

**Performance Audit:
Department of
Watershed Management
Efforts to Reduce Water Loss**

April 2017

City Auditor's Office

City of Atlanta

File #16.10



CITY OF ATLANTA
City Auditor's Office
Leslie Ward, City Auditor
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April 2017

Why We Did This Audit

We undertook this audit of the Department of Watershed Management's efforts to reduce water loss to determine whether it has complied with state-mandated annual water loss initiatives and to evaluate the efforts compared with industry benchmarks.

What We Recommended

To reduce real loss, the Department of Watershed Management should:

- Conduct ongoing leak detection surveys.
- Document clear data management policies and estimate the volume of water loss.

To reduce apparent loss, the Department of Watershed Management should:

- Estimate the number of staff and add resources to monitor vacant accounts.
- Implement the system to alert customers of suspected leaks.
- Finalize the draft of standard operating procedures and begin enforcing provisions to track hydrant meters and collect billing data.

To finalize and implement the Water Loss Control Program, the Department of Watershed Management should:

- Finalize the water loss control program.
- Select specific goals for the program.
- Include leak management and capital improvement plan initiatives as a part of the overall water loss control program.
- Ensure the water loss team meets at least twice a year.
- Participate in the voluntary distribution system audits with the Georgia Association of Water Professionals.
- Create a mechanism to track individual goals and the volume of water.
- Submit annual water audits to the American Water Works Association.

For more information regarding this report, please use the "contact" link on our website at www.atlaudit.org

Performance Audit:

Department of Watershed Management: Efforts to Reduce Water Loss

What We Found

Water loss from the city system averaged 9.9 billion gallons per year between 2013 and 2015, amounting to about 30% of annual water production. The proportion of water loss attributed to real losses—physical losses from the distribution system—increased 17%, from 6.9 billion gallons in 2013 to 8.1 billion gallons in 2015. The proportion attributed to apparent loss—water that is unaccounted for due to error or unauthorized consumption—decreased 30%, from 3 billion gallons in 2013 to 2.1 billion gallons in 2015.

Aging infrastructure is the primary driver of real loss, but an active leak control program could reduce real losses. Since 2003, the city placed \$1.95 billion of assets into service in its wastewater system primarily for consent decree-related projects. Over the same period, the city placed about \$350 million of drinking water infrastructure assets into service. The Department of Watershed Management's consultant recommended an active leak detection strategy in 2014, but the department has yet to implement the recommendation. The planned capital improvement projects should also help to reduce real loss.

The department has implemented most of the consultant's recommendations to reduce apparent losses and to improve data validity, including steps to reduce unauthorized consumption, improve billing accuracy and test and calibrate production meters. The department could continue to reduce apparent losses by devoting additional resources to vacant accounts and reducing adjustments through finalizing efforts to alert customers of suspected leaks.

The Department of Watershed Management compiled its consultant's recommendations to document its water loss control program. The department missed the state's implementation deadline; improved coordination would likely strengthen the program. The department could also strengthen the program by adding initiatives to reduce real loss and identifying measurable goals to track progress.

Summary of Management Responses

Recommendation #1: We recommend the Department of Watershed Management conduct ongoing leak detection surveys.

Proposed Action: DWM currently has a water line condition assessment program underway as part of the Department's asset management strategy. This condition assessment will identify integrity issues in water mains which give rise to leaks and breaks. To capture baseline data, the Department may engage specialists or new technology for system-wide leak detection; however, we are also working to procure additional equipment for in-house Leak Detection surveys as part of a Water Loss Control Program. **Agree**

Timeframe: December 2017

Recommendation #2: We recommend the Department of Watershed Management document clear data management policies to better track municipal leaks and breaks and estimate the volume of water loss, as recommended by the consultant.

Proposed Action: OLIO has developed and is collecting water loss data in a Water Loss Tracking spreadsheet. This will provide an annual data summary for tracking, reporting and progress monitoring purposes. We have also placed policies to collect the water loss data and some of the measures include the use of hydrant meters on the city's use of city water for flushing and other purposes. **Agree**

Timeframe: May 2017

Recommendation #3: We recommend the Department of Watershed Management estimate the number of staff needed to manage the expected volume of vacant accounts, compared to the revenue lost through unauthorized consumption, and add resources to monitor vacant accounts if shown to be economically advantageous.

Proposed Action: The Department has modified the process to handle unauthorized consumption on vacant accounts. As of March 6, 2017, seven investigators from the Office of Safety, Security & Emergency Management have been assigned to investigate vacant properties with water consumption, which will assist in reducing the backlog. We are already seeing results from the process change; customers are coming into the Department to set up accounts and payment plans for back-billed usage. We anticipate that the current backlog will be substantially reduced within the next three months. **Agree**

Timeframe: Fully Implemented

Recommendation #4:	We recommend the Department of Watershed Management implement the system to alert customers of suspected leaks.	
Proposed Action:	The Department has several initiatives underway to address the accuracy of billing, including manual reviews of high consumption accounts. Currently, residential accounts with a 100% increase over the average consumption are flagged for an alert via robo-call from the department. The customer is given a call back number to discuss potential causes of the high consumption. The department is planning to move to AMI (Advanced Metering Infrastructure) which will allow for automatic leak alerts that can be accessed by the customer via the customer portal. A pilot of AMI metering technology is planned for late Summer 2017. In addition, the Department will pilot meter health and analytics technology for large meters this Spring. This technology alerts to the accuracy and health of the meter.	Agree
Timeframe:	August 2017	
Recommendation #5:	We recommend the Department of Watershed Management finalize the draft of standard operating procedures for tracking and reporting hydrant meters and begin enforcing provisions to track meters and collect billing data.	
Proposed Action:	The Department plans to finalize the procedures for tracking and reporting rental hydrant meters. Part of these procedures will include the monitoring and collection of billing data.	Agree
Timeframe:	June 2017	
Recommendation #6:	We recommend the Department of Watershed Management finalize the water loss control program.	
Proposed Action:	The Department has many activities underway related to water loss; however, the Department plans to engage a Water Loss Consultant to prepare a formal, comprehensive Water Loss Control Program Plan that will integrate the various necessary program elements being implemented by DWM.	Agree
Timeframe:	June 2017	
Recommendation #7:	We recommend the Department of Watershed Management select specific goals, or performance indicators, for the water loss control plan in order to measure and improve water supply efficiency.	
Proposed Action:	Specific goals and metrics will be developed and formalized as part of the proposed Water Loss Control Program Plan that will integrate current program elements. The plan will include both short-term and long-term goals and metrics that will help improve DWM's confidence in the data used for estimating Apparent Losses and track reductions of Real Water Loss.	Agree
Timeframe:	December 2017	

Recommendation #8: We recommend the Department of Watershed Management include leak management and capital improvement plan initiatives as a part of the overall water loss control program.

Proposed Action: The Department is in the process of developing a Department Strategic Plan including strategy for water loss reduction. Finalizing the Water Loss Control Program Plan to include descriptions of the processes for leak management, planned capital investments, and tracking implementation progress will be included as part of the strategy. **Agree**

Timeframe: December 2017

Recommendation #9: We recommend the Department of Watershed Management ensure the water loss team meets at least twice a year, as recommended, to assess progress in reducing water loss.

Proposed Action: The proposed Water Loss Control Program Plan will include both short-term and long-term schedules for achieving the goal established. **Agree**

Timeframe: December 2017

Recommendation #10: We recommend the Department of Watershed Management participate in the voluntary distribution system audits with the Georgia Association of Water Professionals.

Proposed Action: Once the Water Loss Control Program Plan is final and has completed one-year of formal implementation, DWM will request an independent distribution system audit from GAWP. **Agree**

Timeframe: March 2019

Recommendation #11: We recommend the Department of Watershed Management create a mechanism to track individual goals and the volume of water saved from apparent and real loss categories, including the various initiatives and methods used, and to relate the revenue recovery or cost reduction as appropriate in order to demonstrate progress of the water loss control program.

Proposed Action: The Department has developed a draft tracking spreadsheet designed for interim tracking on a year-by-year comparison basis. In addition, OLIO developed a water loss tracking system that will be used to track more detailed information, beginning with calendar year 2017. Based on future data, the Department will be able to improve on implementation initiatives developed in the Water Loss Control Program Plan that will help the City to further reduce overall system water losses. These processes will be formalized in the Water Loss Prevention Program Plan and implemented by the Department. As part of revenue recovery efforts under our Collections Unit, we are tracking the revenue recovered from vacant with consumption accounts and illegal tie-ins. **Agree**

Timeframe: May 2017

Recommendation #12:	We recommend the Department of Watershed Management submit annual water audits to the American Water Works Association for benchmarking and comparison.
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Proposed Action:	DWM will submit its 2016 Water Loss Audit Report to the AWWA for benchmarking and comparison and will continue to do so in future years.	Agree
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Timeframe:	June 2017
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CITY OF ATLANTA

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AUDIT COMMITTEE
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April 17, 2017

Honorable Mayor and Members of the City Council:

We undertook this audit of the Department of Watershed Management's efforts to reduce water loss to determine whether it has complied with state-mandated annual water loss initiatives and to evaluate the department's efforts compared with industry benchmarks. Our recommendations are intended to strengthen the water loss control program and reduce overall water loss within the city. The department agreed with all of our recommendations. The commissioner's response is appended in Appendix B.

The Audit Committee has reviewed this report and is releasing it in accordance with Article 2, Chapter 6 of the City Charter. We appreciate the courtesy and cooperation of city staff throughout the audit. The team for this project was Ivy Williams, Nia Young, and Diana Lynn.

