City of Austin
Office of the City Auditor

Audit Report

Water Main Maintenance and Replacement

March 2025

Water main leaks cause the City to lose a considerable amount of water, but Austin Water is working to minimize these leaks. The City's water main failure rate has been generally decreasing over time. The City has taken positive steps to identify and address issues with its water mains and minimize resulting disruptions. However, Austin Water has not formally documented certain policies and procedures related to water mains. Austin Water should document these policies and procedures to ensure they consistently focus on their most at-risk water mains.

Water Main Maintenance and Replacement Audit

Objective

Is the City identifying and addressing issues with water mains effectively and taking appropriate measures to minimize resulting disruptions?

What We Found

Austin Water transports treated water underground to customers through water mains. Sometimes water mains fail and cause leaks. Leaks can range in severity and visibility from small and concealed to large and flooding. Water main leaks cause the City to lose a considerable amount of water. Leaks and associated repairs can contribute to a host of disruptions. These could include temporary water outages, road closures, and pipe excavations. In rare cases, water main breaks can be catastrophic and seriously hamper a utility's ability to service their customers.

The City has seen a steady increase in water loss over time. Yet, the City's water main failure rate has also been generally decreasing over time. The City has taken positive steps to identify and address issues with its water mains and minimize resulting disruptions. However, Austin Water has not formally documented certain policies and procedures related to water mains. It is important for Austin Water to do this to ensure they focus on the most at-risk pipes and maintain institutional knowledge.

What We Recommend

The Austin Water Director should ensure policies and procedures related to condition assessment, leak detection, and pipe replacement projects are fully and formally documented.

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Cover: Austin Water

Objective

Is the City identifying and addressing issues with water mains effectively and taking appropriate measures to minimize resulting disruptions?

Background

Austin Water serves over one million customers in and around Austin. Austin Water draws its water from the Colorado River and treats it to make it safe to drink. Treated water first moves through large pipes called transmission mains, which distribute water to large areas. These connect to smaller pipes known as distribution mains. Combined, Austin Water has roughly 4,000 miles of water mains. Smaller pipes, called service lines, bring water from water mains to individual homes and businesses.

Exhibit 1: Water mains convey treated water from plants to customers

SOURCE: OCA's summary of the water distribution system, January 2025.

Sometimes water mains break and cause leaks. Various factors contribute to water main breaks such as the following:

- Pipe age and material
- External conditions (e.g., water pressure, temperature, soil and ground conditions, etc.)
- Accidental pipe strikes (e.g., construction work)

Breaks can range in severity and visibility from small leaks that generally go unnoticed to large leaks that gush water into the street. A typical water main repair takes several hours, but large repairs can last multiple days. Repairs may cause temporary water outages. They may also cause road closures and contribute to traffic. Many repairs require the utility to cut through the road to access a main. Street cuts may worsen road conditions. In rare cases, water main breaks can be catastrophic and seriously hamper a utility's ability to serve their customers.

Austin Water has been losing increasing amounts of water year over year. For instance, Austin Water lost an estimated 6.5 billion gallons of water in 2021, 6.9 billion gallons in 2022, and 7.1 billion gallons in 2023. Water main failures contribute to this. To help minimize water loss and resulting disruptions, it is important for water utilities to identify and address issues in their water mains.

According to the American Water Works Association, water utility infrastructure may be much less costly to replace before failure.

What We Found

Summary

Water main leaks cause the City to lose a considerable amount of water, but Austin Water is working to minimize these leaks. The City's water main failure rate has been generally decreasing over time. The City has taken positive steps to identify and address issues with its water mains and minimize resulting disruptions. However, Austin Water has not formally documented certain policies and procedures related to water mains. Austin Water should document these policies and procedures to ensure they consistently focus on their most at-risk water mains.

Finding 1

Although the City has seen a steady increase in water loss over time, the City has taken positive steps to identify and address issues with its water mains and to minimize resulting disruptions.

