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DALLAS WATER UTILITIES

City of Dallas

2024 Water Conservation Five-Year Work Plan

Draft 03.05.24

Fiscal Years 2015-16 through 2021-22

www.savedallaswater.com

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ES.0 Executive Summary

Dallas Water Utilities (DWU) is a major retail and wholesale provider of water in North Texas currently serving more than 2.5 million people. DWU has met the water and wastewater needs of the City of Dallas since 1881. DWU currently supplies treated water to 23 wholesale treated water customers and untreated water to four wholesale customers.

Dallas meets these needs through a system of six surface water reservoirs and through its transmission, treatment, and distribution facilities. These geographically diverse reservoirs are in different watersheds therefore allowing the capability of balancing the level of use in each reservoir to ensure that the supply of any single reservoir will not be prematurely exhausted.

The reservoirs comprising DWU's system are subdivided into western and eastern systems. This designation corresponds to DWU's overall water treatment system infrastructure, which includes two western water treatment plants, Bachman Water Treatment Plant (WTP) and Elm Fork WTP, and one eastern water treatment plant, East Side WTP. There are two wastewater treatment plants (WWTP) in the DWU water system—Central and Southside. Recycled water projects, existing and proposed, are also components of the DWU water system.

ES.1 Water Conservation as a Demand Management Tool

Water Conservation is defined as "those practices, techniques and technologies that will reduce the consumption of water, reduce the loss and waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses" (Texas Water Code § 11.002 (a) (8) (B)).

State of Texas Requirements

The Texas Administrative Code Title 30, Chapter 288 (30 TAC § 288) requires holders of an existing permit, certified filing, or certificate of adjudication for the appropriation of surface water in the amount of 1,000 acre-feet a year or more for municipal, industrial, and other non-irrigation uses to develop, submit, and implement a water conservation plan and to update it every five years. Because DWU provides water as a municipal public and wholesale water supplier, its Water Conservation Plan must include information necessary to comply with Texas Commission on Environmental Quality (TCEQ) requirements for each of these designations. The minimum requirements of Subchapter A that must be included in the City of Dallas Water Conservation Plan are summarized below.

- **Utility Profile:** Includes information regarding population and customer data, water use data (including total gallons per capita per day (GPCD) and residential GPCD), water supply system data, and wastewater system data.
- **Description of the Wholesaler's Service Area:** Includes population and customer data, water use data, water supply system data, and wastewater data.
- **Goals:** Specific quantified five-year and ten-year targets for water savings to include goals for water loss programs and goals for municipal and residential use, in GPCD.

- **Accurate Metering Devices:** The TCEQ requires metering devices with an accuracy of plus or minus 5 percent for measuring water diverted from source supply.
- **Universal Metering, Testing, Repair, and Replacement:** The TCEQ requires that there be a program for universal metering of both customer and public uses of water for meter testing and repair, and for periodic meter replacement.
- **Leak Detection, Repair, and Control of Unaccounted for Water:** The regulations require measures to determine and control unaccounted-for water. Measures may include periodic visual inspections along distribution lines and periodic audits of the water system for illegal connections or abandoned services.
- **Continuing Public Education Program:** TCEQ requires a continuing public education and information program regarding water conservation.
- **Non-Promotional Rate Structure:** Chapter 288 requires a water rate structure that is cost based and which does not encourage the excessive use of water.
- **Reservoir Systems Operational Plan:** This requirement is to provide a coordinated structure for operation of reservoirs owned by the water supply entity within a common watershed or river basin to optimize available water supplies.
- **Wholesale Customer Requirements:** The water conservation plan must include a requirement in every water supply contract entered or renewed after official adoption of the Water Conservation Plan, and including any contract extension, that each successive wholesale customer develop and implement a water conservation plan or water conservation measures using the applicable elements of Title 30 TAC Chapter 288.
- **Means of Implementation and Enforcement:** The regulations require a means to implement and enforce the Water Conservation Plan, as evidenced by an ordinance, resolution, or tariff, and a description of the authority for conservation plan enforcement.
- **Coordination with Regional Water Planning Groups:** The water conservation plan should document the coordination with the Regional Water Planning Group for the service area of the public water supplier to demonstrate consistency with the appropriate approved regional water plan.

The 2024 Water Conservation Five-Year Work Plan (covering FY 2015-16 through FY 2021-22) serves as a road map for compliance with the state's mandates. It also serves as a major component of DWU's long range water supply strategies.

Benefits of Water Conservation

A well-designed Water Conservation Plan will not deprive the community of essential water uses; it will provide a blueprint for efficient water use. The benefits of water conservation include those derived from avoided costs, and benefits that may not be easily enumerated in terms of dollars yet hold significant importance in terms of value. Benefits of water conservation include:

- **Delays the need to develop expensive future water supplies.** Costs associated with developing new water supplies (or purchasing new water) are numerous. These can include capital costs for

construction of reservoirs, pumping facilities, pipelines, treatment plants, water storage, and related facilities; costs of obtaining water rights and permits; and operational costs such as labor, energy, and chemicals.

- **Extends the life of existing water supplies and infrastructure.** Pressures within the water system will increase in localized areas to meet increasing customer demands. Increased pressures within an aging infrastructure will mean more leaks from the system. When water demands are maintained or reduced through conservation, higher system pressure is avoided.
- **Reduces peak requirements.** A water system is sized to meet customer peak demands. When these peak demands are reduced through water conservation, a portion of the system's capacity is freed-up for other water customers. This, in effect, increases the base capacity of the system.
- **Lowers capital and operating costs of the existing system.** The need for expanding the water treatment and distribution system is delayed or avoided. Operational costs, such as power and chemicals, are also reduced.

Other benefits include the generation of positive environmental effects, improving customer goodwill and promoting a positive image for Dallas. Water Conservation is DWU's most cost-effective water supply. These water efficiency measures will work in tandem to save approximately 3.9 billion gallons or 2.1 million gallons per day (MGD) by 2027.

The Water Conservation Program, part of the City of Dallas Office of Environmental Quality and Sustainability (OEQS) is responsible for changing the perceptions and behaviors of its customers. Water conservation alone will not solve long-term water needs. Continued customer engagement and ongoing reevaluation of the conservation program are necessary to sustain the water savings that have been achieved. Anything less will erode the gains made and over time will be lost.

Water demand has been reduced despite population increases and periodic drought. As the program has expanded and matured, the next five years will focus heavily on further increasing the DWU water system's efficiency and targeted programming for the top water using premise types. These efforts are segmented by:

- Water System Improvements
- Ordinance Changes
- Continued Customer Engagement

Fifteen (15) measures have been identified for implementation and/or continuation for the 2024 Water Conservation Five-Year Work Plan (hereafter referred to as the 2024 Work Plan). Based on the DWU water use profile, the measures in Table ES-1 were selected based on estimated water savings, benefits, and costs. These measures address a broad range of customer premise types and water use types.

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Proposed Measure	User Group				Action		
	SF	MF	ICI	DWU	Ongoing	Enhanced	New
Existing Conservation Programs - Implemented Savings							
New Throne for Your Home (Single-Family Toilet)	●				●		
New Throne for Your Home (Multifamily Toilet)		●			●		
Minor Plumbing Repair Program	●	●			●		
Additional Savings - Existing Real Loss Program				●	●		
ICI Audit Program			●		●		
ICI Rebates			●		●		
Environmental Education Initiative K-12	●	●	●		●		
Residential Irrigation System Evaluation Program	●				●		
City Leadership and Commitment Grant Program			●		●		
Behavioral Changes							
Enhanced Enforcement	●				●		
Wholesale Customer Cities Program					●		
Ordinance Changes							
Landscape Ordinance Review							●
Structural Changes							
Revised ICI Incentive Program			●				●
Residential Irrigation Incentive Program	●						●
Enhanced Real Loss Reduction				●	●	●	

Table ES-1: Proposed Measures by User Group

ES.2 2024 Work Plan Development Process

The inaugural Five-Year Work Plan, adopted in 2005, and the 2010 and 2016 updates were completed by outside consultants with assistance from DWU staff. The 2024 Work Plan was a joint effort between DWU/OEQS staff and Plummer Associates, Inc.

The 2024 Work Plan was developed through a multi-faceted approach that included review of the previous water conservation planning efforts; review of numerous water conservation programs, initiatives, data, and literature; and through interviews with OEQS water conservation staff and DWU staff.

City of Dallas water use data was examined to identify strategic areas to target additional water conservation opportunities. Numerous water conservation strategies were evaluated using screening criteria, a benefit-cost analysis, and other means to determine their suitability for implementation during the next five-year planning period.

ES.3. Organization of the 2024 Work Plan

The following information and procedures are provided in the 2024 Work Plan:

- **Section 1.0: Introduction Profile** describes customer categories and water use patterns of the DWU service area, including summary data showing water use by water user category.
- **Section 2.0: City of Dallas Water Conservation Progress (OEQS)** documents water conservation measures implemented to date and resulting water savings. This section outlines proposals for new programs and recommendations for existing programs.
- **Section 3.0: DWU Planning and Wholesale Services Divisions Progress** describes planned program enhancements and recommendations as well as new conservation measures likely to be implemented.
- **Section 4.0: Wholesale Customers** examines the long-range needs of existing wholesale customers and their impact on overall water demand.
- **Section 5.0: Projected Water Savings, Estimated Costs, Benefits and Staffing** includes projected water savings, potential benefits, estimated costs, recommended budgets and staffing needs for proposed measures.
- **Section 6.0: Conclusions, Recommendations, and Work Plan Implementation** outlines the process and summarizes recommendations to be implemented during the scope of the Work Plan.
- **Appendices**
    - GANNT Chart
    - WCC TWDB Best Management Practices
    - WCC Wholesale Customer Cities GPCD, Water Loss and Consumption Graphs
    - Landscape Ordinance Review

1.0 Introduction

The City of Dallas is a regional supplier of potable and raw water that serves (in FY 2021-22) approximately 2.5 million people including approximately 1.3 million people within the City of Dallas and approximately 1.2 million people in the 23 treated Water Customer Cities (WCC). See **Figure 1-1** for population trends for the City of Dallas and the WCC.

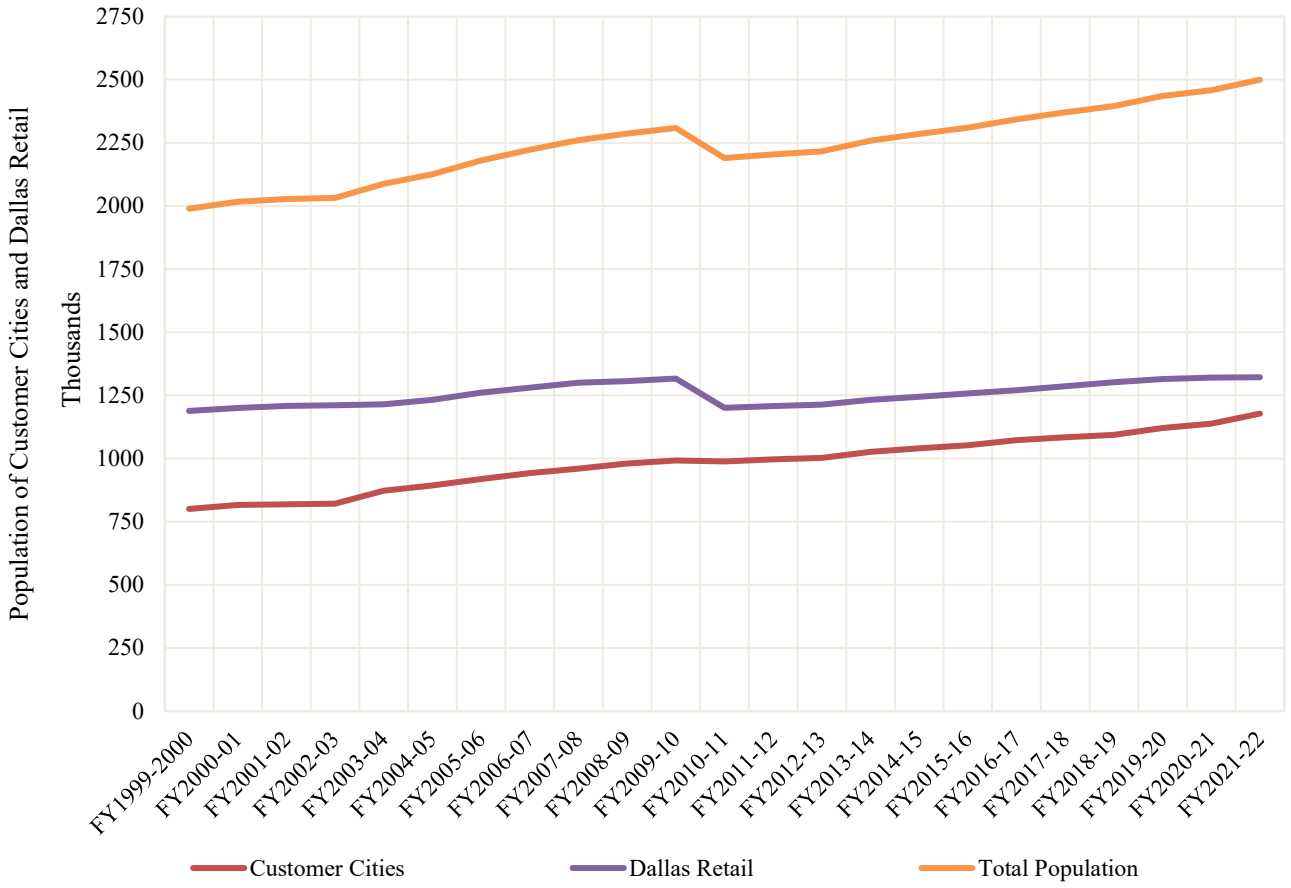

Figure 1-1: Dallas and Customer City Population FY 1999-2000 through FY 2021-22

The City of Dallas currently obtains its water supplies from six local reservoirs: Lake Tawakoni, Lake Fork, Lake Ray Hubbard, Ray Roberts Lake, Lewisville Lake, and Grapevine Lake. The connection to tie in Lake Palestine by 2027 to supply the western portion of the city is underway.

The City of Dallas Water Conservation 2024 Five-Year Work Plan (Work Plan) is a living document updated every five years. The purpose of this plan is to look at existing water conservation programs in a critical way, analyze which programs have been successful and which have not, discontinue unsuccessful programs, determine if any new water conservation programs should be added, and explore what innovative programs may offer in expenses, cost savings, and water savings. This work plan replaces the 2016 Work Plan. The 2024 Work Plan covers FY 2015-16 through FY 2021-22.

Since the completion of the 2016 Work Plan, Dallas has made several significant organizational changes. T.C. Broadnax, the Dallas City Manager, implemented administrative changes, including moving the Water Conservation Division from Dallas Water Utilities (DWU), which continues to fully fund the division, to the Office of Environmental Quality and Sustainability (OEQS), which administers the programs **Figure 1-2** outlines the new organizational structure. This move was made to consolidate existing resources, engagement, and outreach into one office to maximize resources and minimize overlap, while achieving water conservation goals.

The City of Dallas water conservation initiative consists of activities and programs throughout the city. Figure 1-2 depicts the various departments and their associated water conservation efforts. The public outreach, education, and public programs are administered by OEQS Water Conservation Division. The infrastructure improvements and water operations are administered by DWU. DWU fully funds the OEQS Water Conservation Division outreach and enhanced enforcement in code compliance. Ordinances are enforced and social media is posted by multiple departments. This chart is not comprehensive. Other City departments implement water conservation best management practices during their day-to-day activities and have not been included.

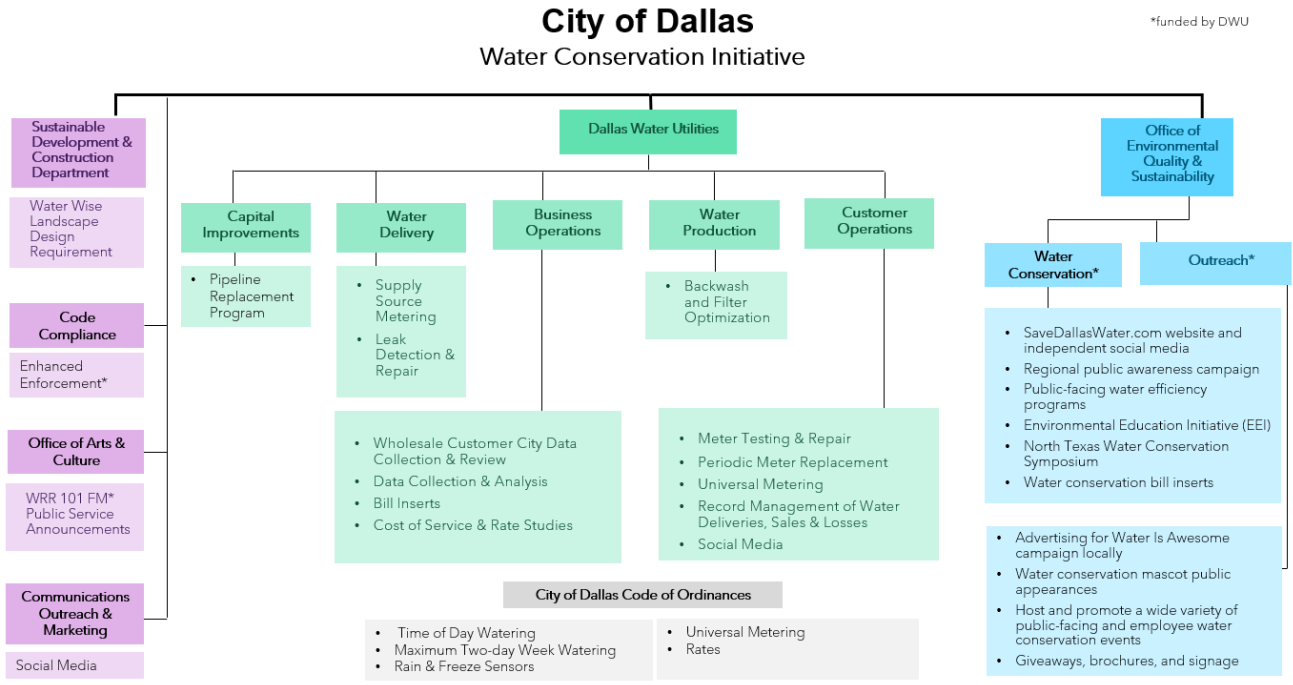

Figure 1-2: Water Conservation Organizational Chart

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1.1 City of Dallas Water Use Profile

From FY 2015-16 through FY 2021-22, Dallas's average annual treated water production was 139.46 billion gallons. Total treated water use is divided into City of Dallas retail sales, known utility system maintenance and operation losses, and sales to customer cities. As illustrated in **Figure 1-3**, during the review period, retail sales accounted for 45.08% of total treated water use and wholesale water sales accounted for 40.66%.

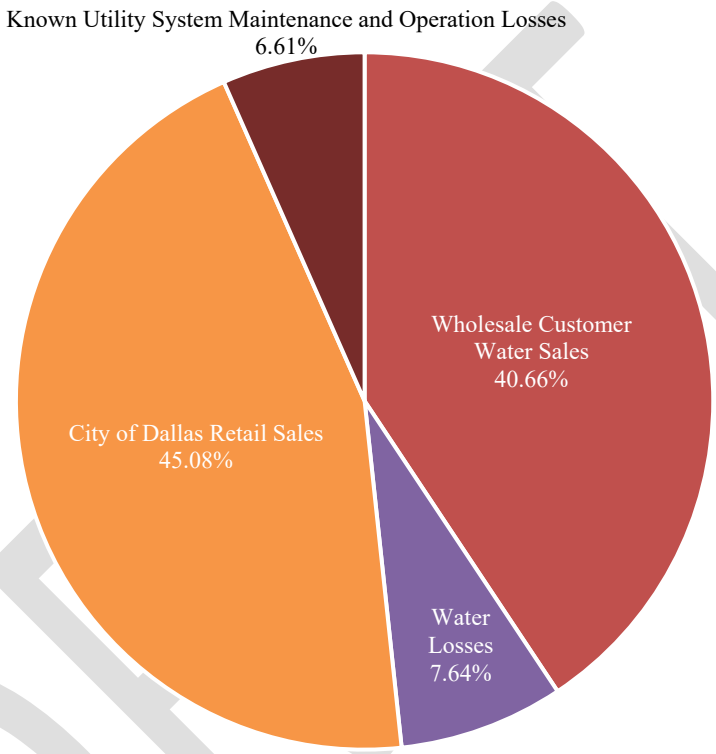

Figure 1-3: Summary of DWU Total Treated Water Use FY 2015-16 through FY 2021-22

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Total Annual Water Consumption has trended up from FY 2015-16 through FY 2021-22 as depicted in **Figure 1-4**.

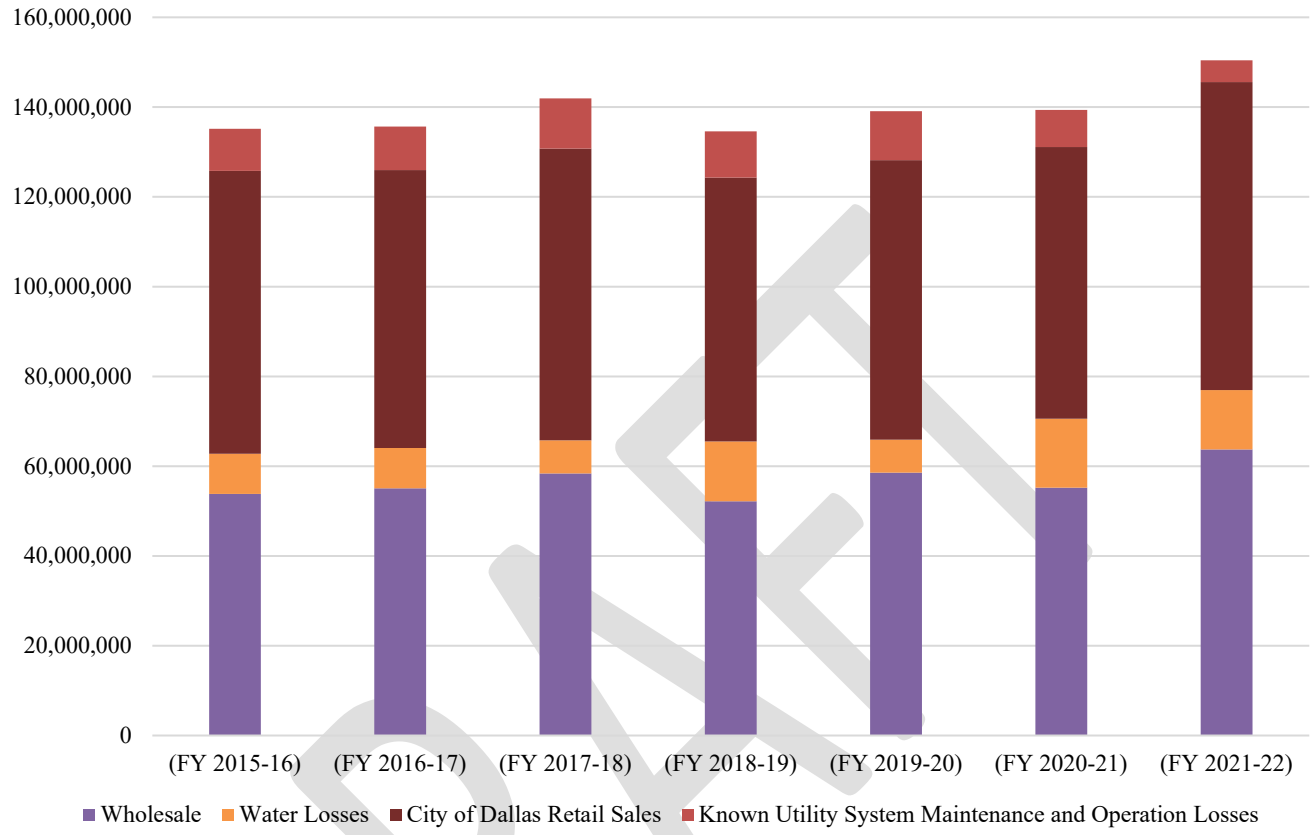

Figure 1-4: Total Annual Water Consumption (in Billion Gallons) FY 2015-16 through FY 2021-22

To make technically sound and economically feasible recommendations, water conservation planners must understand the customer make-up and water use patterns of the service area. This plan analyzes historical performance from FY 2015-16 through FY 2021-22. For the study period, summary data showing monthly water use by water user category was analyzed. Categories included Retail, General Service (GS), Optional General Service (OGS), and Municipal. In the summary data:

- Retail water use is assumed to be single-family.
- The General Service (GS) category has two classifications: Multifamily and Commercial.
- Optional GS (OGS) water users consist primarily of large industrial customers.
- Municipal is water used by the City of Dallas buildings.
- Wholesale Customer Water is water sold through contracts with other cities and entities.
- Unbilled water, also known as nonrevenue water, is a combination of unbilled authorized consumption and water loss. Unbilled authorized consumption includes unbilled municipal uses including ozone cooling water at the water treatment plants, main flushing, firefighting, meter testing, and other uses. Unbilled water loss includes leaks, breaks, and metering errors.
- Total Billed Retail is the sum of all retail categories (Residential, Multifamily, Commercial, Large Industrial and Municipal).

- Billed Metered is the sum of Total Billed Retail and Wholesale water use.

DWU provides treated water to about 314,000 retail customer accounts as of March 2023. The customer categories for billed retail water use are shown in **Figure 1-5**.

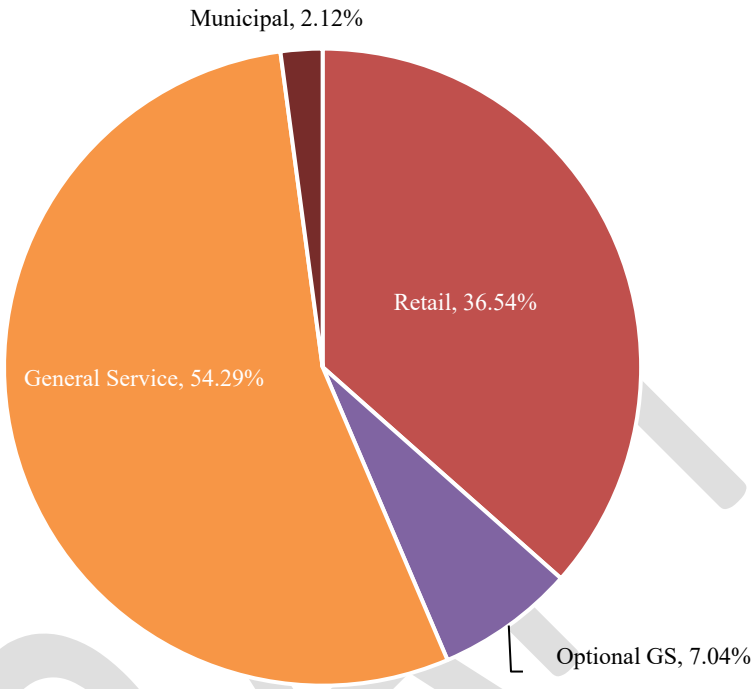

Figure 1-5: Summary of DWU Total Billed Retail Water Use FY 2015-16 through FY 2021-22

1.2 Base vs. Seasonal Water Use

Understanding base and seasonal water use helps target water conservation strategies. Base water use is:

- Generally associated with indoor water uses or other water uses that remain relatively constant throughout the year.
- Estimated to be the amount of water used in the minimum water-use months for a given year.
- Assumed to be constant throughout each year for each category.

Seasonal water use, generally associated with irrigation and cooling water use, is estimated to be all water use greater than base water use.

The City of Dallas uses a conservation-minded approach to calculate water prices retail customers pay. The base rate is the period from December through March (inclusive) when water usage is assumed to be at a minimum. The seasonal rate is the period between April and November (inclusive).

A 2012 Texas Water Development Board (TWDB) study, *The Grass Is Always Greener… Outdoor Residential Water Use in Texas*, *Technical Note 12-01*, found "average total daily per capita residential water use across all study sites to be 172 gallons per capita with 69.3 gallons attributable to indoor

(base) use, 101 gallons attributable to outdoor (seasonal) uses, and 1.7 gallons not clearly attributable to either."[1] The authors stated, "On average, 58 percent of water consumption was for outdoor purposes and 42 percent was for indoor uses, although these figures varied significantly by the city and its associated weather patterns."

Across all uses from FY 2015-16 through FY 2021-22, the City of Dallas used approximately 26% of its annual water supply indoors (base) and 74% of its annual water supply outdoors (seasonal), as shown in **Figure 1-6**. Dallas's usage of seasonal water (74%) is far above the state-wide average (58%) mentioned above in the 2012 TWDB study. However, the Environmental Protection Agency's (EPA) webpage "How We Use Water" estimates 70% of residential water use is indoors, with 30% of water use outdoors, but with the caveat that outdoor usage could be much higher in drier parts of the county.

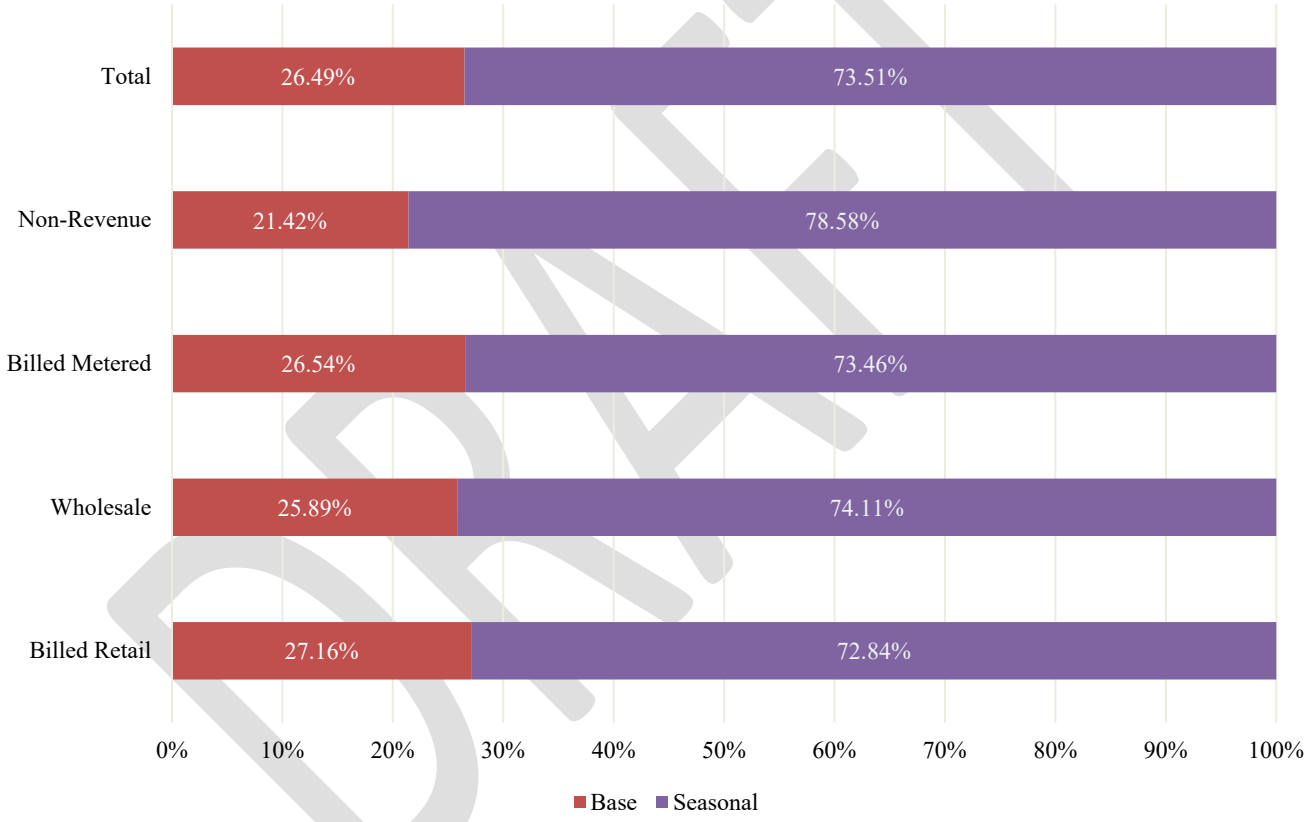

Figure 1-6: Average Seasonal Water Use by Category FY 2015-16 through FY 2021-22

Among retail customers, residential (single-family), commercial, and optional GS accounts used approximately 74% of all water supplied for seasonal purposes, as shown in **Figure 1-7**. Multifamily and large industrial accounts had lower seasonal water use.

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[1] Sam Marie Hermitte, Robert E. Mace. 2012. "Texas Water Development Board." November. Accessed 10 9, 2023. https://www.twdb.texas.gov/publications/reports/technical_notes/doc/SeasonalWaterUseReport-final.pdf.

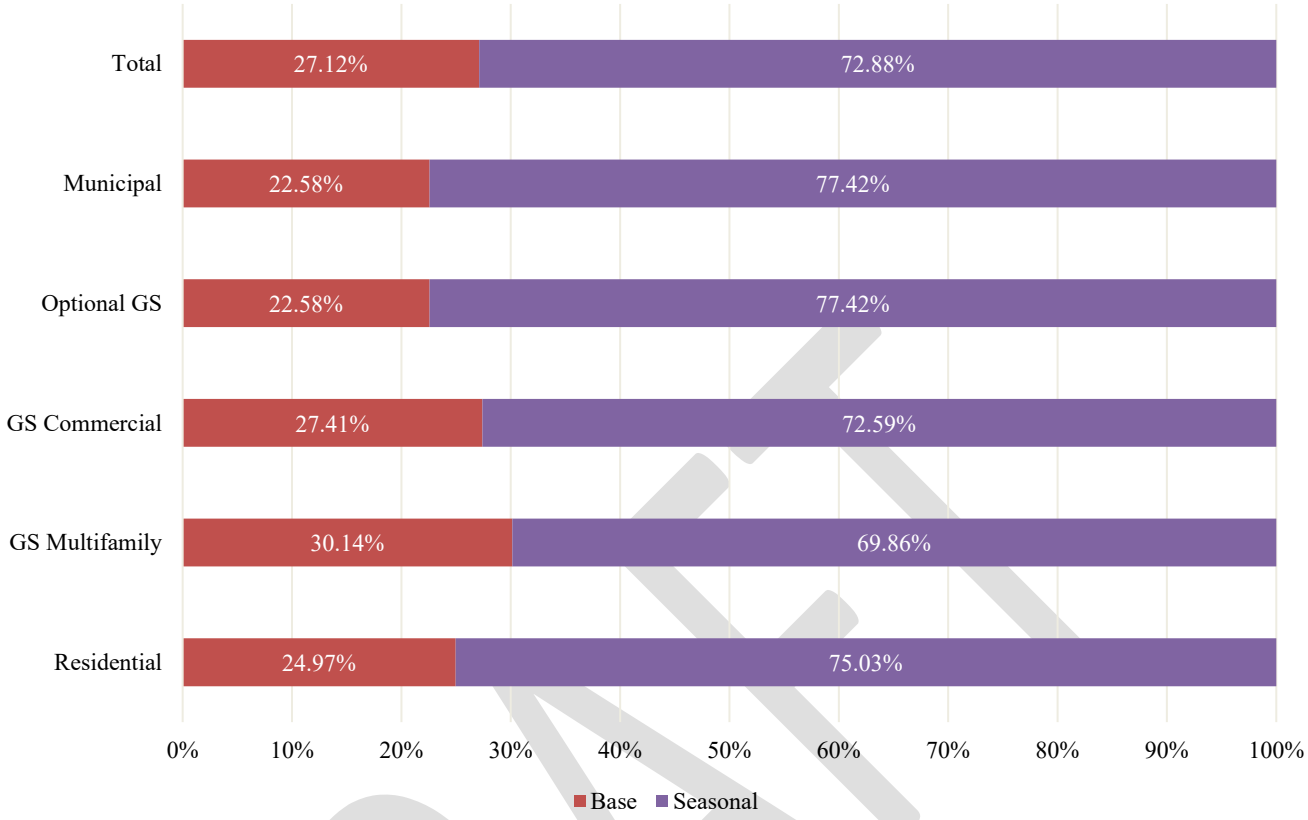

Figure 1-7: Average Seasonal Billed Retail Water Use by Category FY 2015-16 through FY 2021-22

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1.3 Watering Day Consumption

The twice-weekly watering City of Dallas ordinance (Vol. 2, Sec. 49-21.1) designates watering days based on the last digit of the property address. Addresses ending in an even number may water on Sundays and Thursdays and those ending in odd numbers may water on Saturdays and Wednesdays. Wednesdays and Thursdays were the heaviest watering days, while Saturdays and Sundays did not use significantly more water, as shown in **Figure 1- 8**. FY 2021-22 was hotter than other years shown, which may have resulted in increased water use across all days.

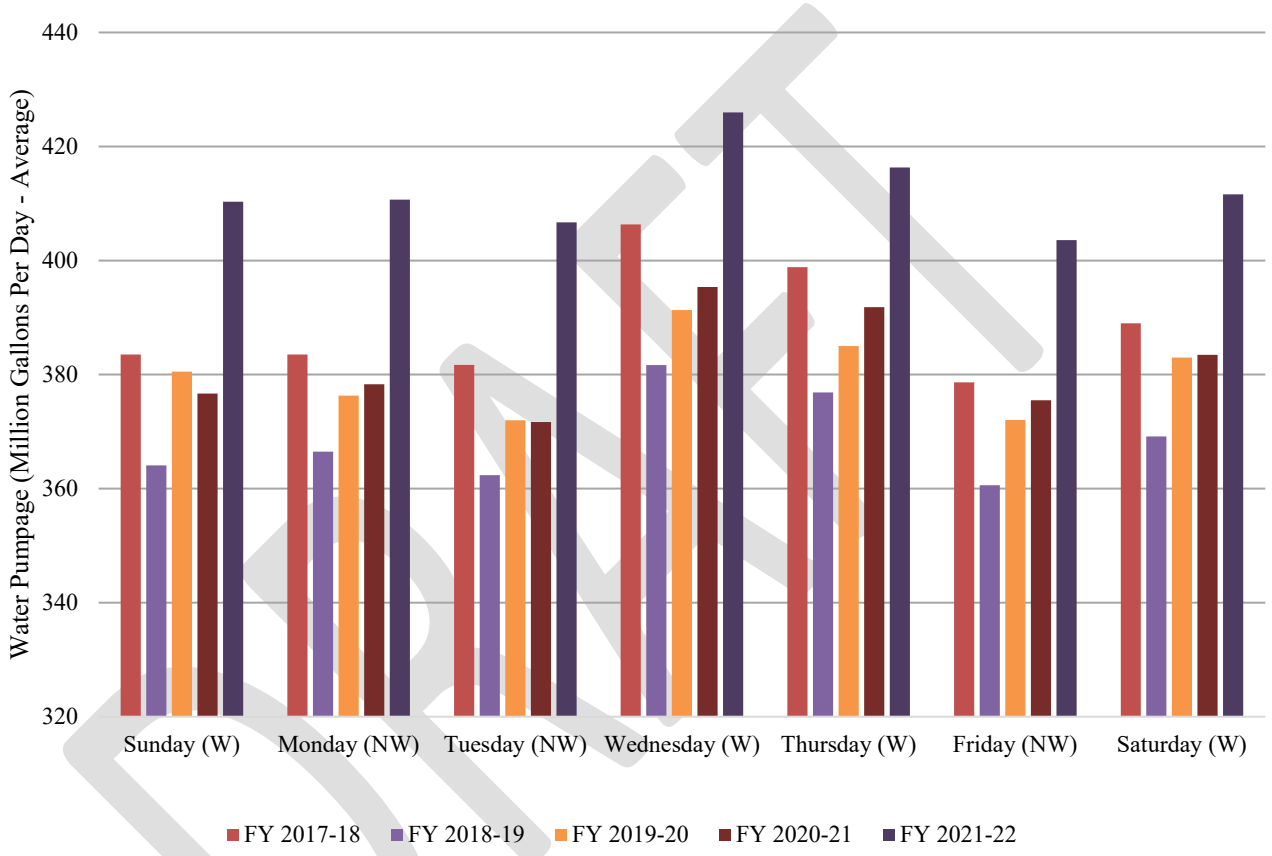

Figure 1-8: Water Consumption (Average MGD) on Watering (W) vs. Non-Watering (NW) Days FY 2017-18 through FY 2021-22

1.4 Gallons Per Capita per Day (GPCD)

Water Use of Texas Water Utilities, the 2020 Biennial Report to the 87th Texas Legislative Session, reported average total daily per capita water use across all Texas study sites was 137 gallons, with residential average daily per capita water use at 82 gallons in 2018.[2]

[2] Peter Lake, Kathleen Jackson, Brooke Paup. 2021. *Water Use of Texas Water Utilities.* January 1. https://www.twdb.texas.gov/publications/reports/special_legislative_reports/doc/2021_WaterUseofTexasWaterUtilities.pdf.

Gallons Per Capita Per Day (GPCD) is a metric that helps water purveyors track consumption patterns. In its *Understanding Best Management Guide*, TWDB recommends a set of standard methodologies for calculating GPCD and residential per capita water use.[3] Using these methodologies, total per capita water use for the City of Dallas (including billed retail water use, unbilled authorized consumption, and water loss) was calculated for the last twenty years. City of Dallas GPCD has steadily declined as indicated in **Figure 1-9**. Total GPCD peaked in FY 1999-2000 at 258.9 GPCD and 74.9 GPCD for Residential. In FY 2021-2022, Total GPCD was 179.7 GPCD and Residential was 56.0 GPCD. GPCD assumptions going forward are based on 1% per year reduction of water use.

