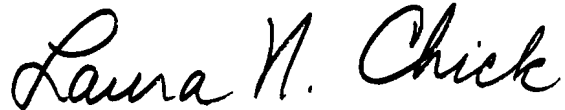


A significant proportion of equipment used in maintenance is unavailable due to needed repairs, which impedes the productivity of work crews. The Bureau needs to have back-up equipment available so repair crews can continue to provide service.

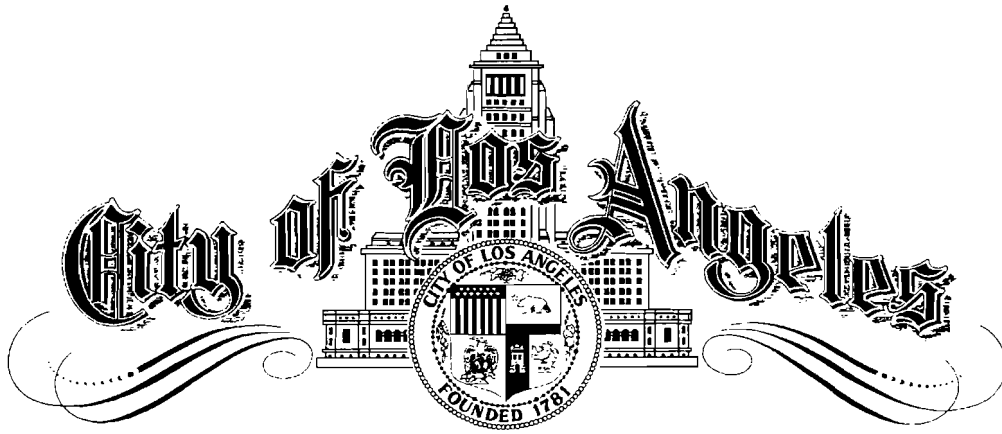
There are also approximately 35,000 “hot spots,” which are areas in the sewer mains that are cleaned more frequently, due to historical problems with grease, debris, roots etc.... My audit found that the Bureau does not re-evaluate these “hot spots” to see if additional maintenance is still needed; once a “hot spot” is put on the list, it is rarely removed. This is a potential waste of precious resources.

This audit lays out a clear path to achieving the highest level of service and environmental quality, while at the same time realizing cost savings. It is a vision that we should push for and implement in all parts of our City.

Sincerely,

A handwritten signature in black ink that reads "Laura N. Chick". The signature is written in a cursive, flowing style.

LAURA N. CHICK
City Controller



OFFICE OF
CONTROLLER

LAURA N. CHICK
CONTROLLER

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January 15, 2009

Cynthia M. Ruiz, President
Board of Public Works
Room 361, City Hall
200 North Spring Street
Los Angeles, CA 90012

Dear Ms. Ruiz:

Enclosed is a report entitled "Performance Audit of the Wastewater Collection Systems." A draft of this report was provided to your office on December 19, 2008. Comments provided by your Department at the meeting held on January 5, 2009, were evaluated and considered prior to finalizing the report.

Please review the final audit report and advise the Controller's Office by February 17, 2009, of actions taken to implement the recommendations. If you have any questions or comments, please contact me at (213) 978-7392.

Sincerely,

FARID SAFFAR, CPA
Director of Auditing

Enclosure

cc: Robin Kramer, Chief of Staff, Office of the Mayor
Jimmy Blackman, Deputy Chief of Staff, Office of the Mayor
Nancy H. Sutley, Deputy Mayor, Office of the Mayor
Enrique C. Zaldivar, Director, PW/ Bureau of Sanitation
Adel H. Hagekhalil, Assistant Director, PW/ Bureau of Sanitation
Raymond P. Ciranna, Interim City Administrative Officer
Karen E. Kalfayan, Interim City Clerk
Gerry F. Miller, Chief Legislative Analyst
Independent City Auditors

Performance Audit of the Wastewater Collection System

LOS ANGELES, CALIFORNIA



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Palo Alto, CA 94303
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January 14, 2009

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1. EXECUTIVE SUMMARY

On behalf of the Controller's Office, the Matrix Consulting Group has completed a performance audit of the City's Wastewater Collection Systems. The primary objective of the audit was to evaluate whether the City of Los Angeles has an efficient and effective process to maintain and improve the City's infrastructure for wastewater collections and conveyance, to identify opportunities for improvement, and to make recommendations accordingly.

The audit was performed in accordance with Generally Accepted Government Auditing Standards and covered the activities from Fiscal Year 2000-01 to August 2008. Fieldwork was conducted between August and October 2008.

BACKGROUND

The City operates and maintains the largest wastewater collection system in the United States that includes:

- More than 6,500 miles of sewers that convey about 550 million gallons of sewage per day from homes and businesses;
- Four wastewater treatment and water reclamation plants that remove potential pollutants to protect river and marine environments and the public's health;
- Twenty-six primary sewer drainage basins and two hundred twenty secondary sewer basins that convey sewage to the wastewater treatment and water reclamation plants; and
- One hundred fifty three thousand maintenance holes providing access to the sewer mains for maintenance and forty four sewage pump stations that pump sewage from a low elevation to a high elevation.

The Department of Public Works, Bureau of Sanitation (Sanitation), through its Wastewater Collection Systems Division (Wastewater Division), maintains and repairs the City's expansive wastewater collection system. More than half of the system is over 50 years old and requires the City's vigilance in inspecting and assessing the condition of the system and to ensure the necessary upgrades, rehabilitation and repairs are made.

In December 2006, Sanitation developed a ten-year capital improvement program for the collection system that is expected to cost \$3.4 billion.¹ The improvements will address projected increases in wastewater flows, capacity issues and the aging

¹ Wastewater Capital Improvement Program Project Descriptions and 10-Year Expenditure Plan, FY 2007-08 – FY 2016-17

infrastructure. The Wastewater Engineering Services Division, within Sanitation, assists in preparing sewer plans to ensure the wastewater collection system meets the City's needs.

The 2008-09 approved budget for the maintenance and operations of wastewater facilities is almost \$259 million which includes the wastewater collections system and water treatment plants. The majority of the costs for operating, maintaining and improving the City's sewer system are paid through monthly sewer service charges to residents and businesses. According to Sanitation management, the typical single family residential monthly sewer service charge is about \$30. There are over 400 positions assigned to the wastewater planning, operation and maintenance divisions.

COLLECTION SYSTEM SETTLEMENT AGREEMENT

In the late 1990s, several communities in South Los Angeles and Eagle Rock suffered significant sewer overflows during unusually heavy rainstorms. In response to these spills, the Los Angeles Regional Water Quality Control Board (Regional Control Board) issued a Cease and Desist Order requiring the City to construct several new sewer lines to prevent additional wet weather overflows. During the same time period, the Santa Monica Baykeeper filed a Federal lawsuit against the City asking for injunctive relief due to the sewer overflows. In January 2001, the U.S. Environmental Protection Agency (EPA), the Regional Control Board and a number of community groups representing residents in South Los Angeles joined the Baykeeper in its lawsuit against the City. On October 29, 2004, the Plaintiffs (EPA, Regional Control Board, South Los Angeles community groups and Baykeeper) and the City entered into a Collection System Settlement Agreement (Agreement) to resolve the pending consolidated litigation.

The Agreement sets out a program that the City must implement to reduce sanitary sewer overflows (overflows) through sewer cleaning, upgrades, and repairs, and processes to investigate, resolve, and mitigate sewer odors to the maximum extent practicable. The Agreement is in effect for ten years – from July 1, 2004 through June 30, 2014. Sanitation has estimated that compliance with the Agreement will cost the City an estimated \$2.3 billion. The Agreement has 127 deliverables and defines the specific maintenance, repair / rehabilitation, and new construction projects with schedules for their completion.

SUMMARY OF RESULTS

Overall, we found that Sanitation has adequately planned for its infrastructure needs to serve the City's wastewater demands and to comply with the Agreement. The ten-year capital improvement plan for the wastewater system, adopted in December 2006, addresses the facilities, upgrades, programs and strategies necessary to move the City's sewage from homes and businesses through the primary and secondary sewer drainage basins to the wastewater treatment and water reclamation plants. We found that Sanitation has been extremely effective in reducing sanitary sewer overflows over

the past eight years, and delivers a high level of service in the maintenance, inspection, and repair of the sanitary sewer system.

However, improvements can be made to ensure that primary and secondary sewer drainage basin master plans are developed by more effectively using computer modeling to minimize risk of future overflows and by better coordination of planning for the entire sewer system. Specifically, we found that the development of secondary sewer drainage basin master plans occurred without the benefit of a computer model to simulate the hydraulic conditions in the secondary basins. The computer model enables an evaluation of the capacity of the sanitary sewer system, how the system would react under various scenarios, and areas where improvements may be necessary. The model also serves as a tool in to identify the future infrastructure required to meet the build-out demands. This computer model has been used only in the development of master plans for the primary sewer drainage basins, despite that 98% of the overflows occurred during the prior two Fiscal Years in the secondary sewer basins. The sanitary sewer system was not analyzed or planned as one complete system (primary and secondary); rather, two separate engineering sections separately prepare primary and secondary sewer drainage system master plans with limited integration between the two sections. This can potentially result in a secondary sewer drainage basin overloading during wet weather events at the connection points between the primary and secondary sewer basins as a result of this limited integration.

Additionally, we noted that workload, resources and staffing could be more effectively managed to ensure their optimal utilization in the maintenance of the sanitary sewer system. The productivity of Wastewater Division staff does not consistently meet its own guidelines, the equipment used by Wastewater Division staff in the maintenance of the sanitary sewer system experiences significant downtime reducing work output, Wastewater Division is not evaluating the high levels of service for maintenance and inspection of the sanitary sewer system to determine whether these levels of service continue to be necessary, and the Wastewater Division lacks an effective computerized maintenance management system to manage workload, resources and staffing. Lastly, while Sanitation has made significant strides in addressing the requirements of the Agreement, delays have occurred in implementing some permanent odor control measures.

KEY FINDINGS

- **Sanitation can more effectively enhance the integration of master plans for the primary and secondary sewer drainage basins and reduce the likelihood of sanitary sewer overflows.**

Sanitation categorizes the sanitary sewer collection system as primary or secondary based upon the size of the mains. Separate master plans are prepared for each of the primary and secondary sewer drainage basins by two separate engineering sections. Although the plans for the primary sewer system will be updated using a computer model and will consider peak wet weather flow

information, Sanitation does not intend to utilize this computer model in the preparation of master plans for the secondary sewer drainage basins. This can potentially result in a secondary sewer drainage basin overloading during wet weather events at the connection points between primary and secondary sewer drainage basins.

Sanitation does not believe the potential results of the use of the computer model in the development of secondary sewer master plans merits the significant effort that would be required for the analysis. However, we noted that almost all (98%) of the overflows in Fiscal Years 2006-07 and 2007-08 occurred in the secondary sewer system.

- **Once the master plans for the primary drainage basins have been updated for peak wet weather flow data and master plans completed for the high priority secondary sewer drainage basins, the frequency of further updates of these master plans should be evaluated to ensure cost effectiveness.**

We noted the City spends a significant amount of resources, including City staff and consulting engineers to update master plans for primary and secondary drainage basins. For example, ten engineers and engineering consultants are responsible for the preparation of master plans for secondary sewer drainage basins. Once the master plans are initially completed or updated for peak wet weather flow data, Sanitation intended to continuously update these plans, rather than relying on the plans for ten to fifteen years as typical with other sanitation agencies. This practice is unnecessary and is not considered an efficient use of resources, especially considering the City's current fiscal constraints.

- **Sanitation spends about \$1.1 million annually to uncover maintenance holes that are paved over by the Bureau of Street Services. Paving over the maintenance holes prevents the access to mains by the maintenance crews and possibly impedes their ability to effectively respond to overflows.**

Maintenance holes are used to access the City's sewer system and are generally located in the City's streets. When repaving the City's streets, the Bureau of Street Services (Street Services) paves over some of the maintenance holes, preventing direct access to the sewer mains by Wastewater Division maintenance crews. When streets are newly paved, these manholes are indistinguishable from the rest of the street and are below the street surface. Standard work practices in the public sector are to uncover maintenance holes and raise the manhole to the street level as part of the street paving process. However, Sanitation uses a private contractor to locate, uncover and raise some of the City's manholes. We noted that the median timeframe to uncover and raise manholes is 36 calendar days from the date requested, but we noted a number of instances in which the maintenance holes were paved over for three to four years before being uncovered. On an annual basis, over 2,300 manholes are

uncovered and raised for a cost of over \$1.1 million (or not less than \$390/maintenance hole).

- **Sanitation lacks an effective computerized maintenance management system to enable Wastewater Division management to effectively control workload, resources and staffing in the maintenance and the repair of the sanitary sewer system.**

The Wastewater Division uses the Enterprise Maintenance Planning and Control (Management Systems) software as an asset management and maintenance system. The Division utilizes Management Systems to manage work through the issuance of work orders to their crews, track warehouse parts, and enable maintenance related purchases. However, the Management Systems is limited in its ability to enable the Wastewater Division to manage workload, resources and staffing, and evaluate service levels in the maintenance and repair of the sanitary sewer system.