Water Loss

Water loss is a result of leaks and failures throughout the water distribution system. A recent independent analysis commissioned by Austin Water found that they have been losing more and more water each year through leaks and other means.[1] In 2023, Austin Water lost an estimated 7.1 billion gallons of water, enough water to fill Lake Austin. Water main failures contribute to this. However, we learned that Austin Water is within industry standards for water loss. One such measure is the infrastructure leakage index (ILI). Target ILI's range from 1.0-8.0 depending on a utility's financial and operational constraints and access to available water. ILI acknowledges that some water loss is unavoidable. The model recommends lower levels of water loss and lower target ILI's when a utility has tighter constraints.

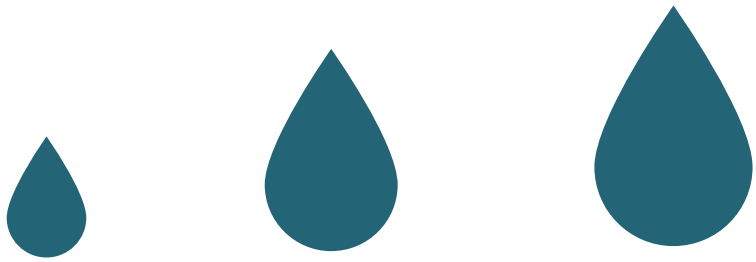
Austin Water currently has an ILI of 4.1. According to the American Water Works Association (AWWA), this is an acceptable level of water loss for utilities that have enough water to meet their long-term needs. However, AWWA recommends that utilities with more limited water strive for an ILI of 3.0 or less. The AWWA discourages utilities from having an ILI greater than 8.0 regardless of their situation. As part of the Water Forward plan, Austin Water's goal is to reduce their ILI to 3.0 by 2040. Water Forward is Austin's 100-year integrated water resource plan. The plan helps ensure that Austin has safe, reliable, affordable, and equitable water for years to come. Repairing and replacing broken and at-risk water mains are key parts of the plan to help Austin Water reduce water loss.

[1] Black & Veatch, Water Loss Program Review, Analysis & Optimization, October 1, 2024.

Water Main Maintenance & Replacement

Austin Water's water main failure rate has been decreasing over time and is below industry average. Austin Water is regarded as an "optimized" utility based on this rate.

Exhibit 2: Austin Water's breaks per 100 miles of water main is below average and optimized benchmarks



Austin: 9.2 | Optimized: 15 | Industry Average: 25

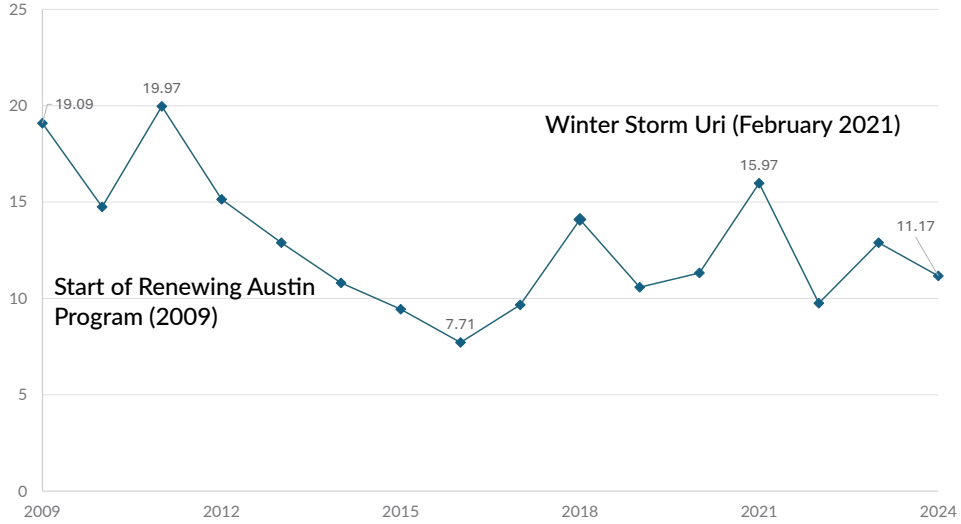
SOURCE: Black & Veatch Analysis of Austin Water's water loss program, October 2024.

According to industry research, water utilities should be risk-based in their asset management of water mains.