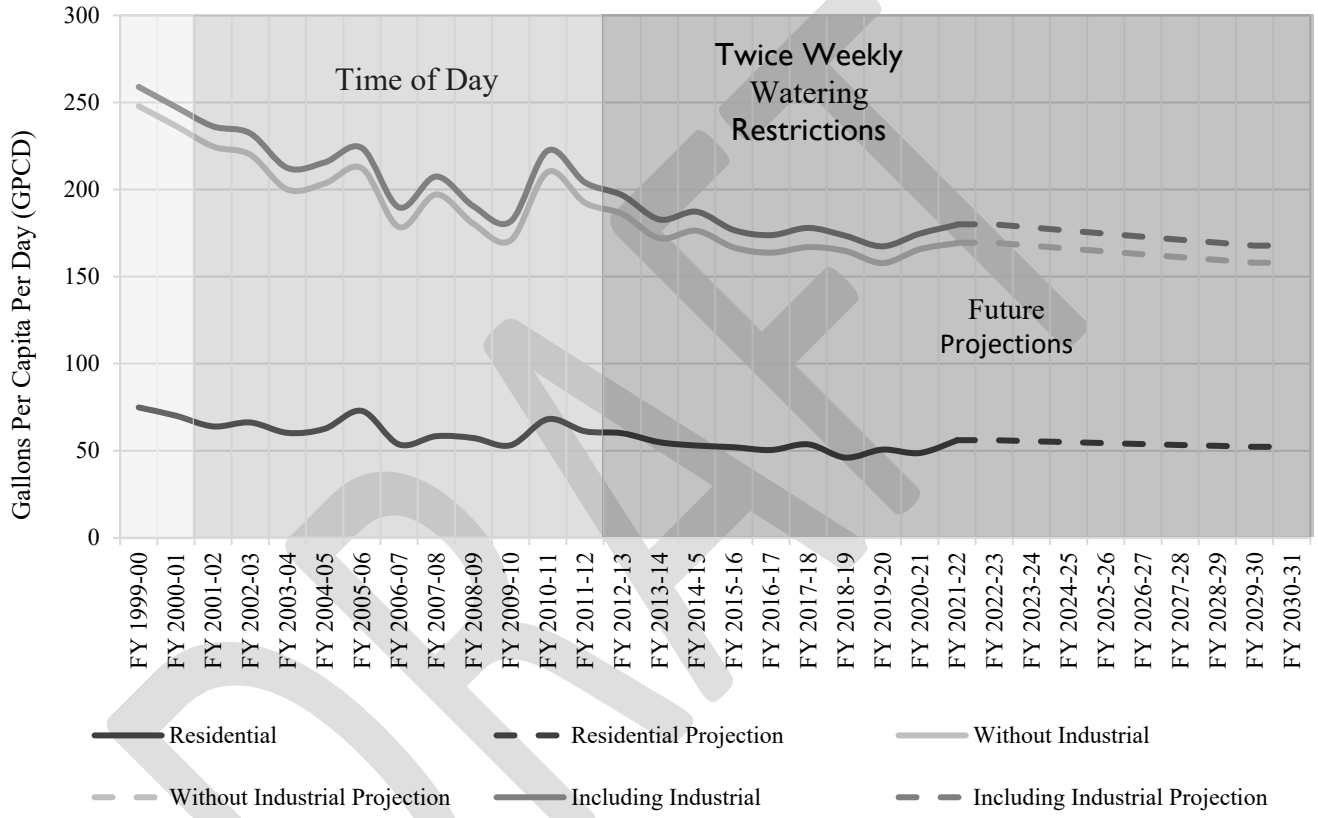

Figure 1-9: GPCD by Premise Type FY 1999-2000 through FY 2030-31

The GPCD metric is used to compare water consumption overtime for an individual entity. GPDC should not be used to compare water consumption between entities. Many factors may affect GPCD.

Some factors are listed below:

- Variation in regional climates
- Population and building density
- Regional economic conditions
- The quality of water supplied in each region

[3] —. 2013. "Water Conservation Best Management Practices." *Understanding Best Management Practices.* February. Accessed October 2023. https://www.twdb.texas.gov/conservation/BMPs/Ubmps/doc/MiniGuide.pdf

- The extent ad effectiveness of local water conservation plans
- Rates of unaccounted water in a distribution system

The GPCD rate of decrease has begun to flatten. This Work Plan sets a goal of a 0.94% annual decrease in the Total GPCD, Residential GPCD, and Water Loss GPCD.[4] To achieve a 0.94% per year reduction goal, based on population projections in the 2021 Region C Water Plan, would require an actual GPCD reduction of nearly 1.64 gallons per year from FY 2022-23 through FY 2026-27.[5] The potential size of this annual reduction will need to be critically evaluated when making conservation recommendations.

1.5 Water Conservation Goals

The City of Dallas is committed to continuing its conservation efforts and building on past accomplishments. The goals identified in this Work Plan are designed to:

- Continue to develop and implement water conservation programs aimed at
    - reducing seasonal peak demand;
    - reducing water loss and waste; and
    - decreasing per capita water use (GPCD).
- Continue public education of the need for water conservation through the Regional Water Conservation Public Awareness campaign with Tarrant Regional Water District (TRWD) and North Texas Municipal Water District (NTMWD) and potentially others.
- Continue and enhance conservation practices that will maintain quality of life and allow economic growth and development.
- Continue to include broad-based public and private stakeholder groups (both English and Spanish-speaking) in new program development and implementation processes.
- Continue to lead by example by upgrading City facilities with water-efficient fixtures, landscapes, and irrigation systems wherever possible.
- Assist facilitation of regional conservation efforts among DWU Wholesale Customer Cities.
- Establish the foundation for continuation of water savings targets for the following five-year period.
- Target an average 0.94% per year reduction in per capita consumption (about 1.64 GPCD per year) for the five-year planning period FY 2022-23 through FY 2026-27 in accordance with the new Work Plan. This target is exclusive of any credit for indirect reuse diversion volumes.

1.6 Retail Cost of Service and Rates

Retail Water Rates are established as a part of the City of Dallas budgeting process. DWU has a conservation-oriented rate structure for customers within the City of Dallas. Under the increasing block rate structure, customers are billed a water meter service charge which increases with the size of their meters. Customers are also billed for water usage and increasing usage results in a higher unit cost for water. Connecting higher rates to increased consumption discourages customers from wasting water. Due to the diversity of customer demand characteristics, recovering the cost of providing service to

[4] City of Dallas. 2019. "2019 Water Conservation Plan." April 19. Accessed October 2023. https://dallascityhall.com/departments/waterutilities/DCH%20Documents/pdf/Water%20Conservation%20Plan.pdf.

[5] Texas Water Development Board. 2021. *2021 Regional Water Plans.* Accessed October 2023. https://www.twdb.texas.gov/waterplanning/rwp/plans/2021/index.asp#region-c.

each customer class in an equitable manner is important to DWU, Dallas City Council, and customers. For this reason, rather than applying across-the-board rate adjustments to all rates to meet annual revenue needs (i.e., the same percentage rate increase to all user charges for all classes), DWU staff annually updates its water and wastewater cost of service model to analyze the proportionate share of system costs that should be allocated to each customer class.

In 2017, DWU engaged Raftelis, a utilities sector consultant, to conduct a rate study encompassing a comprehensive review and update to the cost-of-service analysis and the development of a new retail water and wastewater cost of service and rate model. The volumetric rate structure for the residential class was examined and alternative rate structures were evaluated. The recommendation of the study was to add a fifth tier and redefine both the tier rate differentials and tier usage thresholds. The recommendation of the study is that DWU continue to use the existing volumetric structures for General Services, Optional General Services, and Municipal rates. The City Council adopted the new rate structure in 2018, further encouraging customers to save water. See **Table 1-1** for water and wastewater rates for FY 2021-2022.

Usage Charge per 1,000 Gallons	Water	Wastewater
Residential		
Up to 4,000 gallons	$1.90	$5.41
4,001 to 10,000 gallons	$4.11	$5.41
10,001 to 20,000 gallons	$6.70	$5.41
20,001 to 30,000 gallons	$9.55	$5.41
Above 30,000 gallons	$11.10	$5.41
General Services		
Up to 10,000 gallons	$4.43	$4.56
Above 10,000 gallons	$4.83	$4.56
Above 10,000 gallons & 1.4 times annual average monthly usage	$7.38	$4.56
Optional General Services		
One million gallons or less (minimum)	$2,684.47	$4.21
Above 1 million gallons (per 1,000 gallons)	$4.00	$4.21
Sewer Metered Separately		$4.26
Untreated Water		
Uninterruptible	$1.03	
Interruptible	$0.43	

Table 1-1: Dallas Rate Structure is Based on Water Use, FY 2021-22

The City of Dallas Five-Year Budget Forecast notes retail rate increases will average approximately 3.4% from FY 2022-23 through FY 2026-27. These increases will cover higher personnel costs, additional payments to connect Lake Palestine to the Dallas water supply system, investment in department fleet, and additional capital funding necessary to maintain DWU infrastructure and regulatory compliance.

DWU's goal is to stay within the US EPA affordability guidelines for water and wastewater bills for median income of $70,784 in 2021.[6] EPA guidelines stipulate that water bills should not exceed 2.5% of the median income, which means that monthly water bills should not average more than $147 per month.[7] Lower tier residential bills average use is about 8,300 gallons of water and 5,300 gallons of wastewater. The typical residential Dallas water and wastewater bill is $64.25 per month.

Retail Rates per 1,000 gallons at the highest rate tier for Residential, General Service, Optional General Service and Untreated Water from FY 2015-16 through FY 2021-22 are depicted in **Figure 1-10**. DWU has had a conservation-oriented rate structure for customers within the City of Dallas since 2001. Under the increasing block rate structure, customers are billed a water meter service charge which increases with the size of their meters. Customers are also billed for water usage and increasing usage results in a higher unit cost for water. In 2018, DWU added its highest rate in a new fifth tier. Connecting higher rates to increased consumption discourages customers from wasting water.

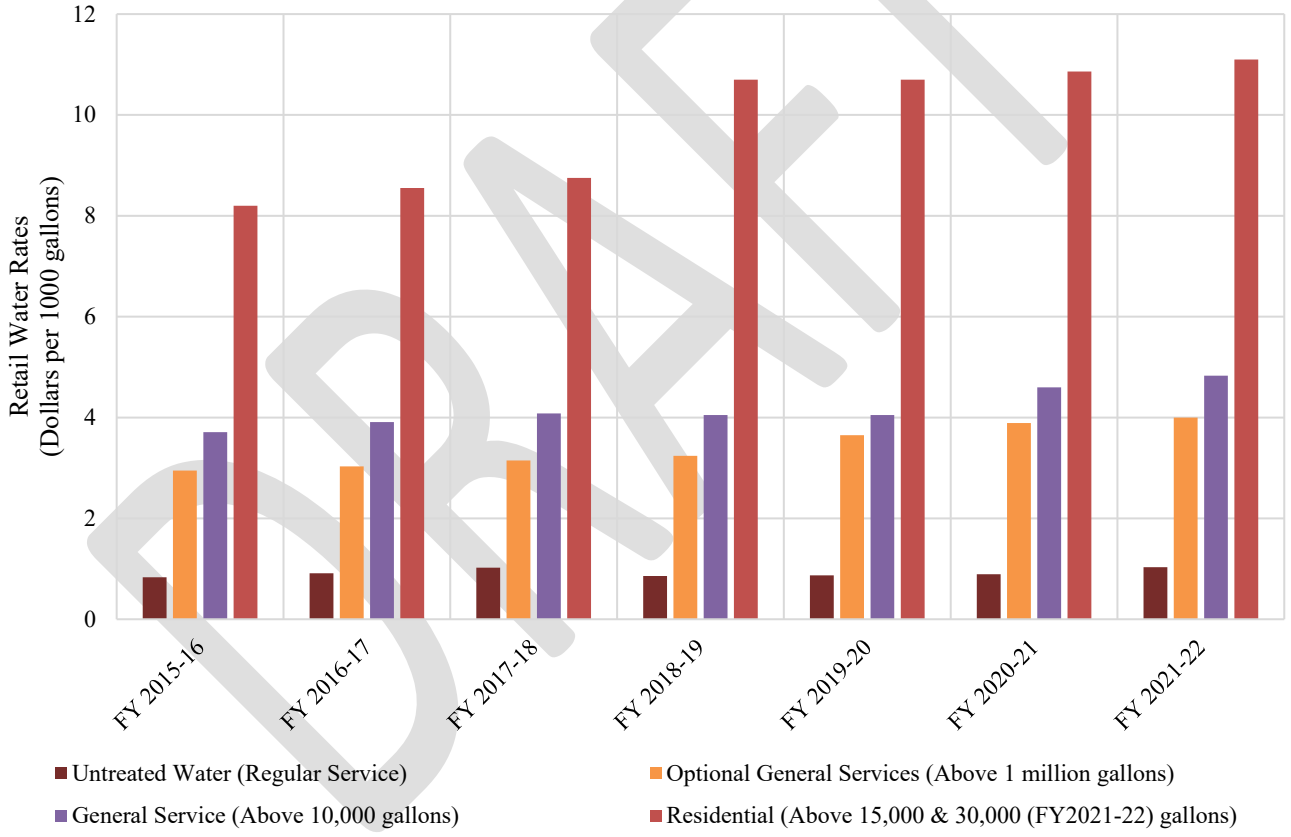

Figure 1-10: Retail Rates per 1,000 Gallons at Highest Tier FY 2015-16 through FY 2021-22

[6] Jessica Semega, Melissa Kollar. 2022. *Income in the United States: 2021.* Washington, DC.: United States Census Bureau. https://www.census.gov/library/publications/2022/demo/p60-276.html

[7] Environmental Protection Agency. 2021. *2021 Financial Capability Assessment Guidence.* Washington, DC: Office of Water. https://www.epa.gov/sites/default/files/2021-01/documents/2021_fca_guidance_-_january_13_2021_final_prepub.pdf

1.7 Governmental Updates Related to Water Conservation

City of Dallas Updates

The City Council did not approve any additional water conservation-related ordinances during the period covered in this report.

The Zoning Ordinance Advisory Committee (ZOAC) is an advisory body appointed by the City Plan Commission and is comprised of three Plan Commissioners and five citizens.[8] ZOAC is responsible for reviewing potential amendments to the City's Development Code and making a recommendation to the City Plan Commission. The City Plan Commission then considers the proposed amendment and makes a recommendation which is forwarded to the City Council. ZOAC's meetings are open to the public. There are no current code amendments related to water conservation as of May 2023.

State Water Conservation Initiatives

The following bills were introduced in the 88th Session of the Texas House of Representatives and/or the Texas Senate.
The Texas Water Development Board (TWDB) amendment to 31 Texas Administrative Code (TAC) §358.6 was adopted on November 10, 2023. Certain retail public utilities are required by the Texas Water Code, Chapter 16 to submit water loss audits to the TWDB. The TWDB proposed a new validation requirement on water loss audits required by certain retail public utilities. Additionally, the TWDB clarified how it will apply water loss thresholds to retail public utilities based on a utility's service connection density and adjusted the water loss threshold values to better ensure water loss mitigation is included as an effective strategy of utilities receiving financial assistance for drinking water projects.

HB 2460 related to a requirement that TCEQ obtain or develop updated water availability models for certain river basins.[9] Not later than December 1, 2026, the commission shall obtain or develop updated water availability models for the Guadalupe, Lavaca, Nueces, San Antonio, San Jacinto, and Trinity River basins. The commission may collect data from all jurisdictions that allocate the waters of the rivers, including jurisdictions outside this state. SB 650 and HB 1845, pertaining to the same subject, were also introduced. The bill became law on May 24, 2023.[10]

National Water Conservation Initiatives

On July 24, 2014, EPA released three revised WaterSense specifications (version 1.1) for professional certification programs. The specifications cover three areas: irrigation system design, installation and maintenance, and system auditing. Certification programs that meet the criteria outlined in one of the following specifications will be eligible for the WaterSense label. No further changes have been made.

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[8] —. n.d. *Code Amendments (ZOAC).* Accessed October 2023. https://dallascityhall.com/departments/pnv/Pages/Code-Amendments.aspx.

[9] —. 2022. *TITLE 31. NATURAL RESOURCES AND CONSERVATION.* November 17. https://www.sos.state.tx.us/texreg/archive/December22022/Proposed%20Rules/31.NATURAL%20RESOURCES%20AND%20CONSERVATION.html.

[10] Water Environment Association of Texas. 2023. *Legislative Issues.* Accessed October 2023. https://www.weat.org/legislative-issues-updated.

As part of the ongoing effort to continually improve the WaterSense program and its independent third-party certification process, EPA released Version 2.1 of the WaterSense Product Certification System in January 2016.[11] EPA has made minor revisions to the product certification system to clarify and ensure equitable interpretation and enforcement of program requirements.

The EPA sunset the WaterSense Specification for Commercial PreRinse Spray Valves as of January 1, 2019. Manufacturers can no longer earn the WaterSense label for these products.[12]

In January 2021, the Biden Administration announced an action plan to improved global water security and build drought resilience.[13] The Bipartisan Infrastructure Law includes investments to provide targeted support to drought-stricken communities and build American communities' resilience to worsening drought conditions caused by climate change.
In February 2021, EPA released the *WaterSense Specification for Homes, Version 2.0.*[14] The specification ensures that WaterSense labeled homes are at least 30 percent more water-efficient than a comparable home using typical new construction and meet homeowner expectations for performance. The specification provides flexibility in meeting WaterSense's technical requirements without compromising on overall water efficiency or performance, improves collaboration with green certification programs, and allows for easier implementation and certification. The specification is applicable to single-family homes and multifamily buildings. To confirm that homes are at least 30 percent more water-efficient than a comparable home using typical new construction, EPA evaluates Home Certification Organization's (HCO) certification methods according to its technical evaluation process.

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[11] Environmental Proction Agency. 2023. *Certification Systems.* May 19. Accessed October 2023. https://www.epa.gov/watersense/certification-systems.

[12] Environmental Proction Agency. 2023. *Pre-Rinse Spray Valves.* May 16. Accessed October 2023. https://www.epa.gov/watersense/pre-rinse-spray-valves.

The White House. 2022. *FACT SHEET: Vice President Harris Announces Action Plan on Global Water Security and Highlights the Administration's Work to Build Drought Resilience.* June 1. Accessed October 2023. https://www.whitehouse.gov/briefing-room/statements-releases/2022/06/01/fact-sheet-vice-president-harris-announces-action-plan-on-global-water-security-and-highlights-the-administrations-work-to-build-drought-resilience/.

[14]Environmental Proction Agency. 2023. *Homes Specifiation.* May 22. Accessed October 2023. https://www.epa.gov/watersense/homes-specification.

2.0 City of Dallas Water Conservation Progress (OEQS)

The City of Dallas takes a proactive, expansive approach to water conservation, incorporating multiple City departments and divisions in its robust, multi-pronged strategy.

The City of Dallas has a long history of leadership in water conservation and continues to be a leader in water conservation efforts in North Texas. The City of Dallas was the first in the region to implement mandatory Time of Day and Maximum Twice-Weekly watering requirements, and the first to introduce a public awareness campaign. The City of Dallas continues to expand its diverse menu of incentive-based programs, public education, and outreach strategies, to ensure that programs, messaging, and content remain fresh, relevant, responsive, and effective.

This section provides a description of the City of Dallas's existing water conservation program, updates and enhancements, and new conservation measures planned for future implementation to help the Water Conservation Division of OEQS achieve its water conservation goals. The Water Conservation Division is funded by DWU, fostering enhanced collaboration across departments.

Beginning in March 2020, COVID-19, and its accompanying restrictions in Dallas County, heavily impacted education and outreach components of the water conservation program. Many events were canceled, plans pivoted on short notice due to unexpected outbreaks, and new delivery systems, using technology, were developed to continue to reach and continue water conservation education for residents. By FY2022-2023 most programs were operating as they did prior to 2020, but with some differing results. Impacts of the pandemic are addressed where relevant in individual program summaries.

2.1 Water Conservation Division Organization

There are currently 10 staff positions in the Office of Environmental Quality and Sustainability (OEQS) Water Conservation Division, including a water conservation manager. A water conservation manager is considered a conservation best management practice (BMP) by the TWDB.[1] Two additional positions are housed in the Outreach Division. See **Figure 1-2** for organization of the water conservation division.

This dynamic group of water professionals are tasked with incorporating BMPs most appropriate for the DWU and its customers, researching and developing new water smart programs, administering incentive-based customer programs, collecting, and analyzing data for program effectiveness, and engaging customers in public outreach and education programs.

As new programs are implemented as outlined in the Work Plan, additional staff may be required. Staff additions will be included in the recommendations section for each program. Program administration through FY2026-27 is $1.46 M per year. Visit www.SaveDallasWater.com for conservation staff profiles, focus areas, and contact information.

[1] Texas Water Development Board. n.d. *Best Management Practices for Municipal Water Providers.* Accessed October 2023. https://www.twdb.texas.gov/conservation/BMPs/Mun/index.asp.

2.2 Water Conservation Program Chronology

The City of Dallas Water Conservation program began in the early 1980s. In 1981, DWU started adding bill inserts to encourage customers to conserve water. In 1984, DWU implemented a school education program that included textbook covers with a conservation message, poster contests, a regional science fair, curriculum aids, classroom presentations, and student tours of treatment facilities.

By the mid-1980s, DWU conservation efforts expanded to include a focus on media relations, speaking engagements, special events, and promotions. Media relations consisted of news coverage of conservation best practices and television and radio public service announcements. DWU staff spoke to professional and civic organizations and made classroom presentations on conservation. Special events and promotions included exhibits at trade fairs and community events, an annual Drinking Water Week poster contest that began in 1984, and water-upon-request promotions at local restaurants in 1985-86.

In 1987, DWU started a retrofit pilot program, fitting 2,025 homes with low-flow showerheads and toilet dams. Since the pilot program, DWU has provided ongoing public education about the benefits of retrofitting and an ongoing distribution of showerheads, upon request.

In 1988, DWU began promoting water-wise landscapes with exhibits, brochures, and seminars (in partnership with Texas AgriLife Extension Service). In 1993, a water-wise demonstration garden was installed at the historic White Rock Pump Station. During that same period, DWU began sponsoring annual recognition awards and a tour of homes focused on water-wise landscaping.

In October 2001, the Dallas City Council amended the City's water and wastewater ordinance (City of Dallas Code of Ordinances, Vol. II, Section 49-18.1) to include conservation-oriented water rates and a prohibition on landscape water waste.[2] As a result of the 2017 rate survey, the inverted block rate structure was amended in 2018 so that residential customers using more than 30,000 gallons per month paid a higher unit rate for the additional water (currently $11.10 per thousand gallons) and commercial customers using more than 10,000 gallons per month and using more than 1.4 times their annual monthly average, pay a higher unit rate of $7.38 per thousand gallons.

In addition, the following wasteful practices were prohibited:

- Runoff from irrigation onto a street or other drainage area;
- Irrigation of impervious areas;
- Operation of an irrigation system with broken or missing sprinkler heads;
- Irrigation during a precipitation event;
- Irrigation between the hours of 10 am and 6 pm from April 1 through October 31 of any year (except irrigation by hand and the use of soaker hoses); and
- Irrigation more than twice per week based on the last digit of the property street address. Addresses ending in an even number may water on Sundays and Thursdays and those ending in odd numbers may water on Saturdays and Wednesdays.

[2] American Legal Publishing. n.d. *The Dallas City Code: SEC. 49-18.1. RATES FOR TREATED WATER SERVICE.* Accessed October 2023. https://codelibrary.amlegal.com/codes/dallas/latest/dallas_tx/0-0-0-125173#JD_49-18.1.

After establishing the Water Conservation Division in 2001, DWU initiated an extensive, ongoing multimedia local public awareness campaign to educate customers about landscape irrigation practices and new restrictions from the ordinance amendment in 2002. The award-winning campaign was themed "Save Water. Nothing Can Replace It." The citywide campaign continues today.

In 2005, the Dallas City Council adopted a Water Conservation Five-Year Strategic Plan to further reduce peak demands and curb water waste. The goal of the Strategic Plan is to reduce per capita water consumption by an average of 1% per year from FY 2005-06 through FY 2009-10. The plan was updated in FY 2009-10, with a new goal of reducing per capita consumption by an average of 1.5% per year from FY 2010-11 through FY 2014-15. In FY 2015-16, the plan was updated as the 2016 Water Conservation Work Plan, with an annual goal of reducing per capita consumption by 1% from FY 2015- 16 through FY 2019-20. This plan updates the 2016 Work Plan, with an annual 0.94% reduction of per capita consumption goal.

In 2019 the City Council adopted a Water Conservation Plan for state submission. The plan included both five- and ten- year water conservation goals.

This Work Plan continues the chronology of the water conservation initiative within the structure of each existing program or project.

Education and Outreach

2.3 Public Awareness Campaigns

Launched in the summer of 2002, a citywide public awareness campaign promoted water conservation using a well- diversified approach including broadcast and digital television and radio ads, and social media advertising. The citywide campaign was featured on billboards on heavily traveled highways, in messaging placed both inside and outside Dallas Area Rapid Transit (DART) buses and trains, and in print ads in a variety of community publications. A concentrated effort was made to ensure that media was placed across all City Council districts and in all communities across the city.

In FY 2019, DWU transitioned away from the consultant management format and begin managing the local public awareness campaign media buy in-house through OEQS staff, using components of creative from the Regional Public Awareness Campaign and additional in-house creative to promote local City of Dallas conservation programs, workshops, and tips. This decision allows the City of Dallas to make direct buys with local media outlets, eliminating third-party media buyer expenses and the industry-standard additional percentage fee on top of any media placements. Now, more money can be spent on specific media placement, focused on diversity and inclusion across the city and across media outlets. Media buy allocation has also begun to shift with the changing times. Extensive research shows customers receive information in more diverse ways and from more different platforms than ever before. Outlets such as public service announcements, public television, and cable television are becoming increasingly obsolete. Today, fewer households watch traditional and/or cable tv, with many opting for internet streaming services instead. Local media buys have begun to shift to include more progressive media platforms, including traditional social media channels, as well as YouTube TV, Spotify, etc., so that Dallas remains relevant with the changing times. DWU budgets $446,000 annually to the local campaign.

Although the Dallas-Fort Worth area has four primary water providers, all providers are part of the DFW media market. As a result, the broadcast component of the DWU public awareness media buy delivers messages to customers of other water service providers, and any broadcast media purchase made by other water providers reaches DWU customers. In 2009, DWU formed a partnership with the Tarrant Regional Water District (TRWD) to minimize the potential for customer confusion by providing uniform water conservation messages to the entire media market. This collaboration resulted in campaign development savings and helped favorably leverage the media budget for both entities.

In FY 2019, the Regional Public Awareness Campaign (Water Is Awesome) was expanded to include a third large water provider in north Texas, the North Texas Municipal Water District (NTMWD). With three large water providers working collaboratively on one regional campaign for the first time, better leverage of media dollars reaches an even wider North Texas customer audience, reducing confusion from multiple conservation messages across North Texas, incorporating more Spanish messaging, only previously done minimally by Dallas and TRWD, and taking the first steps towards what could one day possibly contribute to a statewide conservation campaign, similar to the Don't Mess With Texas statewide litter campaign. While this expansion requires more flexibility and a closer working relationship on the part of the three water providers, it is well worth the gains made. Currently, Dallas contributes $670,000 annually to the Regional Public Awareness campaign creative and media buy. An additional $670,000 in media exposure is leveraged annually through the TRWD and NTMWD partnership. Since 2002, Dallas has spent more than $20 million on public awareness campaigns, demonstrating continued commitment to water conservation for the entire region.

Recommendation 2.3.1 Continue Contributions and Partnership in the Regional Campaign

Consistency in messaging is a vital part of a successful water conservation and efficiency program for Dallas and the region. Leveraging funding across the partners increases the magnitude of the program as well.

2.4 Digital Media

According to commentary by Andrea Facini in *American City & County*, the members of the community now expect a robust digital media presence. It is important for transforming how citizens interact, especially since COVID-19, and fostering a sense of trust and transparency in the government's decisions and action. Especially with younger audiences, digital and online communication is a key form of engagement. Local governments must embrace and improve these channels or risk losing a major path to reaching residents.

In a Center for Digital Government survey of 169 local government leaders, cited in this article, a 51% increase in constituent participation was noted after implementation of digital tools.[3] More than 60% said virtual meetings and social media improved transparency and promoted expanded access. Lowering barriers to public discussion by generating more resident-to-resident and resident-to-state engagement leads to a stronger community voice.

[3] Facini, Andrea. 2021. *Local government's role in citizen engagement: It's now digital.* August 19. Accessed October 2023. https://www.americancityandcounty.com/2021/08/19/local-governments-role-in-citizen-engagement-its-now-digital/.n

In *Citizen Participation in the Information Society*, Sissel Hovik and G. Anthony Giannoumis state that the use of digital tools enables democratization of communications.[4] It creates ease of access for residents, reduces costs for the City when soliciting input or feedback, reduces barriers to participation, promotes inclusion, and is vital in creating connections between residents, City staff, and elected officials. They also point out that digital media channels should not replace traditional in-person channels like town halls, public meetings, etc.; but should supplement them to increase the reach of public engagement.

The SaveDallasWater.com website contains information about water conservation programs for Dallas ratepayers, City of Dallas water conservation ordinance restrictions, and various sustainability events year-round. In 2018, a revamped version of the SaveDallasWater.com website was launched. The new website offers a curated selection of informative tiles and images focused on the many facets of conservation and programs available, providing the public with a more user-friendly, interactive experience. Water Conservation currently uses the following platforms: Facebook, Instagram, X, and YouTube.

Since 2018, a temporary staff member has been responsible for

- Aesthetic coordination of www.savedallaswater.com layout, text, images, colors, fonts;
- HTML and CSS coding to create user-friendly presentation on both browsers and mobile devices;
- Custom graphics for website, social media, upcoming events, and printed marketing materials adhering to City of Dallas branding guidelines and DWU media guidelines;
- Social media updates in real time and scheduled content through Hootsuite software;
- Tailored water conservation marketing materials from other agencies such as EPA WaterSense, Take Care of Texas, and Texas Water;
- Compiling and preparing analytics reports for various platform; and
- Digital signage; including updating graphic slides, removing old slides, and scheduling new slides.

Historically, no permanent position has been tasked with managing these functions. A public engagement specialist is needed to manage an increasingly heavy emphasis on digital media. Having a permanent position fulfilling this role means support for and confidence in a robust online presence for DWU.

Recommendation 2.4.1 Consider Expanding Digital Media Presence to the Public

A public engagement specialist position for OEQS would coordinate the crossover of content from DWU and OEQS and collaborate with DWU to achieve a robust digital presence for both departments—in a variety of digital channels to achieve the goal of expanding transparency, trust, and participation.

A new full-time staff member, a public engagement specialist, is recommended to coordinate and advance water conservation messaging on the website and other digital channels. The new position would work on website updates, evaluate, and manage appropriate social media platforms, and

[4] Sissel Hovik, G. Anthony Giannoumis. 2022. "Linkages Between Citizen Participation, Digital Technology, and Urban Development." *Citizen Participation in the Information Society* 1-23. https://link.springer.com/chapter/10.1007/978-3-030-99940-7_1

coordinate additional technology media platforms, including video content, blogs, podcasts, etc. This specialist would also be a liaison position, coordinating messaging with DWU and OEQS communications staff and other City departments when appropriate.

2.5 Environmental Education Initiative K-12

In FY 2006, DWU augmented its existing school education programs with an Environmental Education Initiative (EEI), through a collaboration with the University of North Texas, to provide programs for grades K-12 in the Dallas School District and in other area schools, including charter and private schools, which serve City of Dallas residents. The EEI program offers professional development for teachers; hands-on, in-class lessons for elementary schools; discussion- based, museum-quality modules for middle schools; and a research summit and internship for high schools. The EEI education team participates in several community events each year, talking with community members about conservation best practices. To date, EEI has reached more than 127,838 students, 8,302 teachers, and 128,741 residents, with 309 area schools receiving EEI lessons and resources. The annual budget for the EEI program is $450,495. The GIS map presented below reflects the scope of the EEI Program's reach since program inception. Information about EEI opportunities for all grade levels can be found at https://dallaseei.org.

EEI staff prepare a valuable annual report with cumulative descriptive statistics for the EEI program. It contains a summary of each facet of the program, with numbers, survey results and comments, and changes/updates to the programs. The fiscal year for EEI differs from that of DWU, running from February 1-January 31. **Table 2-1** tracks participation since FY2016-17 and **Figure 2-1** shows the location of the participating schools.

The Water Conservation Division public education program has been considered one of the best in Texas. DWU's program has received recognition from the Texas Water Development Board, Texas Section of the American Water Works Association (TAWWA), Texas Water Conservation Association, American Advertising Federation, the U.S. Environmental Protection Agency, 2011 Federal Clean Water Framework Report, Keep Texas Beautiful, and the Oak Cliff Chamber of Commerce.

The EEI website (dallaseei.org) serves as an online resource for teachers, with links to videos on outdoor water use, indoor water use, watersheds, the collective power of conservation, and surface-groundwater interactions. The website also has descriptions of water lessons for children in grades K-5. Additionally, teachers can register for free in-class presentations through the website.

Participation in in-school education programs was impacted by COVID-19 disruptions, as shown in **Table 2-1**. The last EEI lesson for the 2019-2020 school year was March 12th, just one and a half months into program fiscal year 2. EEI staff prepare an annual report with cumulative descriptive statistics for the EEI program. The FY2021-22 report addresses COVID-19 procedures and reporting adaptations. EEI offered in-person and virtual options for both elementary lessons and professional development for teachers to combat scheduled cancellations and low attendance. The EEI website allowed digital access for scheduling and an email campaign to promote both options for attendance was implemented. The virtual option has continued on a case-by-case basis.

Environmental Education Initiative (EEI) Participation					
Fiscal Year	Professional Development	Elementary	Middle	Interns	Summit
2016-17*	288	5,693	293	6	94
2017-19*	385	8,777	1,449	6	62
2019-20^{+}	269	8,378	2,845	7	28
2020-21^$^{+}$	195	3,081	575	10	10
2021-22^$^{+}$	166	414	n/a	10	15

*****February 1-January 31* $^{+}$*January 1-December 31* ^*Numbers impacted by COVID-19*

Table 2-1: Participation in Environmental Education (EEI)

As part of a survey of participants in EEI programs, teachers and middle school students were asked to select ways that they felt they could commit to saving water. Options included taking shorter showers, turning off the water when brushing their teeth, and turning off the water when they washed their hands. The estimated average annual savings per teacher/middle school student is 9,863 gallons. While many different forms of water conservation were discussed with elementary students, in FY2016-17 and FY2017-18, the students were asked if they would be willing to commit to turn the water off when they brushed their teeth (average savings of 2,250 gallons per student per year). In FY2019-20, student survey pledges changed to the teacher model, using the annual average savings per student of 9,863 gallons. See **Figure 2-1** and **Table 2-2** for historic participation in the survey and estimated annual savings.

EEI Water-Savings Pledges						
Annual Report Year	**Teachers Taking Pledge**	**Teacher Average Annual Savings**	**K-6 Students Taking Pledge**	**K-6 Average Annual Savings**	**Grade 7-8 Students Taking Pledge**	**Grades 7-8 Average Annual Savings**
2016-17*	288	2,370,404	5,659^	12,393,210	1,845	18,197,235
2017-19*	304	3,122,902	8,689^	11,876,740	1,361	12,861,352
2019-20^{+}	215	2,076,220	8,294	81,803,722	2,690	24,973,116
2020-21^{+}	135	1,384,328	3,050	30,082,150	560	5,523,280
2021-22^{+}	118	1,289,801	6,704	66,121,552	n/a	n/a
Averages	**212**	**2,048,731**	**3,610**	**40,455,475**	**1,280**	**12,310,997**

*****February 1-January 31* $^{+}$*January 1-December 31* ^*only from brushing teeth (survey changed in FY2019-20)*

Table 2-2: Water Savings from Environmental Education (EEI) Save Water Pledges

The EEI program for high school students differs from that of grades K-8. High school students in grades 11 and 12 can engage in water research through five-week paid summer internships and/or through volunteering. They earn volunteer hours working with the EEI team at Community events across Dallas as part of Team Water Works. 142 students participated from 2014-2020.

Interns research issues, talk with experts, and go on field trips to learn about water conservation and quality. Their findings are presented to City of Dallas officials. Interns develop materials for outreach across the community. Applications open each spring. Due to COVID-19 restrictions, the internship

went virtual in 2020 and offered hybrid participation with in-person field trips in 2021. The program began in FY2007-08 with five interns. In FY2021-22, 10 interns were selected.

High school students have an opportunity to participate in a conference style research summit from FY2014-15. In year one, a team of college professors and water professionals work on proposals for water conservation project funding. If funded, projects receive materials to perform the research and track progress to present in year two of the summit. Winning projects are guaranteed interviews for the paid summer internship program. After reaching a high of 94 students in FY2016-17, attendance has dropped off, partially due to the impact of COVID-19 restrictions. Just 10 students participated in FY2020-2021 and 15 students participated in FY2021-22.

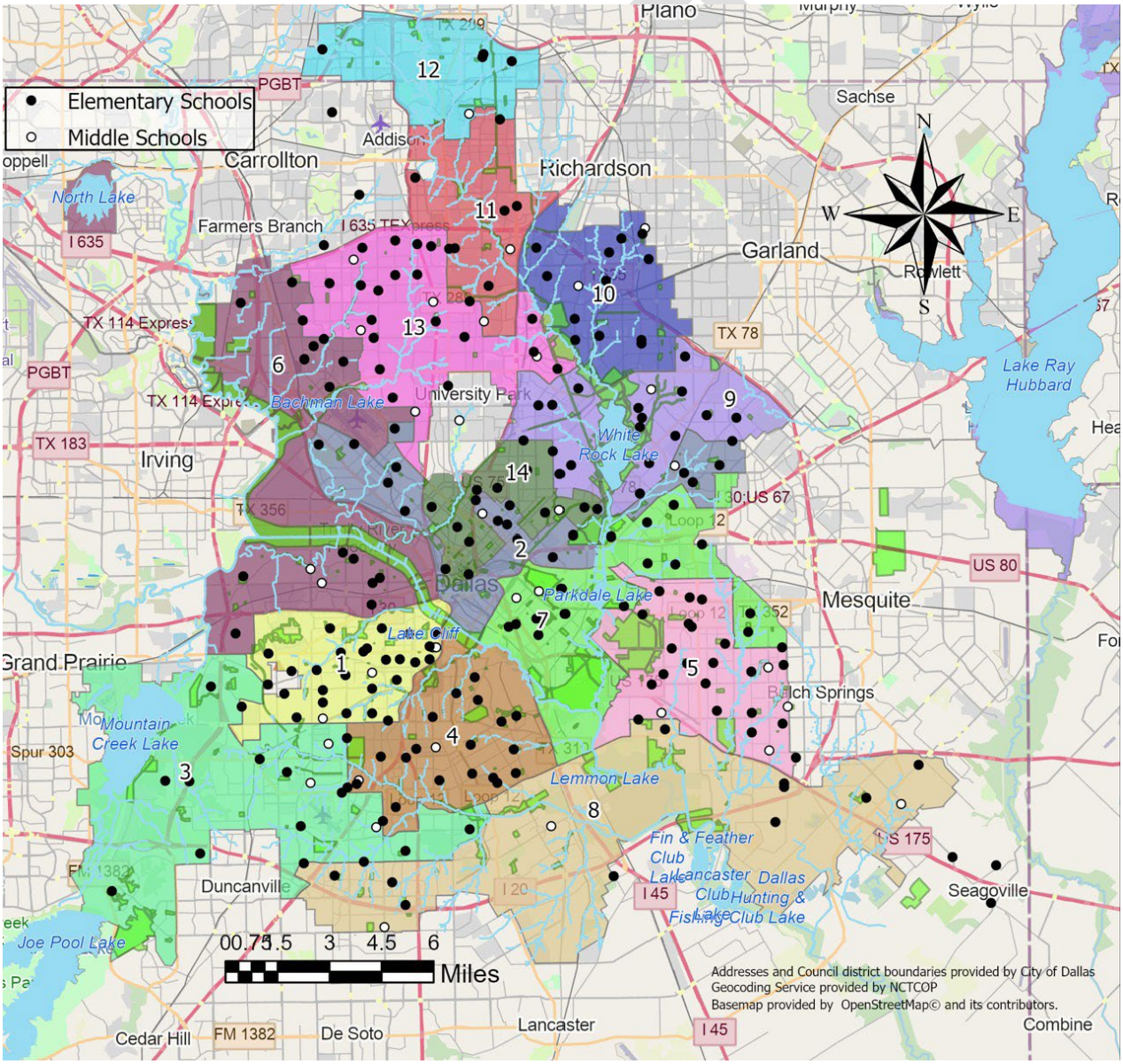

Figure 2-1: EEI School Participation (K-8) FY 2006-07 through FY 2021-22

Recommendation 2.5.1 Enhance Promotion and Evaluation of Education Programs and Delivery Options

In the aftermath of COVID-19 and its impact on K-12 education learning progress, enhanced promotion of these programs is going to be required. It will be important to promote the hybrid options for K-6. The high school internship and summit programs will need to have renewed connections with counselors, teachers, and gifted/talented program coordinators to revive interest. It may be time to look at a new program for junior high students. Junior high students may be ready for an opportunity to do more activity-based and research-based projects rather than a curriculum or lesson-based program using traditional discussion-based instruction as advertised on the website. Continue to do the surveys with teachers and use their data to determine how to adjust the programs for the next few years and beyond.

Recommendation 2.5.2 Consider Offering the EEI Program to Wholesale Customers Cities

2.6 Other Public Education

The City of Dallas also incorporates multiple approaches to public outreach, including water bill inserts, brochures, speaking engagements, special events and promotions, and conservation-focused signage in City facilities.

Since its inception in 2001, City of Dallas Water Conservation has hosted hundreds of free water-wise seminars, workshops, and events year-round, promoting a variety of relevant conservation topics and practices. In 2018, events were hosted in collaboration with Texas A&M AgriLife Water University. These subject matter experts offer year-round workshops and seminars on a wide variety of conservation-focused topics. During FY2019-20, most seminars and workshops were impacted by COVID-19 and switched from a traditional format to a virtual one, using Microsoft Teams. The virtual format allows for a wider audience to be reached and incorporated Spanish, Chinese, Hindi, and Vietnamese subtitles. All events remain in virtual attendance option only through FY 2022.