- **Sewer maintenance equipment is not always available due to excessive use and high downtime, reducing work output by the Wastewater Division staff.**

A review of equipment availability for the use of the Wastewater Division maintenance staff for maintaining the wastewater collection system indicates that a significant proportion of the equipment is down – in the fleet repair shop – for significant periods of time. For example, for one day in June 2008, we noted the following equipment was in the repair shop: nine of fourteen hydroflushers, one of the seventeen rodders, and four of the thirteen cleaner combo's or almost one-third of the cleaning equipment. As another example, the only two hydroflushers (used to clean sewers) assigned to yard 371 were unavailable on June 2, 2008, and were still unavailable on June 26, 2008. Some crews are "hot bunking" equipment – using the same equipment in the same day for the day shift and the swing shift. The work output of crews and the productivity of crews assigned to the maintenance and repair of the wastewater collection system decreased as a result of the lack of equipment. The equipment is worn out more quickly as a result of the levels of utilization, and this does not reflect typical practices in other sanitation agencies.

- **The number of priority sewer locations, or "hot spots" is high and needs to be reevaluated on an ongoing basis to ensure appropriate cleaning frequency and effective use of resources.**

There are approximately 35,000 "hot spots" in the wastewater collection system. "Hot spots" receive a higher and frequent level of service than other sanitary wastewater collection mains. "Hot spots" are added anytime there is an overflow or when a maintenance crew believes there are circumstances that would suggest more frequent cleaning is necessary such as roots, debris, grease, etc.

However, hot spots are not evaluated to determine whether the problem has been abated, and the frequency of cleaning can be reduced or the location can be removed from the “hot spot” list altogether. As a consequence, the number of “hot spots” has continued to grow over the past eight years, increasing the maintenance and workload demands as well as staffing requirements. “Hot spots” that may no longer be a problem will continue to receive a higher level of service when it is no longer necessary.

- **The productivity of the Wastewater Division staff in the maintenance and repair of the wastewater collection system is lower than other sanitation agencies. In addition, the Wastewater Division staff in the maintenance and repair of the wastewater collection system does not meet the Wastewater Division’s own work output guidelines resulting in some instances of lower work output.**

We reviewed work activity reports and noted that maintenance crew productivity is inconsistent and does not meet benchmarks or Division output goals. For example, for one crew, the daily productivity ranged from a low of 620 linear feet of main sewer lines cleaned per crew day to a high of 5,358 linear feet of main sewer lines cleaned per crew day. Further, based on work activity reports for July and August 2008 for all of the maintenance crews, we determined an average of 2,731 linear feet of sewers were cleaned per crew day. Maintenance crews should clean between 3,500 to 4,000 linear feet of mains. Though Sanitation maintenance crews are required to perform additional quality assessment steps, these quality guidelines have been considered in the Wastewater Division work output goals, e.g., the output goal for high velocity cleaning is 3,000 linear feet per crew day.

A higher level of staffing is required to maintain necessary levels of service when maintenance crews do not meet the Wastewater Division’s work output goals. Limitations of the Management Systems prohibit identifying specific reasons for lower output.

- **The levels of services for maintenance of the wastewater collection utilities are high relative to other sanitation agencies and exceed that required by the Agreement resulting in higher costs for Wastewater Division maintenance and operations.**

Under the Agreement, the City must complete specified levels of cleaning and maintenance. The intent of setting specific cleaning and maintenance levels was to ultimately reduce the number of overflows. The number of overflows has decreased from 687 in fiscal year 2000-01 to 200 in fiscal year 2007-08. Over the past three fiscal years, the number of overflows has largely remained constant at about 200 overflows per year. However, the number of overflows per 100 miles of mains in Los Angeles is 43% below the median for participants that serve a population in excess of 500,000 based upon a survey conducted by the

American Water Works Association.

During this time, Sanitation has exceeded the Agreement's minimum requirement for cleaning sewer mains, using CCTV technology to inspect sewers, and applying root chemical treatment to inhibit root re-growth and intrusion in sewer mains. For example, in Fiscal Year 2007-08 the Wastewater Division cleaned almost double the Agreement's minimum requirement. These levels of service not only exceed that required by the Agreement, but also the levels of service reported by other sanitation agencies.

Because the Agreement allows the City to "bank" work performed in excess of annual requirements, exceeding thresholds in some years can assist the City with compliance in years where service levels cannot be met. However, Sanitation has exceeded the minimum requirements in each year of the Agreement. Sanitation has not determined whether service levels for the maintenance and inspection of the sewer mains exceed that required to maintain the overflows at a minimal number.

- **Sanitation has experienced delays in the construction of permanent odor control facilities as part of the odor control requirements of the Agreement which presents a potential risk of non-compliance with the Agreement.**

The Agreement established construction end dates for the installation of seven air treatment facilities (ATFs) to control sewer odors in specific areas of the City. After two ATFs were installed in 2006, because there was some indication that the ATFs were not the optimal solution for mitigating sewer odors, Sanitation determined that further study regarding planned odor control measures was needed.

The Wastewater Division has just initiated an odor control study, two years after the development of the Odor Control Master Plan. This problem was exacerbated by a significant delay in obtaining approval of the rotating consulting engineer contract.

Sanitation has been aware of the need to reevaluate the effectiveness of the ATF's since May 2006. The Environmental Protection Agency (EPA) and the Regional Water Quality Control Board (RWQCB) were made aware of this issue and have been continuously informed by Sanitation that the effectiveness of the ATF's needed to be reevaluated. However, Sanitation did not formally request an extension to the terms of the Agreement regarding the ATF's from the EPA and the RWQCB until November 13, 2007. This has placed Sanitation at risk in terms of compliance with the terms of the Agreement.

Sanitation is currently working with the plaintiffs to determine the best solution to meet the Agreement's requirements in controlling sewer odors.

Review of Report

On December 19, 2008, a draft report was provided to the management of the Bureau of Sanitation for review. An exit conference was held on January 5, 2009 to discuss the contents of the report. Sanitation indicated general concurrence with the findings and recommendations. We considered Sanitation's comments before finalizing the report.

Table of Recommendations

Recommendation	Page Reference
Section 1: Master Planning of the Wastewater Collection System	
The Bureau of Sanitation should:	
1. Extend the utilization of the existing hydraulic model in preparation of primary master plans to include sewer reaches in secondary sewer basins that have demonstrated a high risk for sanitary sewer overflows.	22
2. Extend the utilization of the existing hydraulic model to include sewer reaches where the secondary sewer joins the primary sewer. The Secondary Sewer Planning Section should use the results of the modified hydraulic model to review and revise the completed 62 master plans and account for possible surcharges at the confluence points between the two sewer systems.	23
3. Develop formal mechanisms to integrate their staff in the preparation of primary and secondary master plans so that the updating of secondary master plans are not developed based upon old sewer elevations at the connection points between the secondary and primary sewer mains.	24
4. Once the primary master plans have been updated for peak wet weather flow data and completed for the high priority secondary sewer drainage basins, reduce and reallocate the staff and engineering consultants allocated to master planning primary and secondary sewer systems. A “core” staff should be retained to update the model, use the model as needed, etc.	24
Section 2: Maintenance Management Of The Wastewater Collection System	
The Bureau of Sanitation should:	
5. Coordinate with the Bureau of Street Services to modify its street overlay work practices to include uncovering maintenance holes and raising maintenance holes to grade in the most cost effective manner for the City.	26
6. Modify its Management Systems to enable the identification of the services provided, the levels of service, the outputs of each of these services, and the costs of those services in terms of the total cost and the cost per unit of output.	29

Recommendation	Page Reference
Section 2: Maintenance Management Of The Wastewater Collection System (Cont'd)	
The Bureau of Sanitation should:	
7. Coordinate the planned replacement of its Management Systems with ITA and assure the new system adheres to the City's information technology standards.	29
8. Assure backup or "spare" vehicular equipment is available so that the Wastewater Division maintenance and repair crews can continue to provide service while their primary equipment is in the Fleet Services' repair shop. Individual crews should be assigned their own specific equipment.	29
9. Evaluate "hot spots" annually to determine whether the problem that caused the pipe reach to be placed on the "hot spot" list has been abated, and the frequency of cleaning can be reduced or the pipe each can be removed from the "hot spot" list altogether.	30
10. Develop and implement a formal written process and policy to review, remove or modify "hot spots" by the Wastewater Division.	30
11. Utilize Management Systems to report the productivity of crews and the unit cost of work activities.	31
12. Utilize its reports regarding the productivity of Wastewater Division crews and the unit cost of work activities to assure that their crews meet appropriate work output and unit cost targets.	31
13. Quantify the results of the wastewater collection inspection crews.	32
14. Eliminate the practice of inspecting wastewater collection mains if no appreciable work output can be demonstrated.	32
15. Evaluate the benefit of continuing the existing levels of service for the proportion of mains that are cleaned, inspected using CCTV, and chemically treated for roots each year.	33
16. Establish a formal written policy for reporting newly discovered mains by Wastewater Division crews.	34
17. Develop internal controls within its Management Systems to require supervisory approval for the cancellation or deletion of any work order.	34

Recommendation	Page Reference
Section 2: Maintenance Management Of The Wastewater Collection System (Cont'd)	
The Bureau of Sanitation should:	
18. Develop a database within its Management Systems that logs all canceled and deleted work orders and generates exception reports monthly.	34
19. Identify backup engineers to be trained in the fundamentals of the Microsoft Access database utilized by the Wastewater Division for work planning and scheduling including database design, maintenance and operation. Wastewater Division management should have the backup engineers adequately trained to succeed the incumbent on an interim or a permanent basis.	35
Section 3: Management of the Agreement	
The Bureau of Sanitation should:	
20. Document the recommendations contained within these reports – the Capacity Report and Plan, the Rehabilitation and Replacement Plan, the Sewer Odor Control Master Plan, and the other reports prepared to address the requirements of the Agreement – and report the status of the implementation of these recommendations on a recommendation-by-recommendation basis on a periodic basis.	36
21. Evaluate opportunities to reduce the amount of time required for issuance of requests for proposal for consulting engineers, evaluation of those proposals, and development of proposed contracts.	38
22. Formally request an extension to the terms of the Agreement from the EPA and the RWQCB as soon as the practical after Sanitation is aware that an extension to the terms of the Agreement will be required.	38
The Bureau of Sanitation should:	
23. Modify the Wastewater Division policy manual for reporting overflows to the regulatory agencies so that its reporting requirements are not more stringent than the requirements of the regulatory agencies.	39
24. Provide a specific timeframe within the Wastewater Division’s internal manual regarding when to notify stakeholders that might be affected by a Category 1 overflow.	40

2. INTRODUCTION AND BACKGROUND

BACKGROUND

The City has the largest separate sewer system in the nation with more than 6,500 miles of sewers. The system serves an area of more than 515 square miles and a population of over 5 million people. The system conveys an average of approximately 450 million gallons per day to two water reclamation plants and two wastewater treatment plants.

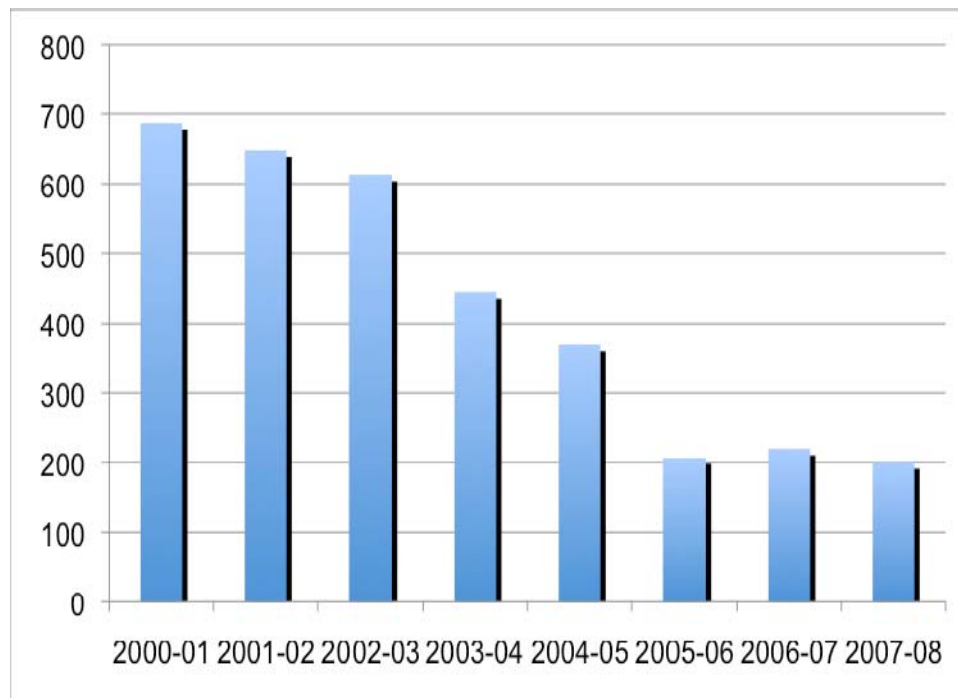
In the late 1990s, several communities in South Los Angeles suffered severe sewage spills during unusually heavy rainstorms because a 70-year old main sewer line failed. As a result, several parties, including the Environmental Protection Agency, the Regional Water Quality Control Board, and the Santa Monica Baykeeper, filed a lawsuit against the City. In October 2004, the City of Los Angeles entered into a settlement agreement to implement a 10-year program to build new sewers, and maintain and repair existing sewers at an estimated cost of \$2.3 billion.

