# PERFORMANCE AUDIT

## Public Works Department

# Wastewater Collection System ~ Asset Management

**June 24, 2016**

Office of the City Manager
Internal Audit Division
Cheryl Johannes, Internal Audit Manager

Internal Audit

# PERFORMANCE AUDIT ~ Summary

## Public Works Department

## Wastewater Collection System ~ Asset Management

### Objective of Review

Assess the efficiency/effectiveness of five core components of wastewater asset management for the collection system.

### Background

With aging infrastructure and limited budgets, the City is tasked with managing/operating the wastewater (sewer) collection system while maintaining a desired level of service to customers/rate payers.

The City's wastewater collection system includes over 820 miles of public sewer pipelines; 414 miles of sewer laterals (public and private), serving a population of over 320,000. Wastewater of approximately 40 million gallons per day from homes and businesses is transported using gravity and 19 pump stations through the miles of sewer lines to the wastewater treatment facility known as the Regional Water Quality Control Plant (RWQCP).

Public Works Wastewater Division implemented a Sewer System Management Plan (SSMP) in 2009 to comply with State of California's General Waste Discharge Requirements (GWDR). The State regulation requires the City evaluate, identify gaps, and document the operation and maintenance of the wastewater collections system according to 11 specified elements.

The City is required to report all Sewer System Overflows (SSOs), public and private, to the Regional (Santa Ana) Water Quality Board. In the past five calendar years the City has reported 97 SSOs.

The Wastewater Division has established adequate administrative practices and internal controls to carry out the goals and requirements of the Sewer System Management Plan (SSMP) as required by state regulatory agencies. A biennial audit, as required by State of California's General Waste Discharge Requirements (GWDR), will be completed in 2016 and reviewed/approved by the City Council.

The large capital costs of replacing or rehabilitating sewer lines/pipelines and pump stations coupled with long sewer pipeline lifetimes implies a need for replacement strategies to incorporate potential future changes, such as economic growth or harmful consequences should an event such as a significant earthquake occur. The Department/Division has a comprehensive Capital Improvement Plan (CIP) that includes funded and unfunded repair/replacement projects for the wastewater collection system for the next five years.

With an aging pipeline infrastructure there is a need to ensure a comprehensive maintenance management system that is integrated with a robust GIS mapping system in order to track all maintenance activities, service requests, work orders, SSO history, sewer line cleaning, sewer line and manhole repairs, sewer line CCTV inspections, gravity and force mains and sewer line rehabilitation and replacement projects.

In our assessment of the wastewater collections operations, we believe the following recommendations will preserve the City's capital investment in the sewer system while improving internal operations in order to continue providing the desired level of service:

- Develop an implementation plan with the Innovation Technology (IT) Department to migrate information from CadMe to ArcGIS; interface the work order system (UWAM) with ArcGIS to improve staff efficiency and effectiveness.

- Improve SCADA system operational efficiency with added equipment to remotely monitor pump motor AMP readings in all pump stations.

## OBJECTIVE, SCOPE and METHODOLOGY

In accordance with the Internal Audit Work Plan for FY 2015-16, we have completed a performance audit of the Public Works Wastewater Collection System[1] Asset Management. The objective of the review was to assess the efficiency/effectiveness of five core components of wastewater[2] asset management for the collection system:

1. Asset inventory – where, condition
2. Level of service – repairs and replacement; regulatory requirements
3. Critical assets – age, condition, failure history, predictive failure
4. Operation and Maintenance – preventative, replacement schedule, work order system, SCADA
5. Long-term funding strategy – CIP, SSMP

We relied upon the following to accomplish our objectives:

- Industry documents from EPA, California State Water Resources;
- California State's General Waste Discharge Requirements (WDR);
- Wastewater Division *Sewer System Management Plan* (SSMP) dated October 2015;
- Division documented operating procedures and responses to audit questionnaires;
- Various data documents provided by the Division and 311 Call Center;
- Interviews with Division management and staff;
- Walkthroughs of initiation and completion of work orders received from 311 or directly to Wastewater dispatch, and asset inspections;
- Demonstration of SCADA to monitor remote equipment; and
- Various industry documents and whitepapers sourced from the Internet regarding wastewater asset management.

## BACKGROUND

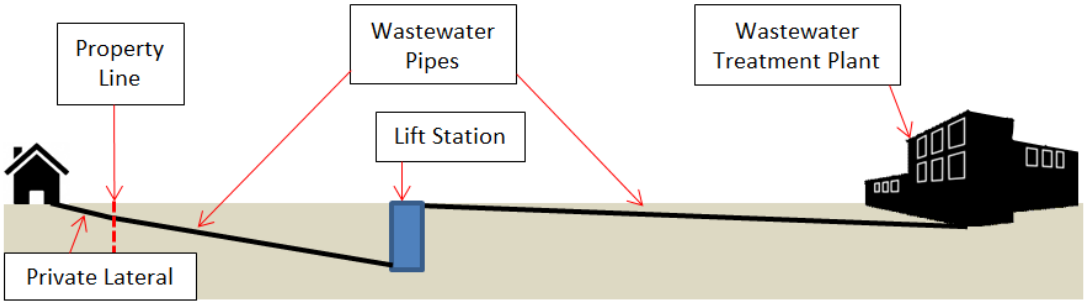
What is Wastewater?

Basically, wastewater is the flow of used water from within the City. Most people think of it as only sanitary sewage, but wastewater comes from many sources including homes, businesses, schools and industries. The flow includes water from showers, sinks, dishwashers, laundries, car washes, hospitals, food processing operations, etc. According to the U.S. Environmental Protection Agency (EPA), the average person produces 100 gallons of wastewater each day. In some cases, water from storm drains or groundwater that seeps into cracked sewer pipes is also added to the wastewater stream.

As the name implies, wastewater is on average 99.94 percent water by weight, with only a small 0.06 percent actually waste material.[3] Aside from the obvious, the wastewater contains food particles, paper products, dirt, oil and grease, personal care products, pharmaceuticals, cleaning chemicals and other organic/non-organic materials. The wastewater treatment plant processes that run continuously,

[1] Collection System means all wastewater conveyance systems owned and maintained by the City and tributary community services districts contracted to the City for sewer service, excluding private sewer service lateral line connections.
[2] Wastewater means any combination of waste and water, whether treated or untreated, discharged into or permitted to enter the collection system or storm drain of the City.
[3] Source: EPA

24 hours a day, 365 days a year are designed to remove most of these pollutants.