Leslie Ward
City Auditor

Marion Cameron
Chair, Audit Committee

Department of Watershed Management Efforts to Reduce Water Loss

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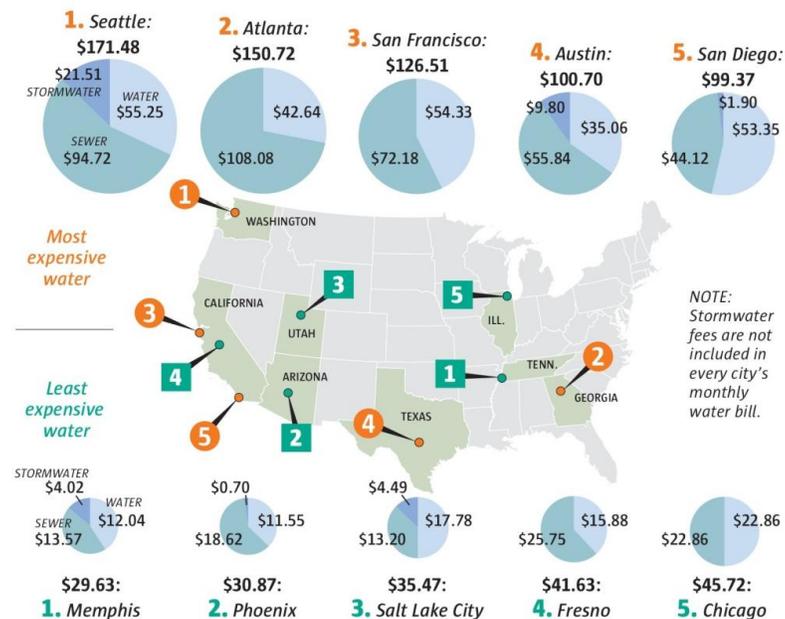
Introduction

Water loss is a measure of the volume of treated drinking water leaving a distribution system that is either not consumed or not accurately billed. A 2009 assessment of the Department of Watershed Management conducted at the request of the City Council found water loss was high. The report recommended establishing strategies to monitor and reduce water loss. Effective water loss control programs reduce costs and improve revenue recovery to ensure that rates charged to consumers are reasonable. This audit reviews the results of recent state-mandated water loss audits and evaluates the department’s water loss control efforts compared with industry benchmarks.

Background

City residents paid the second highest water bills in the country among the 30 largest cities, lower only than Seattle in 2015 (see Exhibit 1). A family of four in Atlanta using 200 gallons of water per day pays roughly \$150 per month for water and sewer. Atlanta’s rates have increased over the past two decades to help pay for the \$4 billion Clean Water Atlanta initiative, a federally mandated overhaul of the city’s aging and deteriorated sewer systems.

Exhibit 1: Average City Water Bill Second Highest in Country



Source: Gene Balk, “Rain-soaked Seattle has nation’s highest water bills,” *The Seattle Times*, April 30, 2015.

While some water loss is unavoidable, excessive water loss increases water rates by inflating production costs and by adjusting the amount of water billed to customers.

Industry Defines Two Types of Water Loss—Real and Apparent

The American Water Works Association defines two broad types of water losses that occur in drinking water utilities:

- *Apparent losses* are non-physical losses that occur in utility operations due to customer meter inaccuracies, systematic data handling errors in customer billing systems, and unauthorized consumption. In other words, this is water that is consumed but is not properly measured, accounted for, or paid for. These losses reduce utilities revenue and distort data on customer consumption. The industry estimates the cost of apparent losses at the customer retail rate so, when customer billing rates are increased, the cost of apparent losses also increases.
- *Real losses* are physical losses of water from the distribution system, including leakage and storage overflows. These losses inflate the water utility's production costs and stress water resources; water that is extracted and treated yet never reaches beneficial use. The industry generally estimates the cost of real losses as the marginal production cost of water, some analysts recommend estimating the cost of real losses at the retail rate when water resources are scarce.

Exhibit 2: Apparent vs. Real Losses

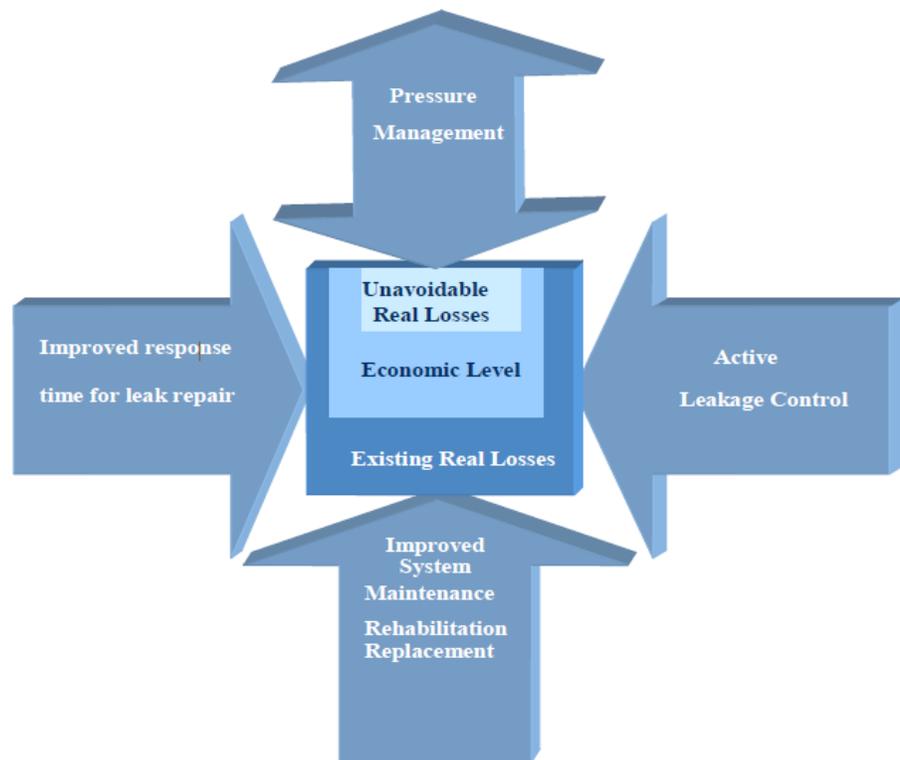


Source: Georgia Water System Audits and Water Loss Control Manual pg. 69

Water loss control programs can have significant financial benefit. Reducing apparent loss increases the water system's income by accurately billing for consumption. Moderating real losses cuts operating costs by reducing the amount of water needed to be produced and distributed and can also reduce overall system demand thereby deferring costly capital improvements in production and distribution infrastructure or water resources expansion.

Industry best practices identify real water loss control strategies, including pressure management, active leak control, timely repairs, and pipeline asset management (see Exhibit 3). Industry recommended practices to reduce apparent loss include minimizing unauthorized consumption, sizing meters properly, and minimizing data transfer and data analysis errors. Guidance recommends water utilities assess the costs of real and apparent losses and the economic benefits of applying different strategies.

Exhibit 3: Industry Recommends Real Water Loss Control Strategies



Source: Georgia Water System Audits and Water Loss Control Manual pg. 73

State Law Requires Water Loss Audits and Control Program

The Board of the Department of Natural Resources adopted ‘Rules for Public Water Systems to Improve Water Supply Efficiency’ in June 2015. According to the *Georgia Water System Audit and Water Loss Control Manual*, the rules are intended to establish policies, procedures, requirements, and standards, as the 2010 Georgia Water Stewardship Act (GWSA) outlines. The Act is intended to conserve water by requiring specific actions of water providers serving 3,300 or more in population. Approximately 250 water providers in Georgia, providing 80% of the potable water to the state’s population, are covered by the Act. Section 3 of the GWSA requires these public water systems to conduct an annual water system audit and implement a water loss control program.

The Georgia Environmental Protection Division requires public water systems to conduct standardized annual water loss audits in accordance with the American Water Works Association methodology for water loss auditing, which are due no later than March 1st the following calendar year. The city began submitting audits to the Georgia Environmental Protection Division in 2011, as required. The Department of Watershed Management conducted the first two annual water loss audits internally.

To address data and methodology concerns, the Department of Watershed Management hired a third party to conduct the audits and validate the data since 2013. The department worked with another consultant to conduct an in-depth analysis of the results of the 2013 water loss audit. The consultant identified specific areas within the water distribution system where short- and long-term improvements could reduce overall water loss, better track use, and improve revenue collection. The consultant updated and expanded its recommendations using the results of the 2015 water loss audit that was completed in February 2016.

According to the *Georgia Water System Audit and Water Loss Control Manual*, future water withdrawal permits, water plant operations permit-controlled production increases, and Drinking Water State Revolving Fund loans through the Georgia Environmental Finance Authority (GEFA) may take into consideration water audit results and the development and implementation of water loss control programs.

According to the National Resources Defense Council, water loss audits allow utilities to identify “economically recoverable” water losses for which investments in corrective actions have a reasonable

payback period. The audits themselves do not result in savings, but the utilities' corrective actions based on the audits yield savings.

Audit Objectives

This report addresses the following objectives:

1. What is the extent of water loss from the city's distribution system?
 2. Are the department's water loss control initiatives likely to be effective?
 3. Is the department implementing a water loss control program, as mandated by the state?
-

Scope and Methodology

We conducted this audit in accordance with generally accepted government auditing standards. We reviewed water loss audits from calendar years 2011 through 2015. We reviewed the two most recent capital improvement plans, 2015-2019 and 2017-2021. We reviewed city processes as of December 2016.