The collection system settlement agreement (Agreement) requires the Bureau of Sanitation (BOS) to enhance the delivery of wastewater collection and engineering services with specific requirements, deliverables, and levels of service that are subject to penalties for failure of compliance to reduce sanitary sewer overflows (overflows) to the maximum extent feasible, and to investigate, resolve, and mitigate sewer odors to the maximum extent practicable. There were 127 deliverables in the Agreement with agreed upon due dates for completion. These 127 deliverables, and the status of their implementation are presented in the appendix at the end of this report (see Appendix 1).

By a number of measures, Sanitation has made significant strides in enhancing the delivery of wastewater collection and engineering services to address the requirements of the Agreement. This is evident from a number of perspectives as noted below.

- The number of overflows has been reduced significantly. Over an eight-year period, the number of overflows has been reduced by 71% (see the chart below).

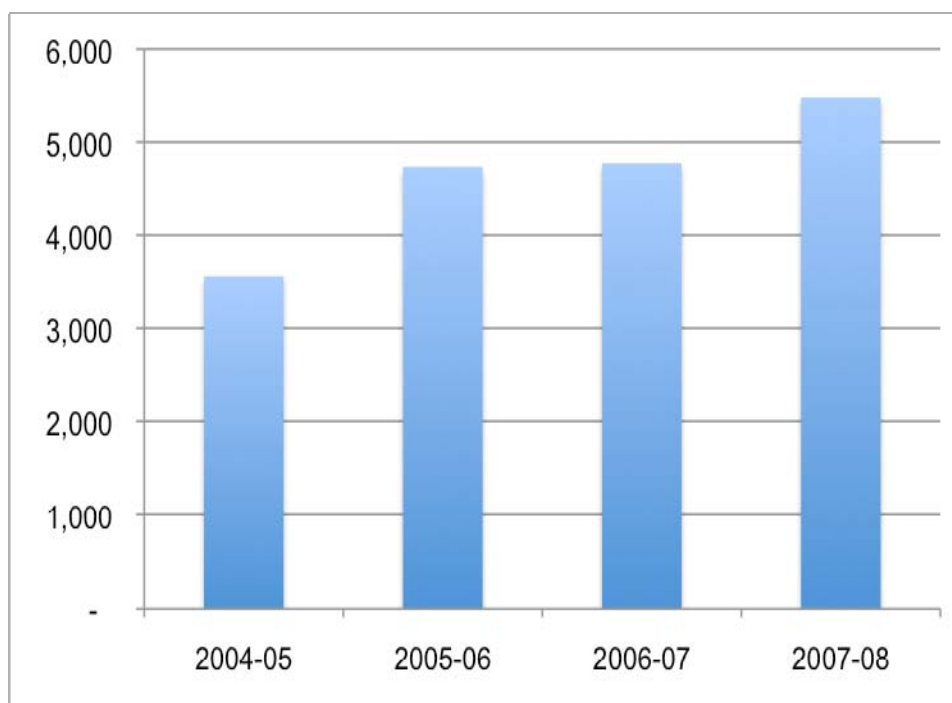
Number of Sanitary Sewer Overflows By Fiscal Year



The number of overflows has decreased from 687 in fiscal year 2000-01 to 200 in fiscal year 2007-08. Over the past three fiscal years, the number of overflows has largely remained constant at about 200 overflows per year. However, the number of overflows per 100 miles of mains in Los Angeles – 3.1 per 100 miles of main – is at the median in the western United States for participants in a survey conducted by the *American Water Works Association*, and is 43% below the median for participants that serve a population in excess of 500,000. This is excellent performance by the Wastewater Collection Systems Division (Wastewater Division) in reducing the number of overflows to a level below their peers in terms of population

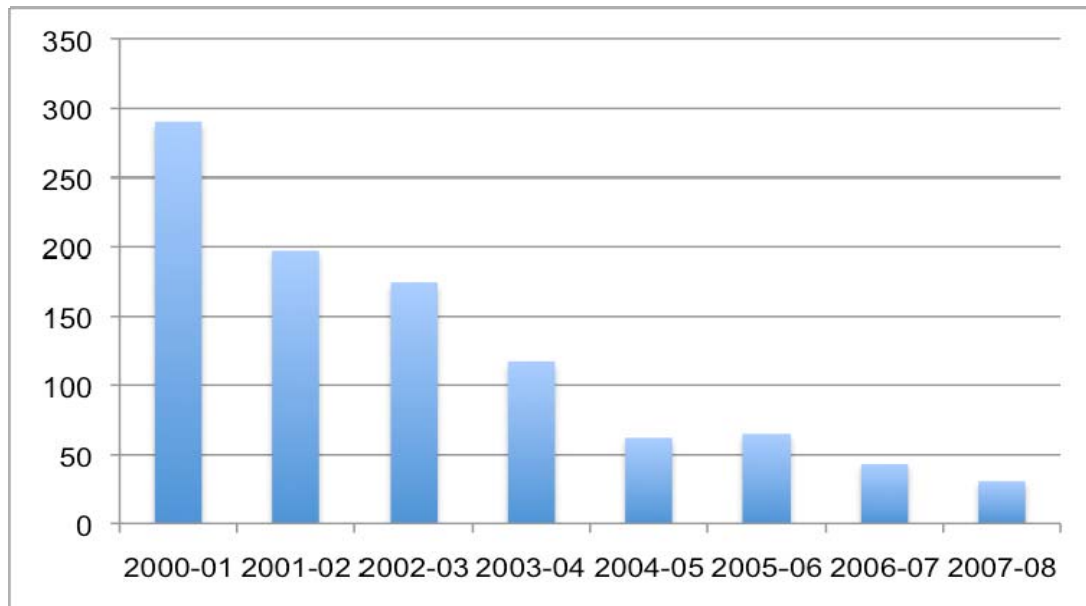
- The miles of wastewater collection mains cleaned by the Wastewater Division has increased significantly over the past four years. In fiscal year 2007-08, the Wastewater Division cleaned the equivalent of 84% of the wastewater mains in Los Angeles. The miles cleaned have increased by 54% over the past four years (see the chart below). The Wastewater Division is required to clean 60,000 pipe reaches annually by the terms of the Agreement; it has exceeded that requirement by 88% over the past three years.

Miles of Wastewater Collection Mains Cleaned By Fiscal Year



- The number of hot spot pipe reaches cleaned has increased over the past four years. In fiscal year 2007-08, the Wastewater Division cleaned 88,012 pipe reaches. The number of pipe reaches cleaned has increased by 44% over the past three years.
- The miles of sewer mains that were inspected using a closed circuit television (CCTV) has increased by 21% over the past four fiscal years from 821 miles in fiscal year 2004-05 to 990 miles in fiscal year 2007-08. This exceeds the requirements of the Agreement, which requires that 600 miles of mains be inspected annually. In 2007-08, 15% of the collection system was inspected. A total of 98% of the mains inspected were assigned a condition rating of good or very good, while 2% were assigned a condition rating of fair, and only 0.3% were assigned a condition rating of poor.
- The number of fats, oils, and grease (FOG) related overflows has decreased significantly over the past eight years from 290 in fiscal year 2000-01 (or 42% of all overflows) to 31 in fiscal year 2007-08 or 16% of all overflows. This has been a clear downward trend in FOG-related overflows as the chart below indicates.

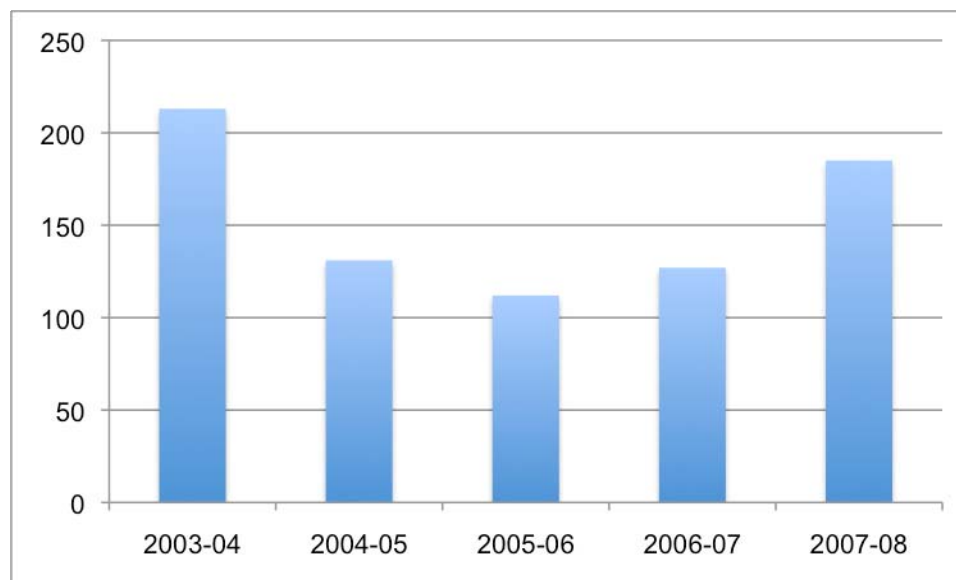
Number of FOG-Related Sanitary Sewer Overflows By Fiscal Year



- The Agreement required the completion of master plans for all of the collection system's twenty-six primary basins by the end of year five of the Agreement (fiscal year 2008-09). The Wastewater Engineering Services Division (Wastewater Engineering) completed master plans for all twenty-six basins by the end of year four or fiscal year 2007-08.
- The Agreement requires the completion of master plans for the 100 highest priority collection system secondary basins by the end of year ten of the agreement. By the end of year four of the agreement (fiscal year 2007-08), Wastewater Engineering completed master plans for fifty-six (56) basins or an average of fourteen (14) a year. In the remaining six years, at current trends, Wastewater Engineering should complete master plans for one hundred forty (140) secondary basins. There are a total of two hundred twenty (220) secondary basins.
- The miles of mains receiving chemical root treatment has exceeded 400 miles of mains for three of the past four fiscal years; in the other year, 314 miles of mains were treated. In fiscal year 2007-08, 435 miles of wastewater mains were treated with chemical root inhibitor or almost 7% of the system. This exceeds the Agreement requirements for 150 miles of mains annually. This has resulted in a clear trend in the reduction of root-caused overflows. The number of root-caused overflows has decreased from 291 in 2000-01 to 105 in 2007-08, a decrease of 64%. However, it should be noted that over the last two fiscal years, the number of root-caused overflows has not changed significantly with 104 in 2006-07 and 105 in 2007-08.

- The Agreement specified fifty-five sewer rehabilitation and replacement projects to be completed in the first three-years of the agreement. All of these projects have been completed. The Agreement also specified ten sewer relief projects to be completed in the first three years of the agreement; nine of the ten have been completed. The tenth project was extended to October 31, 2010 based upon construction delays.
- The Agreement specifies that a minimum of 50 miles of sewers shall be rehabilitated and replaced beginning in year four of the agreement (2007-08). During 2007-08, Sanitation rehabilitated and replaced 101 miles of mains or 1.6% of the system.
- Sanitation has developed and installed a MIKE Urban hydraulic model for the City's wastewater collection system as required by the Agreement. The model has been upgraded to extend its capability to geographic information systems and database management. The model has been calibrated for peak dry weather flow, and data is being collected to calibrate the model for peak wet weather flow, which is expected to be completed by June 2009.
- The number of sewer odor complaints, however, has actually increased over the past three years and was the second highest volume in 2007-08 in the past five years (see chart below). The number of complaints reached 185 in 2007-08 compared to a low of 112 in 2005-06.

Number of Sewer Odor Complaints By Fiscal Year



Sanitation received and responded to a total of 539 odor complaints in FY 2007-08, of which 185 were sewer related. Sanitation believes the increase is due to increased pressure in the North Outfall Relief Sewer (NORS) causing odors to

migrate into the North Outfall Sewer (NOS). To mitigate the increase in sewer odors, Sanitation is proposing to take the following actions:

- Isolate and seal the NORS head space at selected diversion structures to prevent the movement of gas from the NORS into upstream reaches;
 - Evaluate and adopt as appropriate other maintenance hole designs with proven track records and replace the trap maintenance holes accordingly; and
 - Study the feasibility of installing an air jumper between the NORS and the North Central Outfall Sewer (NCOS).
- Sanitation has not met construction end dates for air treatment facilities (ATF's) as stipulated in the Agreement. The Agreement specified May 23, 2008 as the construction end date for five (5) of the required seven (7) ATFs and March 26, 2009 for two (2) others. Design for all ATFs was completed. Two ATF projects have been awarded a construction contract and are now in the construction phase. On November 13, 2007, Sanitation requested the United States Environmental Protection Agency and State Regional Water Quality Control Board to approve an extension of the construction end date for all seven (7) ATFs. In a letter dated July 3, 2008, the United States Environmental Protection Agency asked Sanitation for additional information in connection with the City's November 13, 2007 request.