With aging infrastructure and limited budgets, Public Works' Wastewater Division is tasked with managing/operating the wastewater (sewer) system while maintaining a desired level of service to customers and complying with State regulations.[4]

Riverside's wastewater collection system includes over 820 miles of public sewer pipelines; 414 miles of sewer lateral (public and private) pipelines, serving a population of over 320,000. Wastewater of approximately 40 million gallons per day from homes and businesses is transported using gravity and 19 pump stations through the miles of sewer lines to the wastewater treatment facility known as the Regional Water Quality Control Plant (RWQCP).

**COMPONENTS of ASSET MANAGEMENT**

All wastewater systems are made up of assets – some visible but most buried under streets and public/private property. The components (assets) of the system can include pipes, valves, pumps, manholes, lift stations, treatment facilities, etc. These assets generally lose value over time as the system ages and deteriorate. As these assets age, cost of operation and maintenance increase. Asset management can aide in making better decisions on when it is most appropriate to repair, replace or rehab particular assets and by developing a long-term funding strategy to ensure the Division continuously delivers the required level of service to sewer rate payers.

<u>Sewer System Inventory</u>

A core component of wastewater asset management is the inventory. Management must know not only what is owned, but also where they are located, the condition and how much longer they will last.

The sewer system inventory and mapping may include:

- Pipe information – size, material, age, condition, direction of flow and slope

[4] In 2008, Section 14.08.020 of the Municipal Code established responsibility of the portion of the collection system (sewer lateral) between the property owner and the City. The City is responsible for maintaining the sewer pipes/lies at the property line to point of connection to the main sewer line. This change has increased the number of wastewater-related service requests. In 2015, 47% (302 of 645) of sewer line service requests were related to private property lateral issues.

- Manhole information – location, diameter, depth, material, age, condition, enter/exit line sizes, direction and elevation
- Pump station information – location, capacity, number of pumps, condition, method of alarm indication and method of back-up power

Without the timely and proper mapping of a sewer system, it is difficult to determine which parts of the sewer system need inspection, or to track maintenance work (ongoing and unscheduled). The Wastewater Division uses a GIS-based sewer system map (refer to Appendix A). [5]

The 820 miles of public sewer main lines are made up of 19,030 segments, totaling a length of over 4.3 million feet. According to Division inventory records, approximately 50 percent of the wastewater pipelines were installed before 1966 (more than 50 years ago); some as early as 1892. The years 1959 and 1960 saw the greatest number of new installments – 45.64 miles and 39.11 miles respectively; 29.70 miles of new pipelines were installed in 2003.

The composition of the City's existing 4.3 million feet of wastewater pipelines is 90 percent vitrified clay pipe (VCP), a pipe made from a blend of clay and shale that has been subjected to high temperatures to achieve vitrification (hard, inert ceramic). Installation of vitrified clay pipes by traditional open cut have a long success in the United States; confidence from experience and the recognition of the material properties are the leading reasons for continued specification. VCP has demonstrated a long life expectancy.[6]

Maintenance Management System

Collection system assets require routine care to ensure they function properly. An asset management program builds on the wastewater system inventory and identifies the necessary maintenance actions recommended for the assets within the system based on needs and criticality of the components.

The Division uses a computerized work order management system, ORACLE/Utilities Work and Asset Management (UWAM) for assigning and managing wastewater assets.[7] The UWAM system is used to record and track inventory, prioritize any needed maintenance or replacement, record inspections and work orders.

CadME is the current GIS solution used by the Division to record (map) the location of wastewater assets. The CadME system enables personnel to review up-to-date maps while completing fieldwork.

Due to a reduction in personnel resources within the Wastewater Division, maps of the sewer collection system have not been updated since 2012. New assets are added to the CadME system through inspection or through the completion of a work order. The UWAM system does not interface with CadME. CadMe is outdated; there is a need to implement a more robust GIS system (ArcGIS [8]). Refer to Finding/Recommendations.

[5] The Geographic Information System (GIS) mapping system is based on ESRI's legacy software/hardware platform, maintained by the City's IT Department. ESRI no longer provides support for the existing platform. One of the major projects for IT is the implementation of ArcGIS, an integrated GIS, also used by Riverside Public Utilities for asset management in the Water Division.
[6] "*Comparative Properties and Service Life of Pipes Used as Sanitary Sewers*", Mark. H. Bruce, Can Clay Corp.
[7] UWAM was previously referred to as SPL Enterprise Asset & Work Management. UWAM is maintained by the City's IT Department and used by various City departments.
[8] ArcGIS is an online, cloud-based mapping platform hosted by Esri.

Preventive Maintenance and Inspections

Scheduled proactive maintenance of the sewer collection system can prevent sewer system overflows (SSOs) and other problems from occurring. The focus of sewer system maintenance is the hydraulic capacity of the system. The maintenance program must ensure operation and reliability of mechanical systems such as pump stations and generators. Problems can be caused by structural defects (degradation of the sewer pipe) and operational defects, which affect the hydraulic capacity of the pipe. Roots, sediment, fats/oil/grease (FOG) can all reduce the cross-sectional area of the pipe, which reduces hydraulic capacity.

According to industry "best practices" the sewer collection system maintenance program should include:

- Standard operating procedures to support maintenance activities
- Routine inspection and service of all pumps and associated equipment
- Periodic cleaning of sewers
- Tracking of maintenance activities

Maintenance data should preferably be tracked in an asset management database, or in a GIS database, to facilitate easy access and coordination with other sewer system management-related activities.

Regularly scheduled sewer collection system inspections of the various components are critical in maintaining assets and service. Older areas of the wastewater system, areas with high flow volumes and certain pipe materials are more prone to failure. There are a number of sewer system inspection methods:

1. Physical inspections of manholes and sewer pipes/lines – for frame/cover defects, structural defects, root intrusion, signs of leakage and blockages, etc.;
2. Closed Circuit Television Inspection (CCTV) or other internal pipe evaluation – for structural defects, maintenance needs; and
3. Right-of-way/easement inspection – for missing/unrecorded sewer pipes and manholes, flow surcharging, trees with potential for root intrusion.

The Division has developed an inspection schedule not only for the sewer manholes and pipes, but also the 19 sewer pump stations. Each pump station is monitored daily through SCADA [9] with on-site inspections performed regularly.