In March 2021, Water University disbanded, and the City contracted with Rooted In (RootedIn.com), a new consulting group consisting of past members of the Water University team. Rooted In provides a large variety of in-person, virtual, and hybrid classes on water conservation topics and practices. AgriLife attendance includes impressions from posted YouTube videos viewed after the events. Rooted In does not allow presentations to be posted due to proprietary information. This makes it difficult to determine the success of programs after early 2021. Additionally, by FY21-22 most COVID-19 restrictions were lifted, and residents were not as interested in watching virtual presentations.

Water Conservation Classes & Workshops				
Year	**Events**	**Attendees**	**Format**	**Presenter**
FY19-20	8	9,855	In-person/Virtual	Texas A&M AgriLife
FY20-21	7	2,920	In-person/Virtual	AgriLife/Rooted In
FY21-22	10	496	Virtual	Rooted In

**Rooted In does not allow post-event viewing on digital media channels*

Table 2-3: Classes & Workshops FY 2019-20 through FY 2021-22

DWU has participated in the statewide Fix-a-Leak Week Virtual Workshop series, beginning in 2021. Staff work with water conservation staff from Houston, Fort Worth, San Antonio, Tarrant Regional Water District, and several other entities to offer two workshops—on indoor and outdoor leak repairs. Workshop presenters included DWU staff and Rooted In.

Recommendation 2.6.1 Build a Relationship with Texas A&M AgriLife Center at Dallas

Texas A&M AgriLife Center at Dallas (dallas.tamu.edu) houses scientific research, public outreach, and education programs, which could provide the Water Conservation program with additional resources at no charge. Consider offering classes in a hybrid format, with both in-person and virtual attendance possible. It is important to have good audio equipment and an easy-to-use platform for residents to use to view the classes.

The City of Dallas has partnered with regional North Texas water providers Tarrant Regional Water District and North Texas Municipal Water District for the past several years to host the Annual North Texas Regional Water Conservation Symposium. The symposium provides education on related topics. In 2019, the 13th Annual Regional Water Conservation Symposium hosted 130 water professionals from across the Lone Star State. The City of Dallas offers to fund the attendance of one City staff member from each wholesale customer city. Other regions of Texas, including the Central and Gulf Coast regions, host similar symposiums. In 2020 and 2021, the Symposium, impacted by COVID-19, shifted to a virtual format. It returned to an in-person format in 2022 with 125 water professionals in attendance.

Recommendation 2.6.2 Continue Partnering with Neighboring Water Providers to Grow the Regional Symposium

Continue to partner with the water providers to grow the regional symposium. Reach out to regional universities and highs schools to include students to help grow the future water work force.

The City of Dallas also recognizes that a vital component of public education includes educating its employees on the value of water. Originally, Water Conservation hosted a Conservation on the Plaza event each spring, in coordination with National Drinking Water Week. This event is an opportunity specifically aimed at providing an in-reach experience to City employees in a fun, interactive way, while collaborating with other City departments. About 500 City employees attend the Conservation on the Plaza event each year. In 2020, Conservation on the Plaza was canceled due to COVID-19. In 2021, ongoing Dallas County COVID restrictions required the event to be conducted virtually. In 2022, the event moved to October and returned to a live format. Starting in 2023, the event will be held in September.

Recommendation 2.6.3 Offer Water Conservation Training to City of Dallas Employees

It is easy to underestimate the value of employees armed with accurate and up-to-date knowledge of water conservation efficiency. Encourage all departments to participate in water conservation training. Add employee training videos to digital media portfolios.

2.7 Water Conservation Mascot

In 2005, DISD students elected DWU's first official water conservation mascot, named DEW. Through frequent public appearances and community outreach, DEW continues to help educate children and adults about the importance of using water wisely. DEW has reached thousands of Dallas residents and businesses since his 2005 inauguration. More information on DEW's efforts can be accessed through the Kid's Corner link on www.SaveDallasWater.com.

In recent years, Water Conservation staff have considered updating the DEW mascot outfit, as it can present some challenges. The costume is cumbersome and becomes warm after only a brief period. The current costume always requires two staff members, one to wear the costume and a second to serve as DEW's handler, ensuring safety and mobility. Having only one mascot outfit makes it difficult to accommodate multiple mascot appearance requests.

Recommendation 2.7.1 Update the DEW Mascot Outfit(s)

Staff will continue to research wearability issues and will have graphic art renditions of DEW and potential new mascot(s) created. If new mascots are approved, budget for FY2025-26.

2.8 Water Conservation Art Contest

The Water Conservation Art Contest began in 1985, with records kept since 1996. The contest is usually part of the Drinking Water Week activities sponsored by DWU. Students who are Dallas residents in grades 1-12 may participate. Approximately 750 entries are received each year. Prior to COVID-19, EEI staff provided substantial aid for the program. EEI staff sent out publicity notices to school contacts, collected the art pieces, and worked along with a professional panel of judges to award first through third prizes in each category based on creativity, originality, artistic merit, and adherence to contest guidelines. After pausing from 2020-2022 due to COVID-19, the contest resumed in 2023 with OEQS Water Conservation staff leading the effort, with EEI support upon request.

Each contest has an annual theme. The contest began with a poster category, added T-shirt design in 2006, essay in 2010, and visual art in 2012, and digital art in 2016. In 2012, the essay contest was discontinued. Ages for categories have also been adjusted over time. Current contest categories are listed below:

- Poster for Grades 1-5
- T-shirt Design for Grades 6-8
- Visual Arts for Grades 9-12
- Digital Arts for Grades 9-12

Yearly participation, theme, number of categories, and number of winners is displayed in **Table 2-4** on the following page. Gray cells in the table indicate missing data.

Recommendation 2.8.1 Continue and Expand the Water Conservation Art Contest

Art contests are fun, education-friendly events to engage students in thinking personally and creatively about what water conservation means to them personally. Although there may not be a direct

correlation to quantifiable water savings, the contest is a valuable way to engage students who have different learning styles.

Water Conservation Art Contest			
Year	**Theme**	**Categories**	**Winners**
1996-2003	Water Conservation	1	9
2004	Water Conservation	1	9
2005	What Water Means to Me	1	9
2006	A Day Without Water	1	9
2007	Drip, Drop, Drought	2	10
2008	Water Rules	2	10
2009	What Can You Do to Save Water?	2	10
2010	You Can't Go Green without Going Blue	3	12
2011	Our Water Our Future, Don't Waste A Drop!	3	13
2012	Conserve Together – Water Forever	4	15
2013	Water Conservation Matters	3	13
2014	Water Conservation for Life	3	13
2015	Save Water All Ways, All Days	3	13
2016	Water Conservation, Less Means More	4	14
2017	Water Is Awesome	4	14
2018	Water=Life, Conservation=Future!	4	14
2019	Be Green like a Pro by Conserving H2O!	4	9
2020	No Contest		
2021	No Contest		
2022	No Contest		

Table 2-4: Water Conservation Art Contest (FY 1996-97 through FY 2021-22)

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2.9 Free Irrigation System Evaluations Program

In 2007, DWU added two TCEQ-licensed irrigators to water conservation staff to provide free irrigation system evaluations. Irrigators respond to residential and commercial retail customer high bill concerns in support of the DWU customer service division, or to requests by homeowners interested in improving irrigation efficiency. The irrigators evaluate automatic irrigation systems for potential water loss and suggest improvements to improve potential irrigation water savings. Evaluation includes potential system leaks, diagnosis of equipment malfunctions, recommended irrigation controller scheduling, and recommendations for equipment upgrades to enhance efficiency. Homeowners with an automatic in-ground irrigation system can qualify annually for the assessments.

Nearly 9,600 inspections have been performed since the program was launched. Average projected water savings per year based on implementation of recommendations is 38.4 million gallons per year. **Figure 2-2** reflects the scope of the Free Irrigation System Inspections Program's reach since program inception.

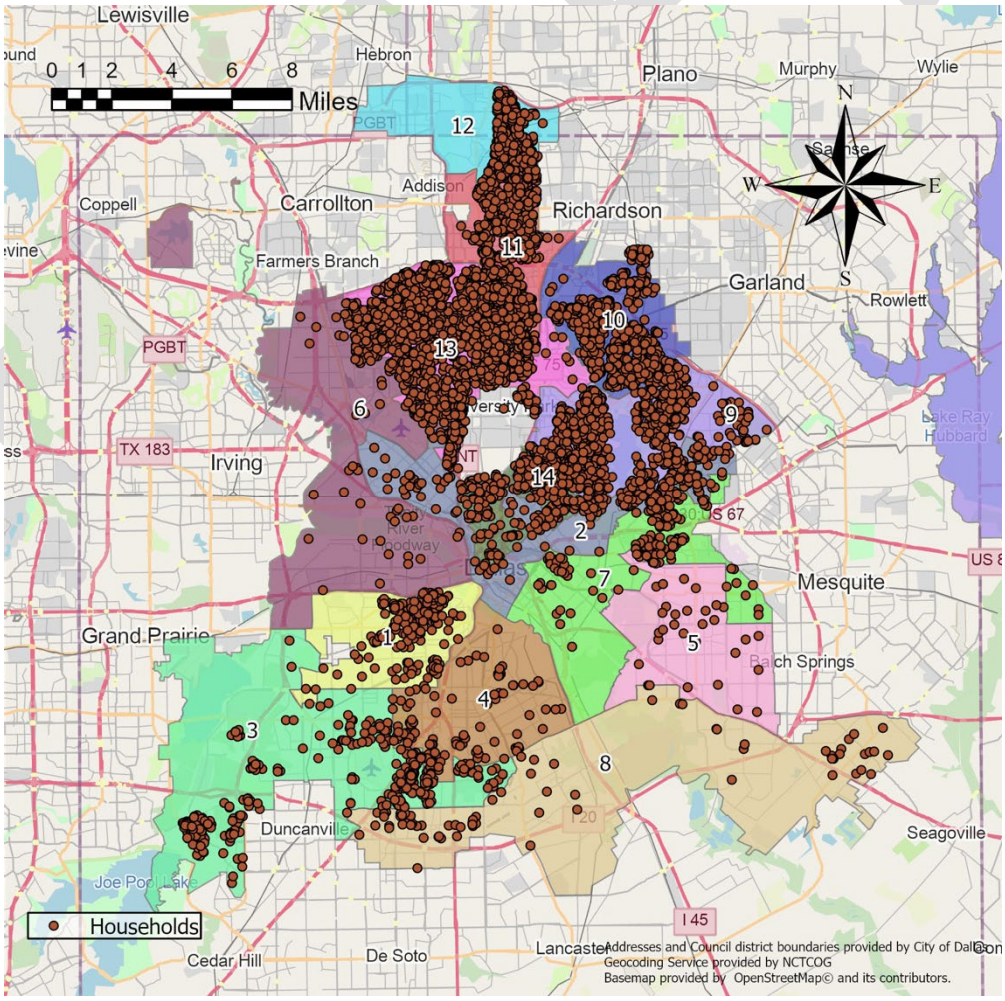

Figure 2-2: Free Irrigation System Evaluations FY 2008-09 through FY 2021-22

DWU's licensed irrigators work with other City of Dallas departments on proper maintenance, operation of City irrigation systems and new system design. Over 200 irrigation system evaluations were performed at Dallas parks facilities to date until, in 2018, Parks and Recreation added its own irrigation staff and no longer participated in this program.

Recommendation 2.9.1 Move Commercial Irrigation Evaluations to the ICI Free Water Efficiency Opportunity Survey

If volume and staffing become an issue for keeping commercial retail customers in this program, it is recommended that the ICI water efficiency opportunity survey contract be amended to include commercial irrigation as part of the survey process. Commercial irrigation evaluation is part of other ICI survey contracts in north Texas.

Working with DWU to enhance the installation requirements through additional ordinance requirements might be a better option. Chapter 51A of the Dallas City Code, Section 10.106 Irrigation Requirements, lists specific guidelines and requirements for designing and installing irrigation systems. This section could be amended to include a pre-occupancy requirement.

2.10 Enhanced Irrigation Ordinance Enforcement Initiative

The *2005 Water Conservation Five-Year Strategic Plan* recommended that DWU improve the utilization of codes and standards to promote water conservation. An additional recommendation acknowledged the need for improved ordinance enforcement. An option was suggested to fund additional City of Dallas Code Compliance inspectors to help enforce the ordinance. The need for more effective enforcement was again addressed in the *2010 Water Conservation Five-Year Strategic Plan Update,* acknowledging that up to that point, enforcement of water conservation restrictions had been a challenge.

In 2014, Dallas Code Compliance (DCC) began a pilot program of enhanced enforcement for water conservation violations related to high mosquito propagation. The effort provided DCC an opportunity to implement an aggressive campaign to target water waste, in particular overwatering of lawns and landscapes. The inspectors targeted areas with high water usage and positive mosquito trap tests.

Additional amendments to the City Code have streamlined the fines portion of the enforcement process. During the 2013 State Legislative Session, Senate Bill 654 was approved allowing municipalities to enforce water violations through civil rather than criminal actions. In 2015, the Dallas City Council adopted this approach for the enforcement of water violations. Although the new law continues to require Code inspectors or other authorized staff to witness the violation, it allows for the notice or citation to be posted on the property and mailed if the person is not available to be personally served. In addition, civil cases are referred to a Municipal Court hearing officer as opposed to a criminal court judge and the Code inspector is only required to appear if the citation is appealed or if requested by the defendant. These changes reduce the efforts and burden on Code inspectors.
Based on the success of the pilot, DCC and DWU developed a permanent program for systematic and continued enhanced enforcement from April 1-October 31. The program includes vehicle signage, inserts and handouts, and additional overtime funding to provide periodic enforcement coverage from 4 a.m. to 8 a.m. and from 8 p.m. to midnight, including weekends, periods when they are not normally on duty but during which irrigation normally takes place. The DWU annual budget for this program is

$166,978, which includes funding for enforcement activities by the DCC equivalent to two full-time personnel.

The projected annual costs were estimated at a maximum of $115,000 for overtime during drought years with lesser amounts for non-drought years and additional cost of approximately $5,000 for materials and vehicle signage. If a drought stage is declared, this effort could be increased to a level that would help provide for the 5% reduction in total GPCD for Stage 1, 15% reduction for Stage 2, and 20% reduction for Stage 3. It could also be possible to expand the program for enforcement of rain and freeze event violations with additional funding. **Table 2-5** shows the efforts of the initiative since FY2016-17.

City of Dallas Code Compliance Enhanced Irrigation Enforcement Initiative			
Fiscal Year	**No. of Assessments**	**Violations Found**	**Citations Issues**
FY 2016-17	N/A	N/A	N/A
FY2017-18	N/A	N/A	N/A
FY2018-19	N/A	N/A	N/A
FY2019-20	3033	1785	113
FY2020-21	4569	2553	139
FY2021-22	4354	2456	134

Table 2-5: Enhanced Irrigation Enforcement Initiative FY 2016-17 through FY 2021-22

Recommendation 2.10.1 Review Outdoor Watering Reporting Procedures for the City of Dallas 311 Program

In the future, DWU should work with the City of Dallas 311 program to make it easier to report water waste and misuse violations. Water conservation staff should address current concerns involving the difficulty of reporting water conservation issues using 311 with its program management, including moving the water waste violation from the Code Concerns to the Water Concerns section of the program. If the process can be utilized more effectively, review of current and possible uses of information and materials to promote reporting is needed. Working with the DWU public information office would be required to achieve this task.

Part of the education component of enhanced enforcement should be promotion of the Weekly Watering Advice. Part of the regional water conservation awareness campaign promoted on WaterIsAwesome.com and other platforms, the ***Weekly Watering Advice*** *uses localized weather reporting data to make a recommendation for the need for supplemental irrigation. Customers can sign up to receive a text or email update each Monday with the total water need and recommendations for run times depending on sprinkler system specifications. The Weekly Watering Advice should be a prominent part of all outdoor water conservation and efficiency messaging across all channels.*

2.11 Residential Irrigation System Rebate Incentive Program (Under Consideration)

The 2016 Work Plan recommended Dallas implement an irrigation system rebate program as a complement to any future landscape ordinance amendments and water budget initiatives. A rebate or other incentive should be offered to single family residential customers that retrofit their existing irrigation systems with water-conserving equipment. **Table 2-6** outlines the new incentives. The program should target the top 1% of residential water users. An example of a program model is outlined below.

Through the Residential Irrigation Design Rebate Program, water conservation staff will work with customers to help identify irrigation system changes that can result in water savings and a healthier landscape. Rebates will be designed to offset a portion of irrigation system redesign costs.

Eligibility

- Existing single-family and multifamily residential customers (duplexes and townhomes) who receive water service from Dallas Water Utilities (DWU). Applicant must have an existing in-ground automatic irrigation system.

Terms of the Rebate

- A one-time rebate of up to $550 per property for any combination of options, depending on the number of zones converted or capped. Only existing systems are eligible for rebates. Labor is not included in the rebate.

Procedures

- The Customer must submit a brief online preassessment form to the Water Conservation Division to be reviewed by a staff licensed irrigator.
- A licensed DWU irrigation professional will be assigned to the project and water conservation staff will track the project throughout the rebate process.
- The customer will have a licensed irrigator complete the work OR complete the work themselves.
- If the customer completes work, they must follow all city and state laws governing irrigation installation and design including obtaining any city-required permits.
- Once the installation of the redesigned system has been completed, the customer will submit a final rebate application and include information on work performed along with original receipts or invoices.
- The licensed DWU irrigation professional will conduct a final inspection, including work completed and irrigation controller scheduling.
- Upon final inspection and application approval, DWU will credit the customer's water bill for the approved rebate.

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Amount	Procedure	Description of Parts
$200	Converting a pop-up spray zone to drip/bubblers	The conversion of a zone that is currently irrigated by a pop-up spray or rotor irrigation system. Drip system pop-up spray must include appropriate pressure regulation, a filter and pressure release valve. For conversion from fixed sprays and rotors to a drip system, emitters must not exceed one gallon per hour. Drip irrigation must consist of: (1.) Half-inch tubing with built-in emitters; or (2.) Smaller point-source tubing connected laterally with individual emitters for specific plants. Tubing with laser holes is not eligible for rebate. Fittings should not be the barbed connection fittings but compression fittings that are more secure. System must include: (1.) A pop-up head with its nozzle closed or capped and the stem painted a bright color; or (2. A manufactured flag indicator. This will indicate that the zone is working properly. Misters are not allowed. Bubblers must be nonadjustable, fixed flow, not to exceed one gallon per minute per head.
$550	Splitting a zone to beds and turf	Conversion of a single zone that covers both turf and beds to two separate zones for turf and beds.
$200	Conversion of spray to multi-stream nozzles in turf zones	Conversion of existing turf zone from spray to multi-stream, rotating heads.

Table 2-6: Proposed Irrigation System Design Rebate Amounts

Recommendation 2.11.1 Evaluate Residential Irrigation System Rebate Alternatives for Pilot Project

This program cannot begin prior to FY25-26 due to budget forecasting to add additional staff. FY23-24 should be used to outline the rebate incentive and create process flows. Consider a one-year pilot program in FY24-25 with a limited scope and budget before opening this up to all residential customers in the city. Also be clear in all advertising the funding for the program is limited and that rebates will be awarded on a first-come, first-served basis.

Implementation of this program will require two additional staff. A licensed irrigator will be required to manage the technical aspects of the rebate process. An administrative staff member will be required to execute and track the rebate portion of the program. A licensed irrigator will need to review the required materials eligible for the rebate incentive for each eligible procedure listed in Table 2-1. Technology in the irrigation system world has evolved quickly over the last decade and the success of the program's water savings is dependent on the quality of the upgrades and retrofits.

2.12 Landscape Ordinance Review

Measures in this category strengthen the City's prohibition of wasteful use practices and sustain advances made in water conservation. Several ordinances have been approved since the publication of the 2016 Work Plan.

On June 27, 2018, the City of Dallas enacted an ordinance amending Article X, Landscape and Tree Preservation Regulations, of Chapter 51A, Dallas Development Code: Ordinance No. 19455, as amended. This ordinance was enacted to provide guidance to what many considered was an inadequate set of landscape regulations within the City of Dallas. For instance, this ordinance provides for and codifies the type of trees and landscaping that are now acceptable to be installed within the City of Dallas. Along with specific guidelines, the ordinance provides specific guidelines for conservation of various existing urban forest and grasslands, conservation of urban wildlife habitat, water conservation, and to enhance the general beautification of the City of Dallas.

The Landscape and Tree Conservation Regulations in Article X of the Dallas City Code of Ordinances allow the City to specify not only desirable plants that may be planted but allows the City to specifically prevent the planting of invasive and undesirable species of plants. The ordinance encourages native plantings, which will conserve water and is specific as to how and where such plantings may take place. This is done using Landscape Plans that must be submitted and approved by the City of Dallas' Building Official prior to the planting of any landscaping–both in new or rehabilitated areas, and in existing areas where a certain amount of landscaping may be repurposed. The intent of the landscape ordinance is to provide residents and developers with a consistent foundation in which to develop the City of Dallas' Urban Forest in a cost effective, thoughtful way with an eye toward conserving water.

Chapter 51A of the Dallas City Code, Section 10.106 Irrigation Requirements, lists specific guidelines and requirements for designing and installing irrigation systems. The section includes Alternative Irrigation Systems, allowing a State-licensed Landscape Architect or Licensed Irrigator to design alternative systems to take advantage of modern irrigation methods as long as the irrigation system is capable of always maintaining plant materials in a healthy growing condition.

To provide DWU with potential paths of action to increase water efficient landscaping and irrigation regulation as a water conservation tool, existing and proposed landscaping ordinances of 12 municipalities, primarily in the Southwest, are summarized in **Table 1-2** at the end of the Landscape Ordinance Review Appendix. This compilation does not include water waste, time-of-day and day-of-week watering restrictions, and other commonly held restrictions in cities and states across the country that are common and already part of the City of Dallas implemented water conservation measures. The Landscape Ordinance Review Appendix focuses only on ordinances and regulations that apply to landscaping. Many of these cities employ other water conservation measures as part of their ordinances that could merit further investigation.

Recommendation 2.12.1 Evaluate Potential Landscape and Water Conservation Ordinances

A review of landscape ordinances in multiple cities, most in the southwest United States, has been included as part of the plan in the Landscape Ordinance Review Appendix.

2.13 Water Wise Landscape Tour

The DWU Waterwise Landscape Tour began in 1995, and as technology advanced, the program made changes and updates to increase the number of tour visitors. With a new 21st Century perspective, in 2019 the OEQS Water Conservation team set out to mark the 25th anniversary of the tour with additional strategic improvements, including:

- Strengthening the educational value of the tour;
- Encouraging participants to visit each of the tour landscapes; and
- Encouraging the incorporation of sustainable gardening practices.

The original tour showcased real-life examples of how to use water-wise principles to produce a Texas-tough, drought- tolerant, beautiful landscape. Judging criteria was expanded in 2019 to go beyond the primarily aesthetic criteria to include sustainable gardening practices in the form of food scaping (designing gardens that include edible plants), composting, and water-conserving practices including drip irrigation and the use of permeable surfaces. To assist gardeners in meeting the new criteria, DWU originally partnered with AgriLife Water University and since 2021, with Rooted In, to offer free classes on these sustainable landscape practices leading up to the tour. Three elements were added to the tour to encourage more people to visit each landscape:

- Offering educational micro-talks at four different tour landscapes;
- Having garden-related giveaways tied to the micro-talks (short explanations on select topic by experts) at each tour stop; and
- Encouraging and recruiting more community garden entries, including hydroponics, vegetable, and pollinator gardens.

An additional new objective was more accurate counting of people participating in the tour. In the past, staff counted the total number of people visiting tour headquarters and every landscape. For more accurate attendance tracking, a new data sheet was developed, and each visitor was asked if this was their first landscape visit that day to avoid double counting.

The 25th anniversary tour had two periods of promotion. First, homeowners were recruited to enter their landscapes for the tour. Second, promotions focused on encouraging tour day visitors. Combined impressions for the tour reached 800,000 with a combination of printed water bill inserts, online ads, social media posts on multiple pages, digital billboards, as well as newspaper and radio ads. In-person recruitment and promotion for the tour included tabling at two Dallas garden centers and distributing flyers at several public events, including the State Fair of Texas.

Once the tour entries were received, a panel of five judges scored the landscapes. The judging team consisted of local Dallas celebrity judges, who created the following categories: Best of Show, Best Large Garden and Best Small Garden. Winners and honorable mentions were announced prior to the tour, and special signage marked their homes. All gardeners received a tour apron featuring the new 25th Anniversary commemorative logo along with a steppingstone affixed with a 25th anniversary medallion. A virtual tour of each garden was posted online to increase accessibility, enable the tour winners to see the other winning gardens, and for those who had to miss the tour day. The webpage (savedallaswater.com/25th-water-wise-landscape-tour) also featured an interactive map for visitors to

plan their route, see the visitor giveaways, and determine which micro-talks were at the four locations. The tour featured ten residential landscapes spread across the city, five community gardens, and tour headquarters at White Rock Pump Station, featuring its waterwise landscape. Four of the residential landscapes held micro-talks on irrigation, rain barrels, composting, and pollinator protection. Monarch butterfly micro-talks and tagging were held at Tennison Pollinator Garden. Tour headquarters had informational booths from City of Dallas Departments and WRR (101.1 FM). Each tour location was staffed with employees and volunteers. The last component was an award ceremony at the City of Dallas Environment and Sustainability Committee meeting at Dallas City Hall. The City Council was invited to join for a casual lunch. The awards presented to the winners were artistic recycled glass objects. Approximately 45 people attended the Committee meeting.

Visitors to each garden were asked to take an eight-question survey. Takeaways from the 132 responses include:

- 16 different North Texas zip codes represented by visitors
- 53% heard about the tour through the water bill insert, social media, or WRR radio
- 72% are likely or highly likely to add water-wise plants to their landscape
- 44% were interested in a shade gardening educational talk or class

The 2019 Waterwise Landscape Tour results highlighted DWU's dedication and vision for the program. Attendance (724 visitors) decreased due to a tornado a few days before the tour date. It is difficult to quantify water savings achieved directly from water-wise events. However, these programs heighten awareness of the beauty and reduced need for water and maintenance with the use of native and adapted plantings and provide tools for landscape conversion and proper maintenance. Due to COVID-19 restrictions, the 2020 and 2021 tours were held virtually. Attendance in 2020 was 75 and 67 in 2021. Attendance improved in 2022, with 165 residents touring in-person again.

The water-wise landscaping BMP is also promoted through a selection of curated year-round water-wise seminars and workshops, the City's WRR Classical 101.1 FM radio station series *Classically Sustainable*, KXT 91.7 FM, and the City's water conservation website (www.SaveDallasWater.com).

Recommendation 2.13.1 Evaluate Ways to Promote and Expand the Waterwise Landscape Tour

The Waterwise Landscape Tour is a great showcase, but attendance is low in proportion to the amount of staff time and effort in planning and execution. Consider working on new ways to promote the program. Partner with a local garden center (perhaps Rooted In) to provide discounts on select plants with a tour ticket. Partner with a local irrigation store to provide discounts on selected irrigation products (drip tubing, rotors, spray heads, etc.) with a tour ticket.

Find the neighborhoods with existing pockets of Waterwise landscapes and encourage them to apply for the tour. Consider a regional geographic focus each year to make it easier to tour multiple sites. Include both residential and commercial sites in the tour. Include a micro-talk or demonstration at each location on the tour.

2.14 Native Vegetation Evaluation Program for Water Savings

The Texas Blackland Prairies run from the Red River in north Texas south to San Antonio. With rich, dark soil, only about 1% of its original vegetation remains in small pockets. The prairie area includes

Dallas County and the City of Dallas. The dark alkaline soil is suited to the growth of tallgrass prairie grasses, and a variety of trees. These plants provide a rich diversity of birds and animals. It is one of the most endangered ecosystems in the U.S.

Dallas Water Conservation is interested in a program to encourage planting of Blackland Prairie native trees, plants, and grasses across the city on public, commercial, and residential properties.

The Landscape Ordinance Review Appendix of this plan reviews irrigation/landscape ordinance for several cities, mostly in the Southwest U.S. It is common to see a landscape plan requirement in those cities. Many of them also have required plant lists for new or replacement landscaping. Some even have requirements for turf percentage of total landscape.

Recommendation 2.14.1 Investigate the Availability of Appropriate Plants for Use in Dallas Landscapes

During this Work Plan, steps should be taken to investigate the availability of appropriate plants for use in the Dallas metropolitan area. Soils in developments may no longer be suitable for these plants without amendments, etc. Sources for these plants must also be cultivated. Rooted In and AgriLife would be helpful resources.

If it is determined that the recommended plant list is viable for the typical City of Dallas lot, then it must be decided if this is to be a voluntary incentive program or a requirement through ordinance for new and/or existing developments.

A challenge to either a voluntary or ordinance approach will be pushback from HOAs. HOA boards are often resistant to the "more unkempt" look of these types of plantings and may not approve them when landscape plans are submitted to them. Public education and outreach will be required, especially if a voluntary program is the goal.

Industrial, Commercial, Institutional (ICI) Water Efficiency Programs

2.15 Industrial, Commercial, Institutional (ICI) Free Water Efficiency Opportunity Surveys

In 2012, the Dallas City Council authorized an Industrial, Commercial, Institutional (ICI) Water Efficiency Evaluation component to help industrial, commercial, institutional, and multifamily customers save water and money by identifying opportunities to increase water use efficiency and reduce water, wastewater, and energy costs in and around their properties. These free assessments are an integral incentive-based conservation program and include a full examination of the following components:

- Cooling Towers, Boilers & Other Thermodynamic Operations
- Plumbing Fixtures, Fittings & Equipment
- Landscape Irrigation
- Food Service Operations
- Laundry and Vehicle Wash Operations
- Laboratory & Medical Facilities
- Swimming Pools, Spas & Fountains

More than 1,000 water efficiency building evaluations have been performed since the program was launched, with an estimated water savings of about 698 MG annually (**Table 2-7**) if recommended process and equipment improvements are implemented. North American Industry Classification System (NAICS) coding and benchmarking for all ICI customers will be completed during this work plan and used to identify future ICI customers for surveys and rebates. The annual projected budget for this program is $218,464.

Fiscal Year	Sum of Number of Buildings Audited	Annual Potential Water Savings (Gallons)
2012-13	25	78,160,860
2013-14	29	101,806,741
2014-15	35	81,210,835
2015-16	226	105,636,595
2016-17*	0	0
2017-18	158	44,212,899
2018-19	365	121,940,182
2019-20	124	98,815,378
2020-21	23	48,228,517
2021-22	66	17,921,284
Total	**1,051**	**697,933,291**

**No Contract in Place*

Table 2-7: Number of ICI Audits per Year with Potential Annual Water Savings FY 2012-13 through FY 2021-22

In 2011, the Dallas City Council authorized a program to encourage hotels/ motels and restaurants to expand their efforts to save water by participating in the City's Water Conservation Hospitality Industry Program. The initiative was voluntary. Participating hotels and motels urged guests to request fewer linen and towel changes, as well as serving water on request only in their dining and bar areas. In support, the City provided free public service announcements to participating lodging facilities to educate their guests about the program. Dallas area restaurants were encouraged to serve water on request only. This simple measure not only saves our water resources but also provides energy savings through less frequent dishwashers and heated water use. Free marketing and promotional materials were provided for participating establishments. In total, 79 hotels, motels, and restaurants participated in the ICI Hospitality Program. In FY 2017, it was decided to fully merge the ICI Hospitality Program with the Industrial, Commercial, and Institutional (ICI) Free Water Efficiency Assessments component, and the ICI Hospitality Industry Program was officially sunset.

Recommendation 2.15.1 Continue the Free Water Efficiency Surveys to the ICI Sector Customer Base

Encourage all members of the Water Efficiency Partnership (WEP) to encourage participation in ICI water efficiency opportunity surveys through the program. Use the ICI Water Efficiency Partnership to conduct and showcase case studies in water efficiency. Consider adding an irrigation component to the survey. This is a common part of other ICI water efficiency opportunity

surveys. It can complement or replace the commercial portion of the Free Irrigation Evaluation program. Having just one visit would be beneficial to businesses. While most ICI properties have a landscape company, most do not have a certified irrigation system professional. Adding this component to the survey process will initiate the discussion of the importance of regular assessment of irrigation systems to maintain efficiency and save water.

2.16 Industrial, Commercial, Institutional (ICI) Rebate Incentives

In FY 2012, Dallas City Council authorized funding for ICI rebates to help industrial, commercial, and institutional customers defray the costs for large water conservation projects. Up to $100,000 (per project) in site-specific rebates are available to ICI customers towards the cost of new equipment and/or processes that help conserve water at existing facilities. To qualify, ICI customers must meet the following criteria:

- Any ICI DWU Customer in GOOD STANDING is eligible to apply for a rebate.
- Participate in an ICI Water Efficiency Opportunity Survey.
- Applicant must agree to operate and maintain equipment in proper working order for an agreed upon period (5 to 10 Years). Water Conservation reserves the right to inspect.
- One-time cash rebate not to exceed $100,000.
- The rebate available for each project is based on the lesser of (1) half the installed cost* OR (2) $0.96 per 1,000 gallons saved over the life of the project (maximum of 10 years). *The installed cost is defined as the cost of the equipment plus the cost of external contracted labor. Internal labor costs are not eligible for consideration.
- Accepted projects require the signing of a legal binding contract between the City of Dallas and the applicant.
- Project must be pre-approved before work begins.
- Rebates are issued only after all invoices have been submitted and all equipment is installed and operational. A post- inspection is required.
- Rebates will not be offered for systems that are already required by local ordinance, state, or federal law.
- Rebates will be determined based on pre-retrofit water consumption patterns, not on projected growth.
- Rebates greater than $50,000 require City Council approval.

As shown in **Table 2-8**, 13 ICI customers have received rebates totaling $408,536.88, for a combined annual water savings of more than 120 MG annually for the life of the replacements. The ICI Rebate Incentive program budget is $500,000 per year and the goal is to award at least five rebates per year. The rebate incentive program has not met expectations in terms of numbers or dollars paid.

Property Zip Code	Annual Water Savings*	Rebate $	Fiscal Year Paid
75390	34,822,000	$34,054.37	FY15-16
75231	3,000,000	$23,628.33	FY18-19
75243	24,883,000	$71,326.49	FY19-20
75001	11,856,618	$87,185.98	FY19-20
75287	12,005,143	$52,484.90	FY19-20
75240	3,686,792	$21,286.75	FY19-20
75287	4,087,416	$18,554.73	FY19-20
75240	3,909,150	$9,881.94	FY19-20
75231	3,426,156	$16,085.87	FY19-20
75214	2,376,094	$7,706.54	FY19-20
75287	7,103,484	$32,632.98	FY19-20
75219	6,368,026	$21,959.00	FY19-20
75221	3,026,610	$11,749.00	FY21-22
Totals	**120,550,489**	**$408,536.88**	

**Based on life expectancy of replacement*

Table 2-8: ICI Rebates & Annual Water Savings FY 2015-16 through FY 2021-22

Recommendation 2.16.1 Evaluate and Streamline the ICI Rebate Process

The current process is long and arduous for the customer. Because of City of Dallas financial requirements, the process must occur in a set order that involves multiple departments with various priorities, each of which can delay the process by a substantial amount of time. Beginning in 2022, the City contractor for the ICI Water Efficiency Opportunity Survey accepted responsibility for guiding customers through the process, by acting as a liaison between customers and the City.

There are several recommendations to increase the number of participants entering and successfully navigating the process.

Recommendation 2.16.2 Develop Interdepartmental Team to Accelerate Rebate Processing

Work through department management teams to help set parts of the process that are out of the control of the water utility as priorities in the other departments. Establish realistic expectations for turnaround times.

Recommendation 2.16.3 Increase Rebate Incentive Amount

Based on the rate of inflation over the past decade, the rebate calculations should be updated to (1) one-half of the installed cost of the improvements, including external labor OR (2) $1.12 per 1,000 gallons of water saved over the life of the project (maximum, whichever is less. Calculations estimate that costs have increased about 16%.

Recommendation 2.16.4 Evaluate Alternatives to Cash Rebates

2.17 Industrial, Commercial, Institutional (ICI) Water Efficiency Partnership

Dallas Water Conservation plans to establish an industrial, commercial, institutional (ICI) Water Efficiency Partnership (WEP) stakeholder group to provide input regarding needs of various industries to address and improve water efficiency in their facilities and properties. The WEP's feedback will aid the development of water conservation resources, training, and education programs to reduce ICI water use. The WEP will also be tasked to champion support for those programs throughout the City of Dallas ICI sectors. The WEP is not a policymaking group but will be vital to gather information about how water efficiency improvement decisions and implementations are made in ICI sectors and what needs could be met by Dallas Water Conservation programs. The plan is for the partnership to be presented to OEQS and DWU leadership in FY 2023-24 with meetings to begin in FY2024-25. The WEP will meet regularly (frequency to be determined). The first meeting will be an orientation defining the purpose of the group, an overview of current conservation programs and offerings.

WEP members will include representatives from a variety of industrial, commercial, and institutional sectors so that effective programs can be developed that address the concerns, needs, and unique water demands of diverse user groups. Sectors and/or organizations to be considered include, but are not limited to:

- Dallas ISD
- Dallas College, UNT at Dallas, Dallas Baptist University Sustainability Offices
- Dallas-Fort Worth Hospital Council
- Apartment Association of Greater Dallas, Dallas County Housing Agency, Dallas Area Habitat for Humanity
- MetroTex Association of Realtors (north Texas)
- Women in Manufacturing (Dallas Chapter), Texas Association of Manufacturers
- Building Owners & Manager Association of Greater Dallas
- Greater Dallas Chapter of the Texas Restaurant Association
- Dallas 2030
- Cooling Technology Institute, Tower Tech Services, Dallas Cooling Tower Depot
- Dallas/Fort Worth Retail Executives Association
- Texas Nursery & Landscape Association Region IV-Greater Dallas Area
- Power Washers of North America
- TEXO Construction Association (North & East Texas)
- Atmos Energy, Texas Utilities Company
- International Facilities Management Association - Dallas/Fort Worth Chapter
- North Dallas Neighborhood Alliance
- North Texas Golf Course Superintendents Association
- Nonprofit Organizations

Recommendation 2.17.1 Establish Water Efficiency Partnership

Presentation to OEQS and DWU leadership is the next step. Be sure to clarify that the role of the WEP is to provide input not set policy for water conservation. The focus is on training, information, and education that can be offered by DWU to help ICI sectors understand water efficiency and how to

better manage their own water use. The group will be structured informally as a focus group with staff asking guided questions.

Encourage WEP members to be industry/sector leaders through participation in the ICI water efficiency opportunity survey/rebate programs. Use them to write up case studies to use for future promotion and for presentations at workshops and conferences.

The WEP could also be the driver for the establishment of an environmental awards program, focusing on recognition of ICI customers who participate in the ICI program and show significant improvement in water conservation programs and outreach, and improvement in water processes to increase water efficiency. Examples of effective awards programs include the City of Fort Worth Environmental Awards (www.fortworthtexas.gov/departments/water/about- us/environmental-awards). WEP members could serve as judges and help promote the awards and the ICI program across the city.

2.18 Industrial, Commercial, Institutional (ICI) WEP Training

Dallas Water Conservation plans to develop water efficiency training programs for industrial, commercial, institutional (ICI) facility managers and irrigators with a focus on the EPA WaterSense Program (*epa.gov/watersense)*. The plan will be presented in FY2024-25, after a series of meetings with the newly formed WEP to determine needs.

Each workshop will involve two to four hours of instruction time and will be developed with specific input from target customers within the DWU service area. Each course will be developed for the end user and will incorporate real world scenarios, actual case studies, and specific exercises aimed at soliciting participation and facilitating idea sharing. Workshop topics may include:

- Water Conservation codes, ordinances, and regional goals and priorities
- How to lower operational costs and environmental impact through water efficiency and conservation
- Best management practices (BMPs) for water efficiency
- The importance and process of identifying end uses
- Property assessments with a walk-through checklist
- Energy/Water Nexus
- Engaging leadership in planning efforts
- Employee-led behavior change programs
- Evaluating the effectiveness of recent technologies
- Evaporative Cooling Towers
- Conducting Cost/Benefit Analyses
- Industry Specific Workshops – Hospitals, Schools, Laundry Facilities, etc.

Recommendation 2.18.1 Prepare WEP Training/Education Materials

If the WEP is to be established during FY2023-24, then training and educational workshops should begin being offered in FY2024-25. Determine training topics based on input of needs from WEP. It is important that trainers/presenters have credentials to provide in-depth knowledge of topics as most attendees will have some level of knowledge due to job responsibilities. Is two to four hours long enough to provide the training scenarios listed above? Will training be recorded or offered virtually

simultaneously? Use the input of the WEP to determine the best ways to promote attendees for the training/workshops. Determine location of trainings, field trip v. classroom, etc.

2.19 Industrial, Commercial, Institutional (ICI) Nonprofit Retrofit Program (Under Consideration)

The City of Dallas ICI Nonprofit Retrofit Program is intended to provide authorized domestic plumbing retrofits for qualifying nonprofit facilities. This program would be administered in house and conducted by a licensed plumbing contractor selected through a Request for Proposals (RFP) process. All fixtures to be installed as part of the program would need to be procured through an RFP process. This plan should be implemented in FY 26-27, with a small pilot of 5-10 facilities during FY2025-26.