Austin Water conducts various activities to keep the water main failure rate low. Austin Water replaces small-diameter pipes that have a history of failure as part of the Renewing Austin program. Austin Water considers multiple risks and characteristics when deciding which pipes to replace. The utility also considers data that repair crews collect when they are conducting their work. Austin Water houses the data in their computerized maintenance management system. Austin Water has approximately 30 years of data to help inform replacement decisions. Staff have reported that Renewing Austin has played a key role in the declining water main failure rate.

According to the U.S. Environmental Protection Agency, water utilities should collect data during repairs and use it to inform maintenance decisions.

Exhibit 3: Austin Water's water main failure rate has been generally decreasing over time since the beginning of the Renewing Austin Program in 2009



Source: OCA's analysis of Austin Water's water main failure rate Fiscal Years 2009 - 2024, January 2025

According to the Texas Water Development Board, leak detection is an important part of a proactive water loss program.

Leak Detection helps identify the location of breaks in water mains where water is already leaking.

Condition Assessments help detect if larger water mains may be at risk of breaking in the future.

Austin Water conducts activities to identify and monitor water main issues. For instance, Austin Water and its contractors plan and execute leak detection and condition assessment projects for large-diameter water mains. Austin Water and its contractors also plan and execute leak detection on small-diameter water mains. These practices help Austin Water find existing leaks and identify water mains that are at risk of breaking.

Water Main Repairs

According to the University of North Carolina, water utilities should use a work order system that prioritizes the most critical repairs.

Austin Water has a leak repair operation that appears to be risk-based. Austin Water prioritizes their work based on several factors. Austin Water characterizes Priority 1 leaks as significant, surfacing, and/or causing damage. These are the most urgently prioritized leaks. Austin Water has a goal of responding to Priority 1 leaks within 3 hours. Austin Water has been approximately hitting this goal in recent years. When a leak is discovered, Austin Water sends an inspector to identify the source of the leak. If the leak is coming from the City's pipes, the inspector may be able to fix it themselves. If they are unable to do so, Austin Water will send a work crew to conduct the repair. Austin Water has emergency and weekend staffing to address leaks outside of normal business hours. Austin Water also has contractors in place for particularly complex and resource-intensive repairs.

Emergency Monitoring and Customer Communication

According to the Texas Commission on Environmental Quality, preparation for emergencies includes creating plans, establishing means of communication, and readying the acquisition and distribution of supplies.

Austin Water actively conducts emergency monitoring. The utility coordinates with various City entities in advance of and during emergencies. These entities include, but are not limited to:

- Mayor and Council
- City Manager's Office
- Communications and Public Information Office
- Homeland Security and Emergency Management

When necessary, Austin Water has many sound policies and practices for communicating with customers and minimizing disruptions from water outages. These practices vary depending on the extent and duration of the issue, and whether an outage was planned. Communication tools and activities include reaching out to customers through the utility's customer

portal, calling or texting customers, and placing door hangers at residences and businesses. Austin Water may also provide bottled water to customers during prolonged outages.

Minimizing Resulting Disruptions

Various disruptions can arise from water mains. Leaks and repairs may cause outages. However, Austin Water's water distribution system has redundancy. This means that there are generally multiple routes of water delivery to customers in the event of a water main failure. Austin Water's leak repair operation prioritizes water provision for customers, especially schools and hospitals. Austin Water's leak repair operation also prioritizes reducing water loss.

According to the United States Department of Transportation Federal Highway Administration, policies should be established to allow for utility coordination and minimize disruptions in the right-of-way.

Water main repairs may disrupt traffic and weaken road quality. Austin Water leverages a traffic control vendor for repairs that require crews to work in the right-of-way. In addition, Austin Water has a permitting process with the Transportation Public Works (TPW) department to manage road closures and traffic during repairs. The process includes emergency procedures. Also, Austin Water has a service level agreement with TPW to repair roads and sidewalks following repairs. TPW has helped restore road quality more timely through this arrangement. Lastly, external entities sometimes strike the City's water mains when digging underground. This can cause disruptions. Austin Water has a process to assess fees and hold entities accountable for damages.

Finding 2

Austin Water has not formally and fully documented certain procedures related to pipe maintenance, repair, and replacement. As a result, it is possible that Austin Water may not always focus on their most at-risk pipes. This could impact the water distribution system and contribute to disruptions for residents and visitors.