Overall, Sanitation has made significant strides in addressing the requirements of the Agreement and enhancing the level of service provided to its customers in Los Angeles. The current wastewater capital improvement is adequate to meet the infrastructure needs of the City. There are adequate controls to ensure appropriate coordination with other agencies related to wastewater collection, and adequate controls to track and monitor the condition of the sewage systems. The controls to ensure compliance with the Collection System Settlement Agreement and to prevent or minimize future sewage spills can be improved. The efficiency of some aspects of the operations of the Wastewater Division can also be improved.

SCOPE OF THE PERFORMANCE AUDIT

The overall objective of the audit was to evaluate whether Sanitation had an efficient and effective process to maintain and improve the City's infrastructure for wastewater collections and conveyance. The audit was to focus on determining the following:

- Is the current wastewater capital improvement program adequate to meet the infrastructure needs of the public?
- Are there adequate controls to track and monitor the condition of the sewage systems?

- Are there adequate controls to ensure compliance with the Collection System Settlement Agreement and to prevent or minimize future sewage spills?
- Are there adequate controls to ensure appropriate coordination with other agencies related to wastewater collection (i.e., County of Los Angeles, EPA)?

The audit focused on wastewater collection and conveyance system infrastructure and did not include an assessment of the City's wastewater treatment process or a review of biosolid disposal.

SECTION 1: WASTEWATER COLLECTION SYSTEM PLANNING

The purpose of a master plan is to evaluate the adequacy of the City's sewer collection system, identify system deficiencies both present and future, and to develop a prioritized list of improvement projects that will be needed to meet the City's collection system needs. Specifically, the scope of master plans consists of the following elements:

- Analyze the existing collection system, and identify existing deficiencies that need to be corrected;
- Analyze build-out conditions, and identify separate projects needed to accommodate the incremental effects of planned growth on the collection system; and
- Develop an infrastructure replacement program that systematically replaces unserviceable portions of the collection system.

The primary sewer basin master plans address 25 and 100-year projection periods. The emphasis is on relief and rehabilitation projects that will be required within the next twenty to twenty-five years. Primary sewers include pipes that are 16-inches in diameter or greater. The master plan evaluates the structural condition, the hydraulic condition, and identifies proposed capital projects to provide relief and the timing for the proposed projects (e.g., immediate, needed by 2090, outside planning window).

The secondary sewer master plans evaluate the structural and hydraulic conditions and project the future needs of the basin. The secondary sewer system consists of sewer mains less than 16 inches in diameter. The basic planning strategy is to evaluate sewers in the basin using ranking and defect categories, based on a priority established by maintenance history, pipe age, material, spill history, and other factors. The master plan includes a structural assessment (pipe age and material), the results of CCTV inspections (physical defects), a watermark analysis, flow gauging, tributary area flow estimates, and problems with inflow and infiltration of groundwater or rainwater into the sewer mains.

Our audit identified a number of opportunities for improvement in the manner Wastewater Engineering develops its master plans. These opportunities are presented in the following sections that briefly summarize the areas that can be strengthened. These include utilizing the computer model for mains with a diameter of 12" through 15", enhancing the integration between the primary and secondary master planning sections, and not continuously updating the master plans once these master plans reflect peak wet weather flow.

Finding No. 1: Sanitation can more effectively enhance the integration of master plans for the primary and secondary sewer drainage basins and reduce the likelihood of sanitary sewer overflows.

Sanitation categorizes the sanitary sewer collection system as primary or secondary based upon the size of the mains. Separate master plans are prepared for each of the primary and secondary sewer drainage basins by separate engineering sections. Although the plans for the primary sewer system will be updated using a computer model and will consider peak wet weather flow information, Sanitation does not intend to utilize this computer model in the preparation of master plans for the secondary sewer drainage basins.

Wastewater Engineering currently analyzes sewer hydraulics for secondary sewer drainage basins using static condition analysis, and not a computer model. Static condition analysis uses an engineering equation to manually calculate the hydraulic grade of sewage as it passes through a sewer main. The use of static condition analysis is a simple way to estimate the hydraulics in a sewer system. However, there are a number of limitations with the use of static condition analysis; it does not take into account several factors that actually occur in sewer mains. These limitations include pipe headloss, minor friction loss, hydraulic jumps, and surcharging of the system. Examples of the impact of these limitations are presented below.

- Pipe headloss. All friction loss reduces the velocity of sewage in a main. The reduced sewer velocity will raise the depth of sewage in the main. There is friction that results from the sewage traveling through the pipe. This is called pipe headloss. There is also friction loss when the water enters and exits a manhole. This friction results from the dynamic motion in the sewer as sewage travels past a manhole. This is called minor losses. The chart below presents a simple visualization of pipe headlosses.

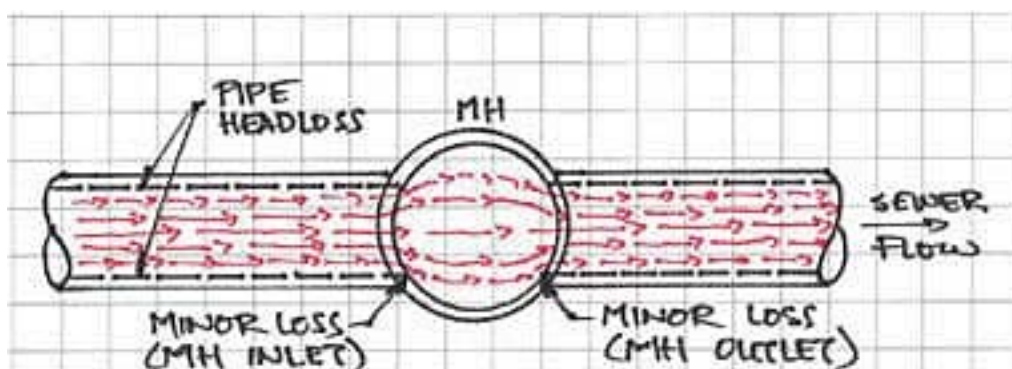


Figure 1

- Hydraulic jumps. Another factor to consider is hydraulic jumps. When the velocity of the sewage traveling on a steep slope is abruptly reduced because of a

downstream pipe with a somewhat flat slope, the sewage tends to jump and create a surcharge. Surcharging affects sewage depths in the mains upstream of the jump. See Figure 3 for a visualization of a hydraulic jump.

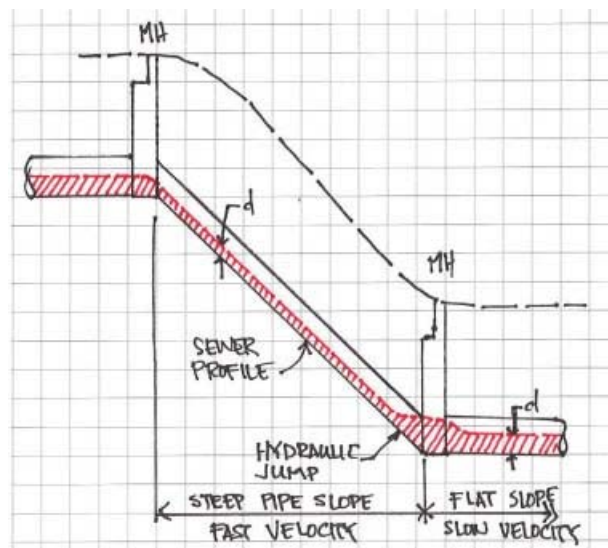


Figure 2

Sanitation agencies use computer models for master planning of sewer basins. The model will automatically calculate friction losses, hydraulic jumps, surcharges and other conditions not mentioned above. Wastewater Engineering utilizes the model's capabilities for the primary sewer drainage basin master plans. However, Wastewater Engineering is not utilizing their sewer computer model for master planning of the secondary sewer collection systems.

The steps that Wastewater Engineering currently utilizes to evaluate the hydraulic capacity of the secondary sewer systems in lieu of a computer model are presented below.

- Review recorded sewage watermarks (or the height of sewage in a main based upon visible marks on the side of the main) from the CCTV data and identify sewer mains with sewage watermarks greater than 50% of the pipe diameter.
- Investigate identified sewer mains to analyze the causes of the watermarks. Certain areas that are known to have high flows due to blockages and maintenance problems are removed from further consideration.
- For the remainder of the mains, flow-gauging data would be requested and reviewed to confirm the high watermarks.
- Wastewater Engineering then performs a static condition analysis only of the identified sewer mains with problematic sewage watermarks.

Wastewater Engineering considers the use of watermarks as subjective and when used alone may not be suitable for hydraulic analysis. The A04 Sewer Master Plan states:

“Watermark analysis by itself is not a reliable indicator of flow depth under PDWF conditions. The watermark information from CCTV tapes is subjective because it depends on individual CCTV reviewer.....Also, the watermarks might represent wet weather flow, not dry weather flow. The highest residue in the pipes could have been caused from PWWF conditions, which could mean that the PDWF are being overestimated and that pipes are not actually hydraulic deficient.”

Watermarks generally do not correspond with flow gauging data or the static condition calculations. In some cases, Bureau Veritas (subject matter expert) has found that watermarks do not consistently depict the actual flow of sewage in a main.

Wastewater Engineering has also completed 62 of the Agreement required 100 high priority secondary sewer drainage basin master plans. Wastewater Engineering does not intend to use the computer model for secondary sewer drainage basin master plans. Wastewater Engineering indicated that modeling the secondary sewer system is a significant task that would require incorporating all the sewers in the secondary sewer systems. Wastewater Engineering believes that the effort to build the secondary system into the existing computer model far outweighs the value of the model results. Given the size of the sewer system and the disparity between the primary sewer and secondary sewer quantities, modeling every secondary sewer basin may be a tedious and inefficient approach.

Nonetheless, it cannot be disregarded that almost all (98%) of the overflows have occurred on the secondary sewer system. There are a number of limitations with the use of static condition analysis; it does not take into account several factors that actually occur in sewer mains. These limitations include pipe headloss, minor friction loss, hydraulic jumps, and surcharging of the system

The preparation of master plans for secondary sewer basins without the use and application of a computer model could potentially result in a master plan that is hydraulically deficient and secondary sewer drainage basin overloading during wet weather events.

Recommendations:

The Bureau of Sanitation should ensure:

- 1. The Primary Sewer Planning Section extends the utilization of the existing hydraulic model in preparation of primary master plans to include sewer reaches in secondary sewer basins that have demonstrated a high risk for sanitary sewer overflows.**

- 2. The Primary Sewer Planning Section extends the utilization of the existing hydraulic model to include sewer reaches where the secondary sewer joins the primary sewer. The Secondary Sewer Planning Section should use the results of the modified hydraulic model to review and revise the completed 62 master plans and account for possible surcharges at the confluence points between the two sewer systems.**

Finding No. 2: The primary and secondary sewer master plans have been prepared by two separate organizational units of the Wastewater Engineering Services Division without sufficient integration between the units.

Wastewater Engineering separates the tasks of preparing the primary and secondary sewer master plans between two units with two different managers. The only coordination between the two sections is at the connection point from secondary to primary sewer system.

The secondary master planning section currently employs one manager and nine planners and consulting engineers. Out of the six planners, only one is capable of running the computer model. The primary master planning section currently employs one manager and six planners. Out of the six planners, four are capable of running the computer model. The two sections do not share planners nor do they cross train.

Most sanitation agencies do not segregate the master planning of their sewer system into primary and secondary systems. The whole system is modeled as a system and a single master plan is prepared.

It is recognized that Wastewater Engineering is on a fast track schedule to complete the primary and secondary master plans, under the terms of the Agreement. The two sections of Wastewater Engineering are producing master plans to meet the Agreement schedule. However, the Sections utilize two different methodologies for determining hydraulic capacity in developing their master plans that have not have historically been coordinated between the two sections.

As the primary master plans will be revised with peak dry weather flow and peak wet weather flow information, the 62 secondary master plans that have been previously completed would be outdated based upon old sewer elevations at the connection points between the secondary and primary sewer mains.

Both groups should integrate their staff, especially engineers with the ability to run the hydraulic model. Both groups will benefit by having knowledge of the other's efforts, not only in modeling, but also on recommendations of the resulting master plans.

Recommendation:

3. **The Bureau of Sanitation should ensure the Primary and Secondary Master Planning Sections develop formal mechanisms to integrate their staff in the preparation of primary and secondary master plans so that updating of secondary master plans are not developed based upon old sewer elevations at connection points between the secondary and primary sewer mains.**

Finding No. 3: Once the master plans for the primary drainage basins have been updated for peak wet weather flow data and master plans completed for the high priority secondary sewer drainage basins, the frequency of further updates of these master plans should be evaluated to ensure cost effectiveness.

Master plans have been prepared for all of the 26 primary sewer basins, and these are being updated for peak wet weather flow. Master plans have been prepared for 62 of the 100 high priority secondary sewer drainage basins (with the balance to be completed by FY 2011-12). A significant number of City staff and consulting engineers are dedicated to the preparation of the master plans; 10 engineers and engineering consultants, for example, are allocated to the preparation of secondary sewer master plans. The intent of Wastewater Engineering is to update primary master plans every five years and secondary sewer plans every twenty years.