Contractors from *Innerline Engineering, Inc.* [10] routinely perform closed circuit TV (CCTV) inspections and rate the sewer pipes according to industry[11] standards (a grade rating on a scale of 1 to 5).

[9] SCADA – Supervisory Control And Data Acquisition is a computer-based control system that allows operators/facility personnel to monitor and control equipment remotely.

[10] Council approved the professional service agreement of NTE $75k per year, which terminates June 30, 2016. Staff is currently reviewing CCTV services RFPs and will bring a new contract to the City Council for approval in 2016.

[11] NASSCO Pipeline Assessment and Certification Program (PACP).

CCTV inspection provides information about internal pipe conditions of the wastewater collection system. Inspections are performed using high resolution pan and tilt cameras, providing a full 360 degree view.

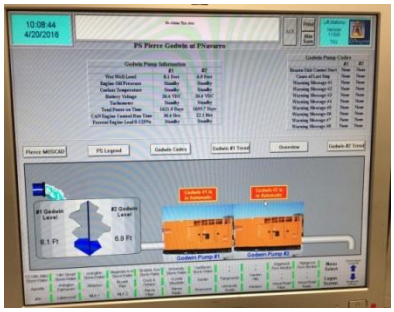
When a deficiency is identified through CCTV inspection, a visible sink hole or collapse, etc., a work order request is sent to the appropriate Public Works engineer who will investigate the problem, determine urgency and take action to resolve the issue. If the pipeline is not considered an emergency (collapse of pipe is unlikely or not imminent), repair/replacement is scheduled within the next 12 months in conjunction with other sewer line projects. According to Wastewater management, over the past five (5) years, 10 to 15 immediate/emergency repairs per year have been completed due to the critical condition of the pipe(s).

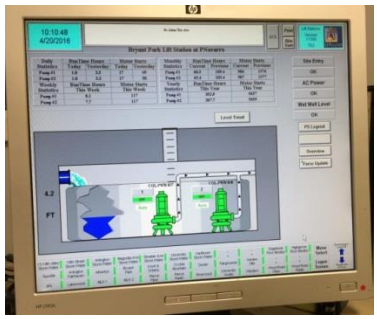
Wastewater collections staff are responsible for performing visual inspections of manholes to check conditions. This inspection usually occurs during daily scheduled cleaning routes of sewer lines per work order assignments. After a section has been cleaned (to remove roots, debris, grease, etc.), a record of service provided is recorded and included with the completion of the work order in UWAM. The Division's goal is to clean the entire collection system every 18 months.

> BEST PRACTICE - The EPA[12] guideline for planning preventative maintenance of wastewater collection systems is a risk-based approach. Rather than use a rotating repair/replacement method, the EPA recommends targeting future preventative maintenance based on likelihood of overflow by evaluating the characteristics of the pipes (age and material) and the history of overflows in areas, also considering the effect an overflow would have on schools, hospitals and major roads.

<u>SCADA</u>

The SCADA system is a critical component of wastewater asset management, performing remote monitoring, and some level of control of equipment at remote pump stations, data logging, alarming and diagnostic functions for the collection system. The monitoring function provides an effective visual interface between the collection system process and an operator.[13]





The data logging function provides a record of changes that have occurred within the system (alarms, set point changes, equipment stop/start, etc.). Integrated into the data and graphical displays are alarm functions that can raise and display alarms as they occur.

[12] EPA *Guide for Evaluating Capacity, Management, Operation and Maintenance Programs at Sanitary Sewer Collection Systems.*

[13] SCADA system screenshots from the Wastewater Collection System headquarters, Water Quality Control Plant

The Collections System management have 24/7 remote access to SCADA with the ability to monitor activity/alarms and ensure field staff are responding to emergencies and service requests. The system runs on an isolated network.[14]

Technology appears to be fairly current and the utilization by operations staff is very good. User access to and functionality/support of SCADA is managed by a Public Works SCADA system supervisor.

The SCADA system provides a wealth of data that facilitates quality of service and makes the collection system more reliable. The City/Public Work's investment in SCADA technology has resulted in numerous labor saving efficiencies over the years since originally installed.

During our interviews with Wastewater Collection System management and staff, we discussed additional labor savings and enhanced service that could be achieved with some minor operational changes and modest investment in equipment. Refer to our Findings/Recommendations for details.

Repair/Replacement Plans

The Wastewater Collections System Master Plan was completed in 2008 and has not been updated. The Division plans to update the Master Plan in FY 2016/17. The Master Plan rates wastewater assets based on condition and hydraulic capacity. Historical high frequency cleaning schedules and instances of root intrusion and root treatment are also considered and prioritized.

According to Wastewater management, the overall strategy for pipeline replacement has been focused on resolving condition/capacity issues to minimize the chance of sewage overflow. The plan to replace aging infrastructures has been limited to replacement of short pipe segments and installation of cured-in-place liners in problematic segments.

Implementing recommendations from an outsourced *2014 CIP and Rate Study*, the proposed fiscal 2-year budget (FY 2016-2018) and Capital Improvement Plan includes completing upgrades to the sewer collection system to increase capacity, replacing deteriorated pipelines and manholes, and upgrading sewer lift/pump stations.[15] The CIP includes $2 million in funded collection system upgrades for Fiscal Year 2017/18 and 2018/19.

Sewer System Overflow (SSO)

A sewer system overflow response program ensures a reliable process for responding to and reporting sanitary sewer overflows to protect human health and the environment. The Division operates a minimally staffed dispatch center 365 days a year, 24/7 at the WQCP and a stand-by call-out program. Upon receipt of a phone call (directly or via the City's 311 Call Center) or Police communication center, Public Works staff is dispatched to respond to a spill. In addition, the dispatch center monitors the SCADA alarm system and provides key communication with various City personnel.

The Wastewater Division maintains a comprehensive standard operating procedure[16] for responding to, repairing, and reporting overflows or spills. As the chart below notes, on average the Wastewater Collection System staff responds to over 6oo service requests annually. The majority of service requests are from private property discharges/overflows. In 2015, 256 calls (40% or an average of 21.5 calls per month) were related to private property service requests.

