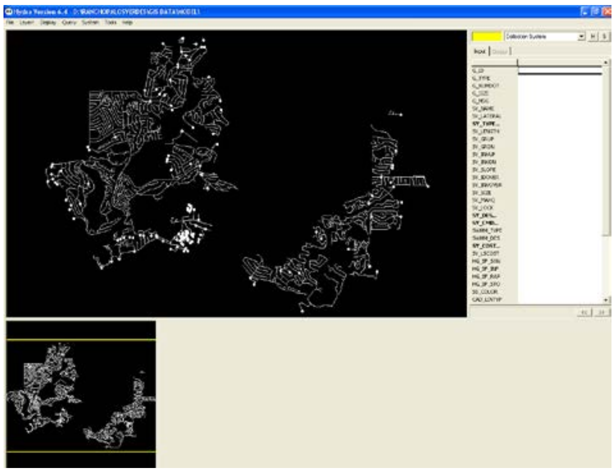
Hydraulic modeling of the collection system allows us to analyze the performance of the system under a variety of conditions. The primary purpose of the hydraulic model is to identify capacity limitations that may exist in the system and to estimate the cost to restore capacity. All models are representations. The hydraulic model of the collection system is composed of two primary aspects. These are the conveyance system (pipes, manholes, pumps, etc.) and the flows to be conveyed. Accurate models require that both of these representations be as accurate as possible.

5.2.2 The Conveyance System

To model the conveyance system, the updated GIS dataset was converted to the format necessary for the hydraulic model. The model that was selected for this analysis was the Hydra model produced by Pizer, Incorporated. This is a commercial, publicly available model that has seen widespread use over the past 30 years and the same model that was used in the 2004 master plan.

The converted GIS files are then used to determine the design capacity of each pipe segment. Figure 5-9 shows a screen shot of the hydraulic model prepared for the Rancho Palos Verdes collection system. The fact that all pipes are modeled allows us to develop an unprecedented view of the collection system. The entire system was checked for continuity to ensure that all outfalls, split manholes, pumps, and force mains had been labeled. Each of these features affects the flow direction of the system and for accurate model representation; these features need to be labeled correctly.

Figure 5-4 Hydra Model of RPV System



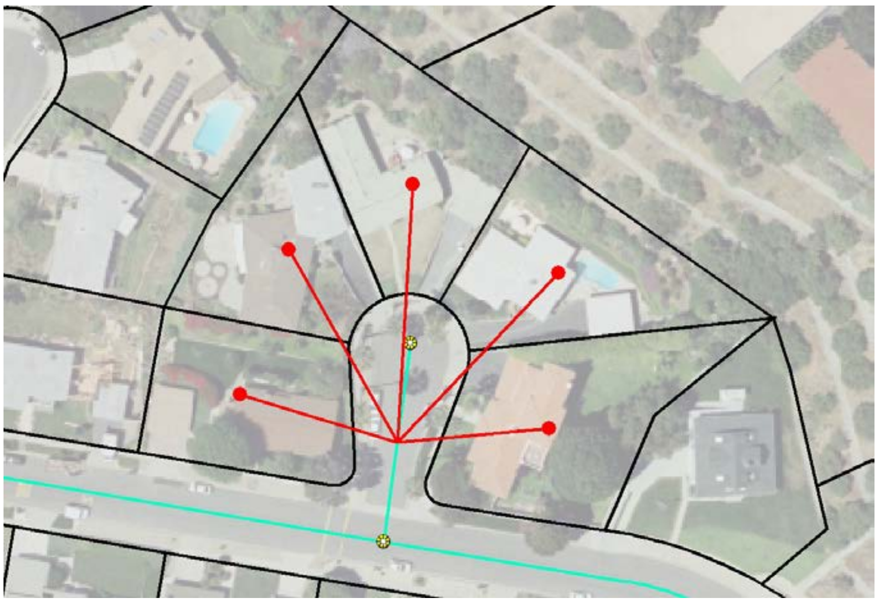
5.2.3 The Flows

The accurate representation of the flows is based on the flow measurements that were observed in the field. Hydra is a model that requires the flow to be defined by daily volume and by hourly variation. This allows the model to accurately route flows through the system to determine the downstream effects. The flow at each of the metering stations was analyzed and a volume and diurnal curve was developed.

Using a combination of the GIS and Hydra datasets, the upstream contributing acreage, number of parcels and feet of tributary pipe were calculated. This allowed us to calculate the flow per acre, flow per parcel and flow per foot respectively. This information was applied to each of the measured basins and to those basins which were not directly measured.

Flows were allocated to each parcel based on the area of the parcel. The flows calculated for each lot, or parcel, were then injected into the nearest pipeline in the model. This allowed the flows to be distributed over the entire collection system. The following figure shows how flows from each parcel were injected into the nearest pipeline. Since there was not a drastic climate change since the last Master Plan, the same flows were used for this master plan as were used in 2004.

Figure 5-5 Flow Injected From Parcels



5.3 CCTV Inspection

The following section introduces the concepts of the CCTV inspection program. Since the 2004 document was prepared the County has increased its CCTV inspections within the City. The current program indicates that the preliminary findings were an accurate reflection of the overall condition of the system.

In addition to the capacity analysis performed using design data, it is important to observe first hand the actual physical condition of the system. The best available technology for this is through closed circuit television (CCTV) inspection.

In this method of inspection a television camera traverses the inside of the sewer pipe and sends back images to a video recorder. An operator views the image on the screen and makes audio notes and database entries related to what is being observed.

Figure 5-6 CCTV Camera

Figure 5-7 CCTV Truck

5.3.1 Flow Generation and Allocation

Flows for the Average Dry Weather (ADW) condition were obtained by loading each parcel in each measured basin with its flow based on its' area based flow factor. The flow for each parcel was further defined with its metered hourly variation of flow.

Flows for those parcels outside the average flow per acre was applied to the parcel and the hourly variations were defined with a maximum peaking factor of 2.03. The flows were then allocated from the parcel GIS to the nearest pipeline as previously shown.

5.3.2 Capacity Analysis

To determine the effects of the flow loading and allocation, a calibration comparison was made between the modeled flows and the measured flows. The following table shows the results of that comparison.

Table 5-4 Model and Meter Flow Comparisons

Calibration Results				
Metered Basin ID	Model ID	Modeled mgd	Measured mgd	Difference % Msrd.
1	2293	0.040	0.040	0.13%
2	1797	0.761	0.760	0.13%
3	1124	0.665	0.690	-3.66%
4	1045	0.158	0.150	5.51%
5	88	0.393	0.400	-1.81%
6	627	0.100	0.100	0.13%
7	686	0.444	0.430	3.36%
8	2692	0.096	0.110	-12.50%

The predicted (modeled) and measured flows are within good calibration limits. This indicates that our modeled assumptions are valid for these basins. Given the calibration results and the number of pipes that are expected to flow more than half full, the overall capacity analysis shows that the collection system has adequate capacity for dry weather conditions. None of the lines identified as flowing more than half full are causing a critical surcharge condition.