ICI Nonprofit Retrofit Program Participant Qualifications:

- DWU ICI customers in good standing
- Property built prior to 1994
- ICI Water Efficiency Opportunity Survey or City plumbing inspector survey required
- Proof of nonprofit status

Qualifying properties may include, but are not limited to:

- Public Schools, State and Private Colleges and Universities
- Municipal, County, State and Federal Facilities
- Non-Profit Housing facilities

Authorized retrofits under this program include:

- Replacement of High-Flow Toilets
- Replacement of High Flow Faucet Aerators
- Replacement of High Flow Showerheads

Recommendation 2.19.1 Develop ICI Nonprofit Retrofit Program

First, it is legally vital to define what the term Nonprofit means for this program. According to the National Council of Nonprofits (https://www.councilofnonprofits.org/what-nonprofit), Congress has created almost three dozen types of tax-exempt organizations in different sections of the tax code. There are more than 38,000 nonprofits in the north Texas region, so a firm definition will help determine scope and budget. A qualification process will need to be developed and vetted.

The next step is to determine the scope of acceptable repairs to be covered by the program. Is the program to be only retrofit/replacements or also repair? The initial proposal includes only retrofits of toilets, showerheads, and aerators. A determination regarding whether repairs of toilets, faucets, and other obvious leaks (inside or outside of walls?) will be included needs to be made.

This program requires an RFP process to procure both plumbers and products. The program would run similarly to the residential Minor Plumbing Leak Repair program. The plumber determines the scope of the repairs which is approved by City staff. The plumber then procures all materials from approved vendors and completes the job.

This program will require additional staff. A licensed plumbing inspector will administer the technical part of the program. An administrative position will be needed to manage the application, financial,

and historical tracking for the program. The scope of this program will require the addition of a program coordinator.

A pilot program may be advisable before rolling out this program. A pilot will help determine the average cost per job to determine the budget. It will also help determine demand for the program and what labor resources will be needed. It will also help determine availability of products through selected suppliers in a timely manner.

2.20 City Leadership and Commitment Grant Program

The City Leadership and Commitment Grant Program for water conservation began in FY2005-06 with a five-year grant awarded to Equipment and Building Services to work on projects at multiple City facilities and properties. Since then, these competitive grants have supported retrofits at City facilities, including replacement of indoor plumbing fixtures and outdoor irrigation audits and corresponding irrigation system/landscaping improvements. Through FY2021-22, $3,777,525 in grant funding for City projects has been awarded since its inception. Estimated total savings for the program are not available due to incomplete reporting through the program history.

In FY 2016-2018, DWU partnered with the City departments of Economic Development, Housing/Community Service, Planning and Urban Design and Parks and Recreation to implement a water conservation and beautification project concentrated on the South Dallas/Fair Park Community in Dallas. The three-year project focused on the area fire stations and the Martin Luther King Jr. Community Center and Library. In all, the project resulted in an estimated water savings of 1.39MG per year. Overall, the project achieved the following:

- 103 new trees and 2,150 native plants planted
- Replace traditional turf landscapes replaced water-wise landscapes with 30 tons of stone
- Retention basins added for the capture and reuse of storm water
- Plumbing upgrades in all buildings including:
    - Replacement and/or retrofit of 65 toilets
    - Replacement of 67 lavatory sinks
    - Installation or retrofit of 75 lavatory faucets
    - Replacement of 67 urinals
    - Replacement of 6 water fountains
    - Replacement of 12 kitchen faucets

Grant funds for FY 2019-20 were awarded to Dallas Fire-Rescue Department for the purchase of two closed-loop pump simulators, to be used for training at DFR pump school. These pump simulators use a recirculating system, practically eliminating water waste and resulting in an estimated annual water savings of 25-35 million gallons per year.

For FY 2018-19 (design), FY 2020-21 and 2021-22 (construction), Dallas Park and Recreation used awarded funds to continue the Dallas City Hall media renovation design project, focusing on conversion of street medians at Akard and Ervay intersection to drip irrigation, to demonstrate regionally suitable water-wise landscape design around Dallas City Hall.

Recommendation 2.20.1 Increase Promotion of City Leadership and Commitment Grant Program

The program and the improvements are not currently promoted except being mentioned in presentations. Signage promoting the retrofits and anticipated water-savings at each grant-winning location would be a beneficial outreach tool to show the City is doing its part to lead water conservation efforts. Press releases announcing each year's grant winner would also be an appropriate way to promote this program to the public.

Indoor Water Conservation & Efficiency Programs

2.21 Minor Plumbing Repair Program

In 2005, the Minor Plumbing Repair (MPR) Program began with the goal of assisting 350 low-to-moderate income DWU customers per year to reduce water waste and increase water efficiency. The average life span on MPR repairs is 10 years. The MPR program repairs or replaces inefficient water use fixtures with water efficient fixtures, including toilets (up to two per household), faucets and faucet aerators, showerheads, hose bibs, and easily accessible pipe joint leaks.

To qualify for the MPR Program, customers must meet the following criteria:

- Must be a DWU customer
- Qualify as low-income, as defined by the U.S. Department of Housing and Urban Development (HUD) (under 50%) income guidelines; verified in-house by plumbing inspector
- Own your home and reside on the property

Since its inception 5,092 customers have participated in the program. **Figure 2-3** shows the geographic distribution of these customers. Projected annual savings for this program are 6.8 million gallons.

Recommendation 2.21.1 Determine the Capacity of the Minor Plumbing Repair Program

Determine if there is more capacity in the program. MPR is promoted at least twice yearly in bill inserts. If that allows for complete spenddown of annual funding, then stop there. If not, consider secondary advertising, through partner organizations with other low-income programs. Provide them with print brochures and ask them to provide referrals

Recommendation 2.21.2 Evaluate the Addition of Small Businesses to Minor Plumbing Repair Program

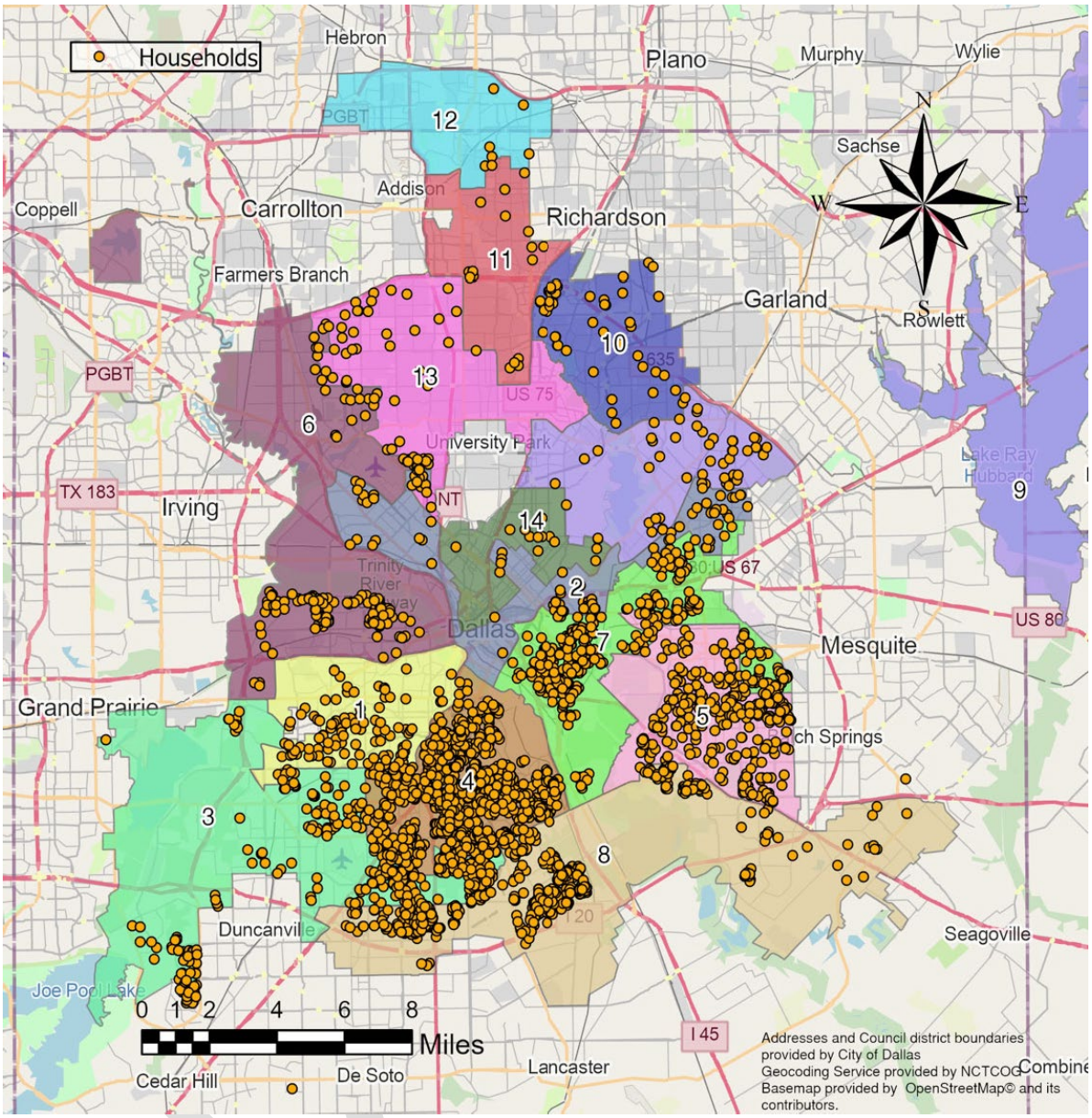

Figure 2-3: Minor Plumbing Repair Map (Households Served)

2.22 New Throne for Your Home Single-Family Free Toilet Voucher & Rebate Programs

Single-Family Program

The New Throne for Your Home (NTFYH) program, initiated in 2007, offers free vouchers and rebates of up to $90 per toilet for the replacement of older, inefficient toilets with high efficiency (HET) models.

Single-family vouchers are limited to two toilets per household. A rebate option is also available, for up to $90 per toilet. Upon proof of purchase, rebates are applied to the customer's water bill, with a maximum of $180 or the equivalent of the maximum of two $90 credits limit of two toilets per home).

To qualify for the NTFYH Single-Family Free Toilet & Rebate Program, applicants must meet the following criteria:

- Must have an active DWU account
- Home must have been built before January 1, 1994
- Must not already have water efficient toilets (will not replace 1.6 gpf toilets)

The NTFYH Single-Family Free Toilet & Rebate Program is promoted in print, social media and at www.SaveDallasWater.com.

From FY2010-11 through FY2021-22, 30,924 vouchers and 8,786 rebates for toilets have been redeemed through the New Throne for Your Home Single-Family Free Toilet Voucher & Rebate Program. Using EPA WaterSense annual savings estimates of 13,000 gallons per toilet, these water efficient toilets are projected to save over 56 MG annually. **Figures 2- 4 and 2-5** reflect the scope of the New Throne for Your Home (NTFYH) Single-Family Free Toilet Voucher & Rebate Program's reach since program inception. The annual budget for the toilet program is $500,000.

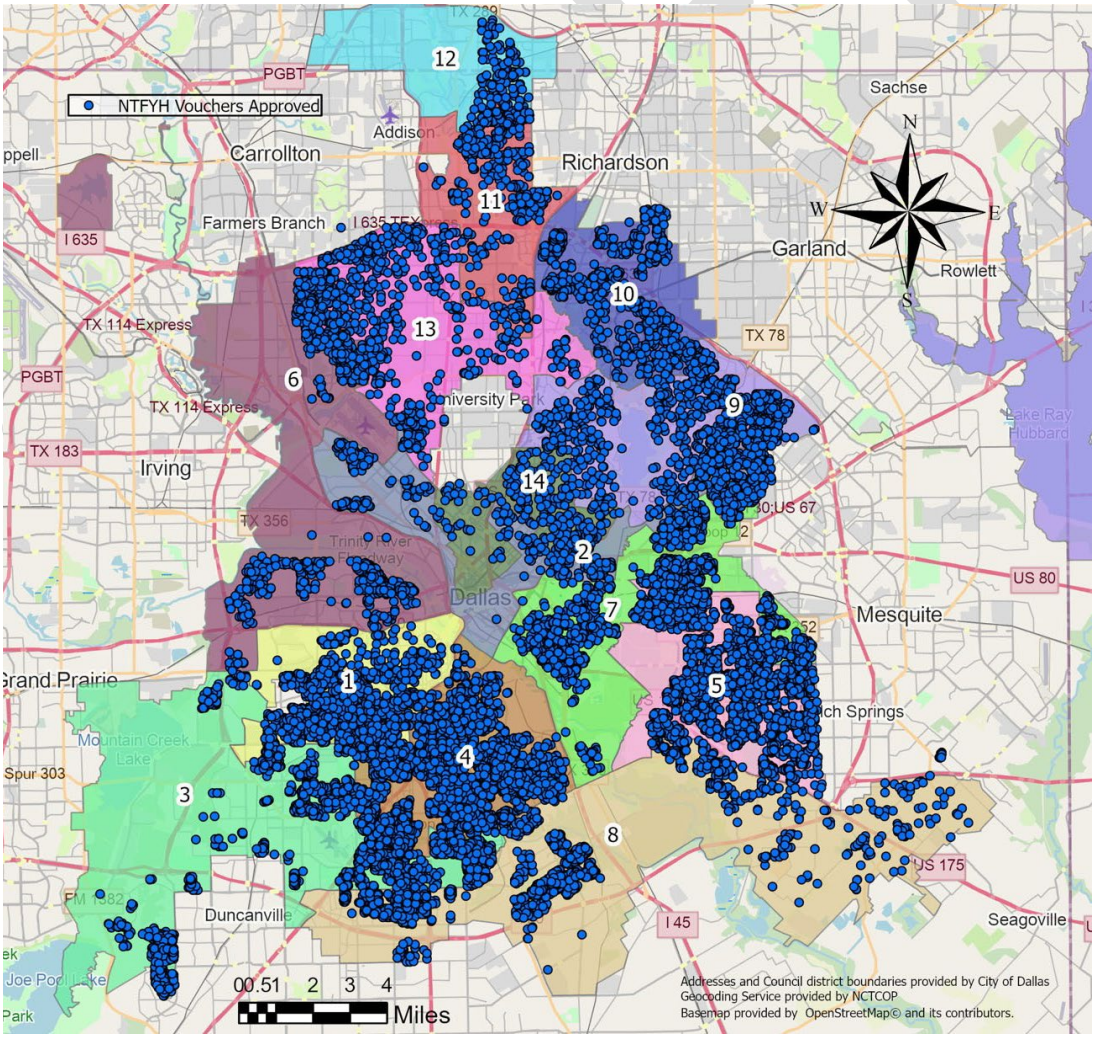

Figure 2-4: New Throne for Your Home Residential Voucher Program Map FY 2010-11 through FY 2021-22

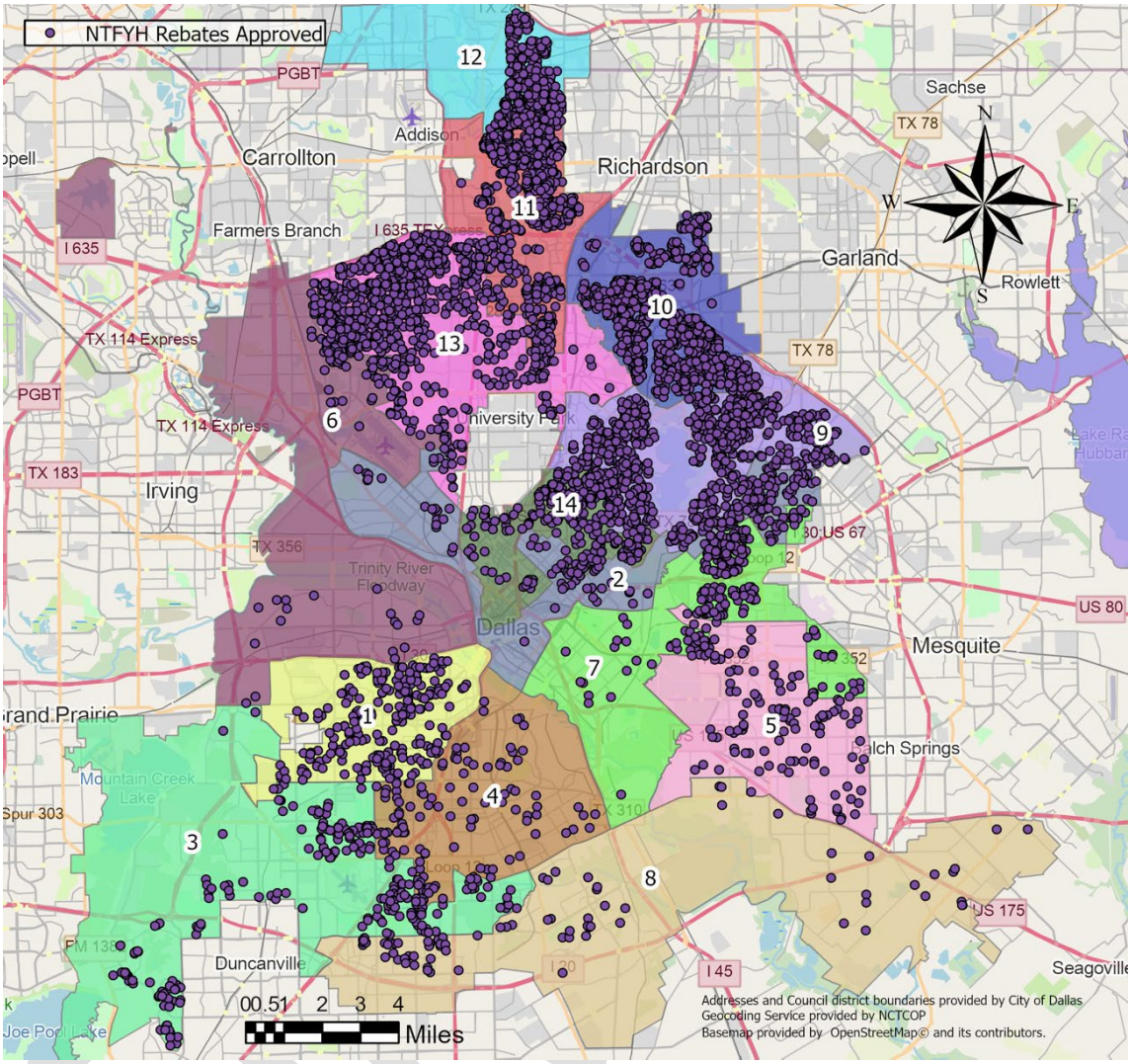

Figure 2-5: New Throne for Your Home Residential Rebate Program Map FY 2010-11 through FY 2021-22

Multifamily Program

The goal of the New Throne for Your Home (NTFYH) Multifamily Program is to assist DWU multifamily customers in replacing older, inefficient water use fixtures with water efficient models. The program provides high-efficiency toilets and low-flow showerheads, to those who qualify, to mitigate water usage at complexes housing large numbers of people.

To qualify for the NTFYH Multifamily Program, applicants must meet the following criteria:

- Must have an active DWU account
- Current toilets on premise must have been installed prior to January 1, 1994
- Must agree to a pre- and post-retrofit inspection

Through FY2021-22, 44,242 toilets and 24,899 showerheads have been replaced through the New Throne for Your Home Multifamily Program. Using EPA WaterSense annual savings estimates of 13,000 and 2,700 gallons respectively, these efficient toilets are projected to save over 57 MG

annually, with the showerheads projected to save over 13 MG annually. **Figure 2-6** reflects the scope of the New Throne for Your Home (NTFYH) Multifamily Free Toilet Voucher & Rebate Program's reach since program inception.

It is recommended that this program be promoted when an ICI survey is done at a multifamily property.

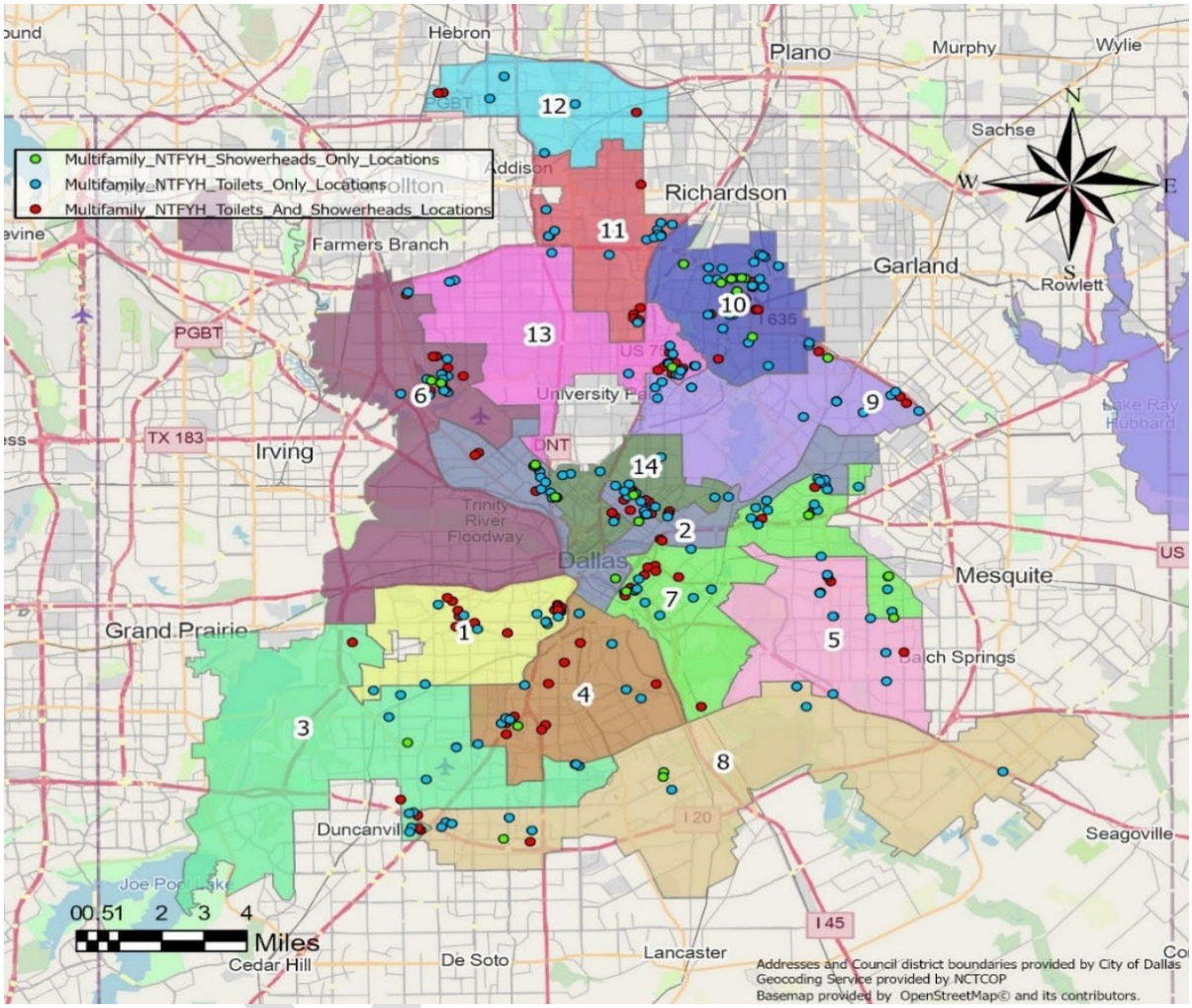

Figure 2-6: New Throne for Your Home Multifamily Program Map
FY 2010-11 through FY 2021-22

Recommendation 2.22.1 Develop Sunset Plan for The New Throne for Your Home Programs

The New Throne for Your Home residential and commercial programs are nearing their sunset phase. During this Work Plan, the final marketing push will be implemented with sunset in FY2027-28. Messaging will need to be tailored for all households that have not yet participated in the program.

Blanket messaging through social media, bill inserts, etc. is not recommended at this point. Despite the requirement that the home be built prior to 1994, it will attract a lot of calls from people with 1.6 gpf toilets (began being required in 1994) which are also aging out at 30 years.

To determine who to target for the remaining distribution program, filter all residential accounts and remove those properties built prior to 1994. Then filter accounts who have already participated in either the rebate or voucher programs. All remaining accounts are the accounts to target for the distribution program.

Another consideration might be to eliminate the rebate portion of the program (more likely to be higher income as they can front the cost) and just offer the free replacement program through a voucher distribution program.

It is recommended that NTFYH-Commercial be promoted, while the NTFYH program is active, when an ICI survey is done at a multifamily property built prior to 1994. Water Conservation staff needs to determine if this program can be used in conjunction with the ICI Rebate Incentive to help recoup more of the cost of the retrofits.

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3.0 City of Dallas Water Utilities Planning and Wholesale Services Divisions Progress

Infrastructure plays a significant role in furthering the City's water conservation goals as defined in the Water Conservation Plan. Multiple divisions of Dallas Water Utilities (DWU) are responsible for meter accuracy, testing, repair and replacement; mainline maintenance and repair; leak detection; water loss and unauthorized consumption; researching and implementing innovative technologies; and investigating water reuse alternatives.

3.1 Planning and Wholesale Services Organization

Divisions included in the care of DWU water supply sources and delivery systems include Capital Improvements, Water Delivery, Business Operations, Water Production, and Customer Operations. See **Figure 1-2** for the DWU organizational chart as it pertains to water conservation.

3.2 Supply Source Metering

DWU has a comprehensive program to meter water diverted from supply sources within the DWU water system. All untreated water diversions or conveyances to the City of Dallas's Water Treatment Plants (WTPs) metered at the plant (treated and untreated water) require a meter be provided and operated and maintained to commercial accuracy, with review and approval by DWU.

All untreated water diverted from supply sources is compiled in an annual *Surface Water Report,* which reflects diversions monthly. DWU's Planning Division is responsible for submitting two annual state-required surface water diversion reports: *TCEQ Report of Surface Water Used for the Year Ending* and *TWDB Water Use Survey,* which are explained in more detail below.

TCEQ Report of Surface Water Used for Year Ending (20--) Texas State Law (Texas Water Code Section 11.031) requires that all water right holders submit a water use report for water right every year. Water right holders complete a water use report for each purpose of use authorized in water right. In the *TCEQ Report of Surface Water Used for the Year Ending,* DWU reports usage for the following: Monthly Maximum Diversion Rate, Monthly Diverted Amount, Monthly Consumed Amount, and Monthly Return Flow.

TWDB Water Use Survey For Year Ending (20--) Texas State Law (Texas Water Code Section 16.012m) requires all recipients of the *TWDB Survey of Ground and Surface Water Use* to submit a completed survey. Failure to return a completed survey results in ineligibility for TWDB financial assistance and ineligibility to obtain water right permits, amendments or renewals from the TCEQ until the surveys are completed. In TWDB's *Water Use Survey,* DWU reports usage for the following parameters: Water Type, County, Basin, Reservoir/River, Water Right Number, Percentage of not Returned, Metered or Estimated, Brackish/Saline, Percentage of Treated Prior to Intake, Total Volume and Monthly Volume.

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3.3 Universal Metering

The current City of Dallas ordinance requires metering of all connections, except closed fire systems with alarms. Individual metering is required at all single-family residential locations. Most multi-family residential locations, such as apartments and condominiums, have individual metering for each building or designated water user. Some commercial businesses are combined through a single master meter. Dual metering is currently provided to some customers based on the individual needs of the user.

Most of the treated water used by wholesale customers is metered by DWU using Venturi meters with rate-of-flow controllers (ROFCs). The remaining treated water usage by wholesale customers is metered by volumetric meters. All treated water pumped from the WTPs to treated water wholesale customers is included in the *Annual Pumped Water Report.* More information about wholesale metering can be found in **Section 4**.

3.4 Meter Testing, Repair, and Replacement

Before a water meter is accepted for purchase for the City of Dallas, it is tested to the specifications listed in the most recent ISO procedure DWU-PRO-18-MET. This document includes specifications concerning appropriate testing procedures for accepting meters of assorted sizes. Once a brand and model of water meter has been accepted for use, they are procured using the City of Dallas procurement process. When a shipment arrives, approximately 10% are tested for quality and accuracy according to ISO procedure DWU-PRO-035-MET. An acceptable number of tested meters must pass quality control tests, or the shipment is rejected. A water meter removed from service is taken to the DWU meter shop where it is cleaned and inspected according to ISO procedures DWU-PRO-040-MET and DWU-PRO-045-MET. During the inspection, DWU meter staff determine whether it will cost more to repair the meter than it costs to replace it. If it costs more to repair the meter, the meter is scrapped. Meters are kept for 30 days to address customer disputes of meter accuracy. After 30 days, 5/8-inch and 1-inch meters are sold for metal recycling per ISO procedure DWU-PRO-044-MET. Meters 1 ½-inch and larger are refurbished and placed back into service.

If a meter can be refurbished, maintenance will be performed. According to ISO procedure DWU-PRO-045-MET, the meter must be tested on Dallas's test platforms before being placed back in inventory. There are several ISO required steps for recertifying repaired water meters. All meters returned to inventory must pass meter accuracy standards. Meters unable to pass the meter accuracy standards will be repaired again, if possible.

All production meters are tested and calibrated in accordance with DWU ISO standards. The City maintains a program to pull, test, and replace any meters determined to be functioning outside of these parameters.

According to ISO procedure DWU-MSD-088-MET, a meter that is 15-years or older will be replaced. Other reasons a meter may be replaced include:

- a stuck meter (not registering when water is flowing through the meter) (DWU-PRO-023-MET)
- a disconnect order received (DWU-PRO-027-MET)
- a failed inspection (DWU-PRO-028-MET)
- a request to exchange the meter (DWU-PRO-031-MET)

- a leaking meter (DWU-PRO-033-MET)

3.5 Leak Detection, Repair, and Control of Unaccounted for Water

Since 2005, DWU has operated a comprehensive, technology-rich Leak Detection Program as part of the City's overall water conservation effort. The Leak Detection Program is a year-round, ongoing process which provides complete surveying of the water distribution system. Once the system has been completely surveyed, the entire process is repeated to ensure that invisible leaks are located and repaired in the shortest period possible.

Currently, DWU has an annual budget of $40.6 million for maintenance and upkeep of the distribution system. Most of the budget is used for personnel, equipment, and materials. DWU operates 23 four-person repair crews. Most leaks, illegal connections, or abandoned services are discovered through either the visual observation of field crews or reported by the public. DWU continues to request additional crews for the Proactive Leak Detection Program, but high departmental vacancy rates make this unlikely during this Work Plan.

DWU has 16 staff members to detect hard-to-find leaks. The Leak Detection Program goal is to survey the entire water system every 2.5 years and improve its integrity by identifying weaknesses in water pipelines before breaks develop. Leak detection staff members utilize state-of-the-art leak detection equipment, including leak listening devices, leak noise loggers, and a leak noise correlator. The DWU leak detection program continues to meet and exceed its annual goal.

To identify and locate invisible leaks, approximately 650 acoustic loggers are utilized daily throughout the distribution system. Surveying crews systematically deploy the loggers along predefined inspection grids. The intelligent loggers are placed on system valves and programmed to wake up during early mornings to listen for and record tell-tale acoustic signals of water leaks. After several nights, the loggers are retrieved, data downloaded, and likely leak locations identified. Survey data is electronically recorded, and the possible leak locations are referred to DWU correlation crews for verification and to pinpoint location.

Utilizing the data collected by the loggers, correlation crews utilize various leak detection devices to verify and locate the previously unknown, invisible leak locations. An advanced ground microphone system is used to listen to valves, services, and fire hydrants. The microphone can be used to locate leaks of significant flow. A leak correlation system is also utilized on system connections; however, this system digitizes leak noises at the source, filters out noise that degrades the signals, and provides a pinpoint location for the leak. The leak correlation systems can locate leaks of assorted sizes. For hard-to-locate leaks, the correlation crews can deploy a specialized over-night leak correlation system that is programed to perform correlations late at night when ambient noise is at a minimum. Whenever leaks are verified and located, they are marked with non-toxic, water-soluble blue paint and the location is forwarded on to the appropriate Distribution Repair Section for repair scheduling. Since 2005, the Leak Detection Program has surveyed 50,636 miles of pipeline, located more than 7,218 leaks, and saved an estimated $3.7 million in water production costs. The cumulative estimate of potable water saved is more than 5.5 billion gallons.

DWU has an extensive leak detection and repair program and is committed to maintaining a rate of less than 10% for unaccounted for water losses in its water system. Annual unaccounted-for water, based on the difference between treated water pumped and treated water sold, was 9% in FY 2021-22. **Figure 3-1** shows a flat 10-year trend of about 8%.

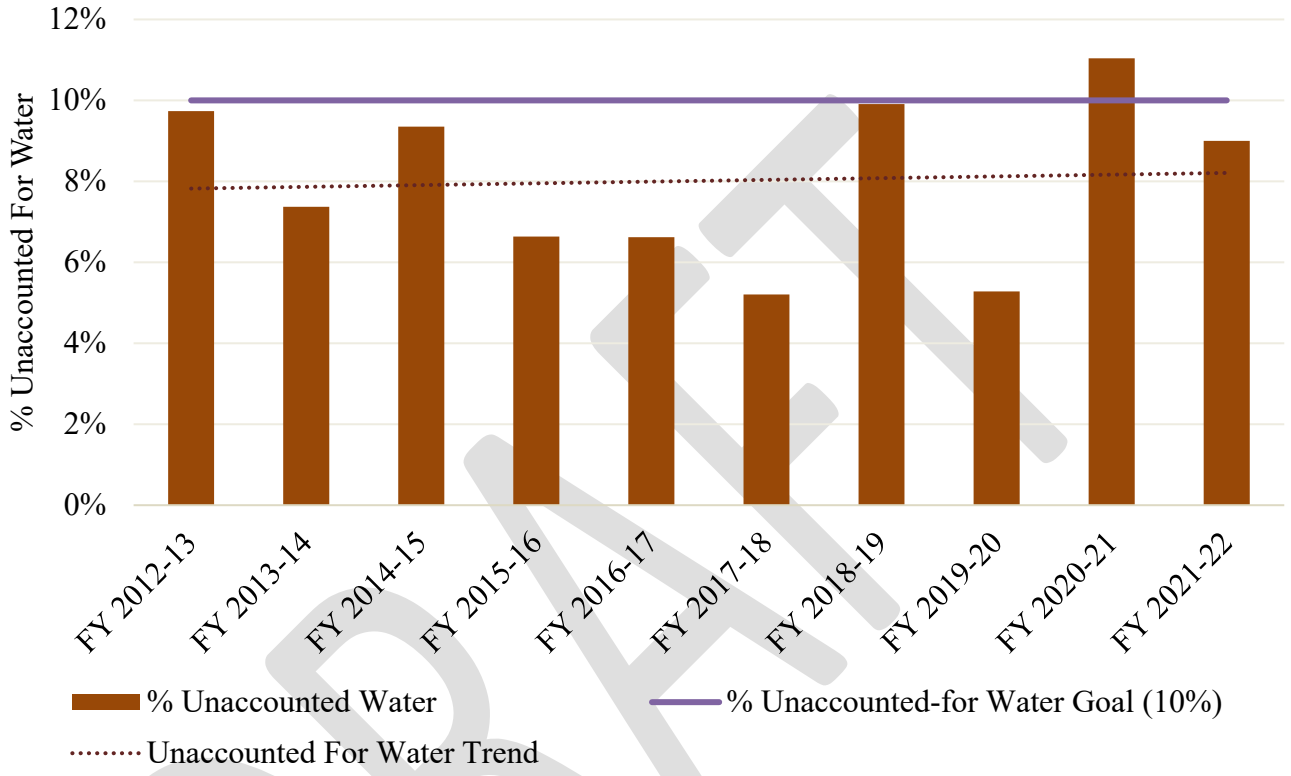

Figure 3-1: Unaccounted For Water FY 2012-13 through FY 2021-22

3.6 Monitoring and Record Management of Water Deliveries, Sales, and Losses

DWU monitors all water deliveries and sales to both treated and untreated water customers. All critical data, such as raw water conveyances to WTPs or wholesale customers, treated water pumped, and unaccounted-for water losses are available as needed. All water sources and service connection accounts are individually metered and read on a regular basis to facilitate accurate comparisons and analysis.

3.7 Water Loss Sources

Unbilled Water Use

Unbilled Water Use, averaging 23 billion gallons per year, is comprised of:

- Unbilled Water Loss
- System Maintenance (flushing, meter testing and sewer cleaning)
- Treatment Plant Process Water

- Main Breaks
- Maintenance of storage facilities
- Fires and fire training
- Unbilled municipal uses

As **Figure 3-2** depicts, since FY1999-2000, DWU has been able to consistently reduce the amount of unbilled water losses. Despite several spikes in unbilled water losses, average loss has been trending downward.

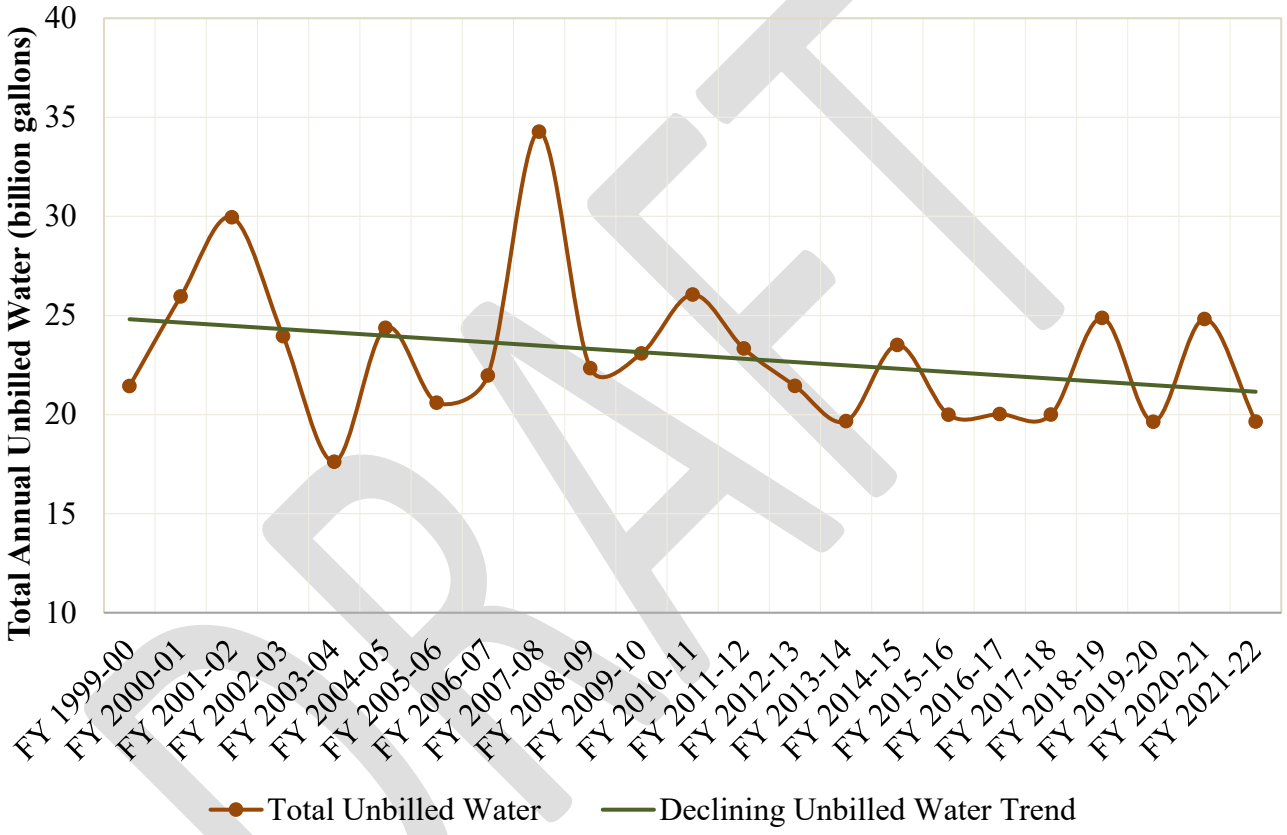

Figure 3-2: Total Annual Unbilled Water Trend FY 1999-00 through FY 2021-22

Apparent Losses

Apparent Losses, also known as commercial losses, occur when water that should be included as revenue-generating water appears as a loss due to unauthorized actions or calculation errors. Unauthorized consumption, meter inaccuracies, and data handling errors are discussed in the following sections.

Unauthorized Consumption

Unauthorized Consumption is water that is removed from the system without authorization and without DWU's knowledge. According to the EPA, unauthorized consumption includes water theft, illegal meter bypasses, vandalism, or unmetered hydrant use for construction or recreation. The amount

of water involved is exceedingly difficult to estimate because by its nature the water use is unknown to DWU.

A small portion of unauthorized consumption is the loss of water due to theft. It only takes a would-be offender a few moments to illegally hook a tanker truck to a fire hydrant, steal several hundred or a thousand gallons of water, and be on their way. As a control measure, DWU has deployed a metering program to help monitor the use of hydrants within its system. The process includes permitting and metering of usage from hydrants for various construction purposes, landscaping, and street sweeping. The department employs an inspector to monitor hydrant usage and perform quality control inspections of tanker trucks to ensure adherence. If tampering or water theft is found, DWU can issue code citations. This citation will prevent use of a water meter until the individual appears in civil court. Thefts are reported through daily meter reading, inspections, other divisions, and reports by customers. The DWU Credit Services section is proactive with reports of theft and sends out inspectors so that staff can verify what is occurring.

Other areas where unauthorized consumption may occur are illegal meter bypasses or when someone removes or tampers with the metering mechanism inside a meter thereby allowing water to flow through the meter without being measured. If evidence of a bypass or tampering is found, the offender is issued a citation, an estimate of the amount of water involved is determined and a bill is subsequently issued to the property owner.

3.8 Meter Accuracy, Repair, and Replacement

A major part of DWU's operations involve the repair and replacement of water meters. Meter Services Division staff indicate that a significant amount of work is being implemented to improve meter accuracy. DWU operates meter testing facilities for large and small meters, maintains an electronic catalog of meters both in service and in the warehouse, and completes ongoing repairs. Currently, all service work, meter replacements, and new installations are performed by City staff.