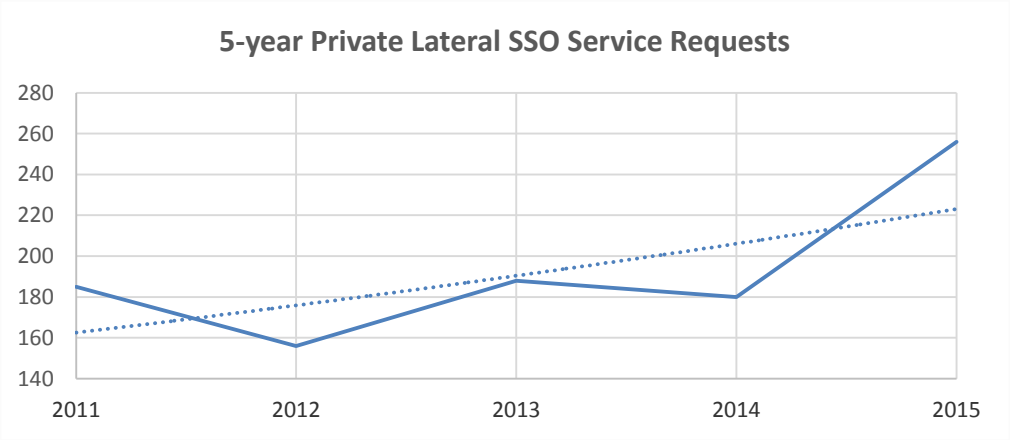
[14] The SCADA system appears to be secure; there is no direct VPN access to the SCADA network from the outside. Operators are assigned security level access.

[15] Public Works/Sewer Operations is an Enterprise Fund, with CIP funding from bond proceeds. Day-to-day operations are funded from sewer ratepayers.

[16] The *Overflow Emergency Response Plan* documents the standard SSO response procedures from notification/receipt of complaint/spill via the 311 Call Center through regulatory notification.

| Public Works Wastewater 311 Calls for SSOs | 2014 | 2015 |
|---|---|---|
| Drainage, Catch Basin or Storm Drain Lid | 7 | 12 |
| Drainage, Concrete Ditch, V Ditch | 47 | 44 |
| Drainage, Storm Drain Fence, Damaged | 25 | 17 |
| Drainage, Storm Drain or Catch Basin, Blocked | 116 | 50 |
| Drainage, Storm Drain, Odor | 9 | 9 |
| Drainage, Water Flowing, Streets or Storm Drains | 1 | 3 |
| EOC, Public Works, Sewer or Storm Drains | 27 | 3 |
| Sewage, Discharge or Dumping, General | 2 | 10 |
| Sewage, Discharge or Overflow, Private Property | 180 | 256 |
| Sewage, General, Non-Emergency | 79 | 68 |
| Sewage, Lateral Line Location, Private Property | 30 | 46 |
| Sewage, Manhole Cover, Loose or Missing | 50 | 52 |
| Sewage, Manhole or Restroom, Odor | 49 | 54 |
| Sewage, Manhole, Overflow | 19 | 19 |
| Sewage, Septic Tank or Sewer, Dye Test | 18 | 2 |
| Sewage, Septic Tank, Overflow | 2 | |
| Total | 661 | 645 |

Over the past five years, private property service requests have increased at an annual rate of 14%. Responding to the growth in service calls reduces the available time for staff to conduct routine operations and maintenance.




Once the collection system personnel arrive at the spill site and begin to control/contain the spill, they will determine if the cause is due to failure of the City's sewer system or if the spill is the result of failure in the property owner's system. (Refer to Appendix B - Municipal Code 14.08). If the spill is due to the City's portion of the sewer line, crews will correct the problem. If the spill is due to negligence of the property's sewer line and the owner cannot be contacted, dispatch will notify the City's Code Enforcement (residential property) or the Public Works Environmental Compliance Section

(commercial/industrial property). All activities are documented and a Spill Data Sheet is completed so that information regarding the SSO can be recorded, communicated and entered into the CIWQS.[17]

State Waste Discharge Requirements (WDRs) necessitate spills (SSOs) be categorized for reporting. Refer to Appendix C.

The tables below provide a summary of the City's SSOs per year, from 2011 through 2015, with a reported total of 97 SSOs for the 5-year period. The data indicates the division is performing better than the statewide average SSO benchmark for similar sized collection systems.

**5-year City SSO by Cause Within the Collection System**

| | Unknown | Blow-over | Debris | Grease | Multiple | Roots | Structure | Vandals | **Total** | **City Average[1]** (SSO per 100-miles) | **Statewide Average[2]** (SSO per 100-miles) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | 3 | 2 | 2 | 4 | 2 | 17 | 5 | 2 | 37 | 4.51 | 3.99 |
| **2012** | 1 | 0 | 4 | 1 | 0 | 8 | 5 | 0 | 19 | 2.32 | 4.86 |
| **2013** | 0 | 0 | 2 | 2 | 1 | 2 | 4 | 0 | 11 | 1.34 | 5.36 |
| **2014** | 1 | 0 | 0 | 3 | 1 | 4 | 2 | 0 | 11 | 1.34 | 4.90 |
| **2015** | 0 | 0 | 3 | 2 | 0 | 5 | 7 | 2 | 19 | 2.32 | 4.64 |
| 5-year Total | 5 | 2 | 11 | 12 | 4 | 36 | 23 | 4 | **97** | **2.37** (5-year Average) | **4.75** (5-year Average) |
| Percent | 5% | 2% | 11% | 12% | 4% | 37% | 24% | 4% | | | |

[1] City SSO data are tracked on a calendar year basis
[2] Statewide SSO performance data is tracked on a fiscal year basis

**5-year City SSO by Collection System Location**

| Location | Quantity | Percent of Total |
|---|---|---|
| Lateral | 20 | 21% |
| Lift Station | 7 | 7% |
| Main | 63 | 65% |
| Manhole | 5 | 5% |
| N/A | 2 | 2% |
| 5-year Total | 97 | |

[17] CIWQS - The *California Integrated Water Quality System* is an online database used by the State and Regional Water Quality Control Boards. CIWQS is a public portal. The SSO Report allows access to summary information of SSOs and private lateral sewage discharges reported by sewer system agencies.

As noted above, the majority (37%) of SSOs over the five-year period were due to root intrusion. Shallow-rooted trees (Shamel ash) were planted years ago by the City in neighborhoods and are the cause for a majority of repairs to the private sewer lateral lines (see Appendix B), at a significant annual cost to the City of approximately $2 million.

According to Wastewater Collections Systems management, there are approximately 843 locations (sewer line segments[18]) considered to be "hot spots" in the City. These are areas where roots, grease and other sources of blockage accumulate. Of these 843 "hot spots", 78 segments are cleaned on a 1-month frequency and the remaining 765 cleaned on a 3-month frequency.