To determine the hydraulic capacity of the system to increased flows like that which they may have experienced in wet weather, all flows were multiplied by a safety factor of 2.5.
The capacity criteria were also increased to allow flow to attain a depth/diameter ratio of 0.9 or 90% of full pipe diameter. This allowance is a widely accepted value for wet weather flows. The results of this showed that of the 3,812 gravity pipes in the system, 71 now exceeded the desired depth/diameter ratio. This represents around 1.9% of the entire system. Again this is

outstanding hydraulic performance. Many systems see more than 25% of their collection system exceeding this performance criterion.

Table 5-5 Capacity Performance (2009)

Flow Load	Deficient Segments	% Deficient
Average Dry Weather	14	0.37%
2.5 x ADW	71	1.9%

Each of the flow scenarios discussed here are presented in Figure 5-8 and Figure 5-9.

Figure 5-8 Existing Capacity Restrictions

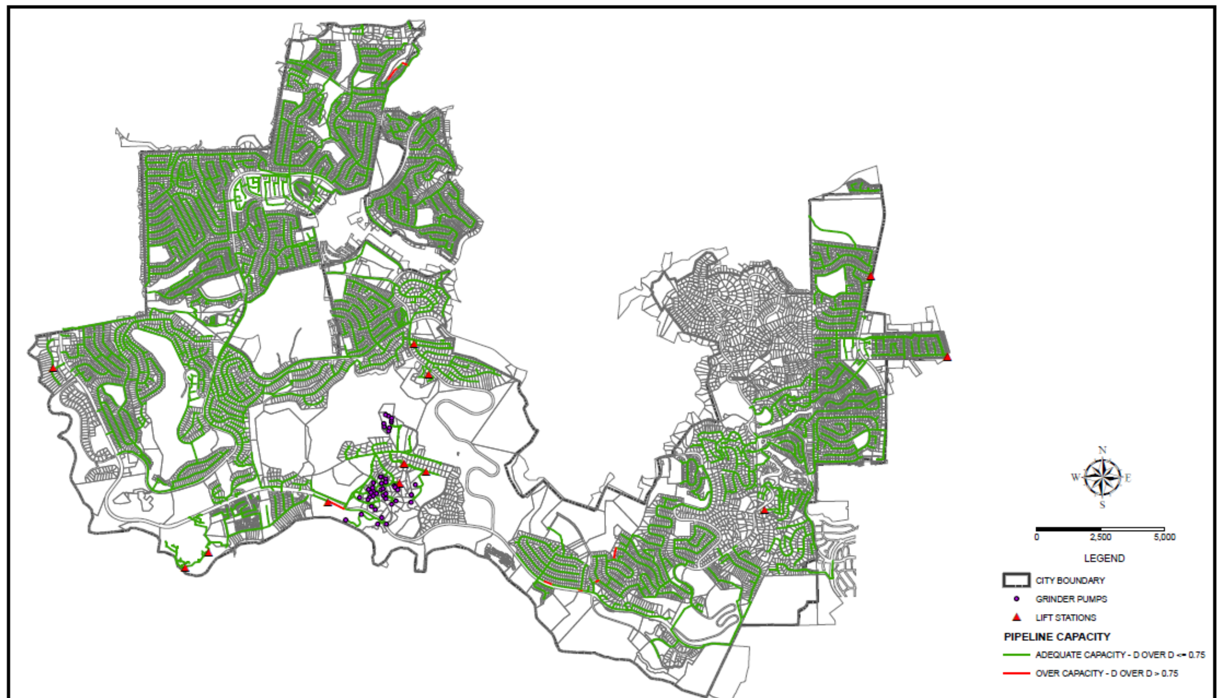


FIGURE 5-11
SANITARY SEWER COLLECTION SYSTEM WTIH EXISTING CAPACITY RESTRICTIONS

Figure 5-9 Capacity Restrictions Safety Factor = 2.5

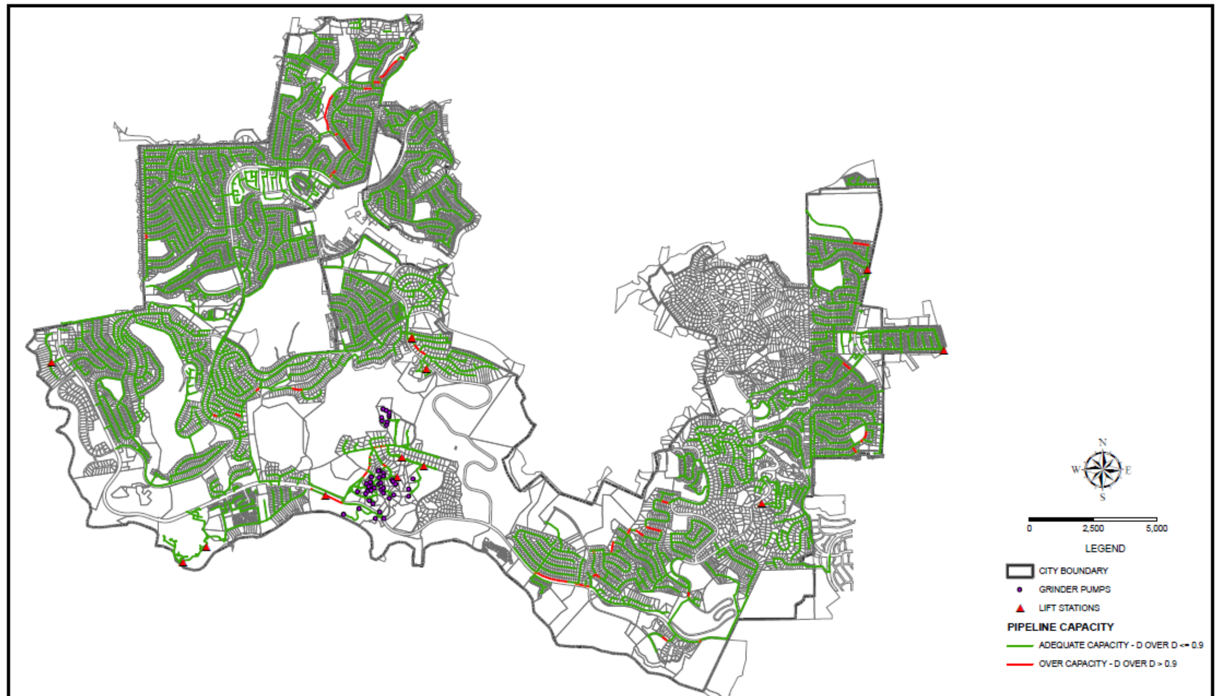


FIGURE 5-12
CAPACITY RESTRICTIONS SAFETY FACTOR: 2.5

5.4 County CCTV Inspection (2005-2006/2007)

In the fiscal years 2005-2006/2007 the county CCTV inspection program Y0TV0506F inspected an additional 76,591 linear feet of sewer pipeline or 10.6% of the entire system. A primary advantage of this inspection was that the county has adopted the relatively new national standard for establishing the condition of the sewer pipes. These codes are assigned to each segment based on a certified operator using the Pipeline Assessment and Certification Program (PACP) coding scheme. The condition codes are provided for cleanliness are called Maintenance codes and those related to cracked pipes are called Structural codes. Each has a similar scale that varies from 1-5 from better to worse condition. The codes and the observed conditions are:

(1) Excellent
(2) Good
(3) Fair
(4) Poor
(5) Need immediate attention (really bad!)