Our audit methods included:

- interviewing subject matter experts associated with the administration of the water loss program through various organizational units
- reviewing water loss literature from national and local government agencies to identify industry best practices
- reviewing legislation related to water loss audit requirements
- reviewing official water loss audits
- reviewing consultant memos and following up on the department's implementation of recommendations
- reviewing records and data to verify the implementation status of recommendations
- reviewing two capital improvement plans for future planned initiatives

Generally accepted government auditing standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and

conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Findings and Analysis

Aging Infrastructure Contributes to Billions of Gallons of Water Lost from the City Distribution System

Water loss from the city system averaged 9.9 billion gallons per year between 2013 and 2015, amounting to about 30% of annual water production. The proportion of water loss attributed to real losses increased 17%, from 6.9 billion gallons in 2013 to 8.1 billion gallons in 2015. The proportion attributed to apparent loss decreased 30%, from 3 billion gallons in 2013 to 2.1 billion gallons in 2015.

Aging infrastructure is the primary driver of real loss, but an active leak control program could reduce real losses. The Department of Watershed Management's consultant recommended an active leak detection strategy 2014, but the department has yet to implement the recommendation. We recommend that the department prioritize hiring the necessary staff to conduct ongoing leak detection surveys. Planned capital improvement projects should also help to reduce real loss.

The department has implemented most of the consultant's recommendations to reduce apparent losses and to improve data validity, including steps to reduce unauthorized consumption, improve billing accuracy and test and calibrate production meters. The department could continue to reduce apparent losses by devoting additional resources to handling vacant accounts and by reducing adjustments through finalizing efforts to alert customers of suspected leaks on the customer's side of the meter. The department should also enforce its new procedures to track hydrant meters.

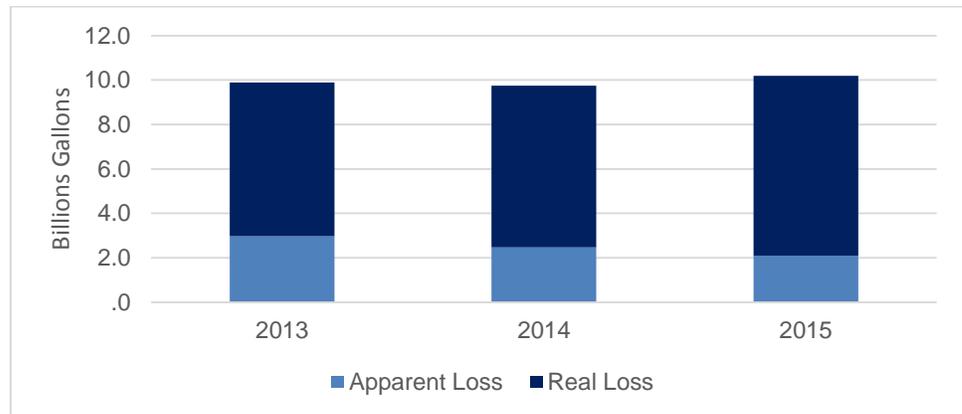
Aging Infrastructure and Lack of Active Leak Control Lead to Real Loss

Real water losses have increased since 2013. While aging infrastructure is the primary driver of real loss, an active leak control program could reduce real losses. The Department of Watershed Management has yet to implement its consultants' recommendations intended to reduce real loss.

Real water loss has increased since 2013. City water loss audits submitted to the state show that water loss averaged 9.9 billion

gallons per year between 2013 and 2015, amounting to about 30% of water produced per year. The proportion of water loss attributed to real losses increased 17.2%, from 6.9 to 8.1 billion gallons (see Exhibit 4). We excluded prior years from analysis due to concerns about data validity. Some of the shift from apparent to real loss between 2013 and 2015 could reflect improved data collection.

Exhibit 4: Water Loss Averaged 9.9 Billion Gallons per Year



Source: City of Atlanta Water Loss Audits, 2013-2015

The Department of Watershed Management identified aging infrastructure as the main cause of significant water losses. During an interview with a local news agency in October 2016, the department reported experiencing more than five water main breaks over the course of one weekend.

Drinking water system relies on old infrastructure. The city’s original water system was constructed in 1851. The oldest of the three current water treatment facilities, the Chattahoochee facility, has been in service for more than 50 years and the newest, the Atlanta-Fulton facility, has been in service since 1991. The distribution system includes more than 2,600 miles of pipes, some of which are 100 years old, according to department staff. One of the main transmission lines serving the city was installed in the 1890s. The original raw water pipelines are still in service. Cast iron mains of 30”, 36”, and 48” diameters were installed in 1893, 1908, and 1924, respectively. Although these mains were renewed with a cement liner in the 1950s, they have far exceeded their design life. A fourth line, a 72” steel main, was built in 1975 but metallurgical weaknesses restrict its operation to warm weather months.

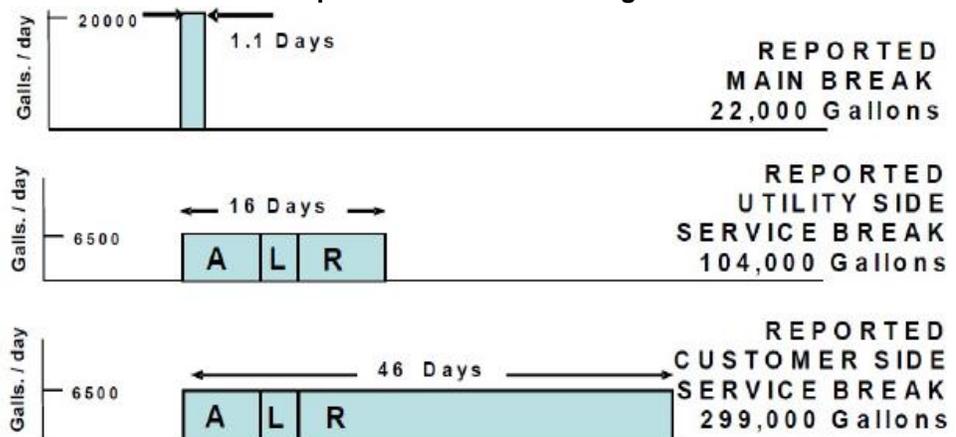
Focus on consent decree projects may have resulted in under-investment in drinking water infrastructure. Since 2003, the city placed \$1.95 billion of assets into service in its wastewater system

primarily for consent decree projects. Over the same period, the city placed about to \$350 million of drinking water infrastructure assets into service. Department of Watershed Management’s capital improvement plan for fiscal years 2015 through 2019 budgeted about 7.5% for water main replacement and other improvements to the distribution system.

Planned capital improvement projects could help reduce real water losses. The 2017-2021 capital improvement plan allocates almost \$165 million to the department to improve efficiency and reliability or replace assets that have reached the end of their useful life; 15 projects total 9.2% of the total capital improvement plan for the entire city. The department has completed an inventory and condition assessment of all water valves and hydrants and has launched a project for replacing mains with a high break history or those with chronic leaks.

Undetected leaks and delayed repairs contribute to real losses. The Department of Watershed Management’s leak management protocol is to respond to emergency water issues first and all other leaks secondarily, which can delay repairs to smaller leaks. The department issued more than one thousand work orders related to leaks between October 2014 and December 2015. On average, it took the department six days to repair water mains, while street leak repairs averaged 58 days to close from the time of report. Exhibit 5 illustrates that a small leak left unrepaired can result in significant water loss, sometimes greater than a quickly repaired large leak or main break. The total time to repair the leak includes awareness, depicted as A on the chart, time to locate the leak, depicted as L, and time to repair, depicted as R.

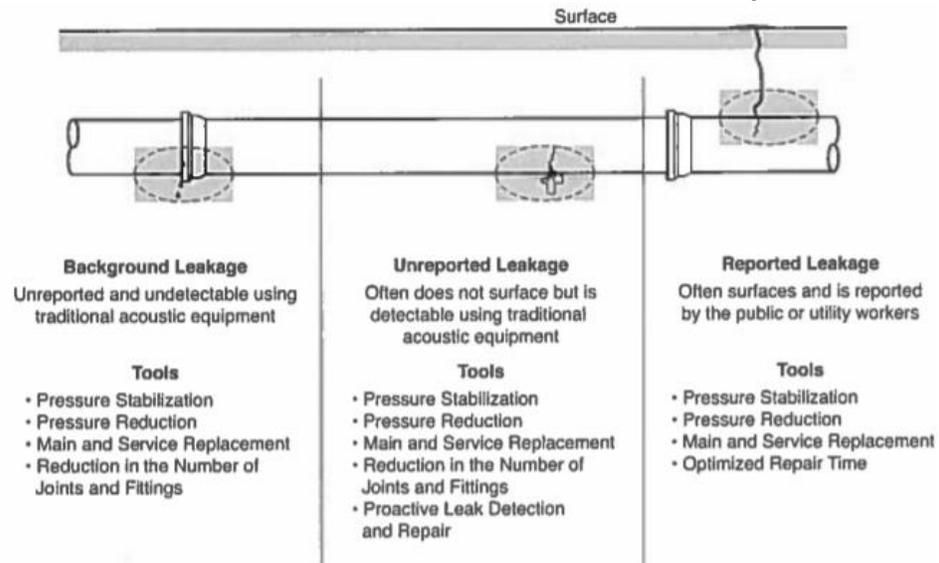
Exhibit 5: Small Unrepaired Leaks Lead To Significant Real Loss



Source: Water Audits and Loss Control Programs: AWWA Manual M36, pg. 97

Unreported leaks exacerbate the problem. Unreported leaks that do not surface can be detected through acoustic equipment (see Exhibit 6). The department's consultant recommended that the department conduct leak surveys to identify leaks and reduce total repair time. According to the consultant's report, the department had conducted leak surveys from 2010 through 2012, but no systematic leak detection survey had been conducted since this period.