Sewer System Management Plan (SSMP)

Public Works Wastewater Division developed a *Sewer System Management Plan (SSMP*) to comply with the State of California's General Waste Discharge Requirements (GWDR). The State regulation requires the City to evaluate, identify gaps, and document the operation and maintenance of the wastewater collections system as outlined in 11 Sections.

The SSMP was approved by the City Council July 14, 2009. GWDR also requires that the SSMP be updated every five (5) years. The City Council is to approve any significant updates to the SSMP. The SSMP was revised in June 2014 to comply with GWDR requirements. The revised SSMP was approved by the City Council and adopted by Resolution June 24, 2014.

The SSMP was further revised in October 2015, however the revisions were minor (mainly organizational structure and personnel contact information). Because the edits to the SSMP were minor, the City Council did not need to review/approve.

Section 10 of the SSMP requires periodic internal audits. At a minimum these audits must occur every two years (biennially); the report must be reviewed/approved by the City Council and kept on file. The audit focuses on evaluating the effectiveness and compliance of the SSMP including identification of any deficiencies in the SSMP elements, as well as corrective actions. We were unable to verify if biennial audits were conducted since 2009, as the Division did not retain documents to demonstrate completion of formal audits.

In collaboration with the Public Works Deputy Director – Wastewater, Internal Audit provided a "best practice" SSMP Audit template. Currently the Division is conducting a formal SSMP audit; the report is planned to be completed in 2016, and presented to the City Council for review/approval. Internal Audit will follow-up with the Division to ensure completion and formal retention of the SSMP audit report.

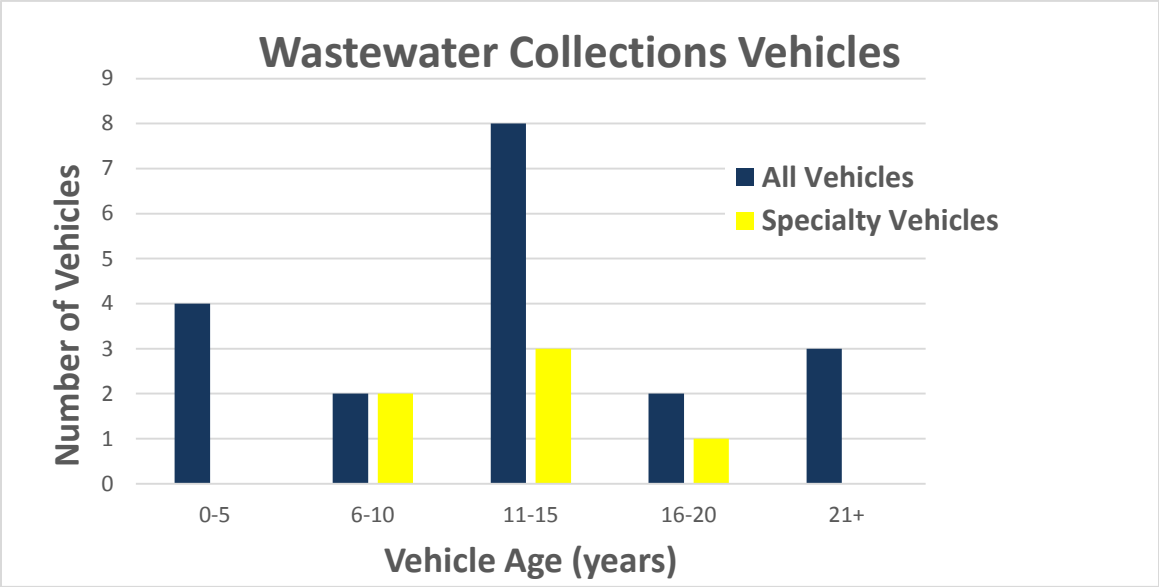
[18] A sewer line segment is 350 feet from manhole to manhole; there is approximately 840 total miles of sewer main lines in the City. Fifty-one (51) miles of City sewer pipeline is cleaned on a 3-month cycle.

## BEST PRACTICES

During our discussions with the Public Works Director and management of the Wastewater Division, the following suggestions (best practices) were deemed critical to include as examples of proactive strategic planning by the Wastewater Division:

A. **Vehicle Replacement**

The Wastewater Division operates a fleet of 19 vehicles necessary to maintain and repair the Collections system in accordance with the SSMP. Most specialized and critical are the six high pressure hydro cleaner and vacuum trucks used to clean sewer lines; the costs of these range from $200,000 to $450,000. The age of all Collections' vehicles are summarized below:




| Equipment No. | Year | Age | Age Category | Number in Category | Description |
|---|---|---|---|---|---|
| **Collections** | | | | | |
| | | | | | |
| | | | | | |
| **FLEET-H331** | **2012** | **4** | | | **Van, Video equipped** |
| FLEET-R037 | 1996 | **20** | **0-5** | 4 | Truck, Water, 1996 International |
| FLEET-C832 | 2001 | **15** | **6-10** | 2 | Truck, Dodge D250, 2001 |
| FLEET-C928 | 2005 | **11** | **11-15** | 8 | Truck, Ford F250, 2005 |
| FLEET-C892 | 2003 | **13** | **16-20** | 2 | Truck, Ford F150, 2003 |
| FLEET-C1278 | 2014 | **2** | **21+** | 3 | Truck, Ford F150, 2014 |
| FLEET-C1292 | 2014 | **2** | | 19 | Truck, Ford F150, 2014 |
| FLEET-C1293 | 2014 | **2** | | | Truck, Ford F150, 2014 |
| FLEET-E218 | 1987 | **29** | | | Truck, Cheverolet Flat Bed 1987 |
| FLEET-E270 | 1992 | **24** | | | Truck, GMC Construction 1992 |
| FLEET-E302 | 1997 | **19** | | | Truck, GMC , Hydro-Jet 1997 |
| FLEET-E314 | 2001 | **15** | **0-5** | 0 | Truck, Aqua-Tech Hydro Vac |
| FLEET-E327 | 2003 | **13** | **6-10** | 2 | Truck, Aqua-Tech Hydro Vac |
| FLEET-E333 | 2004 | **12** | **11-15** | 3 | Truck, Aqua-Tech Hydro Vac |
| FLEET-E372 | 2008 | **8** | **16-20** | 1 | Truck, Haaker Hydro Vac |
| FLEET-E386 | 2009 | **7** | **21+** | 0 | Truck, Haaker Hydro Vac Diesel |
| FLEET-H227 | 2002 | **14** | | | Van, Video Equipped |
| FLEET-H252 | 2004 | **12** | | | Truck, Chevrolet G3000, 2004 |

Following replacement of E-302 in July 2016, half the remaining specialized vehicles (63% of the fleet as a whole) will be 12 years old or older; at or near an age where downtime and repair costs are expected to increase.