Of the 388 pipe segments that were CCTV inspected, 42 were given a Structural Quick Rating of 4 or 5, meaning they were either in poor structural condition or had structural defects that required immediate attention.

Of the approximately 388 pipeline segments that were CCTV inspected, 79 were given a Pipeline Assessment and Certification Program (PACP) Maintenance Quick Rating of 4 or 5, indicating blockages, either due to roots, fats, or grease. This represents approximately 20.4% of the pipelines observed.

These assessments, as provided by the LACSMD are provided in tables Table 5-6, Table 5-7 and Figure 5-13.

Table 5-6 Maintenance Rating[3]

Defect Grade	Pipe Length (ft)	Percent Total Inspected Pipe Length	No. Segments	Percent Cumulative
1. Excellent	3,922	5.1%	23	5.1%
2. Good	46,753	61.1%	235	66.2%
3. Fair	9,898	12.9%	51	79.1%
4. Poor	15,497	20.2%	76	99.3%
5. Immediate Attention	521	0.7%	3	100%
Total	**76,591**	**100%**	**388**	

[3] Consolidated Sewer Maintenance District Condition Assessment Program Report Project Y0TV0506F

Table 5-7 Structural Rating[3]

Defect Grade	Pipe Length (ft)	Percent Total Inspected Pipe Length	No. Segments	Percent Cumulative
1. Excellent	40,577	53%	212	53%
2. Good	6,308	8.2%	30	61.2%
3. Fair	21,148	27.6%	104	88.8%
4. Poor	4,974	6.5%	24	95.3%
5. Immediate Attention	3,584	4.7%	18	100%
Total	**76,591**	**100%**	**388**	

At the time of the preparation of this draft report the review of the County condition coding for the recent CCTV, Fiscal Years, 2007-2008 and 2008-2009 work has not been provided.

5.5 Known Sanitary Sewer Overflows (SSOs)

Known overflow locations, provided by the County were also mapped to determine the overall nature of these occurrences. It is apparent from a review of these that the County is well aware of the frequency of occurrence of overflows. Given the funding limitations described by the County, it is unlikely that a clear program for reducing the number and frequency of overflows in Rancho Palos Verdes exists. Updated known overflow locations are shown in Figure 5-12.

The following tables show the overflow characteristics found in the States CWIQS system.

Table 5-8 SSO Characteristics

2007-2009	SSOs	SSO Vol.	Recover	To Surface	Length	Frequency	Volume to surface waters
Responsible Agency	(count)	(Gallons)	(Gallons)	(Gallons)	(Miles)	(SSO/100 mi.)	(gallons/100 mi.)
West Hollywood	20	8,800	3,210	4,650	39.4	50.7	11,802.00
Palos Verdes Estates	37	8,465	2,161	3,475	76.4	47.8	4,495.40
Rancho Palos Verdes	38	13,425	3,140	8,025	138.8	27.0	5,707.60
Rolling Hills Estates	7	1,285	245	50	32.4	21.4	152.9
Hawaiian Gardens	3	601	101	500	15.7	19.1	3,184.70

This table indicates that the City has more SSOs than any other agency maintained by the LACSMD. When normalized to consider the length of the system, the City ranks third of the highest five ranked systems. The SSO frequency is a further indicator of the physical condition of the system.

The following table shows the same comparisons for the highest frequency (SSO/100 mi.) for all agencies in Los Angeles County.

Table 5-9 Top 10 SSO Frequency LA County

2007-2009	SSOs	SSO Vol.	Recovered	To Surface	Length	Frequency	Volume to surface waters
Responsible Agency	**(count)**	**(Gallons)**	**(Gallons)**	**(Gallons)**	**(Miles)**	**(SSO/100 mi.)**	**(gallons/100 mi.)**
CSU Dominguez Hills	37	113,674	6,174	0	3.0	284.6	-
UC Los Angeles	4	17,340	1,300	15,940	2.0	133.3	**531,333**
Los Angeles Cnty DPW	2	400	250	0	2.9	51.2	-
West Hollywood	20	8,800	3,210	4,650	39.4	50.7	**11,802**
Palos Verdes Estates	37	8,465	2,161	3,475	76.4	47.8	**4,495**
Whittier City	75	15,352	985	445	214.0	35.0	**208**
Beverly Hills	31	6,032	2,960	1,409	98.0	31.6	**1,438**
LA County Sanitation Districts	5	3,750	0	1,700	14.6	28.9	**9,827**
Rancho Palos Verdes City	38	13,425	3,140	8,025	138.8	27.0	**5,708**
LA County Sanitation Districts	4	275	75	0	15.3	25.9	-

Note that in Table 5-9 three of the top five communities are located on "the hill." This seems to indicate that a shared physical characteristic contributes to the frequency and amount of overflows. Factors that are likely to create this situation are the dominant construction material and techniques and the steep slopes. The steep slopes would result in a downward stress on the pipe joints which could enlarge the gap at the joint. This pulling apart could result in more root intrusion and structural cracking. The following table shows the PACP rating (1=Excellent – 5 = Worst), slope and length of pipe.

Table 5-10 Pipe Rating and Slope

	Slope										
PACP Rating	0-0.5%	0.5-1%	1-2%	2-3%	3-4%	4-5%	5-6%	6-7%	7-8%	8-9%	>9%
	Pipe Length (ft)										
1 - Excellent	8,075	2,076	5,142	2,165	2,569	1,810	2,577	2,021	2,204	2,631	9,366
2 - Good	414	254	199	857	639	718	1,529	254	0	0	1,150
3 - Fair	3,010	1,079	2,324	1,414	2,344	1,188	1,702	2,158	2,105	1,021	2,315
4 - Poor	1,081	0	1,090	0	0	0	468	182	647	216	986
5 – Immediate Attention	368	142	622	218	121	685	889	143	136	0	1,127

5.5.1 System Evaluation Conclusion

In conclusion, the CCTV inspections performed in 2004 and in 2006 shows that the actual physical condition of the collection system is deteriorated with maintenance defects in over 20% of the system and structural defects in over 10%. Some pipes have both maintenance and structural defects. The frequency and widely dispersed nature of the overflows indicates a system that needs continuing, consistent maintenance and a watchful eye on the cracked pipes and root intrusion areas. Based on the results of the hydraulic model, no overflows were predicted in the properly cleaned system in the existing or future dry conditions.