Once primary master plans are updated for peak wet weather flow and completed for the 100 high priority secondary sewer drainage basins, these master plans should serve as a guide for upgrading and rehabilitating sanitary sewer infrastructure for a period of not less than ten years. The master planning of the primary and secondary sewer systems should be scaled back once the master plans have been updated for peak wet weather flow data.

Recommendation:

4. **The Bureau of Sanitation should ensure that once the primary master plans have been updated for peak wet weather flow data and completed for the high priority secondary sewer drainage basins, reduce and reallocate the staff and engineering consultants allocated to master planning primary and secondary sewer systems. A “core” staff should be retained to update the model, use the model as needed, etc.**

SECTION 2: WASTEWATER COLLECTION SYSTEM MAINTENANCE MANAGEMENT

The Wastewater Division faces a number of challenges including fiscal limitations and aging infrastructure. Our audit identified a number of opportunities for improvement in the way the Wastewater Division manages the maintenance of the wastewater collection system. These opportunities are presented in the following sections that briefly summarize the areas that can be strengthened. These include working with the Bureau of Street Services to transform the approach to raising maintenance holes after asphalt overlays, more effectively using the Enterprise Maintenance Planning and Control (Management Systems) software program to manage the work output and service levels of the Wastewater Division, resolving significant problems with vehicular downtime that impedes Wastewater Division work output, evaluating “hot spots” on an ongoing basis to determine whether the level of service can be reduced or the sewer pipe reach can be removed from the “hot spot” list altogether, enhancing the consistent productivity of the Wastewater Division crews, and evaluating the current levels of service provided for the maintenance of the wastewater collection system.

Finding No. 4: Sanitation spends about \$1.1 million annually to uncover maintenance holes that are paved over by Bureau of Street Services. Paving over the maintenance holes prevents the access to mains by the maintenance crews and possibly impedes their ability to effectively respond to overflows.

Maintenance holes are used to access the City’s sewer system and are generally located in the City’s streets. When repaving the City’s streets, the Bureau of Street Services (Street Services) paves over some of the maintenance holes, preventing access to the sewer mains by Wastewater Division maintenance crews. These maintenance holes are indistinguishable from the rest of the street and are below the new street surface.

As a result, the Wastewater Division uses a private contractor to uncover and raise these maintenance holes to grade. It requires a median of 36 calendar days from the date that Wastewater Division requests that the contractor uncover and raise the manhole for the construction to be completed (although there were a number of instances in which the maintenance holes was paved over for three to four years before being uncovered). On an annual basis, the Wastewater Division is raising 2,365 maintenance holes to grade, reconstructing 10 maintenance holes to grade, replacing 249 frames / covers, and locating / marking 2,000 maintenance holes. The annual cost for this service is \$1,184,262 (at a fee not less than \$390 / maintenance hole). Uncovering the manhole, raising to grade, and paving around the raised manhole requires two trips and approximately 50 minutes.

Cities that outsource street overlay include within the contract the requirement that the contractor uncover the maintenance hole after the overlay and raise the manhole to grade. Sanitation and Street Services should ensure that street paving and providing

access to maintenance holes reflect best management practices in the public sector and result in the most cost effective process for the City.

Recommendation:

- 5. The Bureau of Sanitation should coordinate with the Bureau of Street Services to modify its street overlay work practices to include uncovering maintenance holes and raising maintenance holes to grade in the most cost effective manner for the City.**

Finding No 5: Sanitation lacks an effective computerized maintenance management system to enable Wastewater Division management to effectively control workload, resources and staffing in the maintenance and the repair of the sanitary sewer system.

The Wastewater Division uses the Enterprise Maintenance Planning and Control (Management System) software as an asset management and maintenance system. The Division utilizes Management Systems to manage work, track warehouse parts, and enable maintenance related purchases. The Division also uses the Field Automation Sanitation Trucks (FAST) a field data access component of Management Systems. FAST enables work order data entry in the field by the crews including closing work orders. Management Systems is linked to Geographic Information System (GIS) enabling linkage of assets to actual field locations, searchable by street address or intersection.

However, this system is not utilized to manage the maintenance of the wastewater collection system. More specifically:

- The Wastewater Division prepares its annual work plan manually based on past workload history and frequency of occurrence of overflows. The Management Systems is then utilized to distribute a monthly work plan to the yards and crews from the annual plan. The Wastewater Division analyzes the costs of the work plan by the number of full time employees (FTE) available to complete it. The FTE hours and costs are maintained in the City's Financial Management Information System (FMIS) to document the budget cost related to the work plan because Management Systems is not equipped for financial activities. However, the Division does not reconcile the actual costs to planned costs to the plan because the two systems do not interface.
- The Wastewater Division does not evaluate actual monthly productivity against performance standards (e.g., a performance standard for Preventive Maintenance: High Speed Cleaning Sewers <= 15 inches) for the work activities in the maintenance and repair of sanitary sewer systems.

- The service levels delivered by the Wastewater Division in the maintenance of the wastewater collection system far exceed the requirements of the Agreement, and reflect the absence of direction regarding the levels of service that management has determined should be delivered to sustain the wastewater collection system.

The Wastewater Division managers are unable to systematically assess and evaluate performance, and consider the quantities and service levels of work accomplished using Management Systems. For example, if the productivity of wastewater collection hydroflushing crew is doubled, does that mean that twice as much cleaning of wastewater collection mains should be done? Or should the resources be released for some other kind of work? How much work should be performed – and what service levels should be attained –by activity? The Wastewater Division management is unable to effectively utilize Management Systems to identify how much work is to be done and to reconcile the actual work output and costs to the plan, evaluate the productivity and unit costs of their staff, the total costs of each work activity, etc.

The Wastewater Division should develop and deploy a fully functional maintenance management system to enable the identification of the services provided (e.g., wastewater collection main jetting), the levels of service (e.g., wastewater collection mains are cleaned once every three years), the outputs of each of these services (e.g., the linear feet of wastewater collection mains cleaned), and the costs of those services in terms of the total cost and the cost per unit of output (e.g., cost per linear foot of wastewater collection main cleaned).

A maintenance management system should be acquired to serve as the basis of a comprehensive maintenance plan that identifies the services provided (e.g., high velocity wastewater collection main cleaning), the volume of each of these services (e.g., the miles of mains), and the costs of those services, both total and per unit of output. This is not an idealized perspective of what the Division should be doing, but a basic perspective of what is necessary to manage the maintenance and repair of the infrastructure.

There are a number of elements to the successful installation of a comprehensive maintenance plan by the Field Services Division. These elements include the following:

- A complete inventory of work activities performed by the Wastewater Division needs to be developed that accounts for all of the labor hours of Wastewater Division field operations staff. The Wastewater Division needs to assure that all of the primary work activities (i.e., high velocity wastewater collection cleaning, power rodding, CCTV inspection, etc.) that consume the majority of staff work hours are defined. This would include all forms of leave. All 2,080 staff hours for each employee should be included within the system.
- Performance standards need to be developed. While performance expectations have been defined in Wastewater Division procedures, the development of the

performance standards would define these expectations in greater detail for each work activity (e.g., high velocity wastewater collection main cleaning). Performance standards are formally established criteria for determining the need for work, required quality of work, the resources necessary to achieve quality and expected rate of productivity, etc. Performance standards are developed for each maintenance activity. Each performance standard should include, at a minimum, six components:

- A brief description of the specific work involved;
 - The frequency with which the work should be performed (or the level of service);
 - The crew size required for the job;
 - The equipment, material, and tools needed;
 - The performance expectations for each job or average daily productivity; and
 - The recommended procedures for completing the job.
- The monthly performance report should be generated comparing planned versus actual performance and costs. The monthly report should be revised so that managers and supervisors of the Wastewater Division can:
 - Compare planned versus actual staff hours per work activity for the previous month and year-to-date for each work activity;
 - Compare actual versus planned work output (e.g., miles of mains cleaned by high velocity hydroflushers) per month and year-to-date for each work activity;
 - A unit cost analysis that compares the planned versus actual unit costs for each work activity per month and year-to-date; and
 - A comparison of actual productivity (work output per staff hour) versus the expected productivity as stated in the performance standards.

The Wastewater Division plans to replace Management Systems by approximately 2014.

Recommendations:

The Bureau of Sanitation should:

6. **Modify its Management Systems to enable the identification of the services provided, the levels of service, the outputs of each of these services, and the costs of those services in terms of the total cost and the cost per unit of output.**
7. **Coordinate the planned replacement of its Management Systems with ITA and assure the new system adheres to the City's information technology standards.**

Finding No. 6: Sewer maintenance equipment is not always available due to excessive use and high downtime, reducing the work output by Wastewater Division staff.

A review of equipment availability for the use of Wastewater Division maintenance staff for maintaining the wastewater collection system indicates that a significant proportion of the equipment is down – in the fleet repair shop – for significant periods of time. For example, for one day in June 2008, we noted the following equipment was in the repair shop: nine of fourteen hydroflushers, one of the seventeen rodders, and four of the thirteen cleaner combo's or almost one-third of the cleaning equipment. As another example, the only two hydroflushers (used to clean sewers) assigned to yard 371 were unavailable on June 2, 2008, and were still unavailable on June 26, 2008. Some crews are "hot bunking" equipment – using the same equipment in the same day for the day shift and the swing shift. The work output of crews and the productivity of crews assigned to the maintenance and repair of the wastewater collection system decreased as a result of the lack of equipment. The equipment is worn out more quickly as a result of the levels of utilization, and this does not reflect typical practices in other sanitation agencies.

Recommendation:

8. **The Bureau of Sanitation should ensure backup or "spare" vehicular equipment is available so that Wastewater Division maintenance and repair crews can continue to provide service while their primary equipment is in the Fleet Services' repair shop. Individual crews should be assigned their own specific equipment.**

Finding No. 7: The number of priority sewer locations, or "hot spots" is high and needs to be reevaluated on an ongoing basis to ensure appropriate cleaning frequency and effective use of resources.

There are approximately 35,000 "hot spots" in the wastewater collection n system. "Hot spots" are sewer mains that are cleaned more frequently due to historical problems with

grease, debris, roots, etc. “Hot spots” receive a higher and frequent level of service than other mains. “Hot spots” are added anytime there is an overflow or when a maintenance crew believes there are circumstances that would suggest more frequent cleaning is necessary such as roots, debris, grease, etc. Interviews with Wastewater Division staff responsible for managing the “hot spot” list indicate that “hot spots” are added or the frequency of cleaning is increased, but not deleted (or rarely so) or not reduced in terms of the level of service (or rarely so). The Wastewater Division staff responsible for the maintenance of the “hot spot” database are not evaluating “hot spots” to determine whether the problem that caused the main to be placed on the “hot spot” list has been abated, and the frequency of cleaning can be reduced or the main can be removed from the “hot spot” list altogether.

In 2007-08, 52% of the work orders issued for secondary wastewater collection maintenance were for “hot spot” cleaning. The number of “hot spot” pipe reaches has continued to grow over the past eight years, increasing the maintenance and workload demands and the staffing requirements. Mains that are on the “hot spot” list that may no longer be a problem will continue to receive a higher level of service that is no longer necessary.

“Hot spots” should be evaluated annually to determine whether the problem that caused the main to be placed on the “hot spot” list has been abated, and the frequency of cleaning can be reduced or the main can be removed from the “hot spot” list altogether.

Recommendations:

The Bureau of Sanitation should ensure:

- 9. “Hot spots” are evaluated annually to determine whether the problem that caused the pipe reach to be placed on the “hot spot” list has been abated, and the frequency of cleaning can be reduced or the main can be removed from the “hot spot” list altogether.**
- 10. A formal written process and policy to review and remove or modify “hot spots” is developed and implemented by the Wastewater Division.**

Finding No. 8: The productivity of Wastewater Division staff in the maintenance and repair of the wastewater collection system is lower than other sanitation agencies. In addition, staff does not meet the Wastewater Division’s own work output guidelines resulting in some instances of lower work output.

The productivity of Wastewater Division staff is inconsistent. For example, for crew #371, the productivity of the crew per crew day ranged from a low of 620 linear feet of main cleaned per crew day to a high of 5,358 linear feet of main cleaned per crew day. Overall, the average linear feet cleaned per crew day amounted to 2,314.

For the months of July and August 2008, all of the yards allocated a total of 19,795 staff hours to the work activity “Preventive Maintenance: High Speed Cleaning Sewers <= 15 inches”. (The source of this data was a spreadsheet compiled by Wastewater Division entitled All Yards – July – August 08). This is the equivalent of 1,237 crew days assuming a two-person crew (which is the industry benchmark). A total of 3,379,015 linear feet of wastewater mains were cleaned or 2,731 linear feet cleaned per crew day. This is 22% less than what a crew should be cleaning per crew day: 3,500 to 4,000 linear feet of mains. It is also less than the Wastewater Division’s own policy for work output for high velocity cleaning of 3,000 linear feet per crew day.

Though BOS maintenance crews are required to perform additional quality assessment steps, these quality guidelines have already been considered within Wastewater Division work output goals.