Historically the budgeting of vehicle replacements is as needed from the Sewer Fund. The Wastewater Division believes a more forward looking and strategic approach would be to annually allocate funding toward vehicle replacement. A vehicle replacement fund would allow vehicles to be replaced on a pre-defined schedule, reduce downtime and costs, and support effective maintenance and repair of the Collections system in accordance with the SSMP.

B. **Sewer Lateral Response and Claims Processing**

In 2008 the City took ownership of the portion of the collection system (sewer lateral) from the private property line to the sewer main. Responsibilities of the Wastewater Division have increased considerably as a result of this shift. In 2015 the Division received 645 wastewater-related service requests. Of these, 302 (47%) were in regard to a private property matter (typically a lateral issue). The Divisions current approach to maintaining City sewer laterals is a reactive one due to the unique resource requirements to support a preventative program. Some of the concerns which have encouraged such an approach include:

- Employee safety when entering private property;
- Limited resources to respond, evaluate, and resolve service requests;
- Specialized equipment and skillset needed to clean laterals (differs from those needed to clean sewer main lines);
- Increased potential for liability as lateral cleaning, if not done correctly, can cause blow overs into the residence;
- Increased liability from the need for staff to access private property to reach the sewer cleanout (where cleaning equipment is introduced to the lateral);and
- Potential for damage to private property resulting from employee access and equipment placement.

The City receives numerous property damage claims related to sewer laterals. There is typically little interaction between customers and the Wastewater Division when lateral issues are absent. Alternatively, in the event of damage or a backup onto private property, the subsequent resolution process can be challenging and unclear. Although the underlying issue would remain, staff believes customers could be better served if the lateral response and claims process were better defined and communicated to property owners. Wastewater Division management/staff in collaboration with Finance/Risk Management suggest developing a claims process flowchart, which would be publicly available, define the process from submittal to closure including timeframes, milestones, and department contacts responsible for each step.

## CONCLUSION

- The Wastewater Division has established adequate administrative practices and internal controls to carry out the goals and requirements of the Sewer System Management Plan (SSMP) as required by the State of California's General Waste Discharge Requirements (GWDR). A formal and documented internal audit by the Division (per Section 10 of the GWDR) will be completed by Wastewater Division management in 2016 and reviewed/approved by the City Council.

- The large capital costs of replacing or rehabilitating sewer lines/pipelines and pump stations coupled with long sewer pipeline lifetimes implies a need for replacement strategies to incorporate potential future changes, such as economic growth or harmful consequences should an event such as a significant earthquake occur. The Department/Division has a comprehensive Capital Improvement Plan (CIP) that includes funded and unfunded repair/replacement projects for the wastewater collection system for the next five years.

- With an aging pipeline infrastructure there is a need to ensure a comprehensive maintenance management system that is integrated with a robust Esri ArcGIS mapping system in order to know the exact location of wastewater pipelines; track all maintenance activities, service requests, work orders, SSO history, sewer line cleaning, sewer line and manhole repairs, sewer line CCTV inspections, gravity and force mains and sewer line rehabilitation and replacement projects.

We discussed our findings and recommendations with the Public Works Director and Wastewater Director at an exit conference and included management's written response to our comments as part of this report. Our recommendations have been numbered to facilitate tracking and follow-up in subsequent years. We believe that, if implemented by management, these recommendations will improve the effectiveness and efficiency of the Wastewater collection system operations and asset management.

The assistance and cooperation from the Public Works Wastewater Division management and staff during the audit is greatly appreciated.

We respectfully request that in one year from date of final audit report, Public Works Wastewater Division management provide a status of the progress made in implementing the recommendations detailed in this report.

Cheryl Johannes, Internal Audit Manager

## OBSERVATIONS and RECOMMENDATIONS

Based on our review and discussions with the Wastewater Division management, we have noted the following findings and recommendations that warrant management's consideration and response:

### 1. Assign resources and develop an implementation plan in collaboration with IT to migrate CadMe to ArcGIS; integrate ArcGIS with UWAM for the Wastewater Collection System.

The current GIS solution for the Division is CadMe. CadMe is outdated and does not interface with the work order management system, UWAM. Maps of the sewer collection pipelines (assets) in CadMe have not been updated since 2012; many of the newer additions, repairs/replacements are not documented in CadMe. Several efficiencies could be gained by implementing Esri ArcGIS:

- Streamline the work order process for pipeline cleaning assignments; eliminate printed paper work
- Manually highlighted paper maps identifying assets cleaned would be eliminated
- More timely response to system overflows; assess the overflow path via online maps so that containment can be established downstream; eliminate the need for manual paper mapping.
- Eliminate need to manually attach CCTV (video) inspections of pipeline assets in UWAM; ArcGIS would interface with UWAM.

Monitoring and tracking of the wastewater system operation, maintenance and repair/replacement activities would be significantly enhanced.

**Recommendation 1:**

***Develop an implementation plan with the Innovation Technology (IT) Department to interface the work order system (UWAM) with ArcGIS to improve staff efficiency and effectiveness.***

**Management Response:**

**Concur. In order for the UWAM to be effective it needs to be coupled with a modern and up-to-date mapping system. The Division will soon be opening recruitment for a Wastewater Collection System Scheduling Coordinator (Scheduler). The Scheduler job description was recently updated to attract candidates with a GIS skillset. Although the Scheduler alone cannot implement the recommendation, having a member of the Collections Section versed in GIS should help facilitate effective collaboration with IT.**

**The Wastewater Division will meet with the IT department to discuss and develop an implementation plan as recommended.**

### 2. Reduce inefficiencies in troubleshooting and monitoring all wastewater pump stations by investing in specific equipment.

Currently only three (3) of the 19 pump stations have pump motor AMP readings monitored by SCADA. Measuring the pump motor AMP helps to estimate the actual pump flow. Staff will know if the pump is working too hard by measuring the pump motor amp. Pump motor AMP readings allow timely troubleshooting at remote facilities, reducing the need in some instances for staff to physically respond to an unnecessary callout.