Figure 5-10 Area of CCTV Inspection by Year

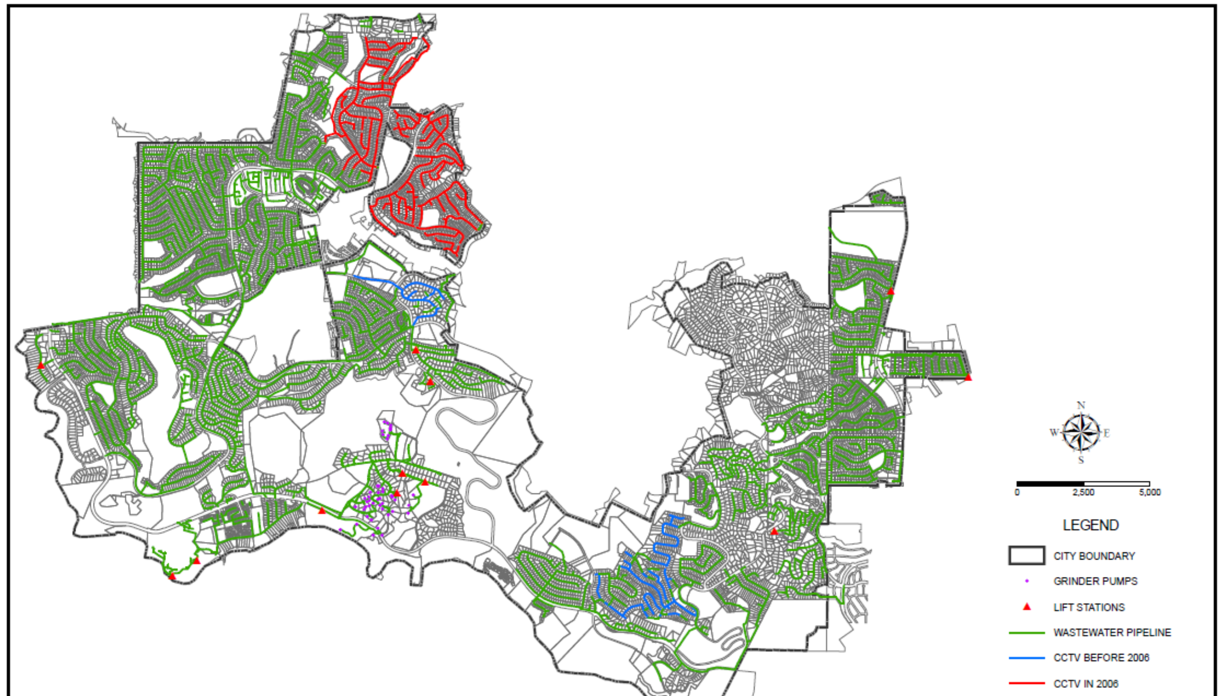


FIGURE 5-19
SANITARY SEWER COLLECTION SYSTEM WITH OBSERVATIONS IN CCTV LINES

Figure 5-11 Frequency of CCTV Observations

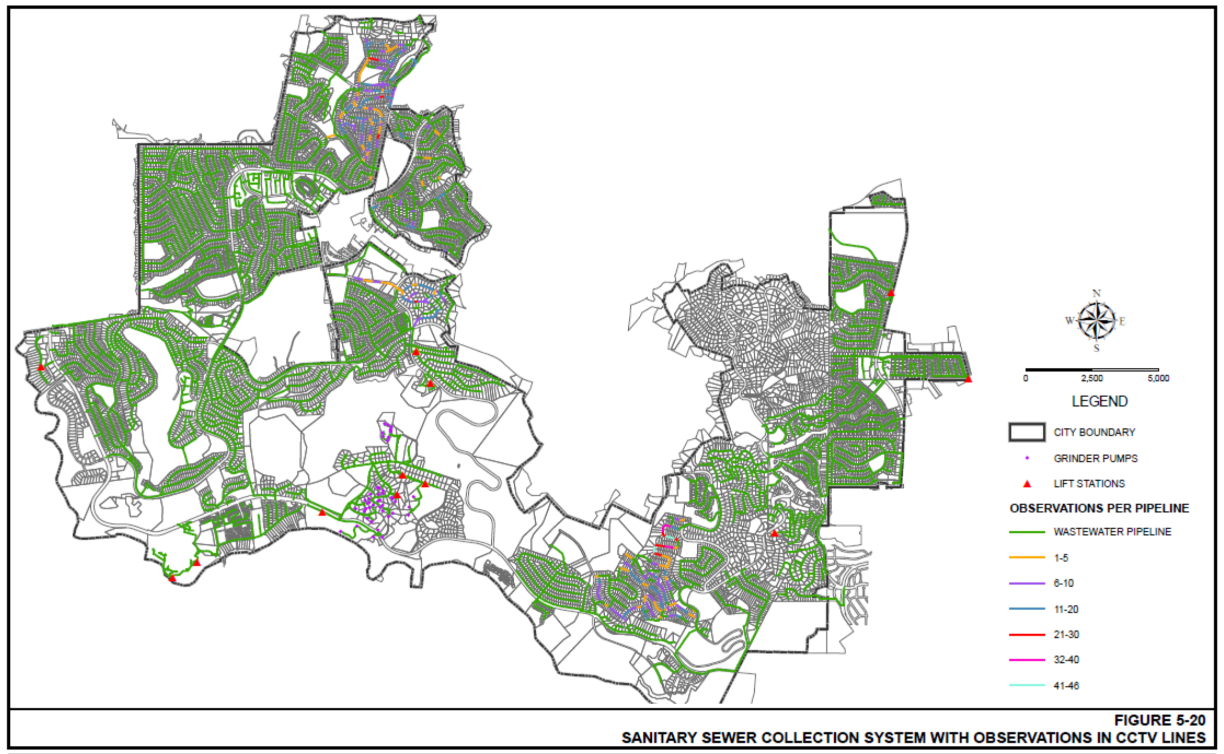


Figure 5-12 Known Overflow Locations

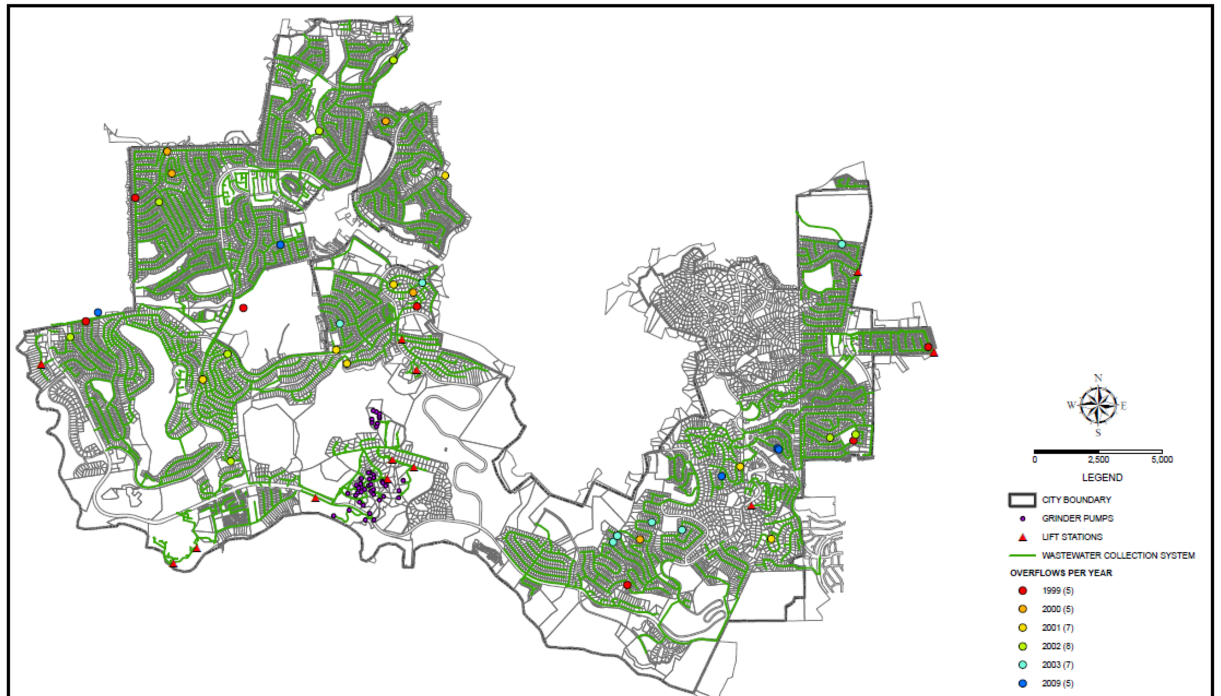
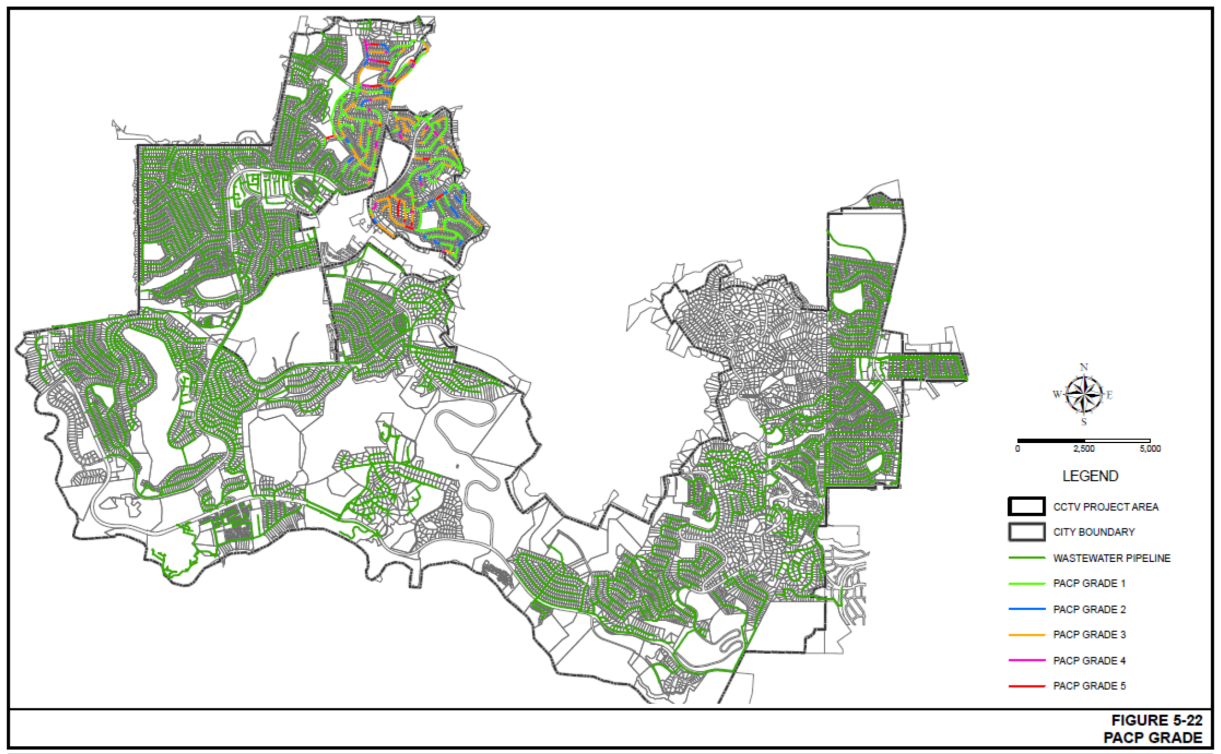


FIGURE 5-21
SANITARY SEWER COLLECTION SYSTEM WTIH SEWAGE OVERFLOW LOCATIONS

Figure 5-13 PACP Grade

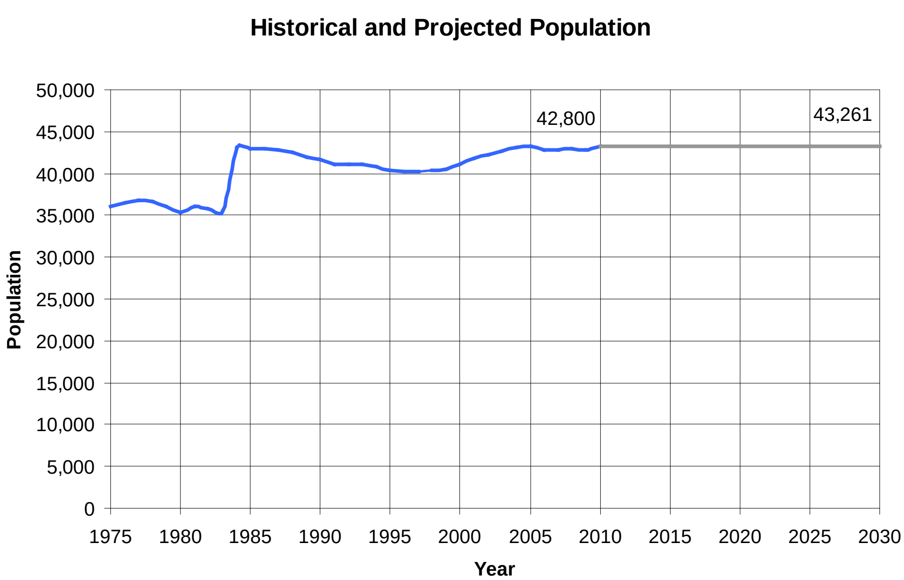


6.0 Future Flow Predictions

6.1 General

Since The City of Rancho Palos Verdes has little undevelopable space left, the future flow predictions will not increase significantly compared to the current flow. Based on the US Census data, the population is predicted to increase to 43,261 in 2030 as compared to 42,800 in 2009. This represents an increase of approximately 1.07%. The historical and future populations are shown in Figure 6-1

Figure 6-1 Historical and Projected Population



6.2 Model Predictions

To account for this slight population increase, the hydraulic model was run with a factor of safety of 1.0107, representing the 1.07% increase in population. It is noted that this value is well below the factor of safety of 2.5 applied to the model. For the future flow condition, the same criteria was used as with the existing conditions, of d/D equal to 0.75.