A higher level of staffing is required to maintain necessary levels of service when maintenance crews do not meet Wastewater Division’s work output goals. Limitations of the maintenance management system (Management Systems) prohibit identifying specific reasons for lower output.

Recommendations:

The Bureau of Sanitation should ensure:

- 11. Wastewater Division utilizes its Management Systems to report the productivity of crews and the unit cost of work activities.**
- 12. Managers and supervisors of the Wastewater Division utilize reports regarding the productivity of Wastewater Division crews and the unit cost of work activities to assure that their crews meet appropriate work output and unit cost targets.**

Finding No. 9: The Wastewater Division is unable to demonstrate the value of “inspection” crews that seek out possible wastewater collection main blockages potentially resulting in increased maintenance and operations expenditures.

The Wastewater Division is cleaning the wastewater collection system, overall, on a cycle of 1.2 years. This is a high level of service. Other wastewater collection agencies clean their systems on a two to three year cycle, overall. This level of service has contributed to the significant reduction of overflows.

The Wastewater Division also conducts inspections of maintenance holes for potential blockages in the secondary wastewater collection system. This is considered a low priority work activity, usually performed when wastewater collection main cleaning equipment is “down” for repair. In July and August 2008, we noted a total of 2,968 staff

hours were spent on this work activity, which, if representative, could result in about 17,800 staff hours to this activity over a year.

Given the high level of cleaning by the Wastewater Division, the value of inspecting secondary wastewater collection mains to identify potential blockages is questionable. In fact, data is unavailable from the Enterprise Maintenance Planning and Control (Management Systems) software application to document the results of these inspections (e.g., number of blockages detected).

Recommendations:

The Bureau of Sanitation should ensure:

- 13. Wastewater Division quantifies the results of the wastewater collection inspection crews.**
- 14. If no appreciable work results can be demonstrated, the practice of inspecting wastewater collection mains is eliminated.**

Finding No. 10: The levels of services for maintenance of the wastewater collection utilities are high relative to other sanitation agencies and exceed that required by the Agreement resulting in higher costs for Wastewater Division maintenance and operations.

The City continues to implement its wastewater collection cleaning program, including hot spot cleaning. In FY 2007/08 the City cleaned 119,953 pipe reaches, 99% more than the Agreement minimum requirement of 60,000 reaches. For the three-year period ending on June 30, 2008, the City achieved a rolling average cleaning of 112,998 wastewater collection pipe reaches, exceeding the minimum requirement of 65,000 reaches by 74%. In addition, the City's quality assurance and follow-up inspection program continue to ensure that cleaning operations are effective. This indicates that the Wastewater Division is cleaning 84% of the sewer system annually.

Using Closed Circuit Television (CCTV) technology and utilizing both City crews and contractors, the City assessed the structural and maintenance conditions of 990 miles of wastewater collection mains, exceeding the Agreement minimum requirement of 600 miles by 65%. The total miles video-inspected and assessed included 797 miles of first-time assessment. Condition rating of these wastewater collection mains revealed that 99.7% of the mains were in fair to excellent condition. The percentage of wastewater collection mains CCTV'd as a % of the total amounted to 15.2%.

The Settlement Agreement required root chemical treatment of a minimum of 150 miles of wastewater collection mains per year in the first two years of the Agreement only (FYs 04/05 and 05/06). The City, however, continues this practice to inhibit roots re-growth and intrusion into mains in root hot spot areas. In FY 2007/08, the City applied chemical treatment to 435 miles of root-infested mains. This represents 6.7% of the

system annually.

The following levels of service were reported by the Water Environment Research Federation, American Society of Civil Engineers, and the Environmental Protection Agency provide a measure of the effectiveness of the Wastewater Division practices.

- % of wastewater collection mains cleaned annually: 20% to 40% annually;
- % of wastewater collection mains CCTV'd annually: 7% to 8% annually; and
- % of wastewater collection mains chemically treated for roots annually: 3% to 13%.

These reflect the levels of service observed and reported by other local governments in the maintenance of their wastewater collection systems. The levels of service delivered by the Wastewater Division far exceed these levels of service.

The Wastewater Division has been extremely effective in reducing overflows to levels below their peers (in terms of overflows per 100 miles of mains). The number of sanitary sewer overflows (overflows) has decreased from 687 in fiscal year 2000-01 to 200 in fiscal year 2007-08. Over the past three fiscal years, the number of overflows has largely remained constant at about 200 overflows per year.

It is unclear that the benefits of these higher service levels are warranted given the costs.

Recommendation:

- 15. The Bureau of Sanitation should evaluate the benefit of continuing the existing levels of service for the proportion of mains that are cleaned, inspected using CCTV, and chemically treated for roots each year.**

Finding No. 11: The identification of wastewater collection mains not included in the Wastewater Division asset inventory is reported by Wastewater Division crews inconsistently, potentially resulting in the failure to document these assets and provide for their ongoing maintenance and repair.

Not all of the wastewater collection mains have been inventoried and included in the annual planning and scheduling. Staff indicated that crews are identifying approximately 2,500 feet to 3,500 feet of mains each month that are not included in the existing inventory. This information is received in a variety of forms including e-mail, paper, telephone, etc.

The Wastewater Division does not appear to have established a formal written policy for reporting newly discovered wastewater mains to the engineer in Wastewater Division responsible for maintaining this asset inventory, and a uniform methodology for reporting the mains to this engineer. As a result, some of this inventory could go unreported.

Recommendation:

- 16. The Bureau of Sanitation should establish a formal written policy for reporting newly discovered mains by Wastewater Division crews.**

Finding No. 12: Information technology internal controls for Management Systems are lacking.

Wastewater collection maintenance and repair staff can cancel work orders in Management Systems without supervisory approval. Management Systems database administrators can delete work orders in Management Systems without supervisory approval. Cancellation or deletion of work orders within Management Systems should require supervisory approval. Any deletion of a work order should be maintained within the Management Systems within a deleted work order database.

Internal controls within Management Systems have not been developed to prevent abuse of Management Systems authority.

Recommendations:

The Bureau of Sanitation should ensure:

- 17. Internal controls are developed within its Management Systems to require supervisory approval for the cancellation or deletion of any work order.**
- 18. A database within Management Systems is developed that logs all cancelled and deleted work orders, and exception reports are generated monthly.**

Finding No. 13: A key Wastewater Division work planning and scheduling position lacks backup.

One of the Wastewater Division engineers designed the Microsoft Access database used to evaluate sewer pipe reaches for maintenance prioritization beginning in 2000. The same individual currently manages this system using the Microsoft Access database and the Enterprise Maintenance Planning and Control (Management Systems) software program to annually prioritize maintenance work, schedule maintenance intervals, adjust for maintenance schedule changes, determine type of line maintenance, and create annual work orders for dissemination to crews through the

management structure. This is a critical function to ensure discrete line reaches are properly classified for maintenance interval and type, and for providing work orders. This engineer is the only person that knows this Microsoft Access database intimately and that can fully use it. There is no other engineer trained on this system in either a basic or fully trained level. Should the incumbent be unable to perform these functions, there is a risk that required maintenance would not be properly assigned and performed, possibly resulting in an increase in overflows.

All key positions in an organization require another person trained sufficiently to be able to take over critical functions when the incumbent vacates the position due to temporary or permanent reasons, such as health, death, voluntary/involuntary termination, retirement, advancement, etc.

Cross training and succession planning for this position and the tasks performed has not been performed.

Recommendation:

- 19. The Bureau of Sanitation should ensure Wastewater Division management identifies backup engineers to be trained in the fundamentals of the Microsoft Access database utilized by Wastewater Division for work planning and scheduling including database design, maintenance and operation. The Wastewater Division management should have the backup engineers adequately trained to succeed the incumbent on an interim or a permanent basis.**

SECTION 3: MANAGEMENT OF THE AGREEMENT

The Collection System Settlement Agreement (Agreement) is a complex document with 127 recommendations. Almost all of the 127 recommendations have already been implemented, but much remains to be done such as implementation of some of the requirements for odor control, the calibration of the MIKE Urban model for peak wet weather flow, and implementation of the recommendations contained within the Capacity Report and Plan. Effective management of the implementation of the Agreement is essential to avoid a recurrence of previous challenges to the City's management of the wastewater collection system. Our audit identified a number of opportunities for improvement in the management of the Agreement including clarifying managerial accountability for monitoring implementation.

Finding No. 14: The management of the specific segments of the Agreement is fragmented potentially resulting in failure to implement recommendations contained in the Agreement.

The Agreement required the preparation of a number of reports such as the Capacity Report and Plan, the Rehabilitation and Replacement Plan, the Sewer Odor Control Master Plan, the FOG Control Program, the Wet Weather Calibration Report, the Chemical Root Control Report, etc. While management of these specific programs is decentralized, under the purview of designated managers, the Wastewater Division has not prepared an overall summary of the recommendations contained within these documents and has not monitored and reported the implementation of the recommendations contained in these reports.

There is risk that some of the recommendations contained within these reports – the Capacity Report and Plan, the Rehabilitation and Replacement Plan, the Sewer Odor Control Master Plan – could fail to be implemented as a result of a lack of a tracking and monitoring system.

Recommendation:

- 20. The Bureau of Sanitation should document the recommendations contained within these reports – the Capacity Report and Plan, the Rehabilitation and Replacement Plan, the Sewer Odor Control Master Plan, and the other reports prepared to address the requirements of the Agreement – and report the status of the implementation of these recommendations on a recommendation-by-recommendation basis on a periodic basis.**

Finding No. 15: Sanitation has experienced delays in the construction of permanent odor control facilities as part of the odor control requirements of the Agreement, which presents a potential risk of non-compliance with the Agreement.

The Agreement contained a number of requirements regarding odor control. Sanitation has already complied with a number of these odor control requirements such as modification of the Odor Complaint Response Form to include a qualitative description of the wind condition, preparation of quarterly reports reviewing the Sewer Odor Hotline program, conducting monitoring of hydrogen sulfide gas levels, air pressure, and other necessary parameters after the East Control Interceptor Sewer is operational, etc.

The Agreement also contains provisions regarding air treatment facilities (ATF) for odor control and interim scrubbers. It requires the City to install and operate seven air treatment facilities for the control of sewer odors by the corresponding dates noted below:

Project Title	Construction End date
ATF-ECIS/NORS (4 sites including Mission and Jesse, 23 rd and San Pedro, Jefferson Siphon [Jefferson and La Cienaga], and at NORS Connection)	May 23, 2008
ATF-NCOS (1 site at Jefferson and Rodeo)	May 23, 2008
ATF-NEIS (@ sites at Humboldt and at Richmond)	March 26, 2009

The Agreement further states that the City shall make best efforts to ensure that any delays do not exceed one (1) year. The Agreement further requires the installation of interim odor carbon scrubbers. Two of these ATF's are in construction: the ATF at Jefferson and Rodeo and the ATF at the Jefferson Siphon.

Subsequent to the Agreement, the WESD began to develop a better understanding of air dynamics in the East Central Interceptor Sewer (ECIS) and Northeast Interceptor Sewer (NEIS) after they were built. Further testing, as well as performance of the odor carbon scrubbers raised questions regarding the need for the ATFs and thus suggested the need for an odor control study to re-evaluate the necessity and possible elimination of some ATFs. This need was recognized in 2006 in the Odor Control Master Plan.

The Wastewater Division noted on page 111 of the Odor Control Master Plan, developed in October 2006, that *"therefore, the necessity for the ATFs at the 23rd & San Pedro, Mission & Jesse, Humboldt, and Richmond sites as well as when each would be needed will be assessed in the ATF study. In addition, the scope of the ATF Study should include odor testing and laboratory analysis, additional pressure testing at key locations in the collection system, and analysis of impacts to upcoming capital improvement sewer projects in order to ensure that the solutions proposed, and ultimately constructed, are the optimal solution and the best use of funds for mitigating sewer odors."* The master plan noted, in October 2006, on page 114, that a study of the ATF program was needed to determine the ATF's necessity under upcoming proposed improvement projects.

The Wastewater Division has just initiated this odor control study, two years after the development of the Odor Control Master Plan. This problem was exacerbated by the delay in obtaining approval of the rotating consulting engineer contract to enable the

selection of a consulting engineer to conduct this study. This process required a little more than two and one-half years. One year was directly attributable to delays within Sanitation; this included the amount of time from initiating the process to the routing of the proposed contract to the Office of Contract Compliance. The Office of Contract Compliance required six months to complete the contract review. The CAO required a little more than eight months to complete the review of the on call list of consulting engineers. These delays significantly limited the ability of Sanitation to initiate the study of the ATF program.

Sanitation has been aware of the need to reevaluate the effectiveness of the ATF's since May 2006 beginning with an ATF workshop. The Environmental Protection Agency (EPA) and the Regional Water Quality Control Board (RWQCB) were invited to the ATF workshop, and have been continuously informed by Sanitation since that workshop that the effectiveness of the ATF's needed to be reevaluated. However, Sanitation did not formally request an extension to the terms of the Agreement regarding the ATF's from the EPA and the RWQCB until November 13, 2007. This has placed Sanitation at risk in terms of compliance with the terms of the Agreement.