Over the past 20 years, the following processes have been implemented to improve meter accuracy:

- Replacement of any meter older than 15 years
- Replacement of traditional meters with Automated Meter Reading (AMR) / Advanced Metering Infrastructure (AMI) ready meters
- Realignment of staff in the Large Meter Division to enhance quality assurance in large meter testing and rebuilding
- Acquisition of a new small test bench allowing gravimetric accuracy which is superior to volumetric accuracy

Customer Meter Accuracy and Meter Exchange

As water meters age, their internal mechanisms begin to deteriorate which can lead to lower measurements. An aging meter will become an economic liability with potential for revenue losses. A comprehensive meter replacement program not only benefits the water distribution system by creating a more efficient operation, but it also allows the City to recover its revenues more fully.

As of March 1, 2023, DWU maintained 313,671 customer accounts. Of these, 262,888 were residential, 46,291 were commercial, 1,696 were municipal, and 58 were Optional General Services

meters. The current average age of small meters within the DWU system is approximately 6.5 years. Because large meters are often repaired in place, the current average age of large meters is not tracked. Ten percent of new meters are tested in a random sample.

Most residential meters in the City of Dallas are replaced at 10 and 15-year intervals, depending on meter size and accurate life of the meter brand. Meters larger than 1.5" diameter can be refurbished if possible. Refurbishing smaller meters is typically not cost effective.

The annual capital expenditure budget for meter exchange is $3,000,000. About $1.5-2 million is spent on meter replacement and $500,000 per year on refurbishment of meters.

In March 2017, DWU implemented an automated maintenance plan for large meters (3” diameter and larger). The new maintenance plan considers not only the size of the meter but also time and/or consumption (12 months or 12 million gallons, whichever came first). If a meter uses more than 15 million gallons per year, the meter is tested every six months. If a large meter uses between 500,000 gallons and 15 million gallons per year, the meter is tested annually. If a large meter uses less than 500,000 gallons per year, the meter is tested every two years. The process is automated and is attached to the City’s SAP accounting system. WCC meters are tested twice a year under a separate testing plan.

Most 4” diameter and larger meters are tested in place while most 3” diameter meters are exchanged and tested in the shop, depending on meter condition, access issues, and other operational concerns.

In past years, DWU used a Sensus W1250TM portable large meter tester. In June 2019, DWU replaced the Sensus W1250TM testers with an OMNITM Verification V2 Portable Test Meter, a portable large meter tester. These portable testers are used to test flows from one-half gallon per minute to up to 500 gallons per minute. There are approximately 6,800 large meters, including 3,500 industrial meters and 3,300 detector check meters, which allow priming of fire sprinkler systems while metering any low flows into a customer’s fire control system.

DWU has a policy of exchanging a meter if its accuracy rating in the field cannot be determined. It is more cost effective to exchange a questionable meter with a newly certified one than it is to pull a meter, refurbish it, and return it to the customer site. **Figure 3-3** reflects the number of meters that have been exchanged over the past 7 years.

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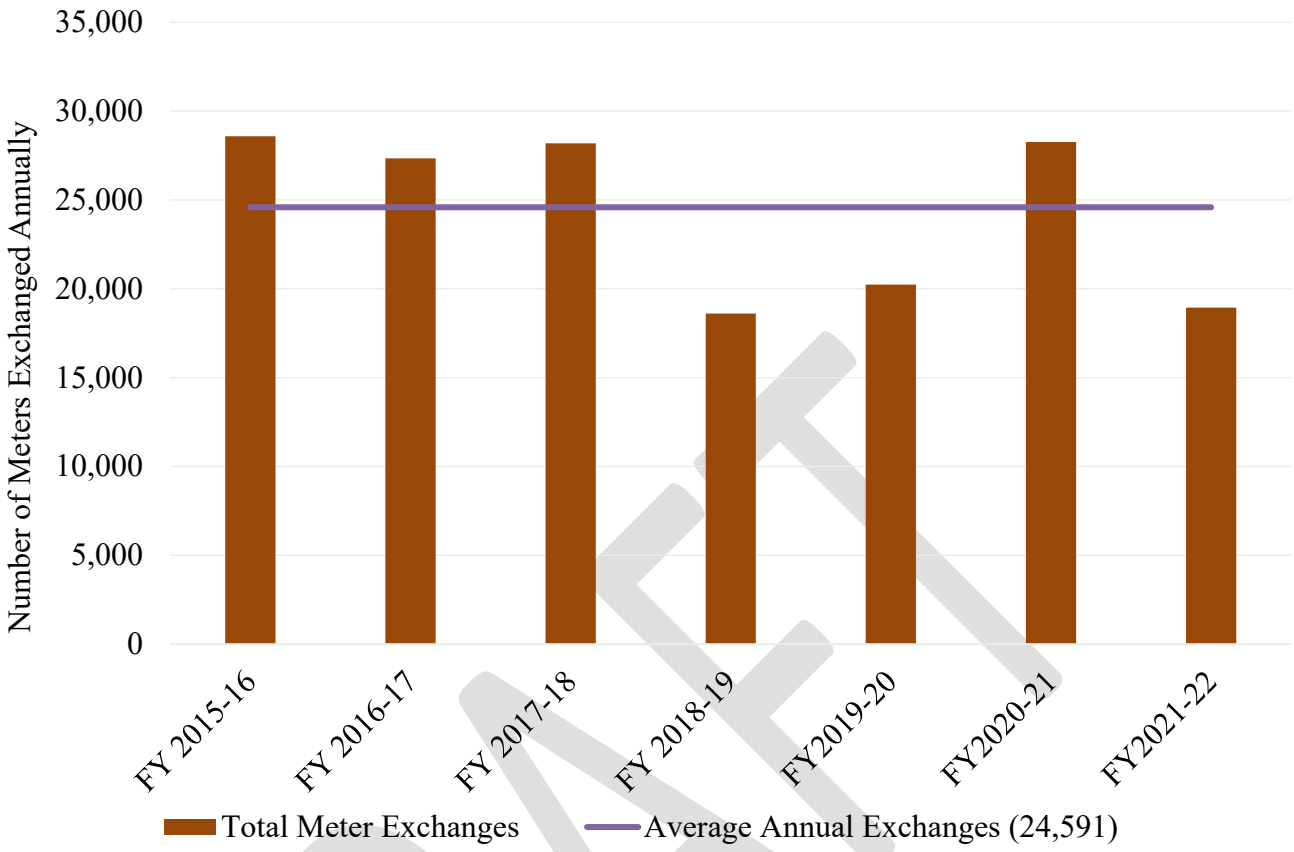

Figure 3-3: Meter Exchange Rate, Annually FY 2015-16 through FY 2021-22

Meter Reading Using Advanced Technology

An active AMR/AMI ready meter can broadcast meter readings (water usage) in time increments as small as every 15 minutes or less. Ultimately, having a system that is AMR/AMI capable will reduce the cost of meter reading and provide timely water usage data to improve customer service, water planning, water conservation, system modeling and pressure zone management, and enforcement efforts.

DWU's effort to replace all exchanged meters with tested and certified AMR/AMI ready meters should result in greater accuracy of its water sales (at least to within 2-3%) to minimize apparent losses from metering inaccuracies within the entire system.

Earlier Work Plans recommended that DWU procure and install AMI infrastructure. Field deployment was recommended over a period of years using a phased-in approach. For example, Phase I could include installation of endpoints and a communication grid on existing AMI ready meters. Phases II and III could include the installation of AMI meter endpoints (route by route).

Prior to FY 2009, all DWU meters were read manually utilizing a touchpad device. In FY 2009, DWU began modernizing its meter reading process. Automated Metering Infrastructure (AMI) Fixed Network was deployed in the Central Business District, Deep Ellum, and Fair Park. Approximately 7,800 meters were originally read using an AMI Fixed Network as depicted in **Figure 3-4** below.

In FY 2014, the modernization process was enhanced with the deployment of Advanced Meter Reading (AMR) Mobile Network. About 14,000 AMR Mobile Network units were installed in sections of West Dallas, Cypress Waters, and some controlled access properties as depicted in **Figure 3-4.**

In 2020, the AMI Itron Fixed Network became obsolete and DWU began reading all 22,000 AMI and AMR installed meters using a Mobile Network. About 85% of the system is AMI ready, meaning the meters have encoded registers. However, only 22,000 have the end points and the rest are still being read manually. In FY 2018-19, the City of Dallas selected a contractor to lead a study to determine the best path for the City to upgrade its water meter reading efforts to a fully operational Automated Metering Infrastructure (AMI). Such a system would include automatic meter reading, two-way communications between the individual water meter (turn-on and turn-offs) and the City's accounting system, the ability for customers to be able to see water usage information on a frequent basis (at least daily, but in some cases as often as every 15 minutes), and other water conservation measures. Due to Covid-19 pandemic restrictions regarding personal interactions, this contract was placed on hold, but was completed in April 2022.

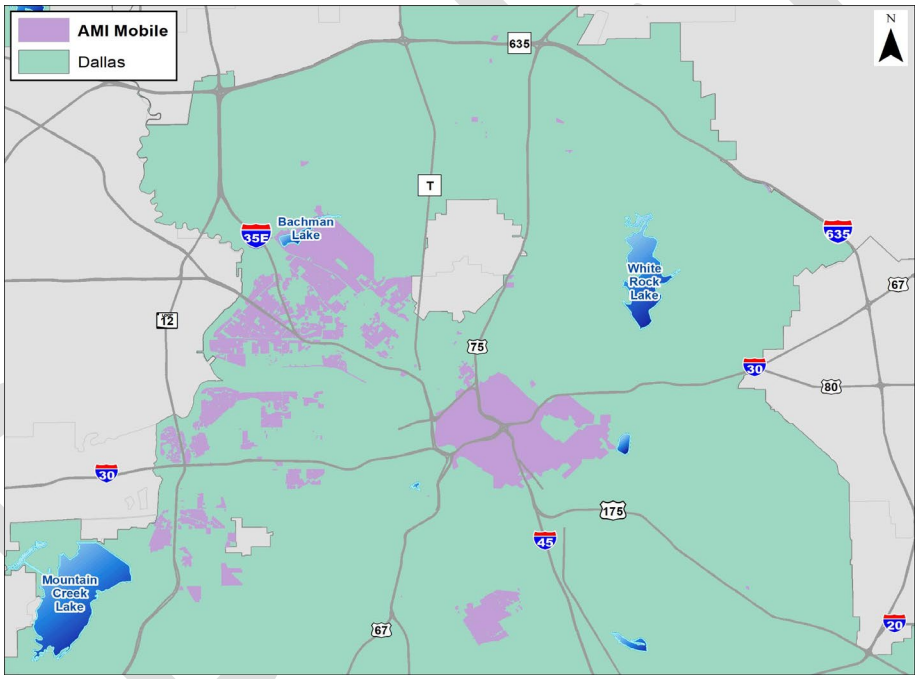

Figure 3-4: City of Dallas AMI Fixed Network System FY 2021-2022

Recommendation 3.8.1 Implement the Migration to Automated Meter Infrastructure

The study presented two business case scenarios to retrofit all meters with either a three-year or four-year project timeline. About 20% of existing meters will require a new register). Based on the results of the business case, DWU is well positioned to migrate to AMI for its meter reading function. E Source recommends moving forward with installation. DWU will need to decide if the lower cost associated with a three-year installation or the lower annual capital expenditure from a four-year installation is best for the utility. See GANNT Chart in Appendix for Dallas Water AMI Project Phase Timeline.

During this Work Plan, E Source (consulting firm for the study) recommends publishing a competitive RFP to solicit vendor solutions, as many vendors can meet DWU operational and customer service requirements. DWU can use this RFP to explore add-on functionality, such as pressure monitoring or remote disconnect applications. E Source recommends in addition to the standard municipal funding options such as bonds, or cash funding that DWU also pursue other opportunities for loans and grants.

E Source recommends utilizing some of the remaining funding from the Assessment phase to allow E Source and Brio Consulting to work together to coordinate the installation of DWU's new CIS system. Additionally, E Source can begin the procurement process prior to finalizing funding for the overall project.

Service Meter Repairs

Figures 3-5 through **3-7** show the number, cost, and average annual water savings for service meter repairs.

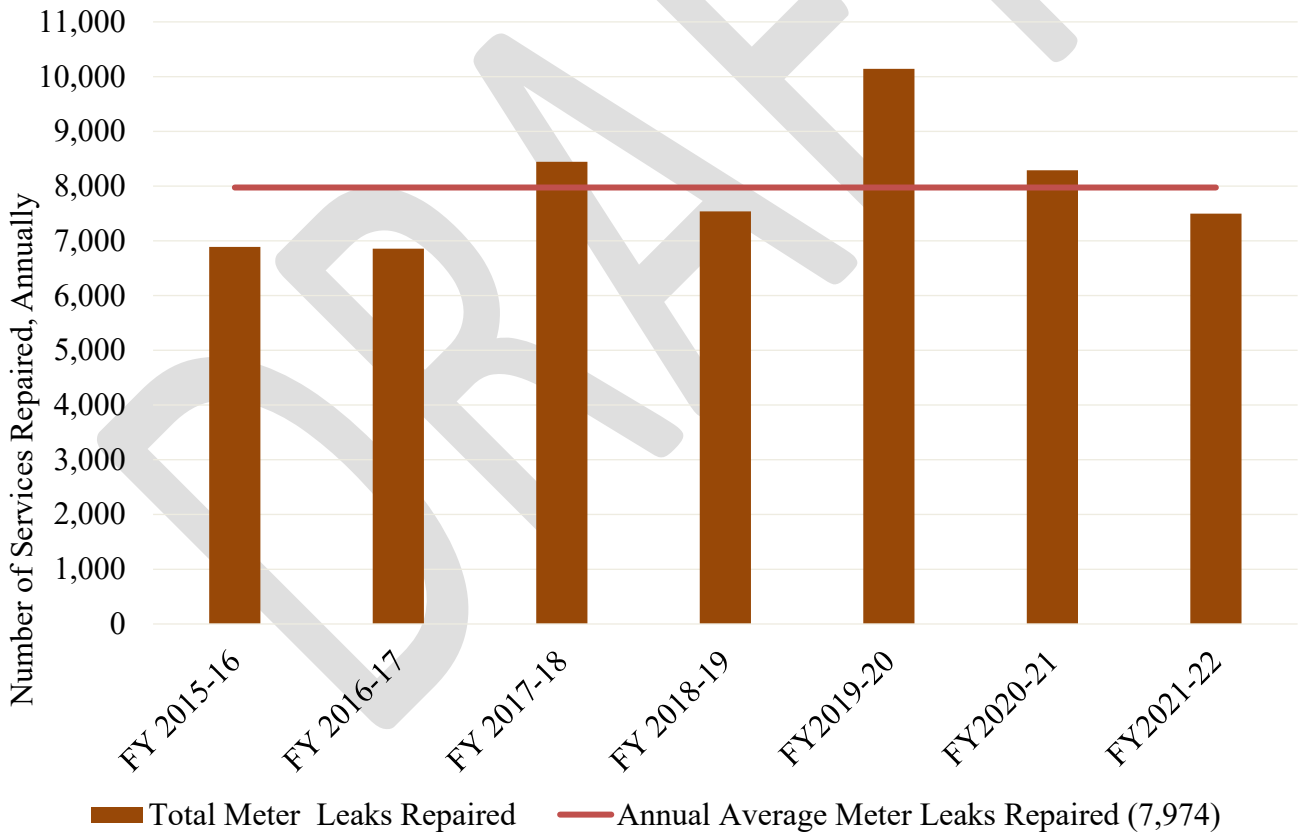

Figure 3-5: Number of Water Service Leak Repairs FY 2015-16 through FY 2021-22

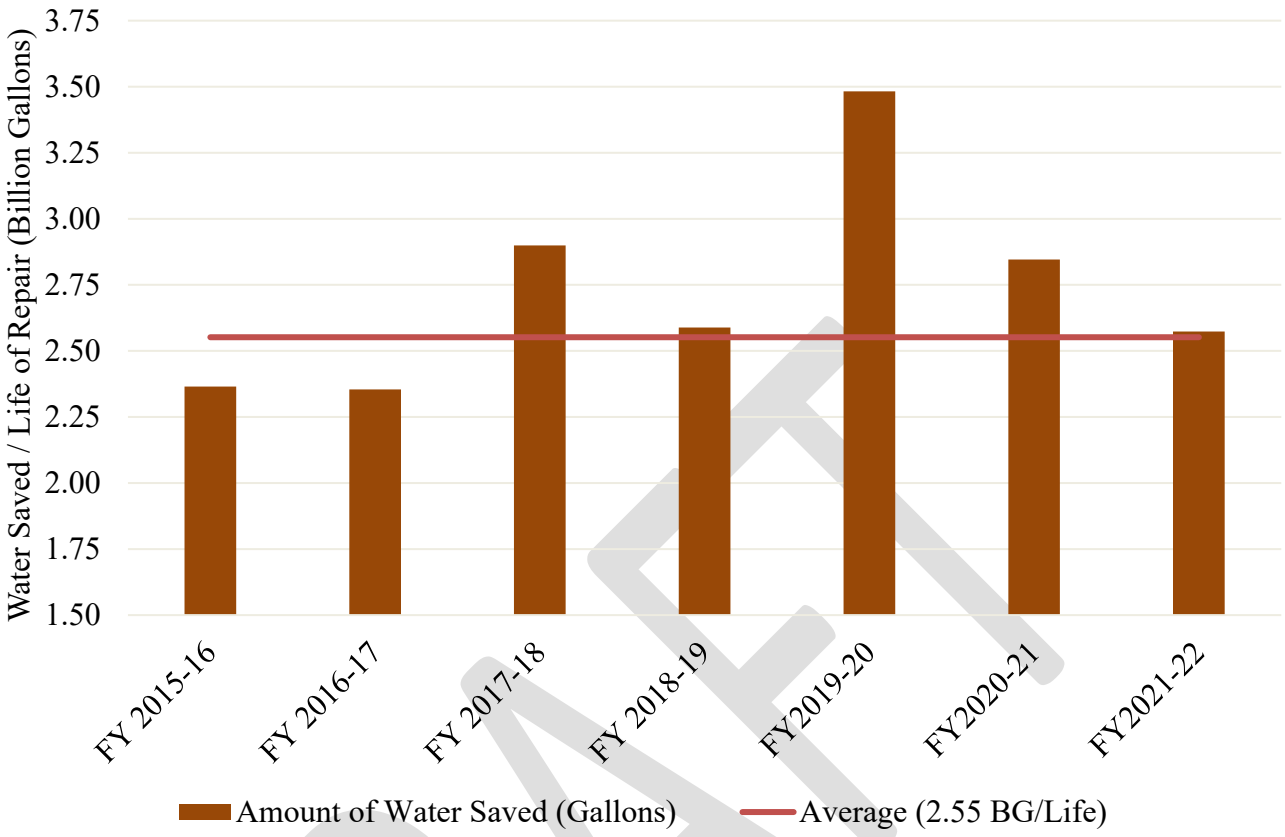

Figure 3-6: Water Service Leak Repairs Savings FY 2015-16 through FY 2021-22

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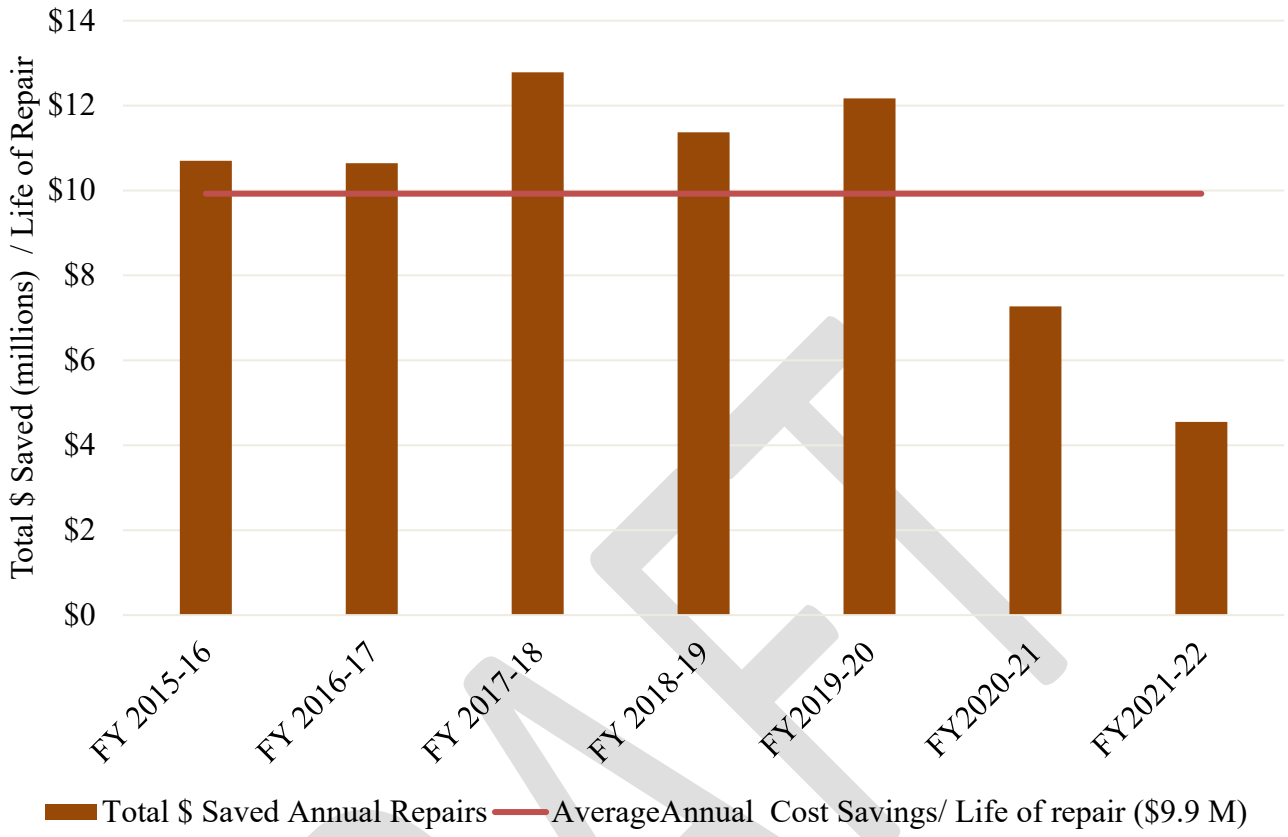

Figure 3-7: Service Repair Cost Savings ($) FY 2015-16 through FY 2021-22

Data Handling Errors

Data errors can occur with manual handling of data entry, billing, and meter reading. The handheld device used by the meter readers contains validation parameters that will trigger a notification to alert the user to read the meter again. In some instances, it will require the meter reader to reenter the meter read and to enter the meter number. After the meter reads are uploaded into the billing system, it will validate the data through algorithms within established parameters. The billing system will produce exception reports.

Exception reports are reviewed every day to determine if consumption is valid or if field verification is needed before invoicing the account. Field audits are performed for read accuracy with a goal of 99% accuracy. If humans read many meters, there will still be some errors.

3.9 Proactive Leak Detection and Repairs Using Advanced Technology

DWU has a Proactive Leak Detection and Repair Program. The benefits of proactive leak detection include:

- Reducing water lost;
- Lowering utility costs;
- Minimizing the potential for property damage from pipeline breaks;

- Improving public relations because of ongoing visibility and promotion of maintenance; and
- Reducing disruption to customers with fewer unscheduled repairs and service interruptions.

Real Loss Proactive Leak Detection

Real Losses consist of leakage from transmission and distribution mains, and leakage from service connections up to and including the meter. DWU has implemented several programs and initiatives designed to keep track of and repair various real losses within the distribution system.

DWU has been highly effective in controlling and limiting water losses caused by leaks within the distribution system. Since 2005, the Water Distribution Division has worked towards reducing real losses by finding and fixing leaking pipes and valves through the Proactive Leak Detection and Repair Program. The goal is to survey the entire distribution and transmission system every 2.5 years (40%/ per year) using state-of-the-art leak detection technology. Since FY 2015-16, leak detection crews have met or exceeded this goal by surveying an average of 67% of the distribution system per year, as shown in **Figure 3-8**.

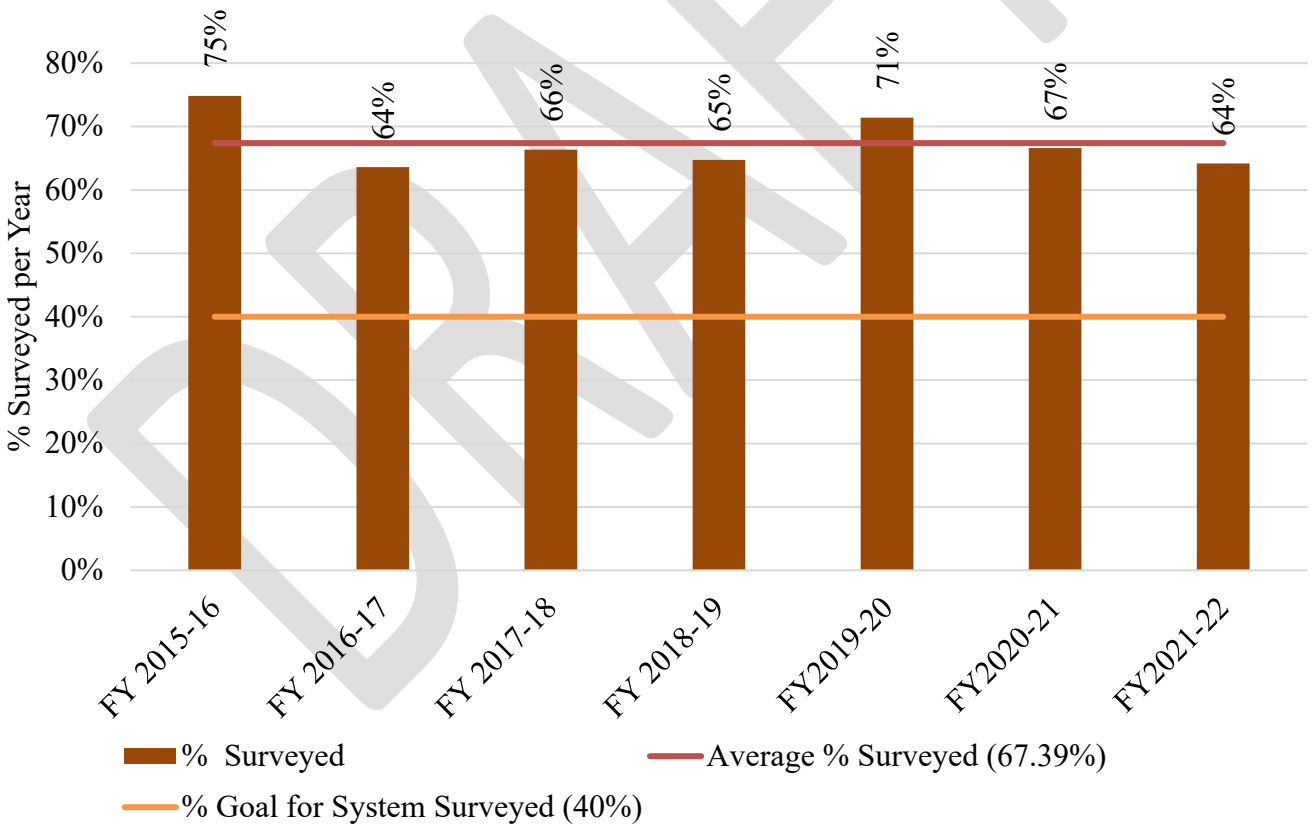

Figure 3-8: Proactive Leak Detection and Repair Surveys of Distribution System Per Year FY 2015-16 through FY 2021-22

Small-diameter Pipeline Proactive Leak Detection

Small-diameter pipelines (those 12 inches or less diameter—about 90% of the potable water system) are surveyed using noise surveys or acoustic leak detection equipment. Noise surveys utilize high-frequency contact microphones on water service meters or fire hydrants to detect leaks in the system.

Acoustic leak detection is performed by survey teams with acoustic correlation equipment that captures the sound of the leak as it radiates to a logger. The equipment consists of Permalog+ Intelligent Leak Noise Loggers™ affixed to pipes and fittings and electronic listening devices used in conjunction with an AC Digital™ or TriCorr Touch Correlator™ to pinpoint the location of the leak. Other equipment used includes Patroller II™ (Logger Communications Unit), Touch Pro™ (Real Time Correlations), Sounds Sens I™ (8 Pods Overnight Correlations), and S30 System™ (Ground Mic & Accessories). The advantage of this technology is that the leak locations may be marked and scheduled for repairs without excessive excavation or in planned outages to customers.

Figures 3-9 and **Figure 3-10** illustrate the success of the DWU Proactive Leak Detection Program. Since FY 2015-16, using this advanced technology has saved an average of 690 million gallons of water and about $220,000 dollars per year.

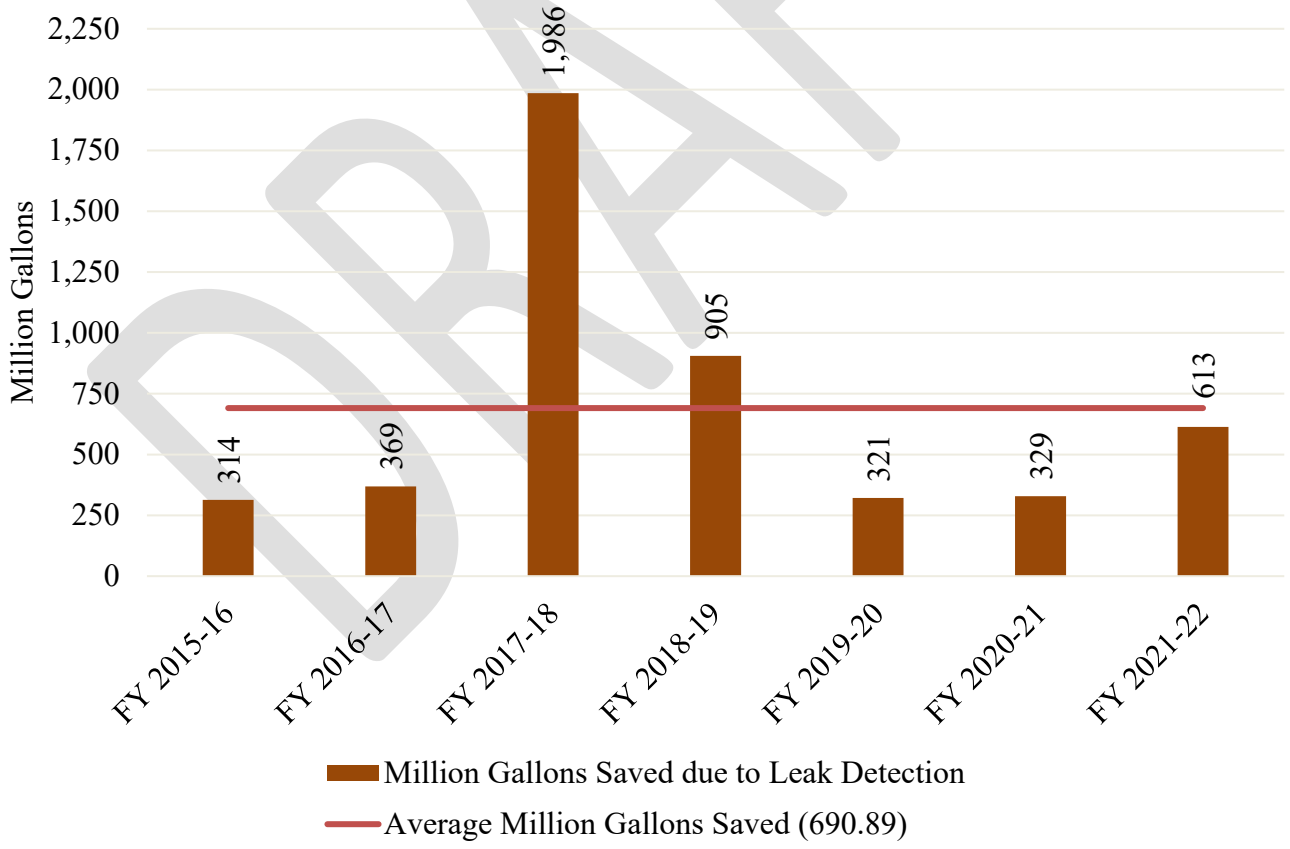

Figure 3-9: Millions of Gallons of Water Saved Due to the Proactive Leak Detection Program (Advanced Technology) FY 2015-16 through FY 2021-22

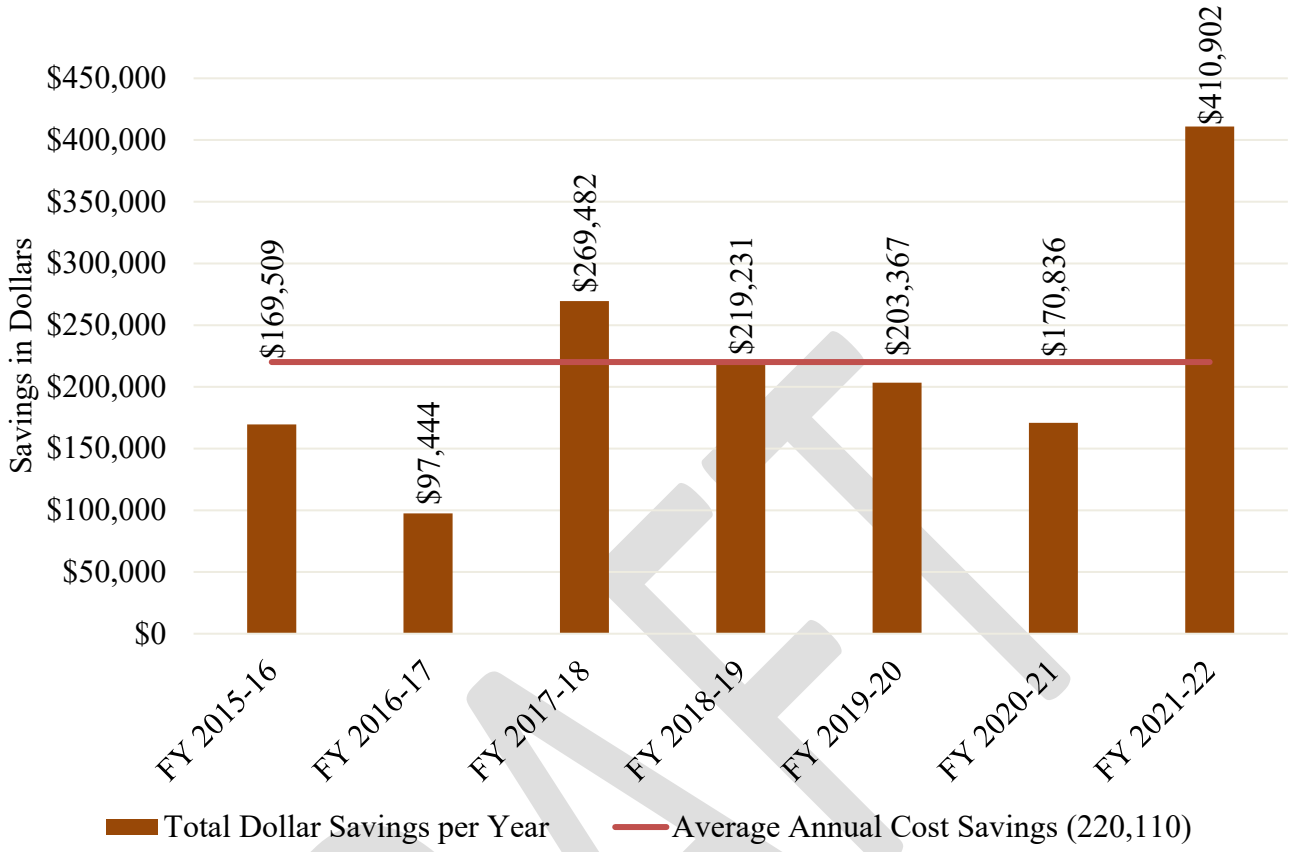

Figure 3-10: Dollar Savings per Year for Proactive Leak Detection and Repairs Using Advanced Technology FY 2015-16 through FY 2021-22

Valve and Pressure Reducing Valve Check Crew

From time to time, valves within the system are closed for assorted reasons, including a contractor or repair crew turning off a valve and not turning it back on. If a valve is closed, water cannot flow in the manner for which the system was designed and this can result in diminished fire flows, degradation of water quality, or other concerns.

Adjusting PRVs requires specialized training and expertise. Leak Detection Crews set up between two valves. During the setup, the Crews clean out the valve stem box and exercise the valve (close and open it a few times). In doing this, the Crews occasionally find a few valves that are in an incorrect position, i.e., open when they should be closed or closed when they should be open.

By checking the status of the valves and exercising them, the DWU valve system becomes more reliable and prolongs the system's life. Having a regular program of checking and adjusting PRVs reduces the burden of checking valves on the Proactive Leak Detection Program, allowing them to be more productive and provide resources with specialized knowledge of the operation of the distribution system.

Since the inception of the Proactive Leak Detection Program, approximately 85,236 valves have been checked and more than 99.4% of these valves have been in the correct position – indicating only a small percentage have had to be corrected. However, due to the size and scope of the DWU system,

it is difficult to check each valve within the system on an annual basis. Additionally, the DWU distribution system contains about 40 pressure reducing valves (PRV) stations with 67 total PRVs and other means to control how the system's pressure is distributed.

3.10 Traditional Main Break and Leak Repairs

In addition to the Proactive Leak Detection and Repair program, DWU maintains traditional repair crews, charged with repairing two different types of water line leaks: (1) breaks, where there is a circumference crack, longitudinal split, or hole in the pipe; and (2) leaks, where there is a small amount of water leaking from a longitudinal crack, at a joint, at a tap, or at a connection.

Main break repair crews are on duty 24 hours a day, 365 days a year, as a break may occur at any time. DWU repair crews have significant resources, including backhoes, trucks, pneumatic equipment, and service centers, etc. Crews pride themselves on their ability to quickly repair any type of leak that may occur and devote considerable effort to training and honing their skills.

Records for main breaks have been kept for several years. However, records for main leaks have been kept separately since FY 2011-12. It is important to note that prior to FY 2010-11, the number of main breaks being repaired rose yearly. **Figures 3-11** shows main repairs per 100 miles have been steadily declining since FY 2015-16, while **Figure 3-12** shows the actual number of repairs by year. **Figure 3-13** shows the location of main repairs and **Figure 3-14** shows the location of leak detection repairs within the city. With the Proactive Leak Detection Program, repairs, and pipeline replacements being performed, it is evident that the system is becoming more efficient, resulting in less wasted water and a better use of DWU's resources. Lower demand, lower peak demand, and milder summers are other factors that could influence main line breaks.