**Recommendation 2:**

***Improve SCADA system operational efficiency with added equipment to remotely monitor pump motor AMP readings in all pump stations.***

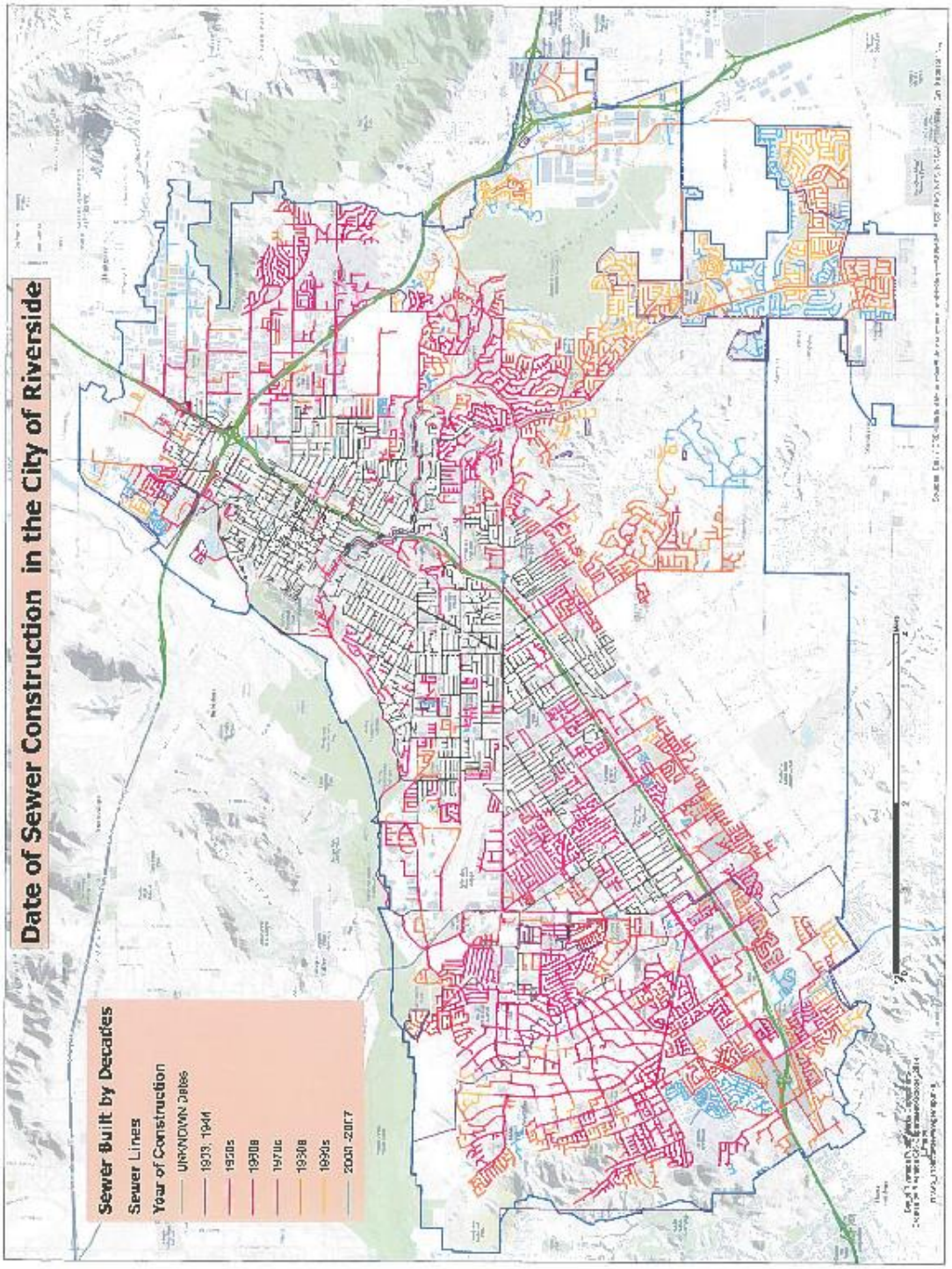
**Management Response:**

**Concur. Incorporation of pump motor AMP readings into SCADA across all stations would improve efforts to troubleshoot issues and, when warranted, dispatch resources to remote facilities. Three of the 19 pump stations already have this capability and all are equipped with failure alarms. Pump motor AMP readings would be an enhancement to existing diagnostics. The Wastewater Division will implement a plan forward as follows:**

**In 2016 the Wastewater Division will undertake a wastewater and storm water lift station evaluation study. The study is intended to assess remote facilities operated and maintained by the Wastewater Division and will evaluate in detail structural, electrical, mechanical, safety, and communication capabilities and needs at each. The effort will result in a condition and needs assessment report and include a prioritized list projects to address issues identified. A similar evaluation was completed in 2008. This effort will revise the 2008 report and expand the scope to include storm water lift stations.**

**Staff suspects many stations are in need of upgrade and repair. As these enhancements are budgeted and moved forward in future years, the Wastewater Division proposes to incorporate into these projects the audit recommendation to add equipment to monitor pump motor AMP readings.**