Recommendations:

The Bureau of Sanitation should:

- 21. Evaluate opportunities to reduce the amount of time required for issuance of requests for proposal for consulting engineers, evaluation of those proposals, and development of proposed contracts.**
- 22. Formally request an extension to the terms of the Agreement from the EPA and the RWQCB as soon as the practical after Sanitation is aware that an extension to the terms of the Agreement will be required.**

Finding No. 16: The Wastewater Division policies and procedures for reporting overflows are more stringent than required by regulatory agencies and difficult for Wastewater Division staff to administer.

Overflows are categorized as Category 1 or 2 to reflect the significance of the spill. These categories are explained below.

- Category 1 overflows are more serious, in that the sewage spill equals or exceeds 1,000 gallons, or spills that discharge to a drainage channel and / or surface water, or a discharge that is not fully captured and returned to the sanitary sewer system.

- Category 2 overflows include those that do not meet the above description.

Category 1 and Category 2 overflows have differing regulatory agency reporting requirements. The Wastewater Division is required to report overflows to the California Environmental Protection Agency, through its sub-agencies, the State Water Resources Control Board (SWRCB), the California Regional Water Quality Control Board Los Angeles Region (RWQCB), and the County of Los Angeles (County).

The Wastewater Division developed a "Sanitary Sewer Overflow Response and Reporting Procedures" manual, with the most current version dated February 22, 2008 (the previous version was dated December 13, 2006). This manual incorporates the State and County notification requirements.

A total of 70 overflow files from March 2007 through June 2008 were tested (spanning the two manuals: 50 files during the previous manual and 20 files for current manual) to determine whether the overflows were reported to the appropriate agencies in accordance with reporting requirements. The sample comprised 28 category 1 overflows and 42 category 2 overflows.

The testing of these 70 files indicates that the Wastewater Division reported overflows to regulatory agencies as required by these agencies.

However, the Wastewater Division's policy manual contained reporting requirements that were more stringent than those of the regulatory agencies. The testing of the 70 overflows disclosed that the Wastewater Division was unable to comply with some of its own policy manual requirements. The Wastewater Division was not in compliance with its policy that required a certified overflow report to be submitted within 10 business days.

The Wastewater Division's policy manual does not specify when to notify stakeholders that might be affected by a category 1 overflow. Specifically, the Wastewater Division utilizes the word "immediately" to indicate when to report the overflows to stakeholders. The word "immediately" is not sufficiently specific to guide the Wastewater Division staff on when to notify stakeholders of overflows.

Recommendations:

The Bureau of Sanitation should ensure:

- 23. The Wastewater Division's policy manual for reporting overflows to the regulatory agencies is modified so that its reporting requirements are not more stringent than the requirements of the regulatory agencies.**

- 24. The Wastewater Division's policy manual provides a specific timeframe regarding when to notify stakeholders that might be affected by a Category 1 overflow.**

Appendix A

**Collection System Settlement Agreement Requirements and
Status of Implementation**

No.	Requirement	Frequency	SA Due Date	Status
SA 1	Interim Scrubber At ECIS (Mission & Jesse)	One Time	08/27/2004	08/26/2004.
SA 2	Interim Scrubber At ECIS (23rd & San Pedro)	One Time	08/27/2004	Completed On 08/26/2004.
SA 3	Interim Scrubber At ECIS (Jefferson Siphon)	One Time	08/27/2004	Completed On 08/26/2004.
SA 4	Interim Scrubber At ECIS (Nors)	One Time	08/27/2004	Completed On 08/26/2004.
SA 5	East Central Interceptor Sewer	One Time	08/27/2004	Completed On 08/09/2004
SA 6	The City will monitor all the odor control facilities as necessary to comply with all regulatory and permit requirements	Ongoing	Ongoing	Ongoing
SA7	The City will modify its Odor Complaint Response Form to include a qualitative description of the wind condition (By entry 10/29/2004)	One time	10/29/2004	Completed on 07/01/2004.
SA8	The City will make an initial return call to the community member filing the sewer odor complaint through the Sewer Odor Hotline (complainant) within 1 week from the receipt of the hotline complaint if requested by the complainant and the complainant has provided call back information (By entry 10/29/2004)	Ongoing	10/29/2004	Completed on 07/01/2004.
SA9	The City will investigate the sewer odor complaint received by the Sewer Odor Hotline and shall call the complainant to attempt to report findings and actions within 30 days from the receipt of the Sewer Odor Hotline complaint if requested by the complainant and the complainant has provided call back information (By entry 10/29/2004)	Ongoing	10/29/2004	Completed on 07/01/2004.
SA10	Within 30 days after the Effective Date of this Settlement Agreement (By entry 10/29/2004), the City shall pay the United States the sum of \$800,000 as a civil penalty.	One time	11/28/2004 Completed.	
SA11	Within two months after ECIS becomes operational, the City will conduct monitoring of hydrogen sulfide gas levels, air pressure, and other necessary parameters. Within 3 months after ECIS, share the result with the Odor Advisory Board.	One time	10/9/2004	Completed on 11/08/2004.

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No.	Requirement	Frequency	SA Due Date	Status
SA12	Within 45 days after the Effective Date of this Settlement Agreement, the City shall pay Baykeeper \$1,600,000; the Intervenor \$425,000; and the Regional Board \$71,745 (By entry 10/29/2004).	One time	12/13/2004	Completed.
SA13	For the first year after the entry into this Settlement Agreement, the City will prepare quarterly reports reviewing the Sewer Odor Hotline program. The final report, including any findings and recommendations for improvement, shall be posted on the sewer hotline web page. Thereafter, the City will prepare and post an annual report.	Quarterly Reports in Year One and Annual Reports Thereafter	Annual Reports by September 1st	Completed all requirements on or ahead of schedule.
SA14	The City will report quarterly to the Odor Advisory Board, or more frequently if requested by the Odor Advisory Board, on the removal levels for hydrogen sulfide at each of the odor control facilities (interim scrubbers and permanent ATFs) showing inlet concentration and outlet concentration. The information will also be posted on the odor hotline web site.	Quarterly	End of the month following each fiscal quarter	Reported quarterly on schedule since October 2004.
SA15	On the thirtieth day of January, April, July, and October (30 days after the end of the fiscal quarter) of each year until this Settlement Agreement is terminated, the City shall submit to Plaintiffs a summary of all overflows occurring during the previous fiscal quarter.	Quarterly	End of the month following each fiscal quarter	Reported quarterly on schedule since October 2004.
SA16	EQ RPR SWRS U298	One time	12/14/2004	Completed on 06/09/2004.
SA17	EQ RPR SWRS U277	One time	01/13/2005	Completed on 07/20/2004.
SA18	EQ RPR SWRS U269	One time	01/13/2005	Completed on 07/20/2004.
SA19	EQ RPR SWRS U290	One time	02/11/2005	Completed on 06/10/2004.
SA20	EQ RPR SWRS U289	One time	02/11/2005	06/10/2004.
SA21	No later than six months after entry of this Agreement (estimated at 04/29/2005), the City shall submit a report that evaluates the need for modifications to its current FOG Control Program Standard Operating Procedures ("SOPs") and Enforcement Response Plan and Enforcement Response Guide ("ERG"), and applicable sections of its existing rules and regulations implementing its Grease Control Ordinance.	One time	04/29/2005	Completed on 04/22/2005.
SA22	SAN PEDRO AREA SWR REHAB	One time	02/28/2005	Completed on 09/07/2004.

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No.	Requirement	Frequency	SA Due Date	Status
SA23	Within six months after the entry of this Agreement, the City shall submit a report on the City's progress on the wet weather Calibration and Validation of the City's MOUSE model	One time	04/29/2005	Completed on 11/17/2004.
SA24	Within six months from the entry of this Settlement Agreement, the City shall, if practicable, arrange for calls to the Sewer Odor Hotline to be answered and documented by a live person rather than a recording.	One time	04/29/2005	Completed on 06/01/2004.
SA25	Within six months from the entry into this Settlement Agreement, the City will develop an updated Odor Outreach Plan for advertising the Sewer Odor Hotline. As part of the City's Odor Outreach Plan, the City will develop a community feedback system.	One time	04/29/2005	Completed on 04/29/2005.
SA26	Within six months of the entry into this Settlement Agreement, the City will prepare written procedures for the odor control measures the City currently employs including the addition of chemicals for sewer odor control.	One time	04/29/2005	Completed on 04/27/2005.
SA27	Within six months from entry into this Settlement Agreement, the City will prepare an implementation plan for implementing the recommendations made as part of the Independent Review of the Sewer Odor Control Program for the City of Los Angeles.	One time	04/29/2005	Completed on 04/27/2005.
SA28	EQ RPR SWRS U346	One time	03/16/2005	Completed on 05/04/2004.
SA29	EQ RPR SWRS U344	One time	03/16/2005	Completed on 05/04/2004.
SA30	EQ RPR SWRS U373	One time	04/15/2005	Completed on 05/12/2004.
SA31	EQ RPR SWRS U369	One time	04/15/2005	Completed on 05/12/2004.
SA32	EQ RPR SWRS U327	One time	05/16/2005	Completed on 06/23/2004.
SA33	EQ RPR SWRS U317	One time	05/16/2005	Completed on 06/23/2004.
SA34	Starting with FY 04/05, the City shall clean a minimum of 60,000 sewer Pipe Reaches annually.	Annual	06/30/2006	Cleaned 109,930 reaches in FY 07/08.
SA35	Starting with FY 07/08, maintain a Three-Year Rolling Average of 65,000 sewer Pipe Reaches cleaned.	Annual	06/30/2007	Three-Year Rolling Average equal to 100,347 reaches cleaned.
SA36	Starting with FY 04/05, at a minimum, the City shall use CCTV to inspect 600 miles of pipes annually.	Annual	06/30/2006	CCTV'd 951 miles in FY 07/08.

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No.	Requirement	Frequency	SA Due Date	Status
SA37	No later than 06/30/2005, the City shall add the agreed to language to its design manual	One time	06/30/2005	Completed on 12/13/2004.
SA38	No later than 06/30/2005, the City shall utilize all current and past valid flow data to complete the development of all "R" Factors for all model basins within the City's MOUSE model.	One time	06/30/2005	Completed on 11/17/2004.
SA39	Starting FY 04/05, the City shall inspect all permitted FSEs annually.	Annual	06/30/2005	Completed 8,418 inspections in FY 07/08 (100% of permitted FSEs).
SA 40	On an annual basis, or as requested by the Odor Advisory Board, the City will share summary data with the Odor Advisory Board regarding the odor control measures utilized by the City and any relevant information	Annual	Annual	Completed the FY 2007/08 report on 08/21/08.
SA41	SOUTH LA CSRP U – 6	One time	07/30/2005	Completed on 08/04/2004.
SA42	SOUTH LA CSRP U – 5	One time	07/30/2005	Completed on 08/04/2004.
SA43	SOUTH LA CSRP U – 3	One time	07/30/2005	Completed on 12/22/2004.
SA44	WILSHIRE AREA NE SWR REHAB	One time	Original 08/30/2005 Revised 11/30/2005	Completed on 09/9/2005.
SA45	MT WASHINGTON AREA SWR REHAB	One time	09/30/2005	Completed on 11/02/2004.
SA46	The City will report on the construction progress of the odor control facilities as part of the annual report	Annual	Annually by Sept. 1.	Completed for FYs 04/05,05/06, 06/07 and 07/08.
SA47	By October 1, 2005 and on September 1 of each following year this Settlement Agreement remains in effect, the City shall submit an Annual Progress Report	Annual	Annually by Sept. 1.	Completed for FYs 04/05,05/06 and 06/07.
SA48	NORTH EAST INTERCEPTOR SEWER, PHASE 1	One time	10/30/2005	Completed on 05/27/2005.
SA49	S BOYLE AREA SWR REHAB	One time	12/8/2005	Completed on 08/10/2005.
SA50	HOLLYWOOD AREA PRIM SWR REHAB	One time	12/30/2005	Completed on 03/02/2005.
SA51	4TH SHATTO VERMONT SWR REHAB	One time	12/30/2005	Completed on 02/03/2006.
SA52	EQ RPR SWRS U274	One time	03/16/2006	Completed on 10/06/2004.
SA53	EQ RPR SWRS U340	One time	04/15/2006	Completed on 3/25/2005.
SA54	EQ RPR SWRS U283	One time	04/15/2006	Completed on 3/15/2005.