Exhibit 6: Active Leak Detection Needed to Address Unreported Leaks



Source: Water Audits and Loss Control Programs: AWWA Manual M36, pg. 116

Three of the consultants' 21 recommendations to reduce water loss pertained to real losses:

- Assign leak detection staff including four inspectors to conduct daily surveys of designated sections of the distribution system and one analyst to coordinate with the leak detection manager and valve maintenance manager to assign work orders for needed repairs
- Coordinate the valve maintenance program with the newly formed leak survey section
- Develop clear data management policies for leak/break data to better track leaks and breaks and estimate the volume of water loss

The department has yet to implement the recommendations to reduce real water loss. The department's consultant recommended the department establish a leak survey program under the leak detection section of the Office of Linear Infrastructure. The new unit would work with the leak detection specialist to actively

identify leaks and speed repairs to minimize real water losses. The consultant recommended the leak survey team monitor 10-20% of the system in the first year of the program, covering 10 to 20 miles per week. The consultant estimated the new program would increase costs by \$419,000 for additional equipment and labor. Based on 2015 calculated variable production cost and real water losses, these efforts would yield a positive return on investment if they reduce real loss volume by at least 16%. Department staff told us that hiring was in progress at the end of 2016.

The consultant mapped historical line breaks and evaluated breaks per square mile to identify areas (meter zones) to prioritize for leak surveys. Results of the evaluation showed that the midtown/downtown area had two or more line breaks per square mile in 2013. Eleven other meter zones had one break per square mile in 2013, while twelve meter zones had fewer than one break per square mile in 2013.

The consultant also recommended that the department develop clear data management policies to better track leaks and breaks and estimate the volume of water lost. While the department implemented a standard operating procedure regarding water service interruptions (including repairs) in August 2016, the procedure does not describe specific data management procedures.

We recommend that the department conduct ongoing leak detection surveys and that it document clear data management policies to better track municipal leaks and breaks and estimate the volume of water loss, as recommended by the consultant.

Department's Efforts Have Reduced Apparent Loss

While real losses have increased, apparent loss has decreased about 30%, from 3 billion gallons in 2013 to 2.1 billion gallons in 2015. The Department of Watershed Management has implemented seven of eleven consultant recommendations to reduce apparent losses including:

- Make the department's vacant account reconciliation project permanent to manage unauthorized consumption
- Continue the large meter testing program
- Audit the top 200 customers to review meter reading accuracy and dwelling codes
- Perform special projects related to billing such as customer-side leak alerts and audits of meter size on converted or underused properties

- Confirm that all wholesale customers' meters are read and billed according to the readings
- Develop and implement written policies for reporting hydrant water use annually
- Meter daily line flushing for a period of time to more accurately estimate line flushing water volume

The department has not implemented four of the recommendations:

- Evaluate the current billing software to determine whether accounts with water use can be billed without an account name
- Revise policies and enforcement for water credits
- Partner with wholesale customers to match water use on the wholesale meter and the customer side meter and investigate discrepancies
- Hire a hydrant meter inspector to record water use and enforce hydrant meter water use reporting and payments; hire a fire service line inspector to confirm fire service lines are properly used and maintained

The department has made progress managing unauthorized consumption. According to the department's consultant, the 2013 water loss audit identified 1.5 billion gallons of unauthorized consumption from vacant water accounts, representing 52% of total apparent water loss, valued at \$8.6 million. The Department of Watershed Management's collections division began a special project in February 2014 to identify and reconcile vacant accounts with water use. The division identified more than 4,000 vacant accounts as registering water use. According to the department's consultant, the division was able to identify owners, establish owner accounts, and recover outstanding balances for 80%-85% of the vacant accounts.

The consultant recommended that the collections division make the vacant accounts reconciliation project a permanent program and review accounts in 'pending' status for water use to manage unauthorized consumption. The department has made the project a permanent program. According to Office of Financial Administration staff, the team currently has one investigator and one data analyst assigned to monitor vacant accounts. The department has also developed standard operating procedures to research, investigate, and collect owed amounts. Water use associated with unauthorized consumption, primarily vacant accounts, reduced by two-thirds from 1.5 billion gallons in 2013 to 487 million gallons in 2015.

The investigation team reviews vacant account reports weekly. The team generates a work order for an inspector to visit the recorded address of the vacant account and leave a notice for the occupant to apply for service within seven days or water will be disconnected.

The resident must submit documentation of occupancy, such as a copy of an original lease, security deed, or settlement statement, when applying for service to establish an account. Once the resident establishes an account and pays the previously billed charges in full, the Office of Consumer Business Services issues a work order to restore service. If the resident does not apply for service, the data analyst issues a work order for the inspector to shut off the water and lock the meter.

According to the team, approximately 400 accounts are vacated each month. The team prioritizes the accumulated backlog of accounts and completes as many new vacant accounts as possible during the month, but is unable to address all vacant accounts each month. The Office of Financial Administration requested additional resources for the vacant accounts process in August 2016, including three backlog technicians, two new vacant account technicians, and one additional data analyst, but the department has not yet added staff.

To better manage unauthorized consumption, the consultant also recommended that the department evaluate the current billing software to determine whether accounts with water use can be billed without an account name. According to Financial Administration, the department's current process does not allow them to bill unidentified residents but the software is not the issue. Since the software is not the source of the problem, the department has no plans to change its billing software. Reconciling vacant accounts and identifying and billing the party responsible for water use will be an ongoing effort. We recommend that the Department of Watershed Management estimate the number of staff needed to manage the expected volume of vacant accounts compared to the revenue lost through unauthorized consumption. If economically advantageous, the department should add resources to monitor vacant accounts.

The department has taken steps to improve billing accuracy. The 2013 water loss audit reported that billed metered water accounted for 98% of authorized consumption. The department's consultant recommended that the billing division audit the top 200 customers to evaluate meter reading and dwelling code accuracy. In response to the recommendation, the Office of Consumer Business Services

audited fiscal year 2016 billings of the top 200 customers. The audit found seven accounts registering use significantly below historical levels. The office submitted a service request for meter and register repairs. As of January 18, 2017, three of the seven meters and registers had been repaired.

The department's consultant recommended that the department continue its large meter testing program, reporting that 53% of water use was recorded by large 3 to 12-inch meters. The program enables the department to test 2% of its meters while ensuring the accuracy of half of billed metered consumption. The Department of Watershed Management hired a contractor in 2013 to test wholesale meters and large meters through the end of 2015.

The department continued the program in 2016, conducting large meter maintenance, inspection, and testing according to meter size. The department inspects and tests 3 inch meters every three years, 4 inch meters every two years, and meters 6 inches or larger annually. The program includes site surveys and meter tests. Site surveys confirm data and system components including service address, meter location, meter type, size, reading, and identification numbers. The crew also records the condition of the meter vault lid, meter register, vault, and valves related to meter installation. The testing crew creates a work order if a repair or replacement of a meter is needed. Once the site survey is complete, the meter testing crew conducts a meter test according to the American Water Works Association standards for each specific meter type. If a meter does not pass the test, the crew recommends corrective action and the department creates a work order. The meter is retested once the repairs are completed.

The consultant also recommended the billing division perform special projects such as customer-side leak alerts and audits of meter size on converted or underused properties to identify water loss from billed meter customer accounts. The department has purchased leak detection devices for customer-side leaks, however the system that alerts the department and identifies the location of the leak does not communicate with the billing software, which would generate a letter to inform the customer. The department has put the special project on hold until the issue can be resolved.

Other initiatives to address water loss from billing include reviewing water accounts inside the city without sewer accounts, identifying owner or tenant status, and reviewing accounts with $\frac{3}{4}$ " meters.

Adjustments now account for 54% of apparent water loss. The department chose not to implement the consultant's recommendation to revise water credits policy and enforcement. The consultant characterized credits as "extensive" and noted these credits reduce revenue, which requires higher overall rates. City code authorizes the Department of Watershed Management to adjust water and sewer bills for meter and other leaks, meter reading errors, and other billing errors. According to a 2015 consumption adjustments report, 13,234 customers received billing adjustments to their accounts between January 5 and December 31, 2015. The adjustments applied to about 1.1 billion gallons of water, accounting for 54% of the city's apparent water loss in 2015. Finalizing the system to alert customers of suspected leaks should reduce the number and amount of adjustments.

The department now reviews wholesale water accounts quarterly. Wholesale customers represented approximately 4% of the total water use volume in 2013. Three cities, Fairburn, Hapeville, and Union City, accounted for the majority of wholesale water sales. The department's consultant found discrepancies in wholesale meter inventories and lack of meter testing. The consultant recommended the department confirm billing of wholesale customer meters. As of June 2016, the billing division implemented a quarterly review of wholesale customer billing accounts. The reviews from June and November 2016 and January 2017 found that all identified wholesale accounts were billing at a reasonable rate. Reports are run to identify accounts with negative, zero consumption, and out of range readings, which the department defines as 5% above or below the historical usage. The consultant also recommended that the department review and revise wholesale customer agreements to allow the department to reconcile water use recorded on the wholesale meter to water use recorded on the customer side of the meter and to investigate discrepancies. The department stated that wholesale customers do not currently capture water use data on the customer side of the meter.