# APPENDIX A




Source: PW CadME

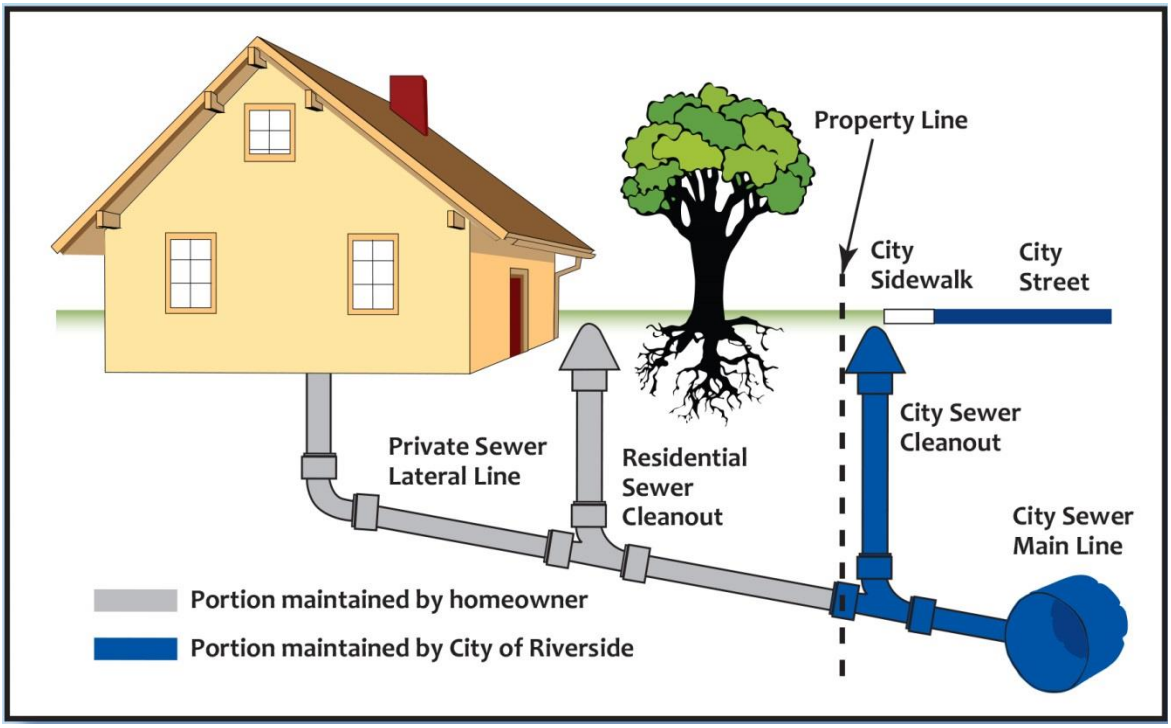
# APPENDIX B

Household plumbing (the drains from sinks, showers, toilets, etc.) is connected to a private sewer lateral line which carries waste water from the home to the City's main sewer line. Care and maintenance of the private lateral line up to the property line is the responsibility of each resident. Care and maintenance of the City's sewer main line and lateral line within the public right-of-way is the responsibility of the City.

Refer to the City's Municipal Code

**Section 14.08.020 Maintenance of house sewer connections--Right of entry of inspectors.**

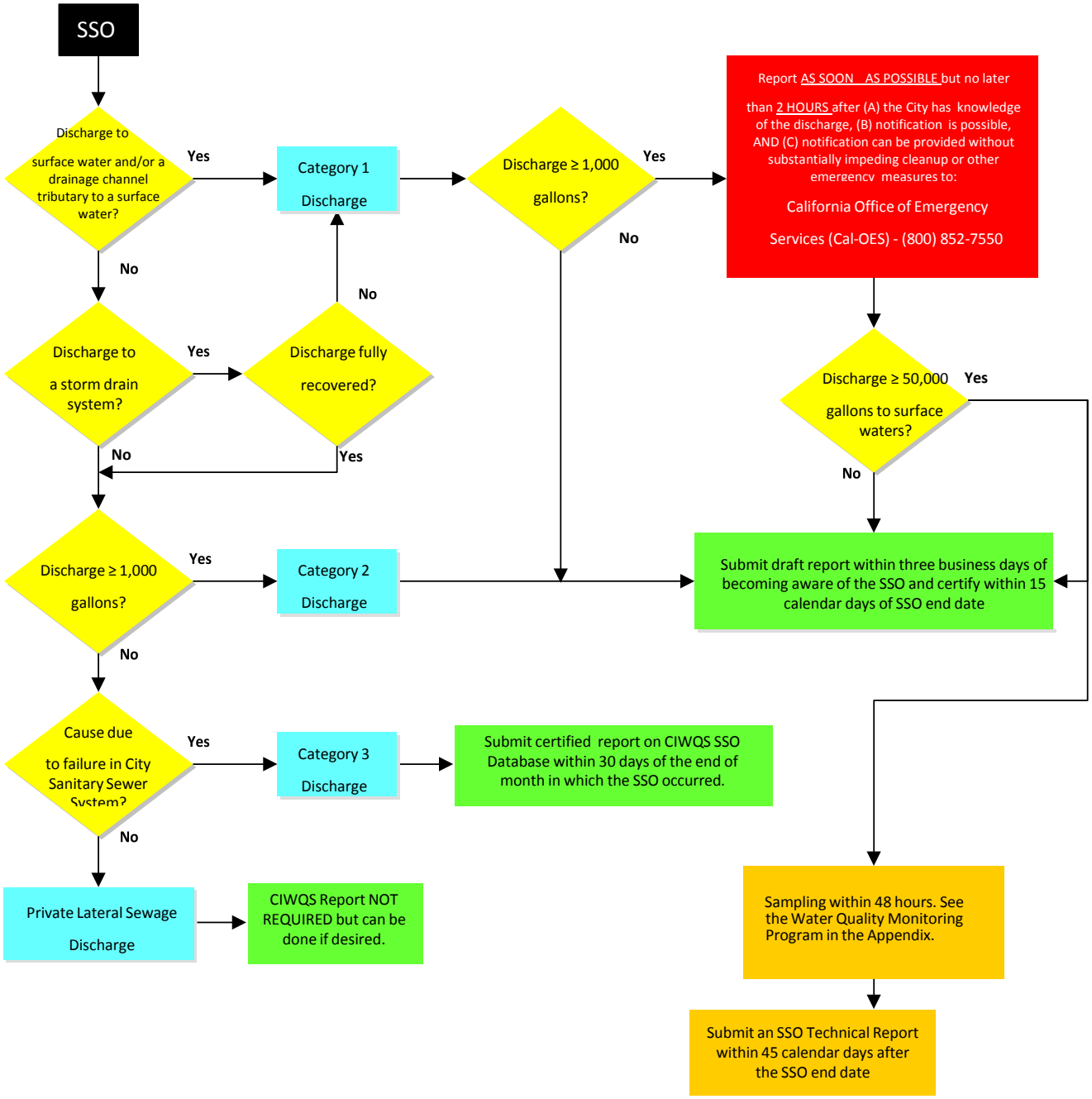
All persons shall keep their house connections (sewer lateral line from the house to the connection at the property line) in good order at their own expense and shall be liable for damages which may result from failure to do so. A City inspector shall be admitted at all reasonable hours at all parts of any premises connected with the sewerage system for the purpose of checking any facilities mentioned in this chapter and establishing sewer service charges as provided in Chapter 14.04. The City shall maintain the collection system beginning at the property line to the point of connection to the main sewer line. (Ord. 7005 § 1, 2008; Prior Code § 27.14)




Source: City website

# APPENDIX C

## SSO Reporting Flowchart Based on Category of Spill




Source: PW Overflow Emergency Response Plan