The model shows that 16 pipe segments out of 3,812 or 0.42% will be over capacity to accommodate the future population predictions. These pipe segments are graphically shown in Figure 6-2 and are included as part of the recommended CIP projects discussed in Chapter 7.

6.3 Abalone Cove

Separate capacity analysis models on the collection system for Abalone Cove are not necessary. For the majority of this system, each residence is served by a single grinder pump and low pressure main connection. These are industry standard designs which reliable serve one to three homes. The receiving line is subject to periodic flows from each of the pumps connected to the system and it in turn feeds into a larger lift station serving both gravity and low pressure customers. The results of increasing the flow into the lift station are that the pump operates for longer period of times. This system was originally designed to handle XXX lots as described in the original design report.

(Holding spot for additional data as provided by City)

Figure 6-2 Future Capacity Restrictions

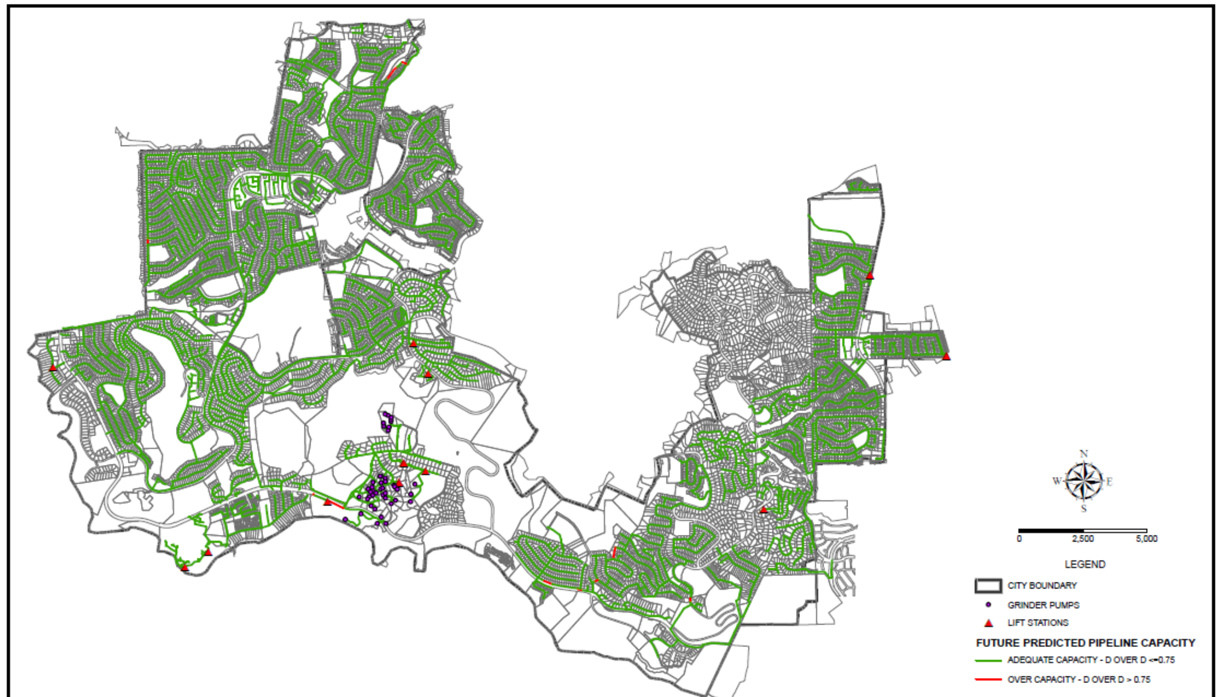


FIGURE 6-2
SANITARY SEWER COLLECTION SYSTEM WTIH FUTURE CAPACITY RESTRICTIONS

7.0 Capital Improvement Projects

7.1 Maintenance and CCTV Inspection Costs

In the 2004 Master Plan a recommendation was made that the entire system be cleaned for a cost of approximately $1,185,000 dollars (est. at $1.50/foot). Since that time the County has recognized its compliance responsibility for the WDRs and has commenced with a program that results in the entire system being cleaned and CCTV inspected in less than 10 years. Currently the rehabilitation portion of the budget is being performed through the LACSMD.

Given the overflow frequency, the City should augment the county's efforts to complete the total inspection and cleaning of the system within five (5) years. Note that there are special coordination efforts and program management functions that would be necessary to expedite repair of pipes found deficient by the City. If the City desires to augment this portion of the project the efforts should be coordinated with the City to minimize duplication of effort. For budgeting purposes it is assumed that the City would CCTV and clean over 300,000 feet of pipeline. The costs are subject to reduction on receipt of the County's reports for fiscal years 2006/7 and 2007/8. The following table describes the approximate costs.

Table 7-1 CCTV Inspection and Cleaning

System Length	744,470
2004 CCTV City	47,000
2005/2006 County	76,591
Estimated remaining	620,879
One Half System	310,440
Total Cost ($1.50 / foot)	$465,659
Years to complete	5
Average annual cost	$ 93,132

7.2 CIP Project Determination

To develop the CIP project list, many factors were considered. The areas of CCTV pipeline were superimposed with the capacity related problems as determined by HYDRA. A priority level of high, medium, or low was assigned to each pipe segment based on their capacity and maintenance condition. Pipe segments showing capacity problems under the existing flow conditions and or a PACP rating of 4 or 5 were given a ranking of "high". Pipe segments over capacity for the 2.5 factor of safety case and or a PACP rating of 3 were given a ranking of "medium". Pipe segments that did not have a capacity problem and did not show any observed structural or maintenance problems (receiving a PACP ranking of 1) were not considered as a potential project. These rankings are shown in Figure 7-1.