Delaying implementing hydrant meter procedures leads to poor asset management and possibly revenue loss. Construction firms and other organizations rent hydrant meters from the Department of Watershed Management to track their authorized use of city water from fire hydrants. The department's consultant reported in 2014 that meter rental rates were favorable to contractors and the Meter Applications Division had difficulty tracking and verifying water use. The department contacted customers with hydrant meters and found that the customers were uninformed about the need to report

water use and some were unsure about how the hydrant meter rental program worked.

The consultant recommended that the department develop and implement written policies for reporting hydrant water use annually. The Meter Applications Division drafted a procedure in October 2016 for renting, collecting payments, and tracking hydrant meters. The standard operating procedure requires all customers to submit hydrant meter reads monthly on a specified form and email it to the department, but many customers call in the meter readings monthly. As of September 2016, the department automatically received direct readings from 120 of the 168 hydrant meters.

We recommend that the Department of Watershed Management finalize the draft standard operating procedure and begin enforcing provisions to track meters and collect billing data.

The consultant also recommended that the department add two positions to the meter program: a hydrant meter inspector and a fire service line inspector. The hydrant meter inspector would record water use and enforce hydrant meter water use reporting and payments. The fire service line inspector would confirm fire service lines are properly used and maintained in case of an emergency. The department rejected the recommendation to hire hydrant meter and service line inspectors as of September 2016, stating that it did not have the funding to hire new personnel for the meter program.

The department's line flushing estimates support consultant's water loss audit process. The amount of water used for fire-fighting, line flushing, street cleaning, or other authorized unbilled, unmetered water use is difficult to quantify and generally represents a small volume of the overall water use. Because the Department of Watershed Management flushes lines daily in some parts of the city to improve water quality, the consultant recommended that the department meter daily line flushing for a period of time to more accurately estimate the associated water volume. The American Water Works Association estimates a default value of 1.25%. If the department is using more than the default value, it is underestimating apparent losses and, therefore, overestimating real losses.

The Laboratory Division calculates unmetered water consumption monthly to determine water volume used for line flushing and retains those measurements for water loss audit purposes. Over 76 million gallons of water were consumed from January through December 2015. While the laboratory results did not include a

comparison to the American Water Works Association default value, our office found the city's estimate to be below the default value.

Department's Efforts Have Improved Data Validity

The Department of Watershed Management implemented four of the six consultant recommendations related to data validity and the water loss audit process:

- Assemble a water loss audit team of staff from various offices within the department to assist with providing information for the water loss audit and managing key programs that are designed to reduce water loss or verify system data
- Test and calibrate production meters annually to accurately determine water demands, production, and storage volumes, while increasing data validity
- Perform maintenance of production meters to improve performance
- Provide training, as needed, for meter reading staff on policies, procedures, data entry, and coordination with billing

The department has not implemented two of the recommendations:

- Develop standard operating procedures for annual testing and calibration of production meters
- Develop standard operating procedures for SCADA (supervisory control and data acquisition) management

More accurate data allows the department to better target water loss control measures. The department's water loss audit validation score increased from 60 in 2013, to 65 in 2014, and 74 in 2015. The score is the composite rating of the utility's confidence in the accuracy of data entered into the audit software. The department uses the level 1 validation method, which is the most common validation method for North American water utilities. Using this validation method, the auditor selects a data confidence score for each data input. These scores range from one to ten, with ten representing the highest data confidence. In assessing the validity of the authorized consumption, for example, a score of 4 or less is warranted if most of the water sources are unmetered and existing meters are rarely tested. A score of 8 or higher is warranted if the utility meters all water sources, regularly tests device accuracy, and applies the test results to data inputs. Once the auditor has entered and assigned scores to all numeric inputs, the software calculates the data validity score. In contrast, level 2 validation corroborates

input data with raw data and archived reports of instrument accuracy, while level 3 validation incorporates field tests of instrument accuracy.

The department assembled a water loss audit team. The department's consultant recommended that the department assemble a team of staff from various offices to assist in providing information for the annual water loss audit and to monitor progress in water loss reduction. The consultant's case studies of other utilities identified such a team as a first step toward a successful water loss reduction program. The department assembled a team of employees to assist with providing information for the water loss audit. According to the consultant, the team has been involved in the water loss audit process since 2013, but staff told us the team does not meet twice a year, as recommended, to assess progress in reducing water loss. According to the water loss team chair, divisions are responsible for their own corrective actions or improvement plans associated with the overall water loss program as well as following up on issues identified in audits.

The department improved production meter testing and maintenance but could strengthen consistency. The department's consultant made several recommendations to improve the accuracy of the department's four production meters, which measure the volume of water extracted and treated before it is distributed. The consultant's initial tests indicated that the department was under-registering volume by 1.5%. The volume of water produced is a necessary input to calculate water loss. Under-registering water production will result in underestimating water loss.

All treated water production sources are metered. The consultant recommended annual testing and calibration of production meters to improve accuracy of water demands, production, and storage volumes as well as increase data validity. The department started implementing the recommendation in 2014, constructing access manholes and installing testing taps at the Hemphill and Chattahoochee water treatment plants. The department hired a third party to conduct calibration testing, which it completed in February 2015.

The consultant also recommended regular production meter maintenance. Production meters have pressure sensors and sensing lines. As general maintenance, the consultant recommended periodically flushing the sensing lines and cleaning and inspecting the pressure sensors. The department provided us with a production meter maintenance schedule: three meters are scheduled for

quarterly maintenance and one is schedule for monthly maintenance. The department also provided us with copies of work orders documenting recent preventive maintenance for two of the meters.

Standard operating procedures could strengthen consistency. The consultant recommended that the department establish standard operating procedures for annual testing and calibration of production meters. The facilities maintenance unit stated in December 2016 that the procedure related to the annual testing and calibration of the meters is contracted out to a third-party and that the department does not need internal procedures. We noted inconsistencies in test results reported for 2014 and 2015. The department excluded two plant meters from its testing and calibration and the third-party tester used different naming conventions for the meters it tested, making comparison difficult. According to the Office of Water Treatment and Reclamation, the department will ensure that the annually submitted calibration reports for the water loss audits will only include the production meters and those meters will be properly referenced for all future tests.

The department's consultant also recommended that the department develop standard operating procedures for SCADA (supervisory control and data acquisition) management. The SCADA is a computer system used to monitor and analyze real-time flow data. Meter testing requires electronic flow data to confirm meter accuracy. The department provided the consultants with flow reports without time stamps. To improve the usefulness of the reports, the consultant recommended that the standard operating procedures include the daily tasks for SCADA data review, data processing to import and export reports, and procedures for providing electronic information to department staff and contractors. As of December 2016, the Office of Water Treatment and Reclamation stated that documenting the methods and means of collecting and archiving the data reported in the water loss audits would not help with data reporting or achieve a reduction in overall water loss. The division had no plans to implement the recommendation.

The consultant recommended that the Department of Watershed Management provide training, as needed, for meter reading staff on policies, procedures, data entry, and coordination with the billing unit. According to the department, continuing education, regular demonstrations, and active coaching are incorporated into the meter reading business operations. In June 2016, the unit developed

standard operating procedures for field operations. We reviewed the draft, which contains detailed instructions for meter readers, in October 2016.

Draft Water Loss Control Program Could Be Strengthened

The Department of Watershed Management compiled its consultant recommendations to document its water loss control program to meet state requirements. The department missed the state's deadline because of difficulty coordinating plans and responses among several divisions. Improved coordination would likely strengthen the program. The department could also strengthen the program by adding initiatives to reduce real loss and by identifying measurable goals to track progress.

Water Loss Control Program Elements Are in Place

According to the department's Office of Performance and Accountability, program elements are in place through the department's recent implementation of the consultant's recommendations. The department is developing an internal plan to provide a consolidated description and outline of its program, establish policies and procedures, and identify the criteria by which the department will measure progress.

City missed state mandated deadline for water loss control program. State law requires public water systems serving at least 3,300 to develop and conduct a water loss control program to investigate, assess, and implement efforts to improve water supply efficiency by July 1, 2016 (Rule 391-3-33). The program must include individualized goals and each utility is responsible for demonstrating progress towards improving water supply efficiency. The Department of Watershed Management acknowledges that it missed the state's deadline. The Office of Watershed Protection planned to finalize the program by October 2016; however, as of December 2016, the draft program was still under departmental review.

While the majority of the documented water loss control program mirrors the consultant's technical memos, including recommendations that the department previously stated it does not plan to implement, the program lacks division-specific information related to leak management, data management, and special programs. Also, because the consultant did not make recommendations related to main and service line replacement, the

department's program does not assess the impact of planned capital improvements on water loss reduction.

The perception of department staff was that the previous commissioner did not recognize water loss as a priority, likely contributing to the lack of coordination among divisions and impeding the finalization the program. Three main divisions are responsible for implementing a majority of the water loss initiatives:

- The Office of Water Treatment and Reclamation - responsible for drinking water production and wastewater treatment
- The Office of Linear Infrastructure Operations - responsible for operating, maintaining, and repairing the City's water distribution systems, wastewater collection systems, and system appurtenances, including maintaining system reliability and compliance
- The Office of Watershed Protection - responsible for overseeing, tracking, and ensuring regulatory compliance, regional planning coordination, and implementation of programs targeted to protect and enhance water quality

Under Georgia Environmental Protection Division's Rule 391-3-33.05, failure to implement water loss control strategies and demonstrate progress toward reducing water loss could hinder the city's water withdrawal permit renewal in 2021. We recommend that the Department of Watershed Management finalize the water loss control program in order to comply with Rule 391-3-33.