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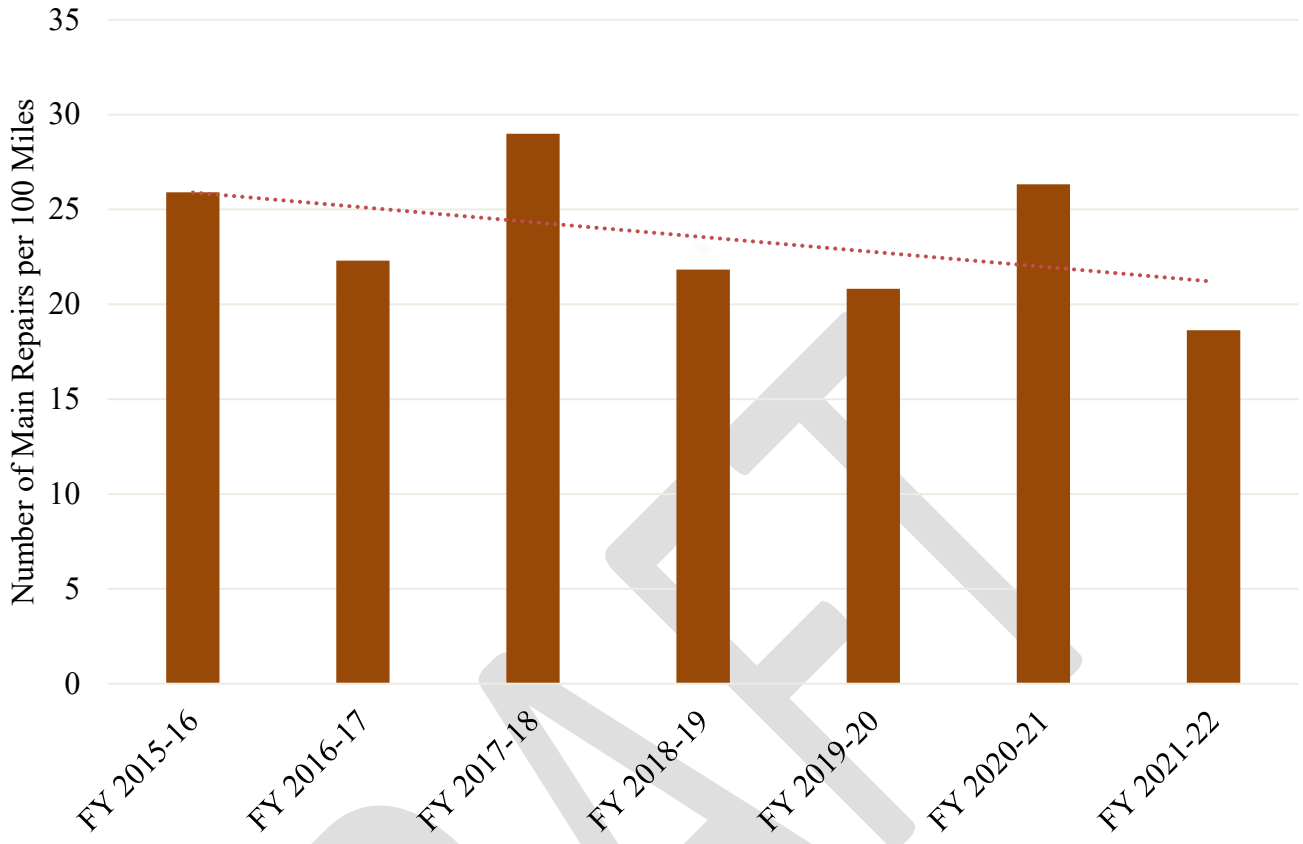

Figure 3-11: Number of Main Repairs per 100 Miles FY 2015-16 through FY 2021-22

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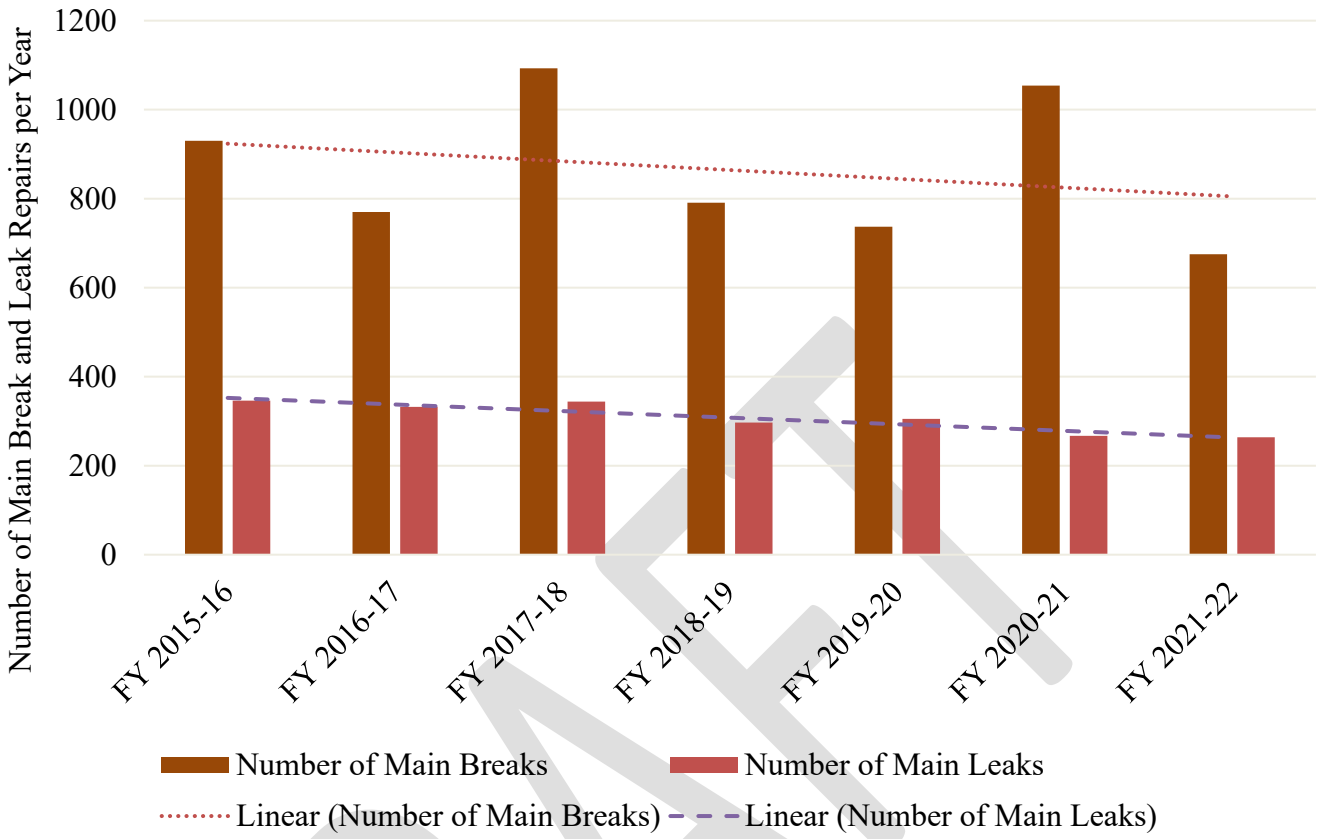

Figure 3-12: Number of Main Leaks Repaired and Main Breaks Repaired Per Year FY 2015-16 through FY 2021-22

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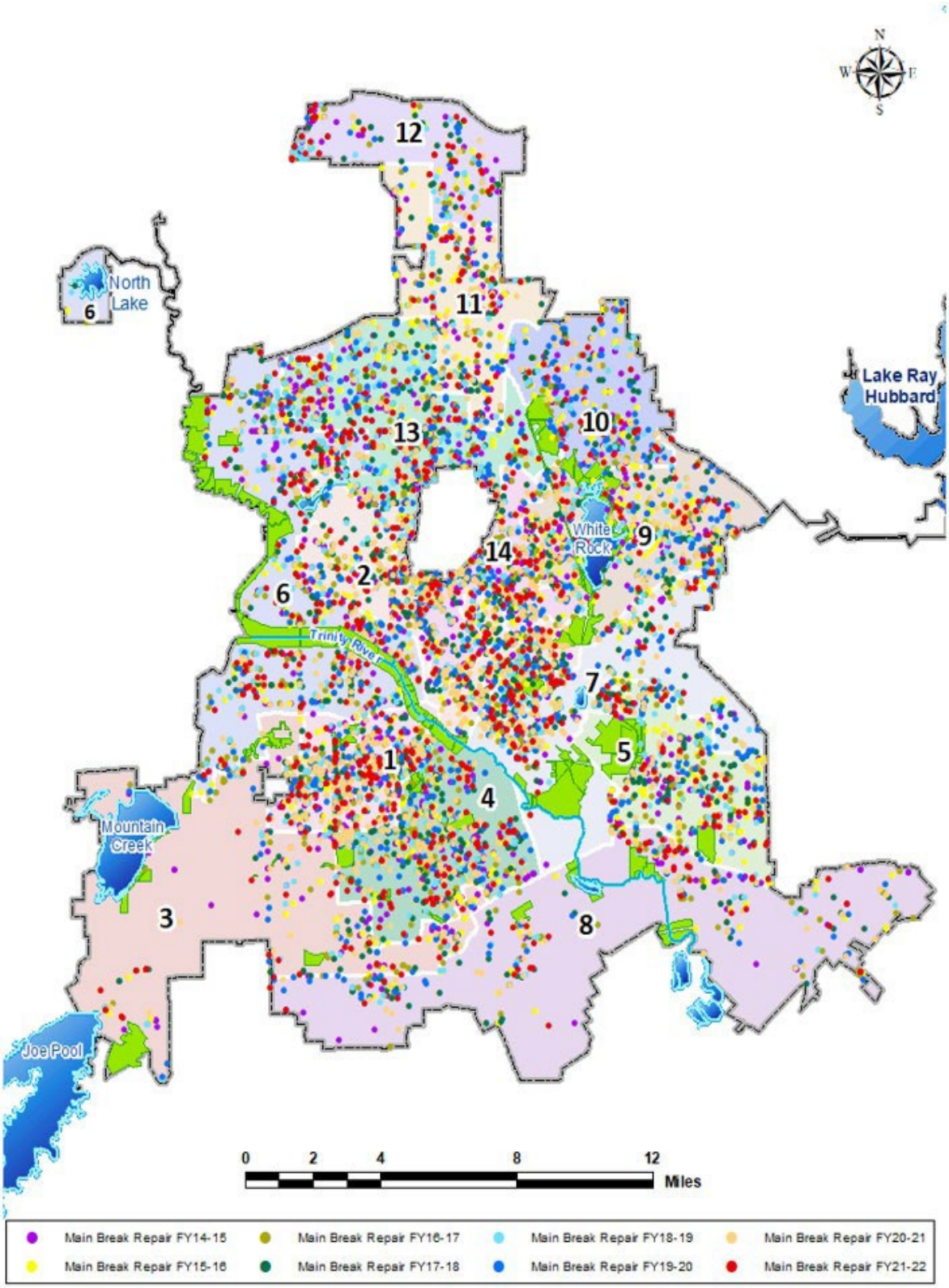

Figure 3-13: Main Break Repair Location FY 2014-15 through FY 2021-22

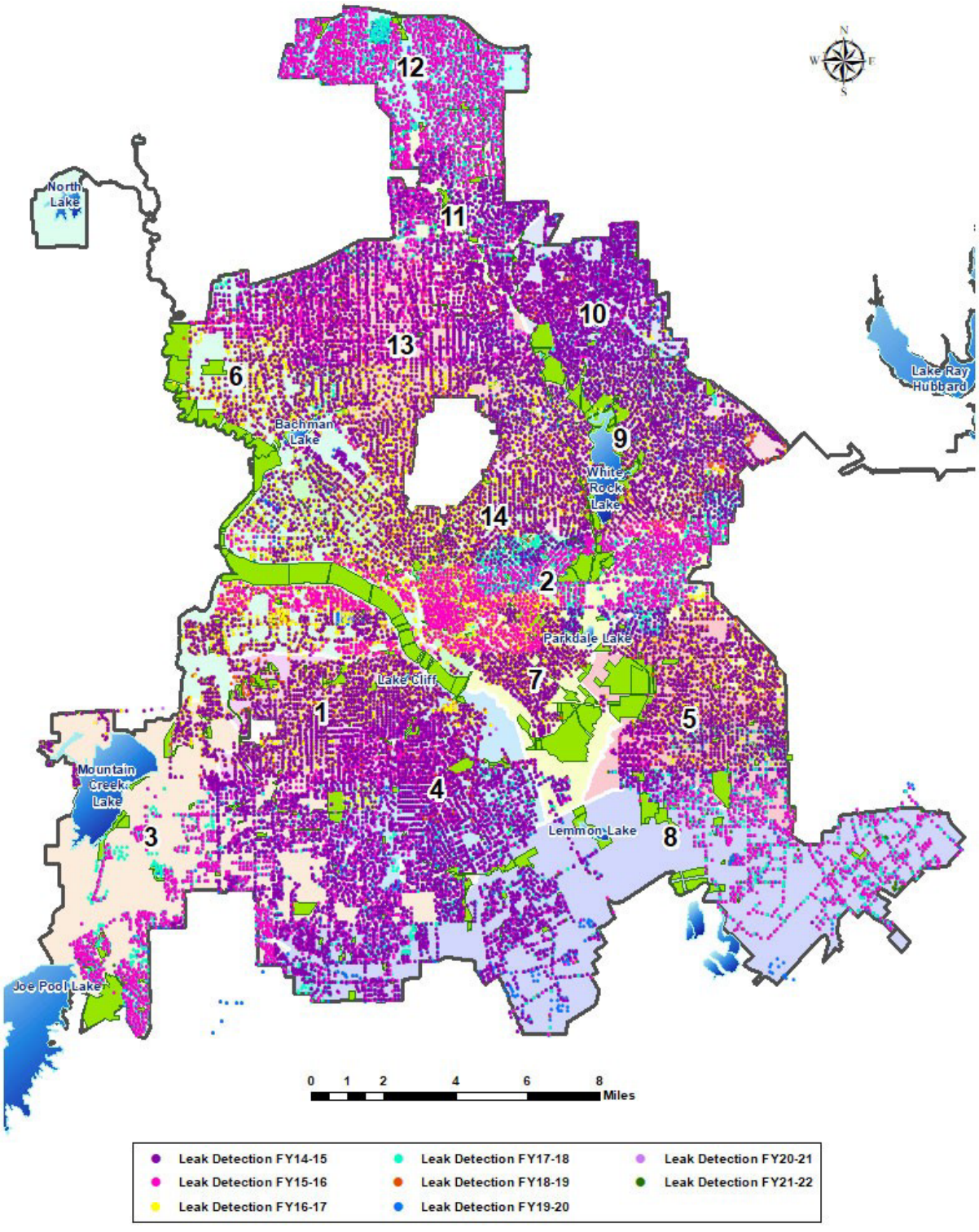

Figure 3-14: Leak Detection Repair Location FY 2014-15 through FY 2021-22

3.11 Pipeline Replacement Program

Over time, the materials used to construct a water distribution system begin to deteriorate. Pipes age, the ground will shift, embedment materials will fail, corrosion will take its toll, and many other mechanical and chemical forces act to cause individual pipes to require repair or replacement. In some cases, pipelines will catastrophically fail and can result in washed out roads and flooded houses. In many cases, the costs to repair exceed the cost to replace the pipeline. Other factors contributing to the decision to replace a particular pipeline include:

- Service interruptions at schools, hospitals, homes, and businesses;
- Damaged roads;
- Formation of sinkholes;
- Dangerous conditions from frozen water on roadways; and
- Interruption of other utility services such as phones, internet, gas, and electricity.

For many years, DWU has maintained a program of replacing pipes that wear out or require too many repairs within a given period. The Distribution Division maintains a database of the number of pipeline leaks and breaks that have been repaired, how often a pipeline segment is repaired, and the number of years since the first repair on a segment was made. This information is used to develop a parameter referred to as the Water Break Index (WBI). The WBI is calculated by dividing the number of breaks by the length of the pipe in 1,000-foot increments and multiplying interval of breaks. WBI indexes of less than 0.4 are not considered for replacement evaluation without other contributing factors, such as water quality concerns due to pipe condition, need for increased fire flow capacity, or failures not repairable by conventional means.

The WBI, together with several other parameters; including property damage (in the case of a catastrophic break), pipe size, water quality, and other critical issues are combined to develop a rating system used to create a prioritized list of pipes to replace. The Pipeline Replacement Program utilizes this list to prioritize replacing the most critical pipelines each year.

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In 2002, a DWU Water Efficiency Study recommended the development of a Distribution Master Plan to address DWU pipeline system replacement programs. The Water Capital Infrastructure Assessment & Hydraulic Modeling Report was completed and submitted in 2007. The report recommended an average annual small diameter pipeline replacement capital investment of $22.5M and average annual replacement rate goal of 0.87%, as shown in **Figure 3-15**.

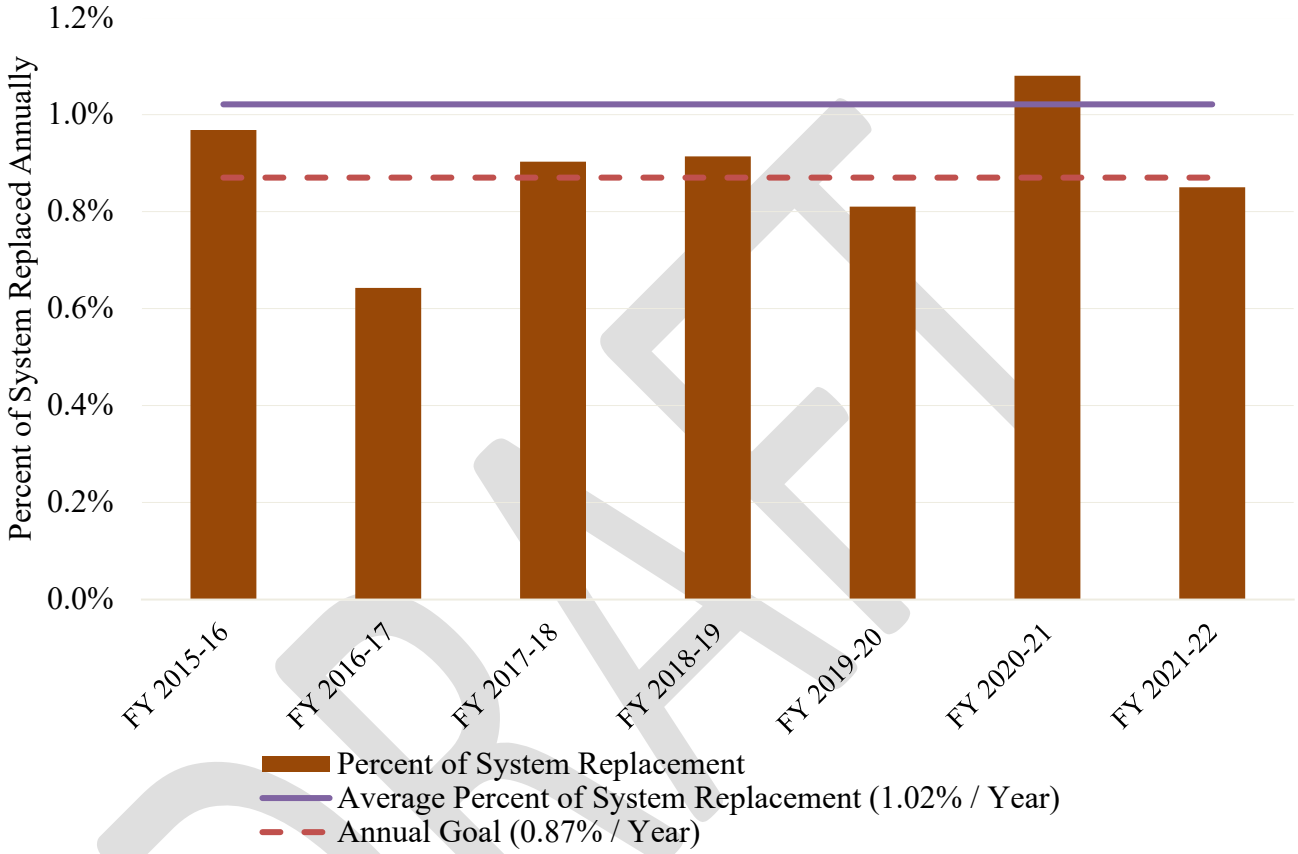

Figure 3-15: Percent of Entire System Replaced FY 2015-16 through FY 2021-22

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In the 2002 study, the system was analyzed to discover the age and the materials making up the system. Approximately 70% of the system was cast iron and 48% of the system was more than 50-years old (the expected life of cast iron pipe). Dallas's five-year average of 0.4 water main breaks per mile was the largest of the large systems as reported in a 2002 American Water Works Association database. Since 2002, DWU has worked diligently to reduce the number of water main breaks per mile. Reducing the number of water main breaks in a distribution system saves a substantial amount of water. **Figure 3-17** shows the number of water main breaks per mile across the DWU distribution system. Through the efforts of the Capital Improvements Program as shown in **Figure 3-16**, water main breaks have decreased from about 0.57 breaks per mile in FY 2000-01 to about 0.13 breaks per mile in FY 2021-22. The percentage of water mains older than 50 years within the DWU distribution system has dropped from 48% to 46%.

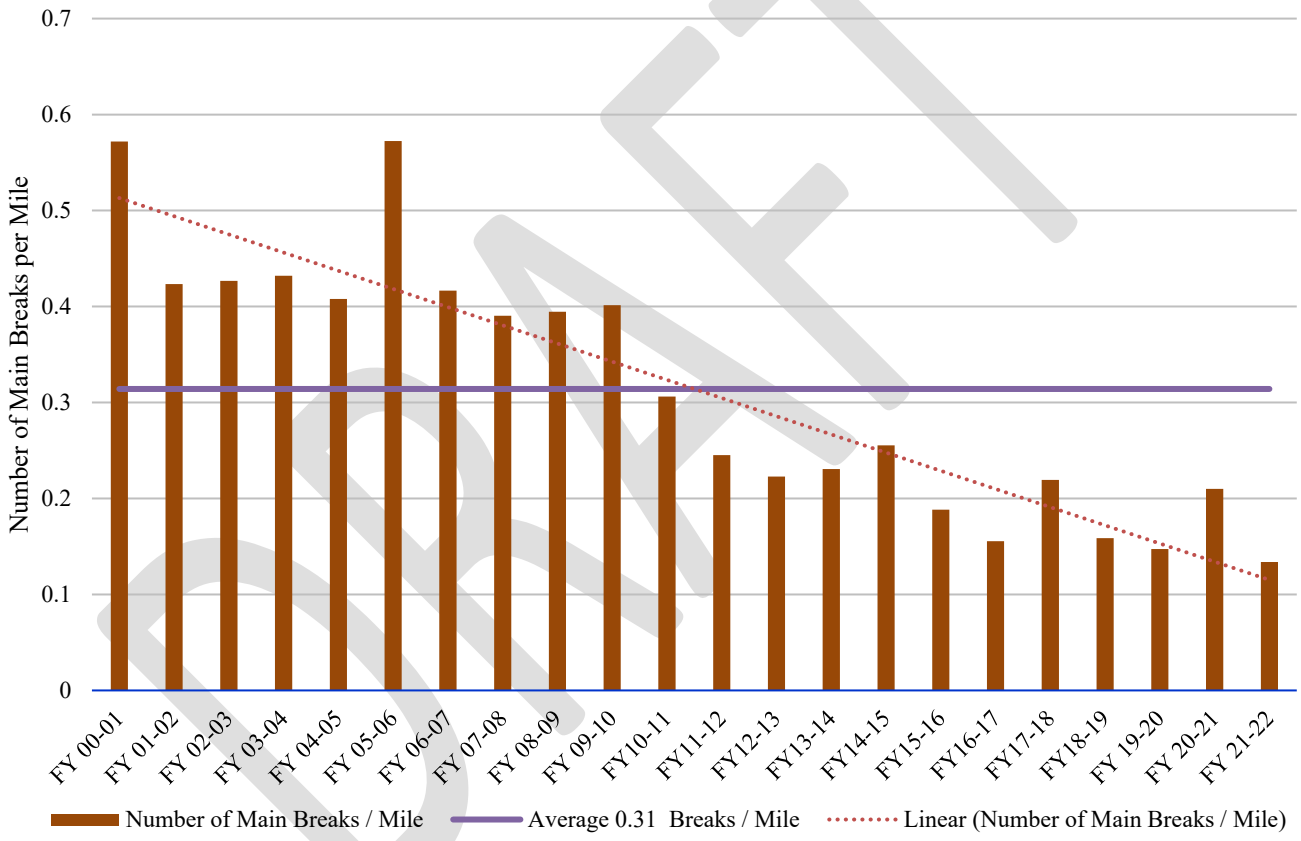

Figure 3-16: Water Main Breaks per Mile FY 2000-01 through FY 2021-22

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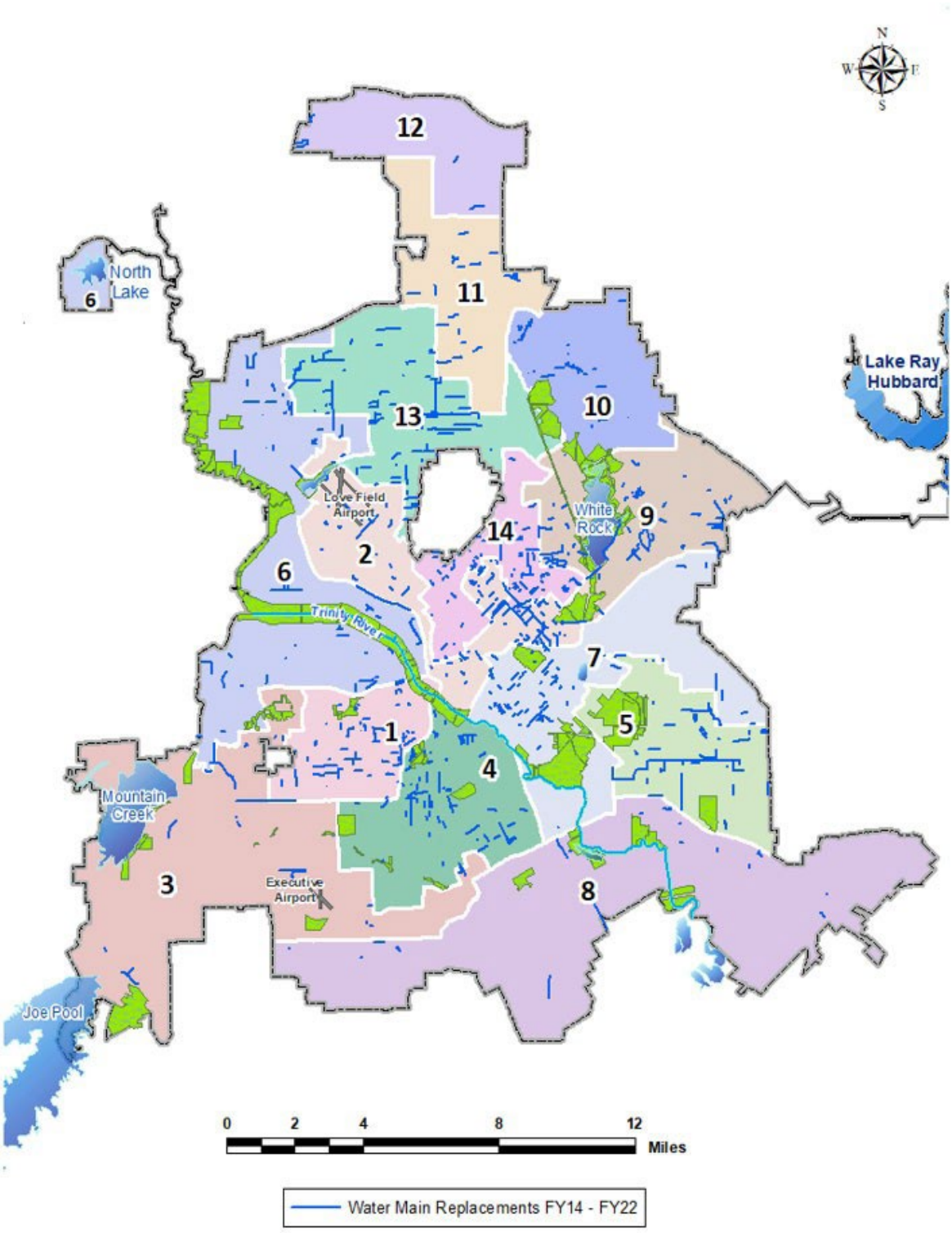

Figure 3-17: Main Replacement Location Map (based on pipe age and composition) FY 2014-15 through FY 2021-22

Figure 3-18 illustrates the miles of pipe replaced each year since FY 2009-10. DWU has replaced an average of 50.5 miles per year through the Pipeline Replacement Program. The Program's annual spending ranged from approximately $32 million in FY 2016-17 to a high of $84 million in FY 2018-19 (see **Figure 3-20**). Since FY 2009-10, DWU has spent approximately $611 million and replaced approximately 657 miles of pipe—approximately 13.3% of the system replaced in 13 years. This is a replacement program that will replace every pipe in the system every 98 years.

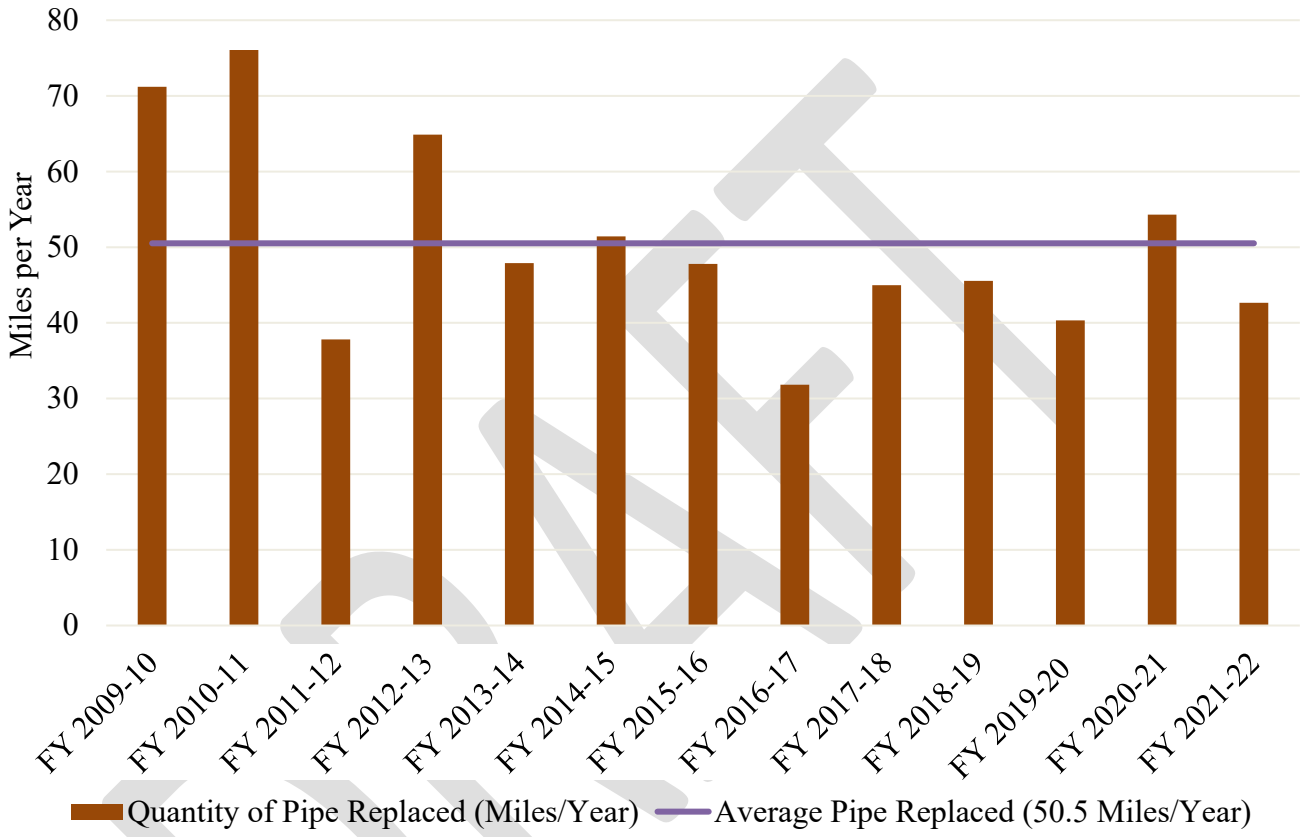

Figure 3-18: Quantity of Pipe Replaced in Miles per Year FY 2009-10 through FY 2021-22

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Figure 3-19 depicts the annual cost per linear foot divided by the linear feet of pipe replaced that year (regardless of pipe size). The average cost per foot of pipe has more than doubled since FY 2015-16.

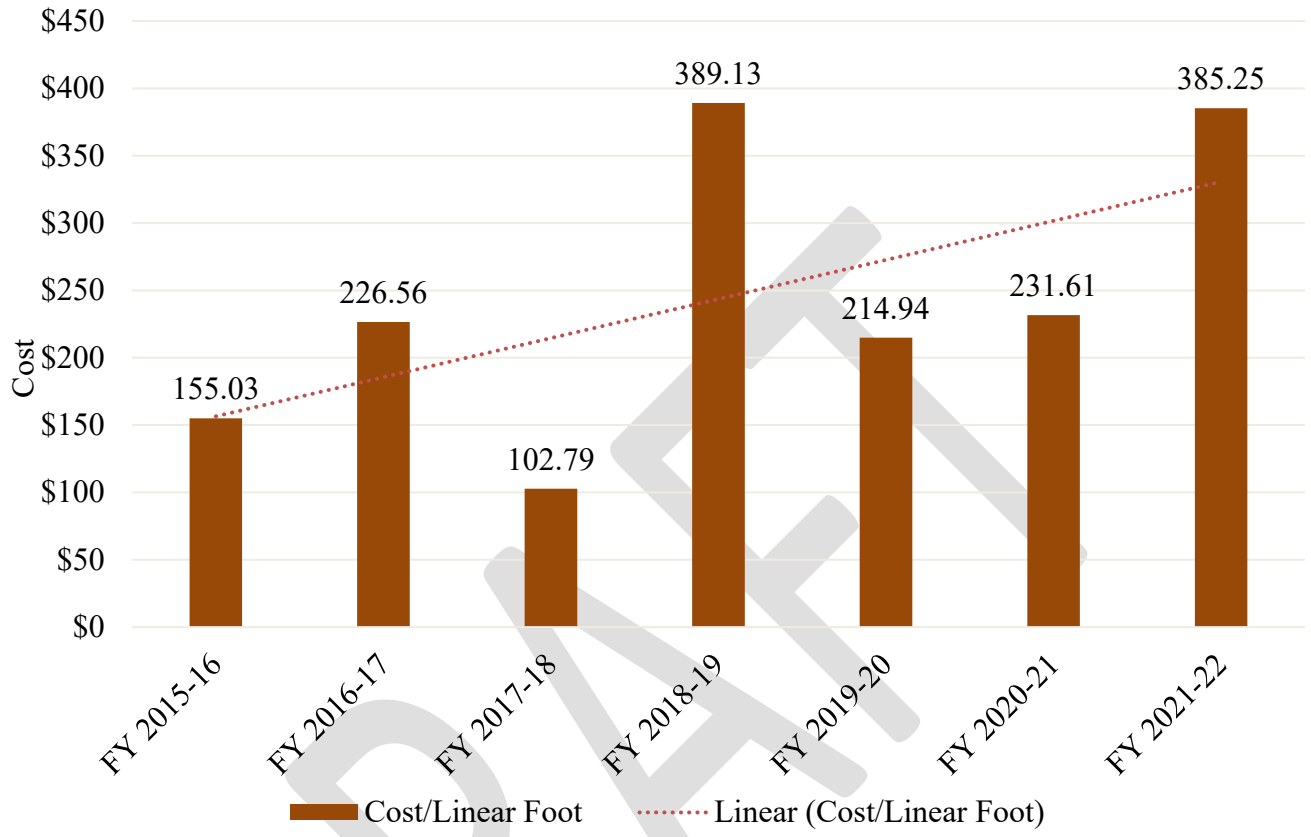

Figure 3-19: Pipe Cost per Linear Foot FY 2015-16 through FY 2021-22

When a pipeline is replaced, it is often in a public right-of-way such as a street, alley, or on private property. When a street or alley is disturbed, it must be replaced, often in its entirety, which adds to the costs of pipeline replacement. When private property is disturbed, it too, must be set back to its original or better condition. Paving, site restoration, and the protection of adjacent utilities can have significant cost impacts and, in some cases, account for 35 to 40% of a project's costs. Other items that can affect pipeline construction cost and vary from project to project include, but are not limited to, pipe depth, pipe diameter, traffic control and construction method (trenchless vs. open cut construction). In other words, sometimes it is difficult to suggest that a particular installation should be installed for a particular unit price.

Figure 3-20 points out costs for pipeline construction have been increasing. For example, in FY 2018-19, pipeline construction costs were unexpectedly high at $84 million. In FY 2018-19, a pipeline replacement project located in the downtown area, an exceedingly difficult area for contractors to work in, resulted in much higher installation cost when compared to other typical projects. This was such a complex project that DWU was forced to negotiate with only a single contractor because other contractors refused to bid on it. Complex projects like this caused annual expenditures for the FY 2018-19 pipeline replacement programs to be significantly higher than previous years.

The Capital Improvements Program is responsible for managing all DWU Capital Improvement Projects. **Figure 3-20** shows construction costs have been steadily increasing. Reasons for this increase center on a robust economy, causing a general increase in the price of construction materials, particularly in pipe prices, and an increase in demand for construction work, including pipeline replacement. It has been difficult to entice large numbers of bidders on projects, resulting in increased bid prices for the work. In addition, labor shortages, manufacturing delays, raw material price increases, and increased salaries and benefits to recruit and retain construction workers have also led to a significant uptick in construction costs over recent years.

Figure 3-20 spending totals represent all capital funds spent on pipeline construction including City construction awards and relocation construction awards, including participation in outside agency projects that required pipeline replacements.

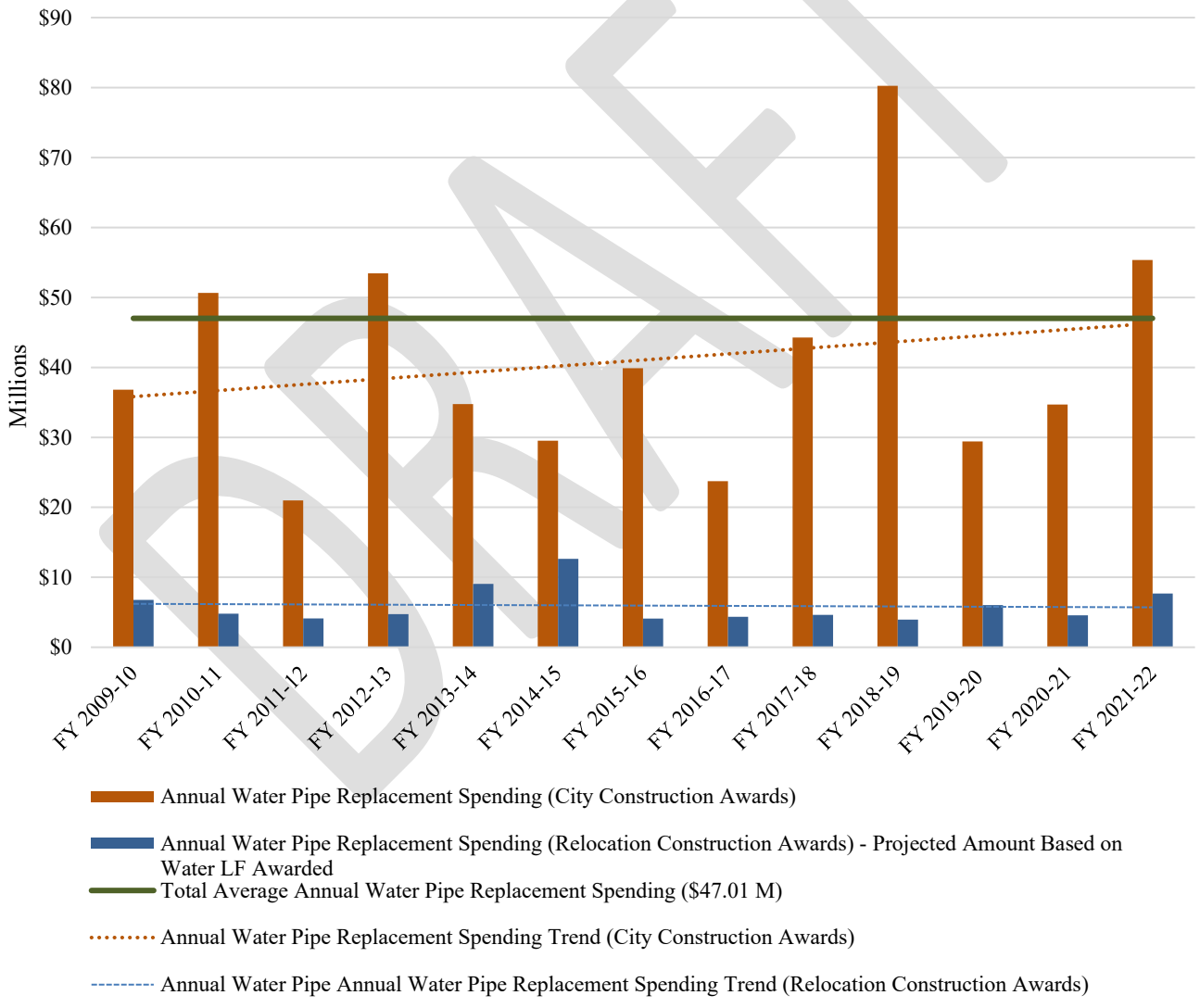

Figure 3-20: Total Annual Spending for the Pipeline Replacement Program (Including Relocation Costs) FY 2009-10 through FY 2021-22

At the end of FY 2021-22, DWU was maintaining approximately 5,038 miles of potable water pipeline. Of this, approximately 189 miles of pipeline, about 3.7% of the system, has been identified for replacement based on the criteria described above and other criteria. Other criteria may include water quality issues and undersized mains, which could result in inadequate fire flow concerns. **Table 3-1** shows the status of all pipelines identified for replacement as of FY 2021-22.

Steps for Replacement of Water Lines	Total Linear Feet of Water Lines	Total Miles of Water Lines
Identified Need	995,535	188.55
Design	1,472,871	278.95
Design Completed	118,758	22.49
Awarded for Construction	225,181	42.65
Totals	**2,812,345**	**532.64**

Table 3-1: Status of Pipelines Identified for Replacement (FY2021-22)

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3.12 DWU Water Savings Strategies

There is a constant state of optimization at the treatment plants to make plants continue to run efficiently due to new processes and technologies being implemented and regulation/requirement changes. Much of this optimization is for the purpose of obtaining the highest quality water most efficiently. While there may be water savings from these optimization strategies, specific quantification of that savings is not readily available due to the frequency of changes and current metering setups.

The 2016 Work Plan recommended expanding optimizing backwash and ripening processes at the Bachman Water Treatment Plant as a potential water conservation recommendation. DWU staff were able to save around 149 million gallons per year. The Bachman Water Treatment Plant transitioned to Biologically Active Filtration (BAF) in 2017, offering significant water quality improvement. The East Side Water Treatment Plant (EFWP) transitioned to BAF in 2019 and continues to work on optimizing backwash not for water savings, but for better water quality reclamation.

In 2020, DWU began to draft a Water Purification Facilities Strategic Plan (WPFSP). The purpose of the WPFSP is to align water production needs with other completed DWU strategic planning efforts and to provide a holistic approach to the future operations, maintenance, and capital investments at the water treatment plants, raw water conveyance infrastructure, dams, spillways, and reservoirs as part of DWU's One Water production system. The WPFSP will validate treatment and water quality goals, align operations and maintenance practices for optimization, address and incorporate sustainable practices and energy management where applicable, coordinate with other City initiatives, and triggers for facilities planning. It is anticipated that the final draft of the WPFSP will be completed in Summer 2024.

The Treatment Process Performance/Optimization Assessment task of the WPFSP focuses on unit treatment processes and an optimization assessment for each water treatment plant. An in-depth analysis of treatment process performance relative to current issues and challenges will assess each unit treatment process in terms of its ability to consistently meet established key performance indicators. This analysis will result in plant-specific measures necessary to optimize operations. The recommended measures may include a combination of SOPs/BMPs for critical processes, rehabilitation of existing processes, design and capital improvements, and overall standardization of practices across the water treatment plants.

Supplemental Agreement No. 4 of the Bachman Water Treatment Plant Water Quality Improvements Project was approved in 2020. This Supplemental Agreement includes process performance optimization of the rapid mix, flocculation, sedimentation, filtration, and disinfection operations. A summary of the process performance results and recommendation for optimization will be produced for consideration and implementation. Most of the scope of work has been completed except for the optimization effort. The Bachman chemical dosing and BAF filter performance optimization effort is underway. The consultant will assist with data analysis and will provide recommendations.

Recommendation 3.12.1 Evaluate Internal Metering of Water Treatment Processes

To better track water savings from optimization processes, evaluate the metering of treatment plant water. Because treatment plants are constantly evolving to optimize performance, a more robust

metering system, including submetering of various processes, would allow for better tracking of water use and identify areas for potential water savings throughout the entire treatment process.