For pipe segments that were not continuous and could therefore not be considered a project, they were placed into the Miscellaneous category. These segments did not have sufficient capacity to convey the existing flows or the 2.5 factor of safety flows. The pipes in the Miscellaneous category are for a new size of 12 inches, based on the recommended new pipe sizes from Hydra. Miscellaneous projects are performed when other work is scheduled in the area (resurfacing, storm drain replacement, other major repairs, etc.)

7.3 CIP Project Costs

Costs associated with these projects were based on $14.50 in/linear foot. The new sizes for the replacement projects were determined from the hydraulic analysis program. These sizes along with their costs are shown in Table 7-2. Pipelines labeled "miscellaneous" have capacity problems and widely scattered funding should be set aside for these to effect their replacement through other programs.

Table 7-2 Capacity Related Projects

Year	Rank	New Name	New Size (in)	Length of Project (ft)	Cost ($14.5in/ft)
2010	1	Ironwood Street	15	930	$202,275.00
	2	Palos Verdes Drive South between Conqueror Drive and Schooner Drive	15	2,377	$516,997.50
	3	Palos Verdes Drive South between Sea Cove Drive and Abalone Cove Shoreline Park	15	748	$162,690.00
2020	4	Basswood Avenue	12	564	$98,136.00
	5	Parallel to Basswood Avenue	15	1,540	$334,950.00
	6	West General Street	12	560	$97,440.00
	7	Ginger Root Lane	12	952	$165,648.00
		Miscellaneous	12	1,951	$339,474.00
Total Cost $1,917,610.00					

7.4 Year 2010 Pipeline Improvements

Ironwood Street and Silver Spur Road Pipeline.
The 8 inch, 930 foot long pipeline partly along Ironwood Street and running through the easement along Silver Spur Road has approximately 50% of its length over capacity for each of the flow scenarios analyzed (existing, future and factor of safety of 2.5). This reach of pipeline is given a high priority ranking due to a portion of the pipe being assigned a PACP grade of 5. 50% of the length of the project is also over capacity for the future flow conditions. It is recommended that this length of pipe be upsized to a 15 inch diameter at an approximate cost of $202,275.00.

Palos Verdes Drive South between Conqueror Drive and Schooner Drive.
The 8 and 10 inch, 2,377 foot long pipelines along Palos Verdes Drive South between Conqueror Drive and Schooner Drive has approximately 75% of its length over capacity for the 2.5 safety factor flow scenario, and 25% over capacity for the existing conditions. Since this length of pipe was not CCTV inspected in 2006 it is unknown what structural and maintenance condition it is in. Based on capacity alone, this length of pipe was given an overall priority ranking of high. 50% of the length of the project is also over capacity for the future flow conditions. It is recommended that this pipeline be upsized to 18 inches at a cost of $516,997.50.

Palos Verdes Drive South between Sea Cove Drive and Abalone Cove Shoreline Park.
The 8 inch, 748 foot long length of pipe running along Palos Verdes Drive South between Sea Cove Drive and Abalone Cove Shoreline Park is over capacity for the existing flow conditions. Since this pipeline was not CCTV inspected in 2006, its priority ranking of high was based solely on the capacity conditions. It is recommended that this pipeline be upsized to 15 inches in diameter at a cost of $162,690.00.

7.5 Year 2020 Pipeline Improvements

Basswood Avenue between Mossbank Drive and Shorewood Road.
The 8 inch, 564 foot length of pipe running along Basswood Avenue between Mossbank Drive and Shorewood Road has the entire length over capacity for the 2.5 factor of safety flow run, and 50% with a PACP grade of 3. This length of pipe was given a priority ranking of medium. It is recommended that the pipes be upsized to 12 inches at a cost of $98,136.00.

Parallel to Basswood Avenue between Mossbank Drive and Mazur Drive.
The 10 inch, 1,850 foot length of pipe parallel to Basswood Avenue between Mossbank Drive and Mazur Drive is over capacity for the 2.5 factor of safety flow condition. This entire length of pipe was CCTV inspected in 2006 and showed no maintenance or structural problems. This project was given a priority rank of medium. It is recommended that this length of pipe be upsized to 15 inches at a cost of $334,950.00.

West General Street between Bernice Drive and West Crestwood Street.
The 8 inch, 560 foot length of pipe on West General Street between Bernice Drive and West Crestwood Street is over capacity for the 2.5 factor of safety flow condition. These pipes were not CCTV inspected, so their priority ranking of medium is based on their capacity restrictions. It is recommended that these pipes be upsized to 12 inches at a cost of $97,440.00.

Ginger Root Lane between Narcissa Drive and Cinnamon Lane.
The 8 inch, 952 foot length of pipe on Ginger Root Lane between Narcissa Drive and Cinnamon Lane is over capacity for the 2.5 factor of safety flow condition. These pipes were not CCTV inspected, so their priority ranking of medium is based on their capacity restrictions. It is recommended that these pipes be upsized to 15 inches at a cost of $165,648.00.

7.6 Conclusions and Recommendations

The collection system has been thoroughly re-evaluated through a combination of physical inspection, data analysis and computer modeling. Three primary needs have been identified which are related to (1) Physical condition of the system (2) Special considerations for the Abalone Cove Sewer System and (3) Hydraulic Capacity Projects.

The physical inspections reveal continued problems with the old, cracked pipes and root intrusion. These problems are currently being addressed through systematic rehabilitation by the County. It is recommended that the City augment the County to expedite their activities knowing the physical condition of the entire system. This project anticipates the City performing half of the remaining inspection and cleaning of the system through specialty contractors.

The Abalone Cove area is in need of special attention to assure its improved funding and operations. As currently operated there is uncertainty regarding the funding, planning, operations and maintenance of the system. A special study is needed immediately to identify the primary concerns and to address these issues through a separate sewer system management plan. This plan would include identifying the funding levels necessary for sustainability and the assignment of operational responsibility to the most equitable party.

The Hydraulic Capacity Analysis as performed through hydraulic modeling revealed few areas in need of immediate attention. The areas flagged should be carefully watched and any improvements coordinated with other public works activities. The following table represents the approximate year and estimated cost for the capacity related projects. The recommended program total is approximately $2.7 Million with an average annual cost in the first five years of $362,098.