Adding Initiatives to Reduce Real Loss and Measurable Goals Would Strengthen the Water Loss Program

Draft water loss control program lacks goals mandated by state rule. The department's draft water loss control program does not include specific individual goals to track progress. According to Rule 391-3-33, each public water system is responsible for establishing individual goals to set measures of water supply efficiency and to improve water supply efficiency, as well as demonstrate progress of the water loss control program. The rule lists five possible performance measures that may be included, but are not limited to:

- economic level of leakage
- infrastructure leakage index
- operational basic real losses
- operational basic apparent losses
- water audit data validity score

The *Georgia Water Loss System Audits and Water Loss Control Manual* additionally lists two operational performance indicators for evaluation:

- variable production cost
- customer retail cost

All of these measures are useful for determining the most economically feasible methods to reduce water loss.

While the department's draft water loss control program summarizes water loss audit characteristics from previous years, it includes only one of the state or the American Water Works Association suggested metrics: the water audit data validity score, which is mentioned in the summary but includes incorrect information for audit year 2013. All recommended performance indicators but one, the economic level of leakage, are calculated in the water loss audits, allowing the department to track the suggested metrics at no additional cost.

According to the *Georgia Water System Audits and Water Loss Control Manual*, economic level of leakage is defined as the level of leakage that any further investment in leakage reduction would incur costs in excess of the benefits derived from the savings. This includes the cost of producing water and the avoided cost of replacing water. Economic evaluations performed on real loss reduction activities should only be after the department has conducted water audits for several years and it has improved its data validity. The Water Research Foundation provides a free software tool to determine economic leakage control activities. By inputting data on leakage occurrences in the utility, as well as various costs, the tool calculates the economically viable level of leakage management activities, including proactive leak detection and pressure management to guide the water utility.

We recommend that the Department of Watershed Management select specific goals, or performance indicators, for the water loss control plan in order to measure and improve water supply efficiency, consistent with Rule 391-3-33.

Operational performance indicators show room for improvement. The city's infrastructure leakage index was 4.84 in 2015 and had increased each year since 2013 (see Exhibit 7). The index—the ratio of the utility's current leakage level to its lowest technically achievable level of leakage—is an important benchmark for water system planning. The lower the ratio, the more effective the utility is at controlling leakage. According to the manual, an index measure

in the range of 3.0 - 5.0 indicates water resources can be developed or purchased at a reasonable expense and existing supply infrastructure is sufficient as long as leakage is controlled.

Exhibit 7: Operational Indicators Show Room for Improvement

Operational Performance Goals <i>Rule 391-3-33</i>	Minimum	Maximum	Median	2013 Actual	2014 Actual	2015 Actual
Infrastructure Leakage Index, ILI	2	10	3	4.19	4.38	4.84
Real Losses Normalized, gal/conn/day	20	100	40	94.33	98.49	108.89
Apparent Losses Normalized, gal/conn/day	2	15	5	40.51	33.59	28.06
Operational Performance Indicators <i>GA WLA & Water Loss Control Manual</i>	Minimum	Maximum	Median	2013 Actual	2014 Actual	2015 Actual
Variable Production Cost, \$/million gal	\$200.00	\$1,000.00	\$400.00	\$339.44	\$323.49	\$326.33
Customer Retail Cost, \$/1,000 gal	\$2.00	\$10.00	\$4.00	\$5.58	\$5.52	\$6.25

Source: Georgia Water System Audits and Water Loss Control Manual and City of Atlanta Water Loss Audit Results

The department could strengthen its water loss control program by adding initiatives to reduce real loss. The city’s 2015 water loss audit results measured normalized real losses at 108.89 gallons per service connection per day, which is higher than the maximum recorded value of 100/gal/conn/day from the Georgia dataset. Industry-recommended methods to reduce real loss include pressure management, active leakage control, improved response time for leak repair, and improved system maintenance and rehabilitation replacement. We recommend additional consideration to enhanced real loss activities, especially leakage management. We also recommend that the department include the capital improvement plan initiatives as a part of the overall water loss control program.

Normalized apparent losses were also higher than the maximum recorded in the Georgia dataset. While apparent losses have decreased since 2013, the 2015 normalized figure of 28.06 gallons per service connection per day is well above the state maximum value of 15. Continuing to reduce apparent loss will directly increase water system income. Customer retail cost increased in 2015 to \$6.25/1,000 gallons of water from \$5.58/1,000 gallons of water in 2013, which is higher than the median cost of \$4.00/1,000 gallons of water recorded in the state data set. The customer retail cost metric is a weighted average of the overall charge per unit; the increase in average cost reflects a change in consumption. Customer water rates have not changed since 2011.

The department could benefit from requesting a distribution audit from the Georgia Association of Water Professionals. A distribution audit evaluates the utility's water distribution system operations against standardized practices: management, maintenance, operations, and capacity.

We recommend the department create a mechanism for tracking individual goals and the volume of water saved from apparent and real loss categories, including the various initiatives and methods used, and to relate the revenue recovery or cost reduction as appropriate in order to demonstrate progress of the water loss control program.

Recommendations

In order to reduce real loss, the Department of Watershed should:

1. Conduct ongoing leak detection surveys.
2. Document clear data management policies to better track municipal leaks and breaks and estimate the volume of water loss, as recommended by the consultant.

In order to reduce apparent loss, the Department of Watershed should:

3. Estimate the number of staff needed to manage the expected volume of vacant accounts compared to the revenue lost through unauthorized consumption and add resources to monitor vacant accounts, if shown to be economically advantageous.
4. Implement the system to alert customers of suspected leaks.
5. Finalize the draft standard operating procedure for tracking and reporting hydrant meters and begin enforcing provisions to track meters and collect billing data.

In order to finalize and implement the Water Loss Control Program in compliance of Rule 391-3-33, the Department of Watershed should:

6. Finalize the water loss control program.
7. Select specific goals, or performance indicators, for the water loss control plan in order to measure and improve water supply efficiency.
8. Include leak management and capital improvement plan initiatives as a part of the overall water loss control program.
9. Ensure the water loss team meets at least twice a year, as recommended, to assess progress in reducing water loss.
10. Participate in the voluntary distribution system audits with the Georgia Association of Water Professionals.
11. Create a mechanism to use for tracking individual goals and the volume of water saved from apparent and real loss categories, including the various initiatives and methods used, and to relate the revenue recovery or cost reduction as

appropriate in order to demonstrate progress of the water loss control program.

12. Submit annual water audits to the American Water Works Association for benchmarking and comparison.

Appendices

Appendix A: Management Review and Response to Audit Recommendations

Management Review and Response to Audit Recommendations

Report # 16.10	Report Title: Water Loss	Date: 3/6/2017
Recommendation Responses		
Rec. # 1	We recommend the Department of Watershed Management conduct ongoing leak detection surveys.	Agree
<p><u>Proposed Action:</u> DWM currently has a water line condition assessment program underway as part of the Department's asset management strategy. This condition assessment will identify integrity issues in water mains which give rise to leaks and breaks. To capture baseline data, the Department may engage specialists or new technology for system-wide leak detection; however, we are also working to procure additional equipment for in-house Leak Detection surveys as part of a Water Loss Control Program.</p> <p><u>Implementation Timeframe:</u> December 2017</p> <p><u>Comments:</u></p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Linear Infrastructure Operations and Asset Manager, Office of Engineering Services</p>		
Rec. # 2	We recommend the Department of Watershed Management document clear data management policies to better track municipal leaks and breaks and estimate the volume of water loss as recommended by the consultant.	Agree
<p><u>Proposed Action:</u> OLIO has developed and is collecting water loss data in a Water Loss Tracking spreadsheet. This will provide an annual data summary for tracking, reporting and progress monitoring purposes. We have also placed policies to collect the water loss data and some of the measures include the use of hydrant meters on the city's use of city water for flushing and other purposes.</p> <p><u>Implementation Timeframe:</u> Finalize by May 2017</p> <p><u>Comments:</u></p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Linear Infrastructure</p>		

Rec. # 3	We recommend the Department of Watershed Management estimate the number of staff needed to manage the expected volume of vacant accounts compared to the revenue lost through unauthorized consumption and add resources to monitor vacant accounts, if shown to be economically advantageous.	Agree
<p><u>Proposed Action:</u> The Department has modified the process to handle unauthorized consumption on vacant accounts. As of March 6, 2017, seven investigators from the Office of Safety, Security & Emergency Management have been assigned to investigate vacant properties with water consumption, which will assist in reducing the backlog. We are already seeing results from the process change; customers are coming into the Department to set up accounts and payment plans for back-billed usage. We anticipate that the current backlog will be substantially reduced within the next three months.</p> <p><u>Implementation Timeframe:</u> Fully implemented</p> <p><u>Comments:</u></p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Financial Administration; Director, Office of Safety, Security & Emergency Management; Director, Office of Performance and Accountability</p>		
Rec. # 4	We recommend the Department of Watershed Management implement the system to alert customers of suspected leaks.	Agree
<p><u>Proposed Action:</u> The Department has several initiatives underway to address the accuracy of billing, including manual reviews of high consumption accounts. Currently, residential accounts with a 100% increase over the average consumption are flagged for an alert via robo-call from the department. The customer is given a call back number to discuss potential causes of the high consumption. The department is planning to move to AMI (Advanced Metering Infrastructure) which will allow for automatic leak alerts that can be accessed by the customer via the customer portal. A pilot of AMI metering technology is planned for late Summer 2017. In addition, the Department will pilot meter health and analytics technology for large meters this Spring. This technology alerts to the accuracy and health of the meter.</p> <p><u>Implementation Timeframe:</u> August 2017 (AMI Pilot)</p> <p><u>Comments:</u></p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Customer Care and Billing Services</p>		