According to The Association of Metropolitan Water Agencies, knowledge management is a cornerstone of "effective utility management" (EUM). EUM is critical to ensuring reliable utility operations and fostering continuous improvement. A key part of this is documenting how and why decisions are made. Austin Water has not formally documented all their policies and procedures for prioritizing, planning, and preparing large-diameter leak detection and condition assessment projects. Instead, it seems like undocumented institutional knowledge drives many decisions.

Austin Water's pipe replacement projects can address issues with water mains. As a result, they help reduce water loss and other disruptions. Austin Water has documented some policies and procedures for prioritizing small-diameter pipe replacement projects. However, staff have yet to formalize criteria for more subjective and qualitative factors that inform project prioritizations. Conversations with staff suggest that they are working to establish firmer criteria for these decisions.

Failing to document policies and procedures for these efforts could pose challenges. For instance, it could cause Austin Water to not consistently focus on their most problematic water mains. This could result in issues with water mains going unidentified or unaddressed and may contribute to further disruptions for residents and visitors. Formally documenting such information can help ensure that Austin Water maintains knowledge in these areas. This is particularly important when there are personnel changes at the utility.

Additional Observation

Austin Water faces challenges with service lines, but they are working to address them.

Service lines are smaller pipes that bring water from water mains to customers at residences, businesses, and other settings.

This audit focused on water mains. However, as we conducted our work, we learned that Austin Water leak repair crews respond to leaks for service lines more often than for mains. Also, Austin Water's failure rate for service lines is higher than industry average. We did not conduct in-depth work in this area, but staff reported that the utility's high failure rate is largely due to polybutylene lines. The City discontinued the use of polybutylene lines years ago, but this material is much more prone to breaking compared to other materials. These lines also account for a disproportionate share of all repairs.

It may be less disruptive and ultimately more cost effective to replace polybutylene service lines outright when they have a break history. While Austin Water replaces some polybutylene service lines, their performance measures motivate swift repairs. This may be problematic because staff informed us that service lines that have broken once are much more likely to break again. For example, there have been several instances in which Austin Water leak repair crews visited the same customer over ten times to repair their service line.

It appears that service lines are becoming an increasing priority at Austin Water. Staff have communicated the issue to Austin Water management. Staff have also taken steps to address the issue that include analyzing their work order data and speaking with staff dealing with similar issues in other utilities. Austin Water staff reported that they are developing a formal strategy to address the issue. For instance, staff have looked at how the San Antonio Water System (SAWS) handles their service lines. They learned that SAWS has a contract to replace service lines when they break instead of repairing them.

Recommendations and Management Response

1 The Austin Water Director should formally and fully document policies and procedures for the following areas:

- Prioritizing, planning, and preparing large-diameter pipe leak detection and condition assessment projects.
- Prioritizing small-diameter pipe replacement projects.

Management Response: Agree

Proposed Implementation Plan: Austin Water staff will prepare a formal document detailing our processes for prioritizing, planning, and preparing large-diameter pipe leak detection and condition assessment projects. Austin Water staff will also prepare a formal document detailing our processes prioritizing small-diameter pipe replacement projects.

Proposed Implementation Date: Both documents will be completed by 9/30/2025.

Scope

The audit scope included Austin Water's water main maintenance, repair, and replacement activities and interactions with other relevant entities.

Methodology

To complete this audit, we performed the following steps:

- Interviewed City staff from Austin Water and Transportation Public Works
- Engaged with and observed the Water and Wastewater Commission
- Reviewed relevant polices, plans, procedures, and reports
- Analyzed data for performance measures and water main failure work order history
- Researched best practices and background information for water main maintenance, repair, and replacement activities
- Evaluated internal controls for water main maintenance, repair, and replacement activities
- Evaluated the risk of fraud, waste, and abuse related to water main maintenance repair, and replacement activities

Audit Standards

We conducted this performance audit in accordance with Generally Accepted Government Auditing Standards. Those 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.

The Office of the City Auditor was created by the Austin City Charter as an independent office reporting to City Council to help establish accountability and improve City services. We conduct performance audits to review aspects of a City service or program and provide recommendations for improvement.

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