Table 7-3 Summary CIP Table

Rancho Palos Verdes Collection System CIP				Near Term					Long Term		
Category		Total Cost	Years	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015-2020	2020-2025	2025-2030
Administrative											
	Abalone Cove Analysis	$ 50,000	1	$ 50,000							
	CCTV Program Management	$ 93,132	5	$ 18,626	$ 18,626	$ 18,626	$ 18,626	$ 18,626			
System Evaluation											
	CCTV-Cleaning	$ 465,659	5	$ 93,132	$ 93,132	$ 93,132	$ 93,132	$ 93,132	Revert to 10 year cycle (County)		
General Projects											
	Abalone Cove Upgrades	$ 150,000	3		$ 50,000	$ 50,000	$ 50,000				
Capacity Projects											
Ironwood Street		$ 202,275	3	$ 67,425	$ 67,425	$ 67,425					
PV Drive S. ,Conqueror to Schooner		$ 516,998	3		$ 172,333	$172,333	$172,333				
PV Drive S., Sea Cove to Abalone Cove S		$ 162,690	3			$ 54,230	$ 54,230	$ 54,230			
Basswood Avenue		$ 98,136	3						$ 98,136		
Parallel to Basswood Avenue		$ 334,950	3							$334,950	
West General Street		$ 97,400	3								$ 97,400
Ginger Root Lane		$ 165,648	3								$165,648
Miscellaneous 12"		$ 339,474	10	$ 33,947	$ 33,947	$ 33,947	$ 33,947	$ 33,947	$169,737		
	Total	$ 2,676,361	**Period Total**	$ 263,131	$ 435,463	$489,693	$422,268	$ 199,936	$267,873	$334,950	$263,048

Figure 7-1 Priority Ranking

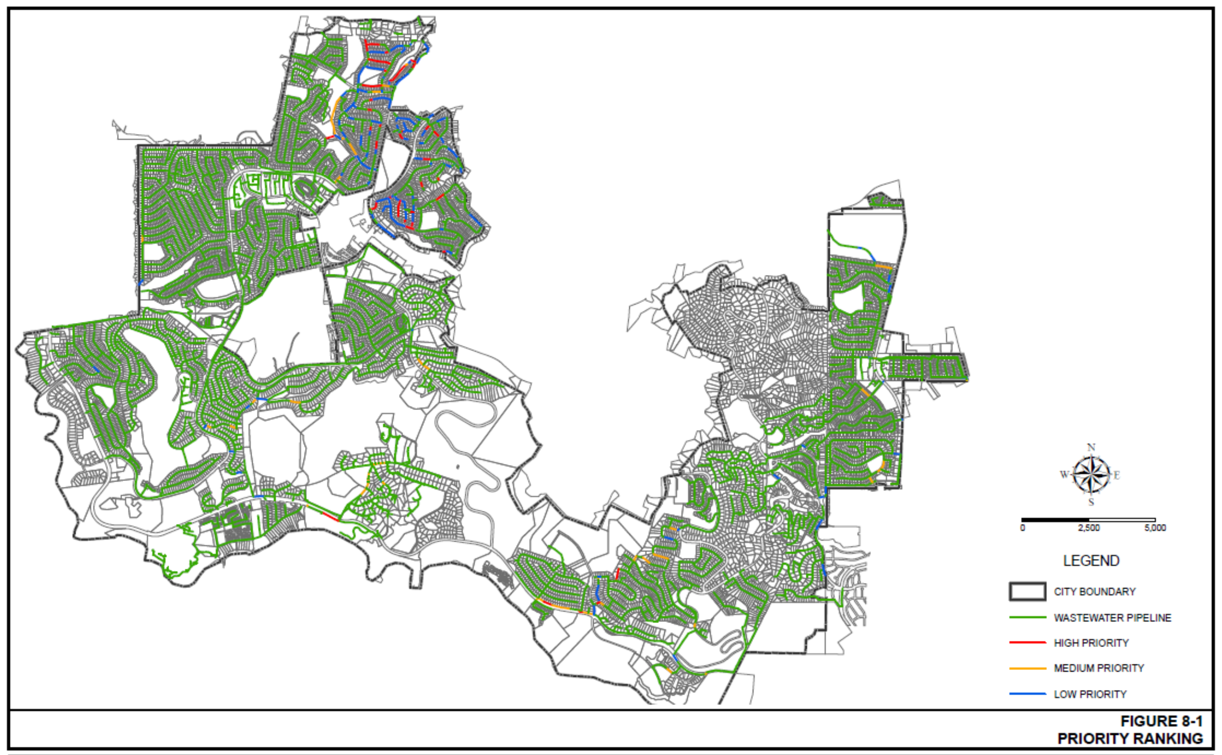


Figure 7-2 Capacity Related Projects

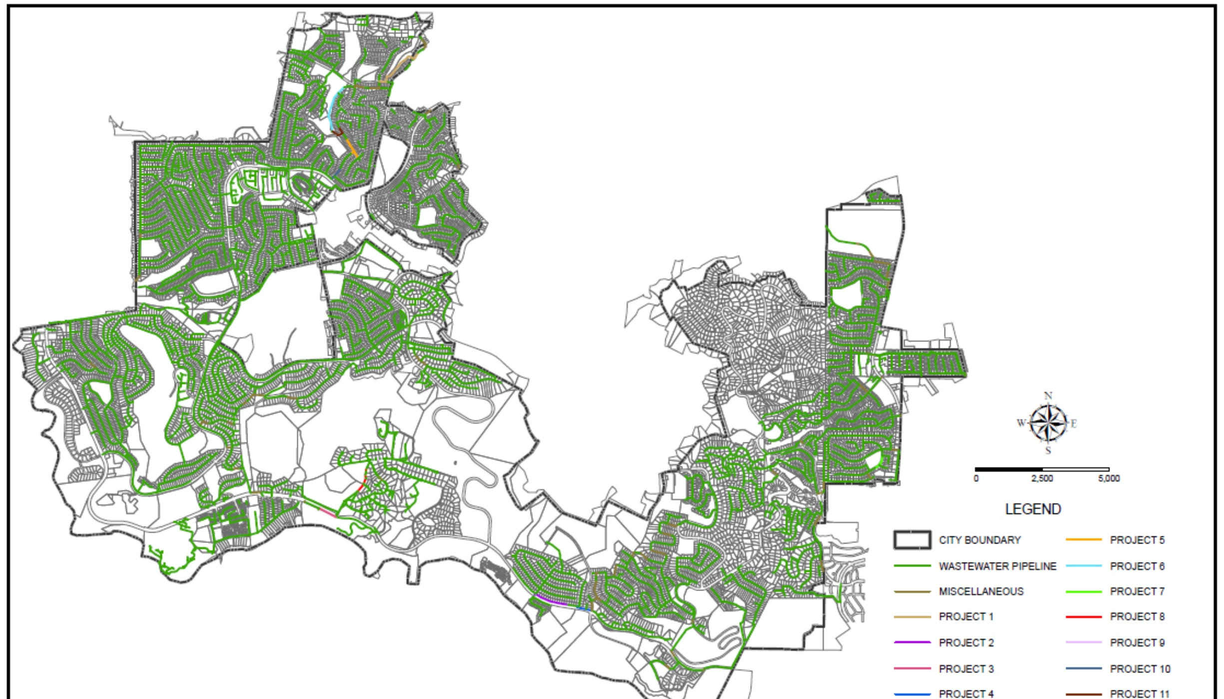


FIGURE 8-3
CAPACITY RELATED PROJECTS

Appendix B – Authorization

Appendix C – County CCTV Results