Rec. # 5	We recommend the Department of Watershed Management finalize the draft standard operating procedure for tracking and reporting hydrant meters and begin enforcing provisions to track meters and collect billing data.	Agree
<p><u>Proposed Action:</u> The Department plans to finalize the procedures for tracking and reporting rental hydrant meters. Part of these procedures will include the monitoring and collection of billing data.</p> <p><u>Implementation Timeframe:</u> June 2017</p> <p><u>Comments:</u></p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Financial Administration</p>		
Rec. # 6	We recommend the Department of Watershed Management finalize the water loss control program.	Agree
<p><u>Proposed Action:</u> The Department has many activities underway related to water loss; however, the Department plans to engage a Water Loss Consultant to prepare a formal, comprehensive Water Loss Control Program Plan that will integrate the various necessary program elements being implemented by DWM.</p> <p><u>Implementation Timeframe:</u> June 2017</p> <p><u>Comments:</u></p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Watershed Protection</p>		
Rec. # 7	We recommend the Department of Watershed Management select specific goals, or performance indicators, for the water loss control plan in order to measure and improve water supply efficiency.	Agree
<p><u>Proposed Action:</u> Specific goals and metrics will be developed and formalized as part of the proposed Water Loss Control Program Plan that will integrate current program elements. The plan will include both short-term and long-term goals and metrics that will help improve DWM's confidence in the data used for estimating Apparent Losses and track reductions of Real Water Loss.</p> <p><u>Implementation Timeframe:</u> December 2017</p> <p><u>Comments:</u> Dependent on putting task order for service in place immediately</p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Watershed Protection</p>		

Rec. # 8	We recommend the Department of Watershed Management include leak management and capital improvement plan initiatives as a part of the overall water loss control program.	Agree
<p><u>Proposed Action:</u> The Department is in the process of developing a Department Strategic Plan including strategy for water loss reduction. Finalizing the Water Loss Control Program Plan to include descriptions of the processes for leak management, planned capital investments, and tracking implementation progress will be included as part of the strategy.</p> <p><u>Implementation Timeframe:</u> December 2017</p> <p><u>Comments:</u> Same task order as No. 7</p> <p><u>Responsible Person:</u> Deputy Commissioner, and Asset Manager, Office of Engineering Services</p>		
Rec. # 9	We recommend the Department of Watershed Management ensure the water loss team meets at least twice a year, as recommended, to assess progress in reducing water loss.	Agree
<p><u>Proposed Action:</u> The proposed Water Loss Control Program Plan will include both short-term and long-term schedules for achieving the goal established.</p> <p><u>Implementation Timeframe:</u> December 2017</p> <p><u>Comments:</u> Same task order as No. 7</p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Watershed Protection</p>		
Rec. # 10	We recommend the Department of Watershed Management participate in the voluntary distribution system audits with the Georgia Association of Water Professionals.	Agree
<p><u>Proposed Action:</u> Once the Water Loss Control Program Plan is final and has completed one-year of formal implementation, DWM will request an independent distribution system audit from GAWP.</p> <p><u>Implementation Timeframe:</u> March 2019</p> <p><u>Comments:</u> Pending completion of 2018 reporting year</p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Watershed Protection</p>		

Rec. # 11	We recommend the Department of Watershed Management create a mechanism to use for tracking individual goals and the volume of water saved from apparent and real loss categories, including the various initiatives and methods used, and to relate the revenue recovery or cost reduction as appropriate in order to demonstrate progress of the water loss control program.	Agree
<p><u>Proposed Action:</u> The Department has developed a draft tracking spreadsheet designed for interim tracking on a year-by-year comparison basis. In addition, OLIO developed a water loss tracking system that will be used to track more detailed information, beginning with calendar year 2017. Based on future data, the Department will be able to improve on implementation initiatives developed in the Water Loss Control Program Plan that will help the City to further reduce overall system water losses. These processes will be formalized in the Water Loss Prevention Program Plan and implemented by the Department. As part of revenue recovery efforts under our Collections Unit, we are tracking the revenue recovered from vacant with consumption accounts and illegal tie-ins.</p> <p><u>Implementation Timeframe:</u> Partially implemented – May 2017 (finalize framework)</p> <p><u>Comments:</u></p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Watershed Protection</p>		
Rec. # 12	We recommend the Department of Watershed Management submit annual water audits to the American Water Works Association for benchmarking and comparison.	Agree
<p><u>Proposed Action:</u> DWM will submit its 2016 Water Loss Audit Report to the AWWA for benchmarking and comparison and will continue to do so in future years.</p> <p><u>Implementation Timeframe:</u> June 2017</p> <p><u>Comments:</u></p> <p><u>Responsible Person:</u> Deputy Commissioner, Office of Watershed Protection</p>		

Appendix B: Management Response to Water Loss Audit



Kasim Reed
MAYOR

CITY OF ATLANTA
DEPARTMENT OF WATERSHED MANAGEMENT
72 MARIETTA STREET NW
ATLANTA, GEORGIA 30303

Kishia L. Powell
COMMISSIONER

MEMORANDUM

To: Leslie Ward, City Auditor

From: Kishia L. Powell *AP 3.15.17*
Commissioner, Department of Watershed Management

Date: March 15, 2017

RE: Watershed Management Response to Water Loss Audit

The Department of Watershed Management appreciates the work that the auditors have contributed to this project and the recommendations made for improvements and implementation of measures to reduce the amount of real and apparent water losses that attribute to the 30% of estimated non-revenue water we are experiencing. The Department has agreed with the recommendations overall and believes that they mirror the industry guidance provided in the American Water Works Association Manual of Practice No. 36; a best practice that the Department has adopted as the foundation of a water loss control program and continued development of our asset management framework.

Given the work the Department has had underway to identify and address water loss, DWM believes that it is important to provide additional information and context to the annual Water Loss audit prepared by your team, which we understand is largely based upon the draft report prepared by our consultant; to describe the efforts and initiatives underway to reduce water loss; and explain the barriers we have faced in making more substantial progress in certain areas. These barriers are typical among water utilities and are largely contingent upon funding, particularly for those utilities that have been required to make substantial investments in sewer infrastructure as part of consent decree programs.

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The annual Water Loss Audit is intended to measure the quality of the data used to measure and track real and apparent water loss; the results are intended to drive water loss control initiatives.

DWM has conducted annual water loss audits since 2011 using the American Water Works Association (AWWA) tracking program; this annual audit became a mandate in 2016. The program was developed to provide a guidance tool to water suppliers for loss control planning and resource allocation, not solely as an assessment of operational efficiency.

The audits are intended to assist a utility in measuring both real and apparent losses. The *Georgia Water System Audits and Water Loss Control Manual* define these as follows:

Real Losses are the annual volumes lost through all types of leaks and breaks in water mains and service connections, up to the point of customer metering. Real losses also include overflows from treated water storage tanks or reservoirs.

Apparent Losses occur due to errors generated while collecting and storing customer usage data. The three categories of apparent losses include: *Unauthorized Consumption, Customer Metering Inaccuracies, and Systematic Data Handling Errors.*

Based upon our annual internal water loss audit, our overall water loss percentage is approximately 30% with 77% of the losses being attributable to real losses and 23% being attributable to apparent losses. We believe these components are reflective of the trend that we have seen in the year over year increase of water leaks and breaks as well as a focus on reducing unauthorized consumption through a dedicated investigations unit and increased collection activities. Additionally, our data validity score has improved from 60% for 2013 to 74% for 2016.

Since 2012, DWM has used a three-pronged approach to address water losses: **1)** improving the quality of the data used in the AWWA model to ensure that actual conditions are accurately represented; **2)** developing and implementing programs to reduce and eliminate sources of real and apparent water loss, including repairs of outstanding water leaks on mainlines, service lines and hydrants and responding to water main breaks more timely; and **3)** reprogramming capital investments to address the water distribution system repair and replacement needs following

the September 2012 amendment to the First Amended Consent Decree that extended the completion schedules for the mandated sanitary sewer system projects to allow for investment in water infrastructure.

Data Quality Improvement.

Watershed Management's four recent audits have demonstrated an upward trend in the reliability of the data, going from a 60 percent confidence level for calendar year 2013 to a 74 percent confidence level for calendar year 2016. While this is a positive trend, DWM acknowledges that much more can be done to further improve the data confidence level, as noted in the City Auditor's report and in DWM's concurrence with their recommendations. For example, DWM has issued a task order that includes upgrading the data monitoring and collection systems at the Hemphill Water Treatment Plant (WTP) and is in the process of acquiring high quality equipment to provide more detailed and accurate information for field leak detection efforts.

Approaches for Reduction of Real and Apparent Losses. Although the data confidence levels have been increasing, the trends suggested by the annual audit reports provide clear indications of areas for improvement that are being proactively addressed. Currently, DWM has the operational and programmatic elements necessary for an effective Water Loss Control Program; however, these various programs and elements are currently being assimilated into a consolidated program plan. To this end, DWM initiated development of a program plan in mid-2016 that will be finalized and under implementation by the end of 2017.

Once finalized, the Water Loss Control Program Plan will address a variety of operational and monitoring processes, including:

- Programmatic goals and initiatives;
- Leak detection and monitoring programs;
- Leak repair and service delivery programs;
- Record management requirements and standards;
- Capital Improvement Plan (CIP) investments; and
- Metrics for tracking progress and identifying priority initiatives.