3.13 DWU Water Reuse Alternatives

Water reuse is categorized into three primary types: de facto, direct, and indirect. Direct reuse and indirect reuse are further broken down into potable and nonpotable reuse.

- **De facto water reuse** is a drinking water supply that contains a significant fraction of treated wastewater, typically from wastewater discharges, although the water supply has not been permitted as a water reuse project.
- **Direct potable reuse** is advanced-treated reclaimed water introduced directly into the potable water system or into the raw water supply entering a water treatment plant.
- **Direct non-potable reuse** is advanced-treated reclaimed water not used for drinking water but is safe to use for irrigation or industrial purposes**.**
- **Indirect potable reuse** is reclaimed water discharged into a water supply source, such as surface water or groundwater. The mixed reclaimed and natural waters then receive additional treatment at a water treatment plant before entering the drinking water distribution system.
- **Indirect non-potable reuse** is reclaimed water discharged into a surface water or groundwater water supply source. The mixed reclaimed and natural waters may or may not receive additional treatment is not used for drinking water but is safe to use for irrigation or industrial purposes.

DWU makes use of de facto water reuse, direct non-potable reuse, indirect potable reuse, and indirect non-potable reuse as part of its water supply.

De Facto Reuse

DWU water is currently supplied from six reservoirs, four in the Trinity River Basin and two in the Sabine River Basin. DWU also has one reservoir, Lake Palestine, in the Neches River Basin not currently connected to the system. Each of Dallas's reservoirs receives treated effluent from multiple wastewater treatment plants situated upstream of the reservoirs. The de facto reuse is treated as inflows into the lakes.

Direct Nonpotable Reuse

In 2005, DWU placed a reuse water line from its Central Wastewater Treatment Plant to Dallas's Cedar Crest Golf Course in service and began serving the golf course with treated effluent. In 2014, an extension of the reuse line was placed in service to serve Stevens Park Golf Course.

Dallas was issued a Chapter 210 reclaimed water reuse authorization from the TCEQ dated January 22, 2008 (R10060-001). On December 31, 2013, Dallas received an amended reclaimed water reuse authorization. **Figure 3-21** illustrates the reuse water line from Central Wastewater Treatment Plant to Cedar Crest and Stevens Park Golf Courses. The direct nonpotable reuse system has provided 451,964 gallons of golf course irrigation (448,002 at Cedar Crest Golf Course and 3,962 gallons at Stevens Park Golf Course) in FY 2021-22.

Figure 3-21: Direct Nonpotable Reuse Line

Indirect Potable and Nonpotable Reuse

Dallas was granted a water reuse permits by the TCEQ on October 12, 2016, as an amendment to Dallas's Lake Ray Hubbard water right (Certificate of Adjudication 08-2462G) and October 16, 2006, as an amendment to Dallas Lewisville Lake water right (Certificate of Adjudication 08-2456E). On March 31, 2010, the TCEQ granted Dallas a reuse water right that severed previous rights COA 08-2462G and 08-2456E and combined them into a new water right, Water Use Permit 12468. The reuse permit authorizes Dallas to divert effluent discharged by the City of Lewisville Wastewater Treatment Plant, Town of Flower Mound Wastewater Treatment Plant, and Dallas's Central Wastewater and Southside Wastewater Treatment Plants.

Dallas had diverted City of Lewisville and Town of Flower Mound effluent from the Elm Fork of the Trinity River at Dallas's Elm Fork and Bachman Water Treatment Plants since 2008 as shown in **Table 3-2**.

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Elm Fork Diverted Reuse	
Year	Diverted Reuse (Acre-Feet)
2008	954
2009	11,679
2010	12,361
2011	10,963
2012	11,819
2013	9,382
2014	11,529
2015	18,476
2016	17,355
2017	13,732
2018	14,711
2019	15,995
2020	16,507
2021	16,172
2022	14,971

Table 3-2: Elm Fork Diverted Reuse in Acre-Feet (2008-2022)

In 2008, Dallas entered into an agreement with the North Texas Municipal Water District (NTMWD) to swap NTMWD's permitted reuse water being discharged into Lake Ray Hubbard and Lewisville Lake for a like amount of Dallas's permitted reuse from its Central and Southside Wastewater Treatment Plants for a like amount of water (SWAP Agreement). Per the terms of the contract, Dallas will pass NTMWD permitted effluent being discharged into Lake Ray Hubbard downstream for NTMWD's use until such time as Dallas constructs a main stem pump station below the confluence of the East fork of the Trinity River and the Trinity River. Due to NTMWD's water supply needs, NTMWD has constructed the Main Stem Pump Station. An amendment to the SWAP Agreement is needed to establish Dallas's share in the Main Stem Pump Station for Dallas and NTMWD to facilitate the actual swap of permitted reuse. It is anticipated that the SWAP Agreement Amendment will be finalized in 2023. In calendar year 2022, NTMWD released 26,257 acre-feet (an average of 23.44 MGD) of permitted reuse into Lake Ray Hubbard and 11,208 acre-feet (an average of 10.0 MGD). Once finalized, it is anticipated that the reuse swap will account for approximately 33.4 MGD and will slowly increase over time.

The 2014 Dallas Long Range Water Supply Plan contains the Main Stem Balancing Reservoir as a recommended water management strategy. The Main Stem Balancing Reservoir project is a proposed off-channel reservoir that could store approximately 300,000 acre- feet of Dallas's permitted return flows for reuse. The project implementation is currently scheduled for 2050.

4.0 Wholesale Customers

As a regional wholesale provider, Dallas Water Utilities (DWU) has treated water, untreated water, wastewater, and non-potable/irrigation wholesale customers. The majority of DWU's wholesale treated water contracts are local municipalities. Dallas's water rights were granted by the State of Texas, supported by the demands of DWU's wholesale customers.

4.1 Wholesale Customer Contracts

Municipal wholesale water contracts are negotiated for a term of 30 years and approved by the Dallas City Council and the governing body of the wholesale customer. Wholesale Customer Cities (WCC) are sovereign entities, not subject to City of Dallas policies or ordinances. Wholesale customers are required to observe the conditions of their contracts and to follow State of Texas requirements for water use and reporting.

A DWU wholesale water supply contract (new, renewed, extended) requires the wholesale customer to develop and implement a water conservation plan or water conservation measures using the applicable elements in 30 TAC §288. If the customer intends to resell the water, the contract between the initial supplier and customer must provide that the contract for the resale of the water must have water conservation requirements so that each successive customer in the resale of the water will be required to implement water conservation measures in accordance with the provisions of 30 TAC § 288.

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Entity	Water Consumption (Gal/Yr)	2020 Pop. Proj.*	Contract Expiration
Treated Water Customers			
Carrollton	7,858,759,000	130,481	2043
Grand Prairie	8,572,111,000	166,208	2042
Irving^	15,047,173,000	259,186	2033
DeSoto	3,700,387,000	54,505	2043
Coppell	3,493,745,000	40,848	2047
Lewisville	3,464,738,000	106,485	2046
Lancaster	3,213,426,000	45,097	2041
Farmers Branch	3,023,745,000	30,852	2040
Cedar Hill	2,500,824,000	53,938	2044
Duncanville	1,889,755,000	43,110	2044
Addison	1,960,658,000	14,869	2042
Flower Mound	1,811,270,000	75,315	2047
The Colony	1,647,308,000	53,029	2040
DFW Airport	936,887,000	—	2045
Glenn Heights	913,338,000	13,822	2052
Balch Springs	794,098,000	26,418	2045
Seagoville	649,937,000	18,853	2043
Red Oak	488,318,000	7,667	2033
Hutchins	426,541,000	9,901	2042
Ovilla	232,851,000	4,485	2035
Cockrell Hill	165,419,000	4,787	2044
Combine WSC	123,036,000	3,714	2035
Ellis County WCID#1	—	—	2033
Untreated Water Customers			
Upper Trinity Regional Water District	8,635,025,000	297,528	2052
Grapevine	346,266,000	52,243	2030
Lewisville	3,801,029,000	106,485	2046
Irving	1,552,190,000	259,186	2033

**Population estimates from 2021 Region C Water Plan*

Table 4-1: Wholesale Water Customers (Treated and Untreated Water Consumption FY 2021-22)

*^DWU treated 15,047,173,000 gallons of water that the City of Irving purchased from Jim Chapman Reservoir (included in **Table 4-1** totals).*

4.2 Water Planning

The City has a designated planning and service area as described in the 2014 Dallas Long Range Water Supply Plan to 2070 and Beyond (2014 LRWSP) as the area serviced by its existing customers. In accordance with the plan, the City is planning for the long-range needs of all its existing customers and anticipates renewal of all existing contracts. Treated water is now supplied on a wholesale basis to the cities and authorities under contracts expiring in the calendar years indicated in **Table 4-1**.

Untreated water from existing reservoirs is supplied to the Upper Trinity Regional Water District, the City of Grapevine, and the City of Lewisville, under contracts extending to the years 2052, 2030 and 2046, respectively.

Cities and governmental entities, in addition to those listed in **Table 4-1**, periodically request wholesale water service. These requests are reviewed considering the Conditions of Service for Treated Water Wholesale Customers approved by the Dallas City Council in December 1984. The LRWSP identifies the DWU current service planning area which includes DWU's current wholesale customers' corporate limits. The wholesale service area includes most of Dallas County and portions of Collin, Denton, Ellis, Kaufman, Rockwall, and Tarrant counties. The Conditions of Service identify a set of conditions to help "ensure that the provision of water service is equitable; that issues related to the public health and well-being are addressed; that water resources in the service area are protected and maintained for the benefit of those who depend on them; and that adequate infrastructure within the Dallas water system are built thus protecting the level and quality of service to existing as well as new customers." Included in the conditions are additional considerations for water conservation beyond the state standard. These additional considerations include the metering of all accounts, including municipal accounts, and the development of contingency plans for conservation during water shortages, peak demand periods and emergencies (i.e., emergency management and/or drought contingency plan).

4.3 Wholesale Rates

In 1979, the City and its wholesale treated water customers negotiated and reached consensus on a 30-year Memorandum of Agreement (MOA) for a wholesale treated water rate-setting methodology. Upon the expiration of the MOA in 2009, the City and its wholesale treated and untreated water customers negotiated a MOA approved by the City Council on May 12, 2010, superseding the 1979 MOA. It was automatically incorporated and became a part of all existing wholesale treated water contract rate structures without any further action or approval on the part of the City or of the wholesale treated water customers.

City of Dallas wholesale rates are determined by Cost-of-Service studies performed annually by DWU, during which wholesale customers participate through a committee of their representatives. Wholesale rates are based on the capital and operating costs needed to purchase, treat, and deliver water. This includes a two-part wholesale treated water rate (volume and demand), with allocation of costs in rate design to encourage conservation and efficient operation of the water systems of Dallas and its wholesale treated water customers. WCC are briefed on rates every year and Cost of Service studies are available for review. Dallas's wholesale rates are lower than retail rates because all costs associated with storage, distribution, and billing are the responsibility of the wholesale customer.

Treated water costs are recovered through a two-part system made up of demand and volume charges for outside customers.

The **demand charge** recovers costs to maintain the peak capacity in the system for customer needs. DWU sets a rate of flow controller (ROFC) valve on the line that delivers customer water. The ROFC restricts the flow to the volume initially requested. If the customer requires additional water, they are required to increase their setting and pay retroactively to the beginning of the water year and commit to the higher level of water for five years. Customers pay the demand charge for each million gallons per day (MGD) requested. The two-part rate structure encourages water conservation in several ways. The

demand charge is calculated by multiplying the demand charge rate annually times the amount (million gallons) of daily capacity reserved. The wholesale customer may request additional water at any time; however, they are charged for demand going back to the start of the current water year. This contract provision promotes water conservation by discouraging high one-year water use and then returning to lower demand levels. Under this provision, wholesale customers pay annual demand charges based on current water year demand or the highest demand established during the five preceding water years, whichever is greater.

Volume charges recover costs based on the amount of water used. Most (98%) wholesale treated water customers are charged both demand and volume, and the remaining 2% are charged at a flat volume rate. The volume charge is calculated based on actual water use.

These two rates encourage the WCC to be mindful of how much water they use and provide a financial incentive for WCC to utilize less water. It also helps WCC to encourage their own residents and other treated water customers to conserve water.

4.4 Impact of Wholesale Water Customers on Water Demand

Wholesale water customers account for a sizable portion of DWU's water demand. In FY 2021-22, these customers currently use 42.37% of treated water supplied by DWU, as shown in **Table 4-2**.

Category	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Treated Water Demand (MG)								
Total Treated Water Demand	136,578	135,159	135,665	141,920	134,589	139,092	139,364	150,433
Retail Treated Water Demand	61,525	61,354	60,559	63,550	57,535	60,890	59,339	67,051
Wholesale Customer Treated Water Demand	51,543	53,811	55,086	58,372	52,175	58,563	55,202	63,736
Wholesale Percent of Treated Water	37.74%	39.81%	40.60%	41.13%	38.77%	42.10%	39.61%	42.37%

Table 4-2: Treated Water Consumption by Customer Class (MG)
FY 2014-15 through FY 2021-22

Figure 4-1 shows the treated water consumption of DWU retail and wholesale customers since FY 1999-2000. The overall treated water consumption has decreased by 12% from FY 1999-2000 to FY 2021-22.

The WCC population for treated water has increased significantly during the past 20 years, from 800,475 in 2000 to an estimated 1,080,558 in 2020 (approximately 27% population growth). During that same period, wholesale consumption remained flat. This may indicate that the WCC are successfully implementing water conservation measures despite unprecedented population growth.

Figure 4-1: Treated Water Consumption by Customer Class FY 1999-2000 through FY 2021-22

Use by DWU's current wholesale water customers could increase to approximately 50% of all water and 62% of treated water by 2070. Therefore, water demand reductions by DWU's wholesale customers are essential if DWU is to achieve its long-range water supply objectives.

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4.5 Non-Potable/Irrigation Customers

DWU sells non-potable water to municipal and commercial entities for various purposes, as listed in **Table 4-3**. These short-term contracts are typically negotiated for a three-year term. By providing these customers with wholesale untreated water contracts, these customers and associated demands are removed from DWU's treated water system. Potable water is more expensive to treat and distribute and puts an undue burden on water treatment facilities and planning for nonmunicipal purposes. **Figure 4-2** shows the locations of those contracts.

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Non-Potable/Irrigation Wholesale Customers		Annual Maximum Purchase
Map #	**Golf Courses**	
37	City of Rowlett	290,000,000
11	Gleneagles Country Club	243,440,000
3	Bent Tree Country Club	159,997,907
10	City of Garland	155,576,778
18	Preston Trail Golf	153,656,121
7	City of Allen	145,000,000
34	Wynnewood Army	110,000,000
8	City of Carrollton (Indian Creek)	100,000,000
23	Rockwall Golf & Athletic Club	97,500,000
20	Prestonwood: The Hills	96,351,795
5	CF Lake Park Arcis, LLC	80,000,000
6	CF Plantation Arcis, LLC	80,000,000
16	Lantana Golf Club	80,000,000
17	Moon Golf Club	80,000,000
19	Prestonwood: The Creek	61,468,533
25	Stonebriar Country Club	61,417,452
27	Twin Creeks Golf Club	57,000,000
21	Richardson Country Club	50,000,000
9	City of Carrollton (McInnish Park)	46,632,950
22	Riverchase Golf Course	35,000,000
1	Anderson Express Lane	5,000,000
HOAs		
14	Lake Forest Community Assn.	32,000,000
24	Signal Ridge HOA	9,000,000
15	Lakeside Village HOA	6,500,000
30	Willowbend Place HOA	3,200,000
29	Waterford on the Park HOA	1,000,000
Other Types		
33	Luminant	325,851,427
12	DXC Technology Services	287,075,000
36	GUSH Inc. - Javier Ranch	65,170,200
26	Travis Ranch	9,000,000
4	Blue Sky Sports Center	8,797,988
28	U.S. Army Corps of Engineers	4,887,765
35	Carrollton-Farmers Branch ISD	4,000,000
13	City of Highland Village	4,000,000
39	Connemara Conservancy	1,303,000
2	Bass Pro Outdoor World	310,000
38	Town of Hickory Creek	10,000

Table 4-3: Types of Non-Potable/Irrigation Wholesale Customer Contracts

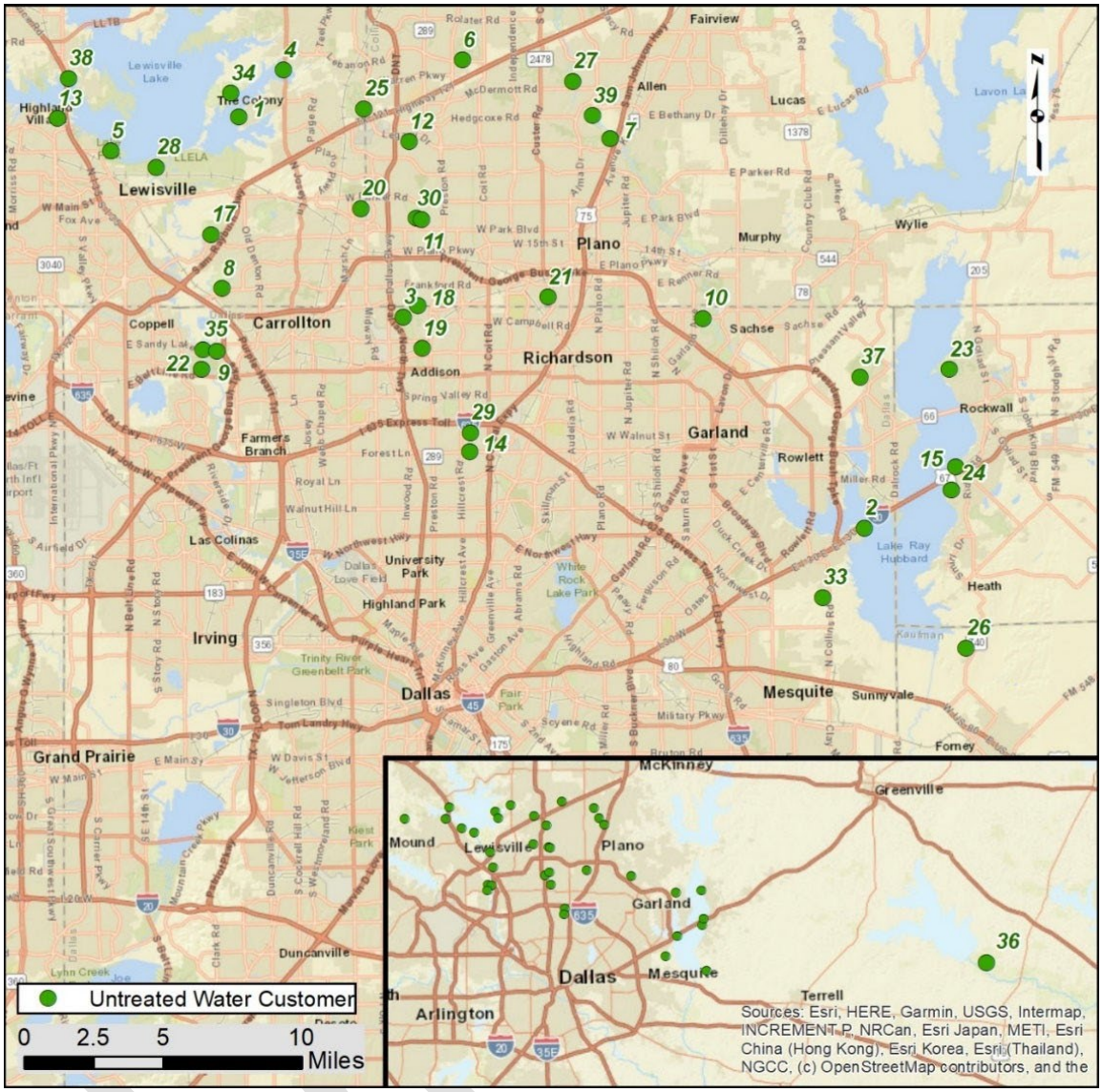

Figure 4-2: Non-Potable/Irrigation Wholesale Customers

4.6 Wholesale Customer Reporting

Per Texas Water Code Section 13.146, Water Conservation Plans from retail public utilities serving 3,300 water connections or more are required to be submitted to TCEQ every five years. TWDB requires the submission of a Water Conservation Annual Report to document implementation of Conservation Plans from retail public water suppliers with more than 3,300 retail connections or an active financial obligation with TWDB. Utilities are also required to conduct and submit annual Water Loss Audits, which detail any real or apparent losses of water in utility distribution systems because of several factors, including leaking pipelines, metering problems, and other issues. Retail public utilities with fewer than 3,300 connections must conduct and submit Water Loss Audits to TWDB every five years. **Table 4-4** identifies state-required reports related to water conservation and their submission frequency. **Table 4-5** notes the status of WCC reporting to TWDB in 2022.

Report	Reference	Agency	Frequency
Utility Profile and Water Conservation Plan Requirements for Municipal Water Use by Public Water Suppliers	30 TAC §288.2(a)(1)(A)	TCEQ	Every five years by entities that are required to submit a water conservation plan to the TCEQ
Water Conservation Implementation Report Form and Summary of Updates and Revisions to Water Conservation Plan	30 TAC §288.30(1)-(4)	TCEQ	Every five years by entities that are required to submit a water conservation to the TCEQ in accordance with 30 TAC §288
Water Conservation Plan Annual Report	31 TAC §363.15(g)	TWDB	Shall file a report annually not later than May 1st to the executive administrator on the entity's progress in implementing each of the minimum requirements in the water conservation plan
Water Loss Audit	31 TAC §358.6(b)	TWDB	Audit required annually if the utility has 3,300 or more required every five years by May 1st if the utility has 3,300 or fewer connections and is not receiving financial assistance from the board.
Water Use Survey	TWC 16.012m 31 TAC §358.5	TWDB	TWDB Executive Administrator shall conduct surveys at least annually of persons and/or entities using groundwater and surface water for municipal, industrial, power generation, or mining purposes

Table 4-4: Required Utility Reports for TCEQ and TWDB

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PWS	Water Use Survey	Water Loss Audit	Conservation Annual Report
Addison	Submitted	Submitted	Submitted
Balch Springs	Submitted	Submitted	Submitted
Carrollton	Submitted	Submitted	Submitted
Cedar Hill	Submitted	Submitted	Submitted
Cockrell Hill	Not Submitted	*Not required*	*Not required*
Combine WSC	Submitted	*Not required*	*Not required*
Coppell	Submitted	Submitted	Submitted
DeSoto	Submitted	Submitted	Submitted
DFW Airport	Short form submitted	*Not required*	*Not required*
Duncanville	Submitted	Submitted	Submitted
Ellis County WCID 1	*Not required*	*Not required*	*Not required*
Farmers Branch	Submitted	Submitted	Submitted
Flower Mound	Submitted	Submitted	Submitted
Glenn Heights	Submitted	Submitted	Submitted
Grand Prairie	Submitted	Submitted	Submitted
Hutchins	Submitted	*Not required*	*Not required*
Irving	Submitted	Submitted	Submitted
Lancaster	Submitted	Submitted	Submitted
Lewisville	Submitted	Submitted	Submitted
Ovilla	Submitted	*Not required*	*Not required*
Red Oak	Submitted	Submitted	*Not required*
Seagoville	Submitted	Submitted	Submitted
The Colony	Submitted	Submitted	Submitted

Table 4-5 Wholesale Customer City Reports to TWDB (2022)

WCC Self-Reported Data

DWU consolidates and tracks customer metrics for the TWDB Annual Water Conservation Report. DWU staff have used the self-reported customer data since 2010 to create individual WCC charts, which are in the WCC GPCD, Water Loss, Consumption Appendix. These metrics include Total and Residential GPCD, Total Water Loss, and Total Water Consumption with trends. Individual WCC graphs are in the **WCC GPCD, Water Loss, Consumption Appendix**. Please note that not all WCC reported yearly data, resulting in gaps.

Self-reported Total Water Consumption data includes all treated water sources, including additional water not provided by DWU (purchase of treated water from other water providers and/or their own treated water). Average WCC Total Water Consumption has increased since 2010 from 4,042 MG to 4,767 MG in 2022 with an overall average during that period of 4,241 MG.

Total Water Loss has gone from 12.5% in 2010 to 13.0% in 2022 with an overall average during that period of 11.24%.

Based on the Water Conservation Annual Reports submitted to the TWDB, the average WCC Total GPCD has gone from 170 in 2010 to 172 in 2022, with an overall average during that period of 161. Average WCC Residential GPCD has gone from 106 in 2010 to 94 in 2022 with an overall average during that period of 90 GPCD.

Overall, Total and Residential GPCD are trending down. Total Water Loss continues to exceed the 10% goal. Total Water Consumption remains flat. Wholesale treated water customer population has risen drastically over this period, as indicated in **Figure 4-1**.

4.7 Wholesale Outreach Program

DWU recognizes that WCC consume a sizable portion of the treated water that is produced. Effective water efficiency strategies and reduced water consumption by Dallas and its WCC are vital to ensure water is available for the future. Reduced consumption by WCC is vital to the reliability of DWU's long term commitment to supply water and to push the need for new water sources further into the future.

DWU has some inherent challenges making water conservation progress across its WCC. Many WCC have limited resources, including staff. DWU also faces challenges in effectively documenting conservation program water savings of its WCC. Since WCC have a direct connection with their respective retail water users and associated data to track their respective conservation progress, DWU is reliant on the WCC data accuracy and reporting frequency.

Additionally, DWU's regulatory constraints on WCC water conservation progress is limited to what is specified in the wholesale water contracts.

The 2016 Work Plan recommended an outreach program to establish additional communication and strengthen the working relationship between DWU and its WCC. Over the past few years, DWU has been developing a Wholesale Outreach Program, designed to review WCC Water Conservation and/or Drought Contingency Plans and understand the WCC water conservation efforts. DWU analyzed and prioritized the WCC and visited larger customers to offer suggestions for reducing water consumption. In prioritizing the customers for the outreach program, DWU recognized that smaller customers may want distinct types of help not currently available. Therefore, DWU targeted smaller customers after the initial discussions with the larger customers.

4.8 WCC Water Conservation Activities

In 2020, the DWU Wholesale Services Division requested current water conservation activities from WCC. DWU provided its current activities in a grid and asked customers to check the box next to any activities in which their city is participating. DWU also asked the customers to add additional activities not included in the original list provided. For this Work Plan, that information was added to BMPs indicated in Annual Reports submitted to the TWDB in 2022. Activities are summarized in **WCC TWDB BMP Appendix**.[1]

[1] Texas Water Development Board. n.d. Best Management Practices for Municipal Water Providers. Accessed October 2023. https://www.twdb.texas.gov/conservation/BMPs/Mun/index.asp.

The top three water conservation activities currently implemented by WCC are conservation tiered rate system, public information, and time of day watering. Most WCC have some type of water conservation tiered rate system, where the more water that is used, the higher the rate paid within a tiered structure. Another activity reported by most WCC is public information, such as promoting water conservation through outreach events including special events and promotions, speaking engagements, water bill inserts, brochures and signage encouraging conservation at City facilities. Time of day watering is also a popular WCC water conservation activity. From April 1-October 31, watering is prohibited between 10 a.m. and 6 p.m. on all days of the week, including the allowed watering days. In some cases, time of day restrictions are implemented year-round.

Effective water efficiency strategies and reduced water consumption by Dallas and its WCC's are vital to ensure water is available for the future. Reduced consumption is vital to the reliability of DWU's long term commitment to supply water, which has a direct impact on WCC. DWU is committed to supporting its WCC in their water conservation efforts. DWU will continue to monitor its WCC water conservation measures that comply with their contractual obligations and State requirements, including:

- Continuing to request and track TWDB Annual Water Conservation Reports, and
- Sending email reminders each year to the required customers that annual reports are due.

In addition, DWU will explore the development of a website data clearinghouse for WCC that can provide electronic and printable resources. DWU will also review, evaluate, and update as necessary the Conditions of Service for New Treated Water Wholesale Customers.

4.9 Recommended WCC Outreach Measures

The *2016 Work Plan* made recommendations for WCC continued customer engagement, which included monitoring, measurement, and reporting, summarized in **Table 4-6**. These recommendations are still relevant with new ways to accomplish them included below.

Strategy	Recommendation
Continued Customer Engagement	
Wholesale Customer Cities Monitoring, Measurement and Reporting	● Monitor WCC state-required water conservation and drought plans
	● Consolidate, track, and analyze current and historical consumption, GPCD and other metrics
	● Recognize and promote WCC water conservation achievements
	● Assist WCC in enhancing and expanding their existing programs

Table 4-6: Recommended Measures Summary

Monitor WCC state-required water conservation and drought plans

In 2018, the DWU Wholesale Services Division began a more methodical process of documenting, tracking, and storing contract deliverables (i.e., conservation activities matrix). This information includes the customer requirement to furnish Dallas electronic copies of its water conservation and drought contingency plans and updates. Wholesale Services staff are responsible for the process.

In 2020, Wholesale Services requested that WCC provide an update on current water conservation activities. DWU provided its current activities in a grid and asked customers to check the box next to any activities in which their city is participating. DWU also asked WCC to add additional activities not included in the original list provided. This list was combined with data reported to the TWDB in the 2022 Annual Reports by WCC. The most recent grid is provided in the WCC TWDB BMP Appendix.

Consolidate, track, and analyze current and historical consumption, GPCD, and other pertinent metrics

DWU has 23 treated water wholesale customers (Ellis County WCID #1 is not currently taking water), with 17 required to submit state reports. DWU requested 2022 information directly from TWDB for analysis in this report.

Recommendation 4.9.1 Encourage Wholesale Customers to Submit State Reports

To help encourage annual participation in the TWDB Annual Water Loss, Water Use and Water Conservation Reports, DWU Wholesale Services could provide a reminder email to its WCC each year notifying WCC OF the report deadline. Provide reminders in January, March, and April to increase awareness of the May 1 deadlines. DWU should also forward information about Water Loss Use and Conservation (WLUC) Workshops.

Recognize and promote WCC water conservation achievements

As part of the Wholesale Outreach Program suggested in the 2016 Work Plan, DWU planned to recognize WCC who achieve water efficiency and reduced consumption goals. The purpose of recognition is to demonstrate DWU's appreciation for the dedication of time and resources to help change water use habits and encourage efficient water use. DWU believes that the water provider/water customer relationship is a partnership, and goals can only be achieved by working together.

While meeting with WCC during outreach efforts for the 2016 Work Plan, DWU discussed what sort of recognition, if any, was desired. Some recognition methods to be considered included:

- News release and press conference in the Wholesale Customer City
- Small advertising campaign, to include a billboard or newspaper ad
- Proclamation by the Dallas City Council or Dallas Mayor
- Certificate of Conservation Achievement or Innovation
- Luncheon with the Director of DWU
- Memorandum to TCEQ

When asked during the customer meetings, the WCC stated that they did not wish to be publicly recognized by DWU for their water conservation efforts. The consensus was that water conservation can be challenging for smaller wholesale customers and the larger wholesale customers did not want special recognition. Their fear was that public recognition could unfairly pit customers against each other.

Recommendation 4.9.2 Develop Wholesale Customer Water Conservation Recognition Program

Moving forward, DWU might consider providing individual recognition or acknowledgement directly to the WCC to respect their concern while at the same time acknowledging their success. Because of the reticence on the part of WCC to receive recognition directly from DWU, it is recommended that the recognition come in the form of an awards program, with categories to recognize accomplishments based on WCC size. Recognition is approached from the perspective of the WCC, who can choose to apply for the various awards on a voluntary basis. The awards ceremony could become part of either the annual meeting of WCC or as part of the annual North Texas Water Conservation Symposium. An awards program is being considered for the OEQS Water Conservation Division and the two could be combined, and be expanded to include regulatory compliance, wastewater, backflow, and stormwater accomplishments—a step toward a one water program.

Examples of effective awards programs include the City of Fort Worth Environmental Awards (https://www.fortworthtexas.gov/departments/water/about-us/environmental-awards) and the Houston-Galveston Area Council's Water Innovation Strategies of Excellence Awards (https://www.h-gac.com/wise-awards). Plummer staff has been involved in the development of both awards programs.

Recommendation 4.9.3 Include Wholesale Customer Representative on the Water Efficiency Partnership

This Work Plan recommends that OEQS Water Conservation Division create a Water Efficiency Partnership (WEP) with as many ICI sectors that can be included. Adding wholesale customer cities as a sector might be a way to include them in water efficiency/conservation discussions and help them learn the needs of the ICI sectors and develop programs within their communities to improve water efficiency/conservation.

Assist WCC in enhancing and expanding existing water conservation programs

Beginning in 2017, DWU staff met with all WCC to discuss water conservation topics, including:

- WCC conservation strategies and programs
- WCC challenges for implementing strategies and programs
- How DWU has or could help WCC efforts
- Resources for those WCC struggling to attain conservation goals
- Whether they would be willing to be an information resource for other WCC
- If and how WCC's would like to be recognized for their conservation efforts

Most WCC were interested in social media assistance. They requested electronic water conservation flyers and easily printable water conservation materials. Customers asked about water conservation

website links that they could put on their City's webpage. Some customers asked which companies DWU uses for their water conservation giveaways.

After each customer meeting, Wholesale Services staff followed up with the customer on outstanding requests. In 2020, staff developed an Outreach Resources flyer for WCC (See **Figure 4-3**). The flyer lists several of the items requested by WCC during the individual customer meetings. Items include a link to sign up for free, personalized watering advice for all customers, social media handles, website links to DWU water programs, and water conservation giveaways/specialty item contractors. One contractor will honor Dallas's negotiated 10% discount on pricing for WCC.

Recommendation 4.9.4 Meet with Wholesale Customers on a Regular Schedule

Programs and projects to help WCC need to provide maximum benefit at minimal cost. Funding for education and outreach to WCC is not part of either the DWU or OEQS budgets, partly due to the contractual restraints to require conservation activities by WCC and the varied sizes and budgets of individual WCC.

Wholesale Customer Management should schedule regular meetings with WCC to talk about water conservation best management practices and help with proper tracking for completion of required state documents.

Recommendation 4.9.5 Include Wholesale Customer Employees in Water Conservation Education/Outreach and Water Operations Training

Employee training related to both water conservation education/outreach and water operations could be offered at no charge to personnel from WCC. DWU could sponsor staff from WCC to the North Texas Regional Water Symposium each year. DWU could provide AWE and AWWA memberships to WCC at a low cost.

Recommendation 4.9.6 Inform Wholesale Customers of Master Agreements that Extend Pricing to Wholesale Customers

It might also be possible to provide education and outreach giveaway/specialty items through a collective purchase/distribution arrangement with WCC. An advantage of this is that branding/messaging will have continuity across all WCC, and all WCC and DWU benefit from lowered pricing through bulk purchasing. The North Texas Municipal Water District does this and the North Central Texas Council of Governments ran a program like this for members cities in the past.

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Figure 4-3: Outreach Resources Flyer Developed for WCC

5.0 Projected Water Savings, Costs, Benefits, and Staffing

Water savings for the selected residential and ICI strategies and water savings for selected water loss reduction strategies have been projected using different methods, as described below.

5.1 Projected Water Savings from Selected Residential and ICI Measures

Projected water savings for selected residential and ICI strategies are based on water use for the target customers, the target customer market, the projected unit water savings, and other impacts (**Table 5-1**).

Water Use and Unit Water Savings

In **Table 5-1**, the water use figures are the average indoor and outdoor **Water Use (a)** by accounts in the target market. For example, the average indoor water use for all single-family residential accounts is 148 gallons per account per day. The top 25% of single-family accounts with the highest water demands have an average indoor water use of 526 gallons per account per day.

The projected water savings for each strategy are indoor and outdoor water savings goals for customer participants. The figures are based on the experience of other utilities and benchmark data, and as estimates, actual water savings will vary. Once each strategy has been implemented, Dallas Water Utilities (DWU) or Office of Environmental Quality and Sustainability (OEQS) staff should verify that customers are realizing the projected water savings. If they are not, the program should be reevaluated and revised goals should be established.

Target Customer Markets

Most measures will be available to all customers, but some measures will be specifically targeted for high water users and new customers with high water savings potential. For example, the Residential Irrigation System Rebate measure, which will provide an incentive for such measures as improved irrigation controllers and other irrigation system water efficiency improvements, will be available to all DWU residential customers. At the same time, water users in the top 25th percentile should be targeted more aggressively to engage their participation in the program because of their potential for higher water savings than the average customer. Similarly, high water-using customers are expected to be more interested in participating in the program since their potential for cost savings is also greater.

Table 5-1 shows several factors impacting projected water savings over time. **Measure life (b)** is defined as the number of years that the measure can be expected to yield water savings before it must be replaced due to normal product aging (e.g., high efficiency toilets typically last about 25 years before they are replaced). **Annual savings decay (c)** refers to the annual percentage of customers who are expected to remove a water- saving device or discontinue adherence to water efficiency practices (e.g., removing a weather-based irrigation controller or no longer resetting an irrigation clock monthly as recommended during a customer audit).

Ordinances and rules have no decay adjustments because participation is mandatory. The water savings shown for these strategies incorporate the fact that there will not be full customer compliance. Annual savings decay factors are not shown for plumbing fixtures and appliances, because experience has shown few removals due to customer dissatisfaction. Replacements of faulty equipment are assumed to have the same water use and efficiency features as the original product.

Selected Water Conservation Strategies	Water Use(a)		Target Market	Projected Water Savings			Impacts	
	Indoor Water Use	Outdoor Water Use		Indoor Savings (Percent per Account)	Outdoor Savings (Percent per Account)	Net Water Savings (gpad)	Measure Life (b) (years)	Annual Savings Decay(c)
Behavioral Changes								
Enhanced Enforcement								
Residential Enhanced Enforcement	526	355	Top 25% Priority	0%	4%	14	5	n/a
Multi-Family Enhanced Enforcement	1,356	92	All	0%	4%	4	5	n/a
ICI Enhanced Enforcement	1,443	412	All	0%	4%	16	5	n/a
Wholesale Customer Cities Program	4,112,414	1,062,310	Treated Water Customers	0.25%	0.25%	12,937	5	15%
Structural Changes								
Residential Irrigation System Rebate Program	526	355	Top 25% Priority	0%	20%	71	10	5%
Revised ICI Incentive Program								
Non-Profit Facility Incentives	1,443	412	Older Toilets (3.5 GPF and Above)	10%	0%	144	25	n/a
Assumptions Used								
gpad *= gallons per account per day.*								
Measure life *is the number of years that the measure can be expected to yield water savings before it must be replaced due to normal product aging*								
Annual savings decay *is the annual percentage of customers who are expected to remove a water-saving device or discontinue adherence to water efficiency practices.*								

Table 5-1: Target Customer Water Use, Target Customer Markets, and Projected Water Savings

5.2 Program Participation

Program participants are DWU customers who can be expected to adopt the selected water conservation measures. Customer participation goals are set for each of the strategies based on a combination of factors, including:

- Participation levels achieved by other water utilities for similar programs
- Net water savings per account for the strategy
- The implementation schedule for each strategy
- Water savings required to meet the revised per capita consumption goal

The projected number of customer participants must be achieved to realize the water savings projected for each measure. The growing participation figures shown for regulatory strategies are for new customers only. The figures shown for other strategies represent the numbers of customers who must be successfully engaged by DWU to participate in the program or the number of retrofits that must be accomplished for a given program to achieve the projected water savings.

The number of participants shown in **Table 5-2** does not contain adjustments for free riders or silent savers, due to the uncertainties in estimating their net effects. Free riders are customers who participate in an incentive-based water conservation strategy, such as the residential irrigation system rebate program, but who would have still made modifications to their landscape even if a rebate had not been available to defray the cost of the purchase. Silent savers are customers that adopt water efficiency measures but do not apply for available incentives. It is difficult to estimate reliably the number or percentage of free riders and silent savers for a given strategy. If free ridership is a significant concern for a particular measure, program participation rules can be tightened to minimize their impact.

Projected water savings for selected residential and ICI strategies (**Table 5-2**) are based on unit water savings, target customer markets, program participation assumptions, measure life, and annual savings decay assumptions described in the previous sections.

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Selected Water Conservation Strategies	Measures Per Account	Projected Number of New Participating Accounts Per Incentive Each Year				
		FY 2022-23	FY 2023-24	FY 2024-25	FY 2025-26	FY 2026-27
Behavioral Changes						
Enhanced Enforcement						
Residential Enhanced Enforcement	1	3750	3750	3750	3750	3750
Multi-Family Enhanced Enforcement	1	1250	1250	1250	1250	1250
ICI Enhanced Enforcement	1	1250	1250	1250	1250	1250
Wholesale Customer Cities Program	1	5	5	5	5	2
Structural Changes						
Residential Irrigation System Rebate Program	1	0	0	125	375	500
Revised ICI Financial Incentive Program						
Non-Profit Facility Incentives - *Indicates Number of Toilets Retrofitted*	1	0	0	880	880	880

Table 5-2: Customer Participation Assumptions for Projected Water Savings

5.3 Projected Water Savings from Selected Water Loss Measures

All projected water savings for selected water loss measures will come from the Enhanced Real Loss Reduction strategy and from the increased capacity of existing real loss reduction efforts. Although reduction of apparent losses recovers revenue for the utility, it does not reduce water use.

DWU's total water loss percentage over the past five years has ranged from 5.21% to 11.04%, with an average of 8.09%. This includes authorized uses as well as unknown losses. It is recommended that DWU maintain a maximum unknown water loss percent of no more than 10%. Based on experience with other utilities, projected water savings from selected water loss reduction strategies are shown in **Table 5-3** and **Table 5-3a**. Projected real loss reduction is 2.1 million gallons per day by FY 2026-27.

The water savings from the selected strategies are expected to continue beyond FY 2026-27. The incentive- based and educational programs implemented during the five-year planning period will continue to produce water savings depending on the measure life and the annual decay assumptions. In addition, water savings from ordinance-related measures will continue to grow along with the population. Assuming that all the selected strategies are implemented as described, it is projected that measures implemented during the five- year planning period will save a total of approximately 33.9 billion gallons over the next 20 years.