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No.	Requirement	Frequency	SA Due Date	Status
SA55	Harbor Area CSRP U- 6	One time	05/30/2006	Completed on 8/2/2005.
SA56	NICHOLS CYN ESMT SWR REPLC	One time	05/31/2006	Completed on 12/27/2005.
SA57	No later than 06/30/2006, the City shall submit a Capacity Report and Plan	One time	06/30/2006	Completed on 6/30/2006.
SA58	No later than 06/30/2006, the City shall submit a Rehabilitation and Replacement Report and Plan.	One time	06/30/2006	Completed on 6/30/2006.
SA59	In FY 04/05 and FY 05/06, the City shall apply chemicals to a minimum of 150 miles of sewers annually to control the growth of roots.	Annual	FYs 04/05 and 05/06	435 miles were treated in 06/07.
SA60	EQ SWR RPR U300	One time	07/15/2006	Completed on 11/15/2004.
SA61	EQ RPR SWRS U299	One time	7/15/2006	Completed on 11/15/2004.
SA62	LAS PULGAS CANYON SWR REPLC	One time	07/30/2006	Completed on 10/05/2005.
SA63	HOLLYWOOD AREA CSRP U- 2	One time	07/30/2006	Completed on 09/09/2005.
SA64	The City will complete the preparation of its Odor Master Plan within 2 years from the entry into this Settlement Agreement.	One time	10/29/2006	Completed on 10/27/2006.
SA65	EQ RPR SWRS U295	One time	09/15/2006	Completed on 06/30/2005.
SA66	EQ RPR SWRS U292	One time	09/15/2006	Completed on 06/30/2005.
SA67	EQ RPR SWRS U291	One time	09/15/2006	Completed on 06/30/2005.
SA68	No later than 09/30/2006, the City shall submit an evaluation of the effectiveness and applicability of its use of root control chemicals.	One time	09/30/2006	Completed on 09/8/2006.
SA69	AVE 45 ARROYO DR RLF SWR	One time	Original 10/6/2006 Revised 10/30/2010	On Schedule.
SA70	EQ RPR SWRS U354	One time	10/14/2006	Completed on 10/3/2005.
SA71	Interim Scrubber at NEIS (Humboldt)	One time	10/30/2006	Completed on 12/10/2005.
SA72	Interim Scrubber at NEIS (Richmond)	One time	10/30/2006	Completed on 12/10/2005.
SA73	EAGLE ROCK INTER SWR	One time	10/30/2006	Completed on 05/19/2006.
SA74	BAYWOOD BNDCT ESMT SWR	One time	10/31/2006	Completed on 06/29/2006.

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No.	Requirement	Frequency	SA Due Date	Status
SA75	FLOWER WASHINGTON PICO SWR	One time	Original 10/31/2006 Revised 03/31/2007	Completed on 09/22/2006.
SA76	BUCKINGHAM DIVR SWR	One time	11/11/2006	Completed on 07/21/2006.
SA77	EQ RPR SWRS U339	One time	11/15/2006	Completed on 10/3/2005.
SA78	EQ RPR SWRS U338	One time	11/15/2006	Completed on 10/3/2005.
SA79	EQ RPR SWRS U320	One time	12/15/2006	Completed on 09/30/2005.
SA80	EQ RPR SWRS U316	One time	12/15/2006	Completed on 09/30/2005.
SA81	SEPULVEDA VAL MEADOW RLF SWR	One time	Original 12/30/2006 Revised 06/30/2007	Completed on 12/28/2006.
SA82	WASHINGTON FLOWER GRAND SWR REPL	One time	Original 12/30/2006 Revised 06/30/2007 2nd Revised 12/31/2007	Completed on 7/17/2007
SA83	CENTRAL AREA CSRP U-5	One time	12/30/2006	Completed on 12/6/2005.
SA84	CENTRAL AREA CSRP U-3 & U-4	One time	12/30/2006	Completed on 06/17/2006.
SA85	12TH HILL SWR REHAB	One time	12/30/2006	Completed on 08/31/2006.
SA86	NOS DIV HUMBOLDT AV 18 & SFR	One time	Original 12/31/2006 Revised 10/31/2007	Completed on 04/16/2007.
SA87	SLAUSON/VAN NESS/COS EXTERNAL BYPASS	One time	12/31/2006	Completed on 07/13/2006.
SA88	SAN FERNANDO PSDNA SWR REHAB	One time	12/31/2006	Completed on 09/15/2006.
SA89	EQ RPR SWRS U294	One time	01/13/2007	Completed on 06/5/2005
SA90	EQ RPR SWRS U293	One time	01/16/2007	Completed on 06/5/2005
SA91	EQ RPR SWRS U319	One time	02/15/2007	Completed on 11/14/2005
SA92	EQ RPR SWRS U318	One time	02/15/2007	Completed on 11/14/2005
SA93	Harbor Area CSRP U- 3	One time	03/3/2007	Completed on 02/14/2006

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No.	Requirement	Frequency	SA Due Date	Status
SA94	EQ RPR SWRS U342	One time	03/15/2007	Completed on 03/15/2006
SA95	EQ RPR SWRS U341	One time	03/15/2007	Completed on 03/15/2006
SA96	FLINT AVE G ST SWR REPLC	One time	03/24/2007	Completed on 06/13/2006
SA97	EQ RPR SWRS U304	One time	04/14/2007	Completed on 04/21/2006
SA98	EQ RPR SWRS U296	One time	04/14/2007	Completed on 04/21/2006
SA99	HOOVER ST SWR REHAB	One time	05/2/2007	Completed on 04/6/2007
SA100	LINCOLN 83RD SWR REPLC	One time 06/30/2007	Completed on 09/30/2006	
SA101	Harbor Area CSRP U- 5 & WILM U-20	One time	06/30/2007	Completed on 09/13/2006
SA102	ATF at ECIS (Mission & Jesse)	One time	05/23/2008	On hold pending ATF Review Study. Extension request submitted 11/13/07.
SA103	ATF at ECIS (23rd & San Pedro)	One time	05/23/2008	On hold pending ATF Review Study Extension request submitted 11/13/07.
SA104	ATF at ECIS (Jefferson Siphon)	One time 05/23/2008	In construction	Extension request submitted 11/13/07.
SA105	ATF at ECIS (NORS)	One time	05/23/2008	On hold pending ATF Review Study. Extension request submitted 11/13/07.
SA106	ATF at NCOS (Jefferson and Rodeo)	One time	05/23/2008	In construction. Extension request submitted 11/13/07.
SA107	The City will develop written maintenance and operations manual for each of the ATFs.	One time	05/23/2008	Will be prepared during ATF construction.
SA108	The City will install an indicator light on the outside wall of each ATF	One time	05/23/2008	Will be installed during ATF construction.

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No.	Requirement	Frequency	SA Due Date	Status
SA109	With the completion of each of the ATFs, the City will extend an invitation to the Odor Advisory Board to tour the facility.	One time	05/23/2008	Will follow ATF construction.
SA110	In FY 07/08 through FY 13/14, the City shall rehabilitate or replace 50 miles minimum.	Annual	06/30/2008	101 miles replaced, rehabbed, or repaired in FY 07/08
SA111	ATF at NEIS (Humboldt)	One time	03/26/2009	On hold pending ATF Review Study. Extension request submitted 11/13/07.
SA112	ATF at NEIS (Richmond)	One time	03/26/2009	On hold pending ATF Review Study. Extension request submitted 11/13/07.
SA113	No later than 06/30/2009, the City shall have expanded its MOUSE model to include all Primary Sewers.	One time	06/30/2009	On schedule.
SA114	No later than 06/30/2009, the City shall complete and submit its Integrated Resources Plan (IRP)	One time	06/30/2009	Submitted on 06/22/2007.
SA115	No later than 06/30/2009, the City shall complete all Primary Basin Plans.	One time	06/30/2009	Completed on 6/30/2008.
SA116	If, in any three-Year period starting with the three-Year period comprising FY 07/08 through FY 09/10, the City rehabilitates or replaces, on a Three-Year Average, more miles of pipe than is required pursuant to the approved Rehabilitation and Replacement Report and Plan submitted pursuant to Subsection VI.D. of this Settlement Agreement, the City may "bank" the excess miles of pipe.	Annual	09/1/2010	N/A
SA117	No later than 06/30/2014, the City shall complete Secondary Basin Plans for the 100 highest priority secondary basins.	One time	06/30/2014	On schedule.
SA118	The City shall submit Work Plan for the following SEP: North Atwater Creek Restoration Project	One time	N/A	Submitted on 12/19/2007.
SA119	The City shall submit Work Plan for the following SEP: South Los Angeles Storm Water Treatment Project at 54th and Avalon St.	One time	N/A	Submitted on 07/10/2008.
SA120	The City shall submit Work Plan for the following SEP: Hazard Creek and Wetlands Restoration Project	One time	N/A	Submitted on 08/18/2008.

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No.	Requirement	Frequency	SA Due Date	Status
SA121	The City shall submit Work Plan for the following SEP: Inner Cabrillo Beach Pollution Control and Water Circulation Enhancements	One time	N/A	On schedule.
SA122	The City shall submit Work Plan for the following SEP: Downtown Los Angeles Storm Drain Low-Flow Diversion Project	One time	N/A	Submitted on 07/10/2008.
SA123	The City shall complete the following SEP: North Atwater Creek Restoration Project	One time	06/30/2014	On schedule.
SA124	The City shall complete the following SEP: South Los Angeles Storm Water Treatment Project at 54th and Avalon St.	One time	06/30/2014	On schedule.
SA125	The City shall complete the following SEP: Hazard Creek and Wetlands Restoration Project	One time	06/30/2014	On schedule.
SA126	The City shall complete the following SEP: Inner Cabrillo Beach Pollution Control and Water Circulation Enhancements	One time	06/30/2014	On schedule.
SA127	The City shall complete the following SEP: Downtown Los Angeles Storm Drain Low-Flow Diversion Project	One time	06/30/2014	On schedule.

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Finding Number	Description of Finding	Ranking Code	Recommendations
2	The primary and secondary sewer master plans have been prepared by two separate organizational units of Wastewater Engineering Services Division without sufficient integration between the units.	U	3. The Bureau of Sanitation should ensure the Primary and Secondary Master Planning Sections should develop formal mechanisms to integrate their staff in the preparation of primary and secondary master plans so that updating of secondary master plans are not developed based upon old sewer elevations at connection points between the secondary and primary sewer mains.
3	Once the master plans for the primary drainage basins have been updated for peak wet weather flow data and master plans completed for the high priority secondary sewer drainage basins, the frequency of further updates of these master plans should be evaluated to ensure cost effectiveness.	N	4. The Bureau of Sanitation should ensure that once the master plans have been updated for peak wet weather flow data and completed for the high priority secondary sewer drainage basins, reduce and reallocate the staff and engineering consultants allocated to master planning primary and secondary sewer systems. A “core” staff should be retained to update the model, use the model as needed, etc.
4	Sanitation spends about \$1.1 million annually to uncover maintenance holes that are paved over by the Bureau of Street Services. Paving over the maintenance holes prevents the access to mains by the maintenance crews and possibly impedes their ability to effectively respond	U	5. The Bureau of Sanitation should coordinate with the Bureau of Street Services to modify its street overlay work practices to include uncovering maintenance holes and raising maintenance holes to grade in the most cost effective manner for the City.

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Finding Number	Description of Finding	Ranking Code	Recommendations
		U	<p>frequency of cleaning can be reduced or the main can be removed from the “hot spot” list altogether.</p> <p>10. A formal written process and policy to review and remove or modify “hot spots” is developed and implemented by the Wastewater Division.</p>
8	<p>The productivity of Wastewater Division staff in the maintenance and repair of the wastewater collection system is lower than other sanitation agencies. In addition, staff does not meet the Wastewater Division’s own work output guidelines resulting in some instances of lower work output.</p>	N N	<p>The Bureau of Sanitation should ensure:</p> <p>11. Wastewater Division utilizes its Management Systems to report the productivity of crews and the unit cost of work activities.</p> <p>12. Managers and supervisors of the Wastewater Division utilize reports regarding the productivity of Wastewater Division crews and the unit cost of work activities to assure that their crews meet appropriate work output and unit cost targets.</p>
9	<p>The Wastewater Division is unable to demonstrate the value of “inspection” crews that seek out possible wastewater collection main blockages potentially resulting in increased maintenance and operations expenditures.</p>	N N	<p>The Bureau of Sanitation should ensure:</p> <p>13. Wastewater Division quantifies the results of the wastewater collection inspection crews.</p> <p>14. If no appreciable work results can be demonstrated, the practice of inspecting wastewater collection mains is eliminated.</p>

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Finding Number	Description of Finding	Ranking Code	Recommendations
13	A key Wastewater Division work planning and scheduling position lacks backup.	N	19.The Bureau of Sanitation should ensure Wastewater Division management identifies backup engineers to be trained in the fundamentals of the Microsoft Access database utilized by the Wastewater Division for work planning and scheduling including database design, maintenance and operation. Wastewater Division management should have the backup engineers adequately trained to succeed the incumbent on an interim or a permanent basis.
14	The management of the specific segments of the Agreement is fragmented potentially resulting in failure to implement recommendations contained in the Agreement.	U	20.The Bureau of Sanitation should document the recommendations contained within these reports – the Capacity Report and Plan, the Rehabilitation and Replacement Plan, the Sewer Odor Control Master Plan, and the other reports prepared to address the requirements of the Agreement and report the status of the implementation of these recommendations on a recommendation-by-recommendation basis on a periodic basis.
15	Sanitation has experienced delays in the construction of permanent odor control facilities as part of the odor	N	The Bureau of Sanitation should: 21.Evaluate opportunities to reduce the amount of time required for issuance of

D- Desirable- The recommendation pertains to an audit finding or control weakness of relatively minor significance or concern. The timing of any corrective action is left to management's discretion.

N/A- Not Applicable