Capital Investment. In 2012, the City submitted a request for an amendment to the First Amended Consent Decree (FACD) largely due to the need to increase investments in water distribution infrastructure as well as water and wastewater facilities. A primary consideration in granting the amendment was the recognition that the City of Atlanta had the highest water and sewer rates in the US and that the available funding was limited. As a result, the US Environmental Protection Agency, the Georgia Environmental Protection Division, the Chattahoochee Riverkeeper (formerly Upper Chattahoochee Riverkeeper), and the Court recognized the need to reduce the rate of spending for compliance with the FACD by extending the final compliance deadline to allow the City to start re-investing in the water supply operations.

When this amendment went into effect on July 1, 2014, CIP funds for the next year had been programmed and committed to existing and pending projects. However, since 2015, as these projects have been completed, DWM has been able to reallocate and redistribute these funds more broadly in order to address drinking water assets while still remaining on schedule to complete the FACD by the 2026 deadline.

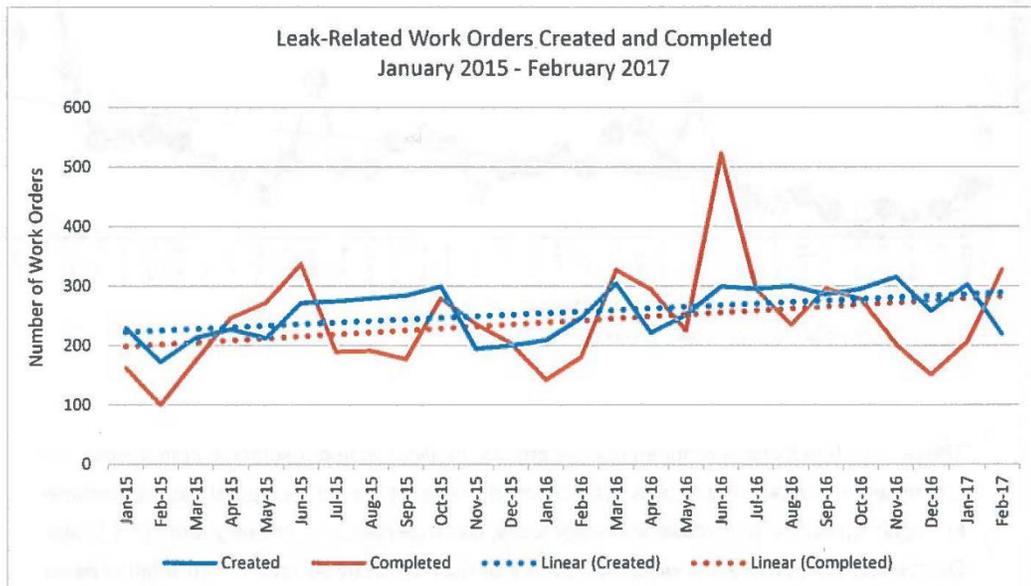
In the most recent DWM CIP, DWM has allocated nearly \$480 million for 13 major projects dedicated to facility and distribution systems improvements.

Watershed Management is also currently implementing several other initiatives that will directly help reduce water loss. These include:

- Prioritization of water line repair and replacement programs specifically coordinated with Renew Atlanta paving project sites;
- A large diameter water main assessment and leak detection program;
- Water distribution system modeling and master plan development for Hartsfield-Jackson International Airport;
- Evaluation and selection of system-wide leak detection sensor technology; and
- A large meter accuracy assessment pilot program designed to identify large meters that may be at risk before they fail.

The Department's workload has increased over time, particularly in the areas of leaks and water main breaks.

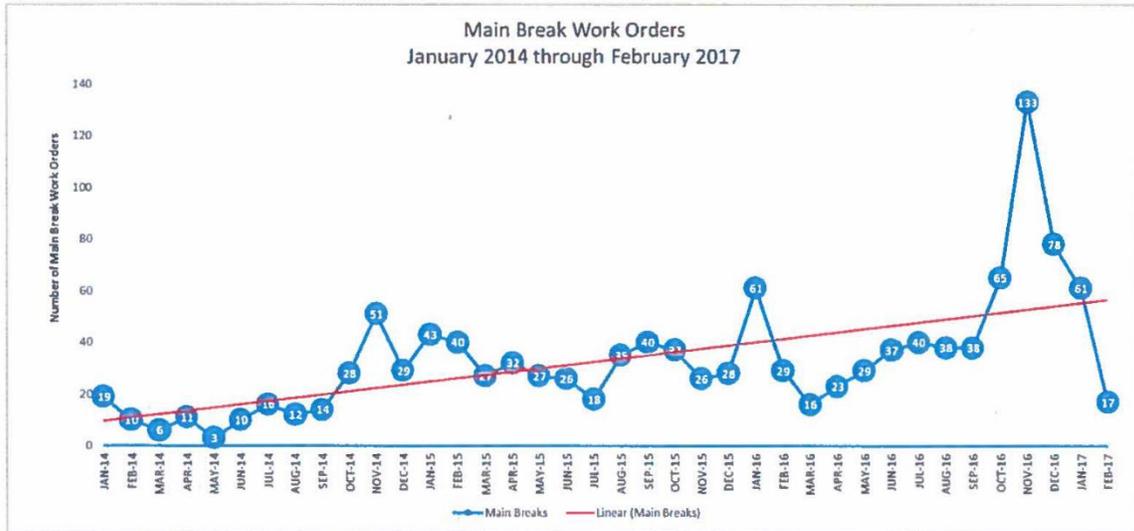
The Office of Linear Infrastructure & Operations (OLIO) has completed 23% more leak and main break work orders in 2016 compared to 2015; however, the number of incoming work orders also increased by 15% during the same time, as shown in the chart and graph that follow. The increase in backlogged work orders is in part due to limited funding available to allocate to water distribution system improvements as well as limited internal resources including crews and equipment. The DWM is now in the position to make these investments and as of September 2016, has implemented strategies to leverage external resources to assist in reducing the backlog by making the necessary repairs to outstanding leaks and improve resolution times for valve operations and resolution of breaks to limit water loss. The leak-related work orders include various leak types, including hydrants, meters, service lines, sidewalk, valve, and street leaks. The following figures illustrate the trends in increased water infrastructure failures.



Note: Work Order activity codes: DWBVS, DWHKOL, DWHLK, DWRCC, DWRML, DWRSK, DWRSLK, DWRTL, DWSLR, DWVL, and DWVR.

CY	Leak-Related Work Orders Created	Leak-Related Work Orders Completed
2015	2,854	2,568
2016	3,279	3,147
% Change	15%	23%

Another factor impacting the Department's ability to address leaks across the city is the increase in water main breaks throughout the distribution system. In November 2016 alone, the department experienced 133 main breaks, as shown in the graph that follows.

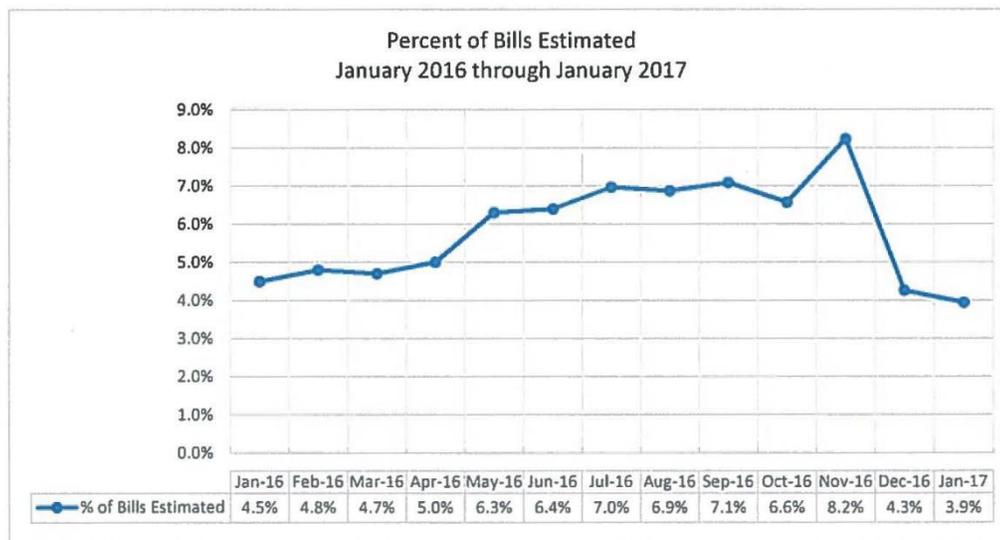


Note: Work Order activity code: DWRMB

These main breaks have required the Department to divert limited resources, both internal and contracted, to address the breaks. The Office of Linear Infrastructure Operations, responsible for repairing water main breaks and water leaks, has experienced a vacancy rate in the Water Distribution Division of 22%, which has left the Division down by six crews. While this division has been supplemented by contracted labor to provide service and ramp up efforts to tackle the workload as timely as possible, as with all utilities, the finite pool of resources does not readily expand to meet the demands of increased infrastructure failures. This leads to longer resolution

times as identified in your report. DWM is actively recruiting to fill internal positions and will continue to allocate the funding available to work on this effort.

Additionally, the Department has also decreased the percentage of estimated bills by repairing or replacing broken meters and broken registers. The percent of estimated bills reached a high of 8.2% in November 2016, and dropped to 4% by January 2017 due to meter infrastructure repairs. This is a significant impact to the reliability of data and reconciliation of what we treat versus what we invoice.



Again, the Department of Watershed Management has appreciated the opportunity to discuss the findings and existing draft report with the Audit team. The Department recognizes the importance of reducing/controlling water loss to meet industry benchmarks and as a means of providing the best service to our customers and the best stewardship of their investments. We see the water loss auditing process as a means of collecting and analyzing data that assists us in prioritizing our investments and adapting our management practices which is the true intent of a water loss audit.