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Selected Water Conservation Strategies	Projected Water Savings (gal/year)				
	FY 2022-23	FY 2023-24	FY 2024-25	FY 2025-26	FY 2026-27
Existing Conservation Programs - Implemented Savings					
New Throne for Your Home (Based on FY 2021-22 Recorded Savings)	56,319,865	112,639,730	168,959,595	225,279,460	281,599,325
New Throne for Your Home (Multifamily Toilet & Showerhead Distribution Program)	70,000,065	140,000,130	210,000,195	280,000,260	350,000,325
Minor Plumbing Repair Program (Based on FY 2013-14 Recorded Savings)	6,770,020	13,540,040	20,310,060	27,080,080	33,850,100
Additional Savings - Existing Real Loss Program	365,000,000	730,000,000	912,500,000	1,095,000,000	1,277,500,000
ICI Audit Program	46,063,000	92,126,000	138,189,000	184,252,000	230,315,000
ICI Rebates	31,937,135	63,874,270	95,811,405	127,748,540	159,685,675
Environmental Education Initiative K-12	54,815,335	109,630,670	164,446,005	219,261,340	274,076,675
Residential Irrigation System Evaluation Program	38,399,825	76,799,650	115,199,475	153,599,300	191,999,125
City Leadership and Commitment Grant Program	8,000,070	16,000,140	24,000,210	32,000,280	40,000,350
TOTAL ANNUAL SAVINGS	**677,305,315**	**1,354,610,630**	**1,849,415,945**	**2,344,221,260**	**2,839,026,575**
Behavioral Changes					
Enhanced Enforcement	28,634,250	57,268,500	85,902,750	114,537,000	143,171,250
Wholesale Customer Cities Program * Not included in DWU GPCD Reduction Calculations*** **	23,609,679	43,677,906	60,735,900	75,235,194	73,393,786
TOTAL ANNUAL SAVINGS	**52,243,929**	**100,946,406**	**146,638,650**	**189,772,194**	**216,565,036**
Structural Changes					
Revised ICI Incentive Program					
Non-Profit Facility Incentives	0	0	46,349,160	92,698,320	139,047,480
Residential Irrigation Incentive Program	0	0	4,999,770	9,999,540	14,999,310
Enhanced Real Loss Reduction					
Large Diameter Leak Condition Assessment	71,743,670	143,487,340	215,231,010	286,974,680	358,718,350
Enhanced Active Leak Detection- Additional Leak Repair Crew	0	0	66,700,100	133,400,200	200,100,300
Enhanced Active Leak Detection- Additional Leak Detection Crew	0	0	50,589,000	101,178,000	151,767,000
Enhanced Active Leak Detection - Additional Pressure Reducing Valve Crew	0	0	13,340,020	26,680,040	40,020,060
TOTAL ANNUAL SAVINGS	**71,743,670**	**143,487,340**	**397,209,060**	**650,930,780**	**904,652,500**

Table 5-3: Projected Water Savings from Selected Strategies

Category	Projected Water Savings (gal/year)				
	FY 2022-23 GPCD	FY 2023-24 GPCD	FY 2024-25 GPCD	FY 2025-26 GPCD	FY 2026-27 GPCD
Savings from Existing Implemented Water Conservation Programs	677,305,315	1,354,610,630	1,849,415,945	2,344,221,260	2,839,026,575
Savings from Structural Changes	71,743,670	143,487,340	397,209,060	650,930,780	904,652,500
Savings from Behavioral Changes	52,243,929	100,946,406	146,638,650	189,772,194	216,565,036
TOTAL PROJECTED ANNUAL SAVINGS	**801,292,914**	**1,599,044,376**	**2,393,263,655**	3,184,924,234	3,960,244,111
TARGET (GPCD Reduction)	0.94%	1.86%	2.86%	3.80%	4.66%
ANTICIPATED GPCD REDUCTION BASED ON TARGETED ANNUAL SAVINGS	1.64	3.26	5.00	6.65	8.16
NEW GPCD GOAL BASED ON 5 YEAR ROLLING AVERAGE OF 175 GPCD (CURRENT AND PROPOSED PROGRAMS)	173	172	170	168	167

Table 5-3a: Projected Water Savings from Selected Strategies Summary

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5.4 Projected Per Capita Water Savings

Figure 5-1 converts the projected savings in **Table 5-3** to per capita water savings by selected water conservation strategy, ordered from greatest projected savings to least. The three most important strategies to achieve savings goals are (1) additional savings from existing water loss programs, (2) enhanced water loss reduction, and (3) revised ICI financial incentives.

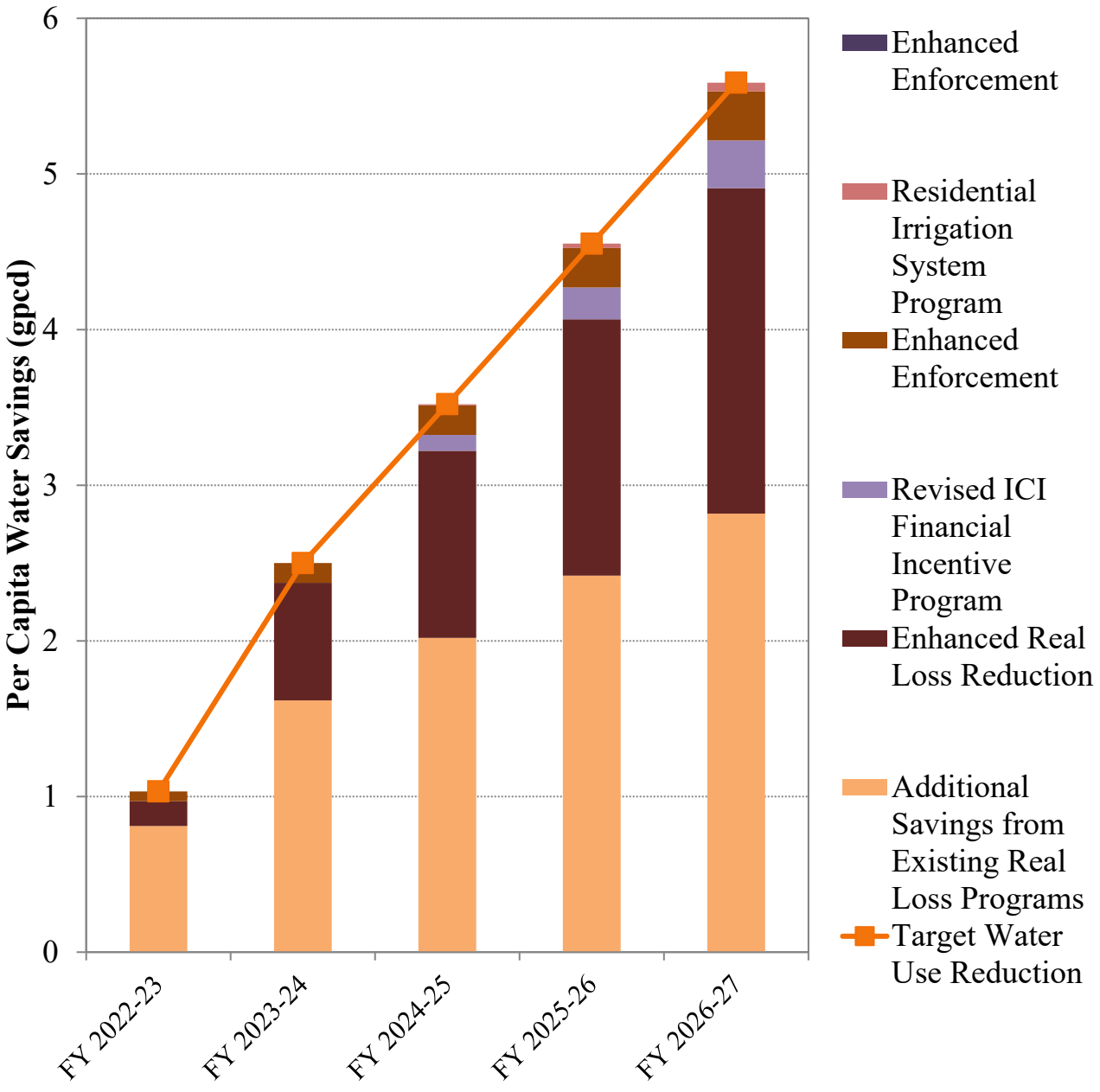

Figure 5-1: Projected Per Capita Water Savings from Selected Strategies

5.5 Water Conservation Benefits

The economic and noneconomic benefits of water conservation include:

- Extending the life of existing water supplies and delaying the need to develop expensive future water supplies. Costs associated with developing new water supplies (or purchasing new water) can include capital costs for construction of reservoirs, pumping facilities, pipelines, treatment plants, water storage and related facilities, costs of obtaining water rights and permits; and operation and maintenance (O&M) costs such as labor, energy, and chemicals.
- Reducing peak requirements, extending the life of existing infrastructure. Water system infrastructure is sized to meet peak demands. When peak demands are reduced through water conservation, the need for infrastructure expansion is delayed.
- Reducing capital and operating costs of the existing system. Deferral of new water supply development or infrastructure expansion allows the utility to avoid associated capital costs. In addition, operational costs, such as power and chemicals, are reduced.
- Positioning the City to obtain future water rights. In the LRWSP, Dallas has identified future water sources that would involve interbasin transfer of raw water. According to TWC, Section 11.085, an interbasin transfer authorization requires that the applicant has developed and implement a water conservation plan that will result in the highest practicable levels of water conservation and efficiency achievable within the jurisdiction of the applicant.
- Other benefits, including positive environmental effects, improved customer good will, continued growth and economic development, a reduction of Dallas's carbon footprint, and a positive image of Dallas.

Projected water savings are based on unit water savings, target customer markets, measure life, annual savings decay, and program participation assumptions depicted in **Tables 5-1** and **5-2**.

Operation & Maintenance Costs

Typically, capital costs are developed for specific projects in specific locations. However, estimated water savings have been developed for the city as a whole and not for specific locations in the water system. Therefore, avoided capital costs are difficult to quantify. In addition, other possible avoided capital costs are dependent on pending decisions about future water supplies for Dallas. Therefore, the benefit evaluation described in this section includes only avoided operation and maintenance (O&M) costs.

According to DWU staff, the marginal O&M cost for water treatment and delivery is $852 per MG, and the marginal O&M cost for wastewater service is $964 per MG. Avoided O&M costs are assumed to increase at an annual inflation rate equal to the historical average inflation rate from 2013 through 2022 (2.35 percent per year). The historical average inflation rate is calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate. Some strategies (e.g., residential irrigation system incentives) only reduce water O&M costs, because irrigation does not return flow to the wastewater system. Other strategies (e.g., toilet retrofits) reduce both water and wastewater O&M costs. O& M savings are reflected in **Figure 5-2** and **Table 5-4.**

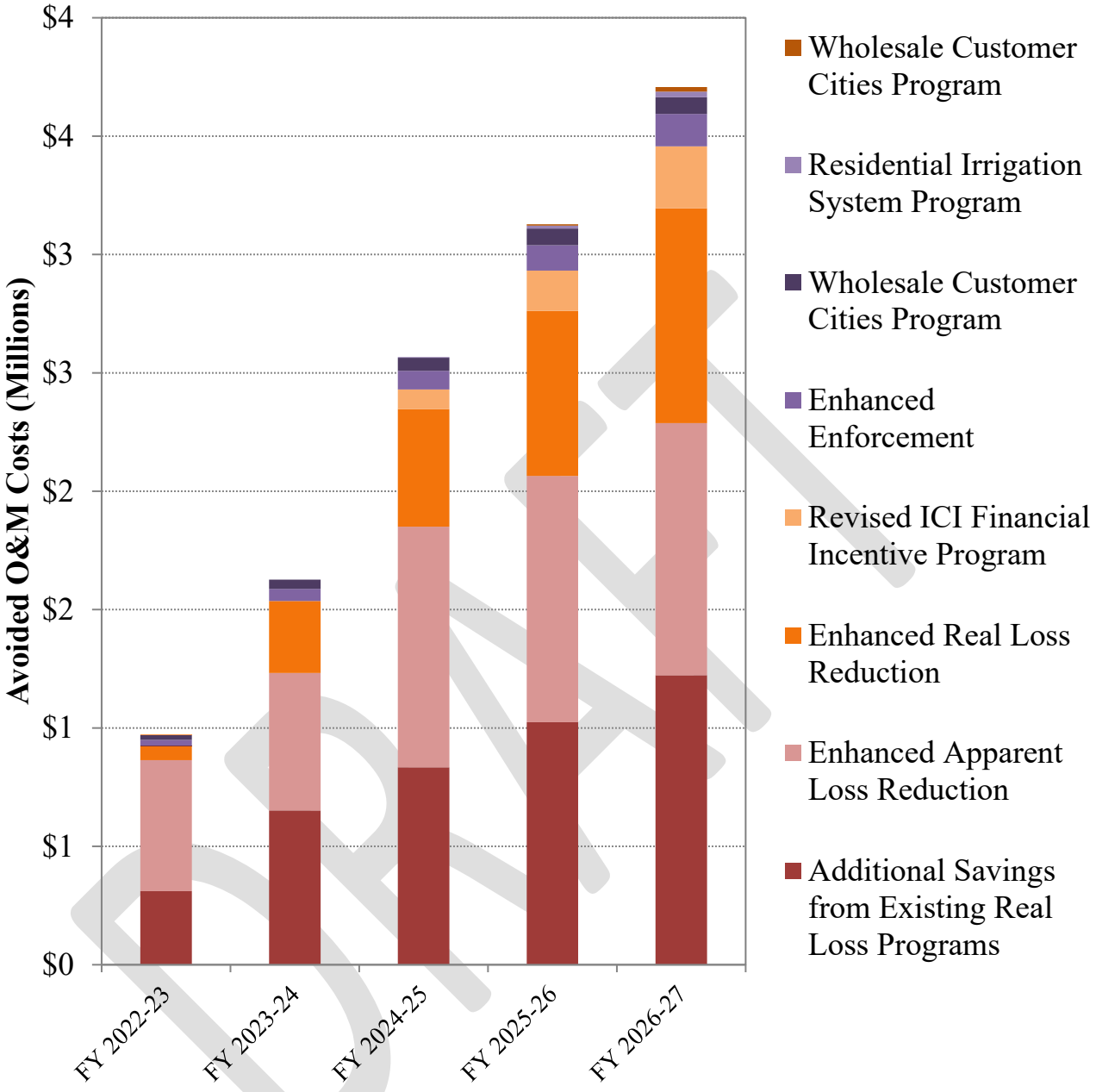

Figure 5-2: Potential Reduced O&M Costs from Selected Strategies

The biggest advantage of apparent loss reduction programs is that it results in additional billed water, increasing revenues for DWU. **Table 5-4** projects the additional billed water per day through FY 2026-27.

Selected Water Conservation Strategies	Projected Additional Billed Water Use (gal/day)				
	FY 2022-23	FY 2023-24	FY 2024-25	FY 2025-26	FY 2026-27
Review accounts with either water or wastewater accounts	100,000	100,000	100,000	100,000	100,000
Evaluate misclassified accounts	250,000	250,000	500,000	500,000	500,000
Report on performance indicators	n/a	n/a	n/a	n/a	n/a
Identify unauthorized uses	n/a	n/a	n/a	n/a	n/a
Total	**350,000**	**350,000**	**600,000**	**600,000**	**600,000**

Table 5-4: Projected Additional Billed Water Use from Apparent Loss Reduction FY 2022-23 through FY 2026-27

Estimated Costs of Selected Water Conservation Strategies

In the following sections, unit cost assumptions are described and estimated costs for selected water conservation strategies are presented. Conservation strategy costs typically include:

- Marketing and public education materials and campaigns
- Hardware devices (e.g., giveaways or free installation of small retrofit devices, high efficiency toilets, hose shutoffs, etc.)
- Incentive fees for rebate and bill credit programs
- Staff or contractor labor
- Equipment, materials, and training (especially for leak detection and repair)

Unit Cost Assumptions for Selected Residential and ICI Strategies

Unit cost assumptions for selected residential and ICI water conservation strategies are presented in **Table 5-5**. The Incentive amount is the projected amount of financial incentive to the customer for each measure (e.g., per toilet, per account, etc.). The Labor amount is the estimated labor cost for each measure for staff or contractor to provide the incentive, training, or audit.

The primary sources of information used to develop unit costs include recent Water Conservation and Water Operations Division budgets and reported unit costs at other water utilities.

Selected Water Conservation Strategies	Unit Cost Assumptions ($/Measure)		
	Incentive	Labor	Combined
Behavioral Changes			
Enhanced Residential Public Outreach			
Enhanced Enforcement			
- Residential Enhanced Enforcement		$20.66	$20.66
- Multi-Family Enhanced Enforcement		$20.66	$20.66
- ICI Enhanced Enforcement		$20.66	$20.66
Increased Multi-Family Outreach Efforts			
Wholesale Customer Cities Program*			
Structural Changes			
Residential Irrigation System Rebate Program	$270	$143	$413
Revised ICI Financial Incentive Program			
-Non-Profit Facility Incentives	$200	$80	$280

*The measure will be implemented without cost or will be performed by existing Water Conservation Division Staff.

Costs shown are in 2021 dollars

Table 5-5: Unit Cost Assumptions for Selected Residential and ICI Strategies

Estimated costs for selected water conservation strategies are presented in **Table 5-6**. Estimated costs for most of the residential and ICI strategies are based on program participation assumptions (**Table 5-2**) and the unit cost assumptions (**Table 5-5**), while estimated costs for other strategies were developed based on experience with other utilities. Estimated costs were adjusted for inflation using the same rates as discussed earlier. By FY 2026-27, the total estimated costs for the selected strategies will be approximately $8.2 million per year.

It is projected that if DWU reduces the amounts shown in **Table 5-6**, it will not realize the projected water savings shown in **Table 5-3**. However, there is a significant difference between these estimated costs and the recommended budgets. ICI financial incentives are funded in the existing DWU budget. To the degree to which they are currently funded, these strategies do not require an increased budget authorization.

Costs associated with additional savings from the Existing Water Loss Program are currently budgeted as part of the Leak Detection Program in the Operations Division. No increased budget authorization will be necessary for this strategy.

Each of the remaining selected strategies will require an increased budget authorization according to the estimated costs shown in **Table 5-6**.

No water conservation ordinance measures are proposed so no level of enforcement is required. Additional staff time for employees of City departments other than DWU would not be included in the estimated costs.

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Recommended Water Conservation Division Budgets by Fiscal Year					
Anticipated Program Costs in Dollars per Year	**FY 2022-23**	**FY 2023-24**	**FY 2024-25**	**FY 2025-26**	**FY 2026-27**
Existing Budget items					
Water Conservation					
Program Administration	$1,448,091	$1,514,113	$1,548,402	$1,583,497	$1,619,417
Minor Plumbing Repair Program	$400,000	$400,000	$409,400	$419,021	$428,868
Public Awareness Campaign	$466,000	$466,000	$476,951	$488,159	$499,631
Regional Campaign (TRWD)	$670,000	$670,000	$670,000	$670,000	$670,000
Environmental Education Initiative	$450,495	$450,495	$450,495	$450,495	$450,495
New Throne for Your Home	$500,000	$500,000	$511,750	$523,776	$536,085
ICI Audits	$218,464	$218,464	$218,464	$218,464	$218,464
ICI Cost Share Program	$200,000	$200,000	$200,000	$200,000	$200,000
City Leadership Grant Program	$195,000	$195,000	$195,000	$195,000	$195,000
Operations Division					
Existing Real Loss Program	$1,800,000	$1,842,300	$1,885,594	$1,929,906	$1,975,258
Additional Budget Items					
Water Conservation					
Residential Irrigation System Rebate Program ($55,000 per FTE in pilot year and additional staff)	$0	$0	$106,625	$264,875	$316,500
New vehicle for Irrigation System Rebate Crew	$0	$0	$55,000	$0	$0
Enhanced Enforcement	$132,159	$135,265	$138,444	$141,697	$145,027
Operations Division					
Enhanced Real Loss Reduction					
Field staff -- leak detection. 2 new technicians by FY 2023-24 ($65,000 per FTE)	$0	$130,000	$133,055	$136,182	$139,382
Additional equipment for new leak detection crew (includes vehicle and equipment)	$0	$50,000	$0	$0	$0
Field staff -- leak repair. 4 new technicians by FY 2023-24 ($55,000 per FTE)	$0	$260,000	$266,110	$272,364	$278,764
New Equipment and Vehicles for Repair Crews $708,000 for Equipment and $118,000 for Materials in Year one. Additional materials will be $82,500 per year for years two through five)	$0	$708,000	$82,500	$84,439	$86,423
One time funding of $277,000 for large diameter leak condition assessment plus $50,000 per year after year one	$277,000	$71,000	$72,669	$74,376	$76,124
Field staff -- pressure reducing valve crew. 2 new technicians ($53,000 per FTE) by 2023-24	$0	$106,000	$108,491	$111,041	$113,650
New vehicle for pressure reducing valve crew	$0	$48,000	$0	$0	$0
Reallocated Budget Items					
Water Conservation					
Revised ICI Financial Incentive Program					
Non-Profit Facility Incentives	*$0*	*$0*	*$264,626*	*$270,845*	*$277,210*

Table 5-6: Estimated Cost for Selected Strategies

Existing Budget Items Totals					
Water Conservation	$4,548,050	$4,614,072	$4,680,462	$4,748,412	$4,817,960
Operation Division	$1,800,000	$1,842,300	$1,885,594	$1,929,906	$1,975,258
Additional Budget Items					
Water Conservation	$132,159	$135,265	$300,069	$406,572	$461,527
Operation Division	$277,000	$1,373,000	$662,825	$678,401	$694,343
Reallocated Budget Items					
Water Conservation	$0	$0	$264,626	$270,845	$277,210
Anticipated Annual Costs					
Totals	**$6,757,209**	**$7,964,637**	**$7,793,576**	**$8,034,136**	**$8,226,298**

Table 5-6a: Estimated Total Cost for Selected Strategies

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Estimated costs for selected strategies are presented in Figure 5-3. Assuming that all selected strategies are implemented as described, estimated costs over the next 20 years for the measures implemented during the five-year planning period is approximately $159.7 million, with the costs actually incurred during the first five years. Comparing the 20-year estimated costs to the projected 20-year water savings gives a unit cost for the water savings of $2.27 per thousand gallons. These unit costs are less than the unit costs of raw water from other potential water supplies for which unit costs are available, excluding the additional costs for water treatment and distribution or the benefits from the conserved water shown in **Section 5.3**.

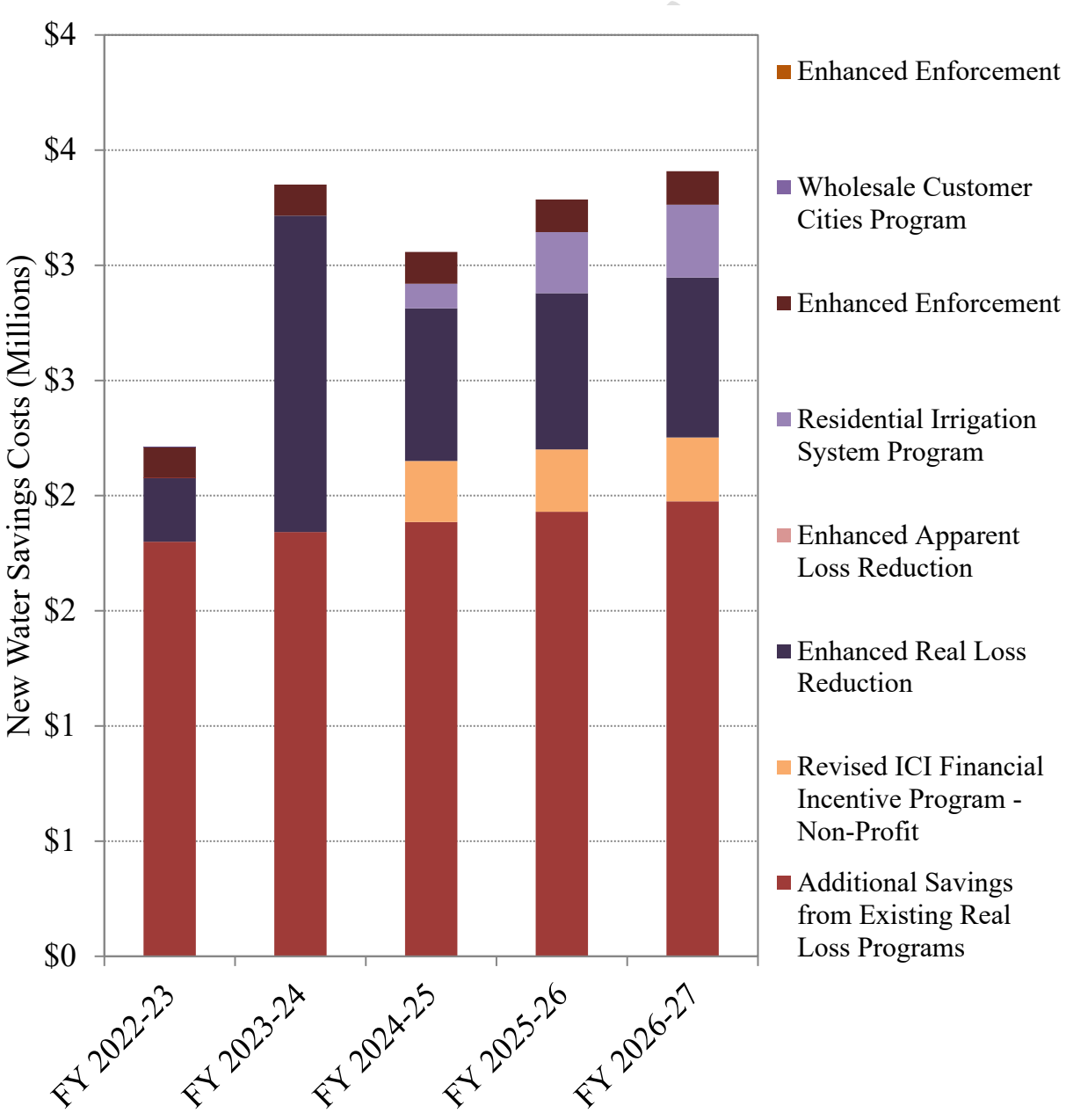

Figure 5-3: Estimated Costs for Selected Strategies

Benefit-Cost Analysis

For the five-year planning period, estimated costs and benefits are compared for the selected strategies in Figure 5-4. By FY 2025-26, the potential reduced O&M costs are projected to exceed the estimated cost of implementing the selected strategies.

Assuming all the selected strategies are implemented as described in this chapter, the estimated net benefit is approximately $58.9 million over the next 20 years.

There may be additional benefits (e.g., avoided capital costs) and additional costs (e.g., increases in water rates) that have not been considered in the benefit-cost analysis.

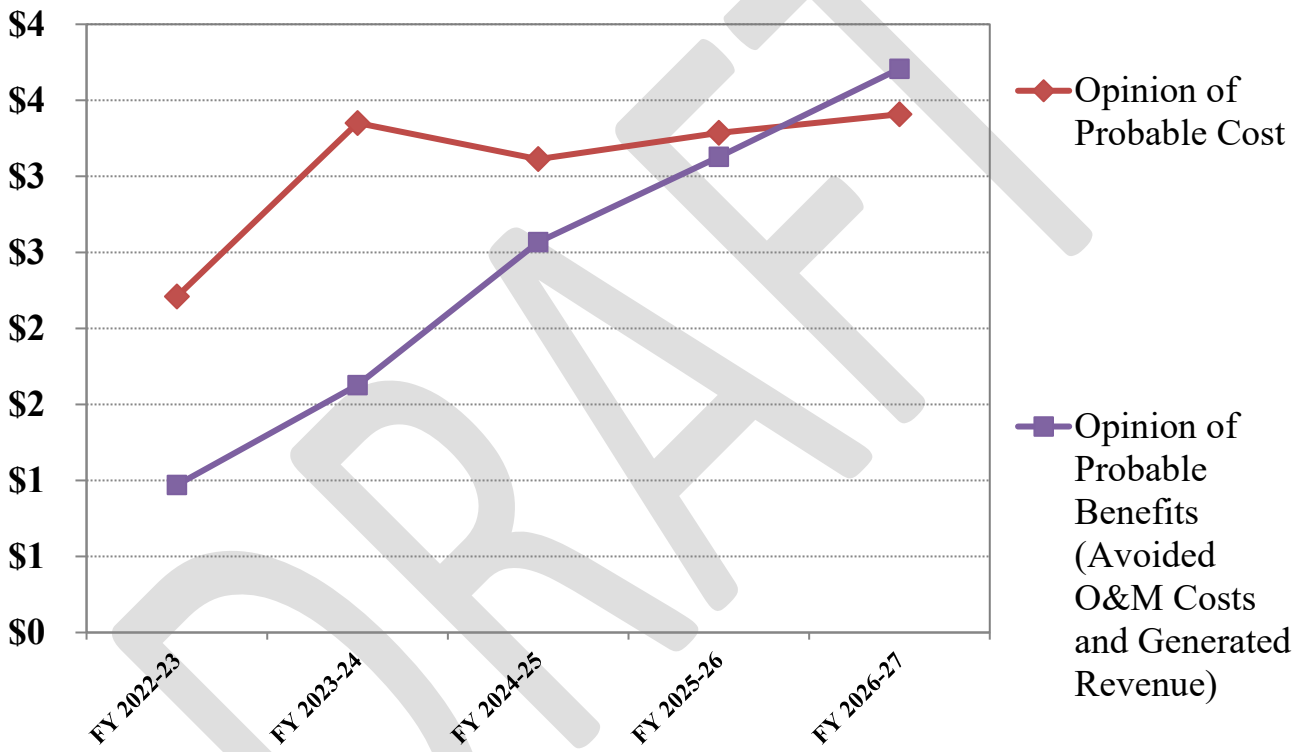

Figure 5-4: Potential Reduced O&M Costs and Estimated Costs for Selected Strategies

Recommended Staffing Levels

It is anticipated that DWU and OEQS will request added resources to implement the proposed strategies. OEQS will need three additional staff, one for digital outreach and two for the Residential Irrigation System Rebate Incentive Program. DWU will request six new technicians for the Enhance Real Loss Reduction programs. The recommended resources needed are based on customer participation assumptions and staff time required for similar programs at other utilities. Each of the recommended water conservation strategies should be reviewed annually to verify that customer participation and the production capacity of the existing staff continue to warrant the recommended increase in resources.

A recommendation to revise budgets to include labor and miscellaneous costs for individual programs and processes would allow future work plans to better represent savings per budget dollar.

6.0 Conclusions, Recommendations, and Work Plan Implementation

While significant analysis and efforts have gone into development of the 2024 Work Plan, it should be reassessed annually to make sure that the City of Dallas is achieving its water conservation goals. It should also be revamped, if necessary, to take advantage of new water conservation opportunities, such as federal or state funding for water conservation. The overall conservation program should be flexible, allowing strategies to be adjusted based on continued feasibility and support of goals, feedback from stakeholders and focus groups, and public participation or interest.

Considering the effectiveness of the City of Dallas's water conservation program over the past 10 years, all the water conservation strategies presently employed by Dallas Water Utilities (DWU) and Office of Environmental Quality and Sustainability (OEQS) are recommended for continuation or enhancement under the 2024 Work Plan.

It is also recommended that DWU or OEQS implement each of the strategies that were evaluated in Sections 2, 3 or 4 during the next five years. It is projected that these new or enhanced strategies will enable the City of Dallas to meet its water conservation goals, will be less expensive than other water supply alternatives, and will provide positive net economic benefits over the next 20 years.

To maximize the success of the recommended water conservation strategies, DWU and OEQS must prioritize implementation to allow for careful planning and development of ordinances, educational programs, and incentive programs, while still meeting the water conservation goals. The recommended implementation schedule (summarized in Table 5-1) is based on the following prioritization criteria:

- Implement measures with higher water savings early
- Implement measures with high community interest early
- Limit the number of programs to be planned/implemented each year
- Align strategies that have similarities/synergies
- Implement training programs in advance of rule changes, where applicable

In addition, there are several general steps to implementing a new water conservation strategy:

Planning and development: Increase staff or hire a contractor as necessary to administer the program. Identify, research, and make decisions about key implementation issues (e.g., rebates versus vouchers, eligibility requirements, ordinance language, etc.). Identify methods for engaging the target customer market. Conduct pilot testing for a limited time to gain experience with the individual program. Planning and development typically occur one or more years prior to full-scale implementation.

Marketing and education: Conduct an aggressive campaign to solicit the participation of targeted customers. Educate customers about potential water savings expected from the program, how water is conserved, and other opportunities to save. This may involve meetings with stakeholder groups, multi-media advertising campaigns, or other communication methods. Marketing and education should begin a brief time prior to full- scale implementation and should continue throughout the life of the strategy.

Full-scale implementation: Depending on the individual strategy, conduct day-to-day operations necessary to enforce ordinance requirements, carry out individual education and outreach initiatives, or provide financial or other incentives to encourage customer participation. Verification/follow-up/data collection: Confirm the installation and implementation of relevant measures. For some strategies, this may involve site inspections. Record relevant data about the customer and the measure. Compare water use before and after installation. Verification/follow-up/data collection begins with full-scale implementation and continues until the individual strategy is discontinued.

Savings/cost comparison: Estimate the water savings and the value of the water saved through the strategy. Estimate the cost to initiate and monitor the strategy throughout its life. Compare savings to costs in terms of a benefit-cost ratio or payback period. Savings/cost comparisons should be conducted annually to monitor the progress of the strategy toward meeting its goals. If the strategy is not meeting its goals, it should be reevaluated, and program parameters should be changed or revised goals should be established.

6.1 Method to Monitor Plan Effectiveness

The effectiveness and efficiency of the water conservation program will be monitored on an ongoing basis by DWU and OEQS staff. DWU and OEQS determine the extent of water conservation by compiling implementation data, monitoring water consumption, modeling water demand, and tracking water conservation costs.

Annual Report on Water Conservation Activities

30 TAC §288 requires that each entity that is required to submit a water conservation plan to the TWDB or the TCEQ shall file an annual report to the TWDB on the entity's progress in implementing each of the minimum requirements in their water conservation plan. DWU submitted its first yearly report in 2010. This report will be submitted in accordance with the requirement.

Quantified Marketing Analysis

DWU conducts surveys at the conclusion of each year’s public awareness campaign to evaluate and improve the effectiveness of the campaign.

Planning, Implementation, and Evaluation

Please refer to the Implementation GANNT Chart Appendix for planning and evaluation timelines.

6.2 Recommendations

Section 2: Water Conservation Division Recommendations

<u>Public Outreach</u>

Recommendation 2.3.1 Continue Contributions and Partnership in the Regional Campaign
Continue contributions and partnership in the regional Water Is Awesome campaign while continuing the local awareness campaign.

Recommendation 2.4.1 Consider Expanding Digital Media Presence to the Public
OEQS needs a public engagement specialist to allow DWU and OEQS to fully collaborate on digital media messaging.

Recommendation 2.7.1 Update the DEW Mascot Outfit(s)
Create new graphic art renditions of the current water conservation mascot (DEW) and potential new mascot(s) for consideration.

Public Education

Recommendation 2.5.1 Enhance Promotion and Evaluation of Education Programs and Delivery Options
Continue the Environmental Education Initiative (EEI) for grades K-12 with OEQS Water Conservation in the leadership role and DWU in a support role. Renew connections and evaluate curriculum to encourage participation.

Recommendation 2.5.2 Consider Offering the EEI Program to Wholesale Customers Cities

Recommendation 2.6.1 Build a Relationship with Texas A&M AgriLife Center at Dallas
Texas A&M AgriLife Center at Dallas (dallas.tamu.edu) houses scientific research, public outreach, and education programs, which could provide the Water Conservation program with additional resources at no charge.

Recommendation 2.6.2 Continue Partnering with Regional Water Providers to Grow the Regional Symposium
Reach out to universities and highs schools to include students in the symposium to help grow the future water work force.

Recommendation 2.6.3 Offer Water Conservation Training to City of Dallas Employees
Encourage all departments to participate in water conservation training. Add employee training videos to digital media portfolios.

Recommendation 2.8.1 Continue and Expand the Water Conservation Art Contest
The Student Art Contest is a valuable way to engage students who have different learning styles to think personally and creatively about what water conservation means to them.

Outdoor Water Conservation

Recommendation 2.9.1 Move Commercial Irrigation Evaluations to the ICI Free Water Efficiency Opportunity Survey
Other North Texas ICI programs offer commercial irrigation as part of the survey. This will relieve stress on the residential irrigation evaluation program.

Recommendation 2.10.1 Review Outdoor Watering Reporting Procedures for the City of Dallas 311 Program

Work with City of Dallas 311 to make it easier to report water waste and misuse violations.

Recommendation 2.11.1 Evaluate Residential Irrigation System Rebate Alternatives for Pilot Project

A Residential Irrigation System Rebate Incentive program has been proposed to improve the efficiency of existing systems. Two additional staff will be required for this program.

Recommendation 2.12.1 Evaluate Potential Landscape and Water Conservation Ordinances

A review of landscape ordinances in multiple cities, most in the southwest United States, has been included as part of the plan in the Landscape Ordinance Review Appendix.

Recommendation 2.13.1 Evaluate Ways to Promote and Expand the Waterwise Landscape Tour

The Waterwise Landscape Tour is a great showcase but needs new innovative ways to promote the program through partnerships and diverse landscapes.

Recommendation 2.14.1 Investigate the Availability of Appropriate Plants for Use in Dallas Landscapes

Investigate the availability of native plants and grasses for use in the Dallas metropolitan area and decide whether to use a voluntary incentive program or a requirement through ordinance for implementation if appropriate.

ICI Water Efficiency Programs

Recommendation 2.15.1 Continue the ICI Water Efficiency Assessment programs to the ICI sector customer base

Encourage all members of the Water Efficiency Partnership (WEP) to encourage participation in ICI water efficiency opportunity surveys and showcase case studies in water efficiency.

Recommendation 2.16.1 Evaluate and Streamline the ICI Rebate Process

Continue to revise and streamline step-by-step standard operating procedures (SOP) for the ICI Rebate Incentive, including realistic timelines for the completion of each step.

Recommendation 2.16.2 Develop Interdepartmental Team to Accelerate Rebate Processing

Work through department management teams to help evaluate parts of the process that are out of the control of the water utility.

Recommendation 2.16.3 Increase Rebate Incentive Amount

Based on cost estimate increases, update rebate calculations to provide more value to the customer.

Recommendation 2.16.4 Evaluate Alternatives to Cash Rebates

Recommendation 2.17.1 Establish Water Efficiency Partnership
Create a Water Efficiency Partnership (WEP) made up of organizations and associations who represent various ICI sectors of water use to help ICI sectors understand water efficiency and how to better manage their own water use through focus groups, case studies, training, and workshops.

Recommendation 2.18.1 Prepare WEP Training/Education Materials
Use the input of the WEP to determine the best ways to promote attendees for the training and workshops.

Recommendation 2.19.1 Develop ICI Nonprofit Retrofit Program
An ICI Nonprofit Retrofit Program would provide authorized domestic plumbing retrofits for qualifying nonprofit facilities to improve water efficiency. Two additional staff positions will be required to manage the program.

Recommendation 2.20.1 Increase Promotion of City Leadership and Commitment Grant Program
Promote the program with signage at facilities and press releases announcing the grant winning projects, completed retrofits, and anticipated water savings.

Indoor Water Conservation

Recommendation 2.21.1 Determine the Capacity of the Minor Plumbing Repair Program
Determine additional capacity in the Minor Plumbing Repair (MPR) program for low-to-moderate income homeowners and adjust promotion of the program to fit capacity.

Recommendation 2.21.2 Evaluate the Addition of Small Businesses to Minor Plumbing Repair Program

Recommendation 2.22.1 Develop Sunset Plan for The New Throne for Your Home Program
The New Throne for Your Home (NTRYH) residential and commercial programs are nearing their sunset phase as toilets with greater than 1.6 gpf age out. Tailor promotion to reach households (built prior to 1994) that have not yet participated in the program.

Section 3: Water Utilities Planning and Wholesale Services Divisions Recommendations

Recommendation 3.8.1 Implement the Migration to Automated Meter Infrastructure
DWU is well positioned to migrate to AMI for its meter reading function. Evaluate business case scenarios to retrofit all water meters using possible project timelines.

Recommendation 3.12.1 Evaluate Internal Metering of Water Treatment Processes
To better track water savings from optimization processes, evaluate the metering of treatment plant water and potential submetering of various processes.

Section 4: Wholesale Customer Cities Recommendations

Recommendation 4.9.1 Encourage Wholesale Customers to Submit State Reports
Provide reminder emails and forward notices to WCC of report deadlines and Water Loss Use & Conservation (WLUC) Workshops.

Recommendation 4.9.2 Develop Wholesale Customer Water Conservation Recognition Program
DWU should consider providing recognition to the WCC in the form of a voluntary awards program, with categories to recognize accomplishments based on WCC size.

Recommendation 4.9.3 Include Wholesale Customer Representative on the Water Efficiency Partnership
Include WCC in the WEP and include in water efficiency/conservation discussions to help them identify the needs of various ICI sectors to develop programs within their communities to improve water efficiency/conservation.

Recommendation 4.9.4 Meet with Wholesale Customers on a Regular Schedule
Schedule regular meetings with WCC to talk about water conservation best management practices and proper tracking for completion of required state documents.
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Recommendation 4.9.5 Include Wholesale Customer Employees in Water Conservation Education/Outreach and Water Operations Training
Provide training related to both water conservation education/outreach and water operations, sponsor staff from WCC to the annual North Texas Regional Water Symposium and subsidize AWE/AWWA memberships to WCC.

Recommendation 4.9.6 Inform Wholesale Customers of Master Agreements that Extend Pricing to Wholesale Customers
Research offering education and outreach giveaway/specialty items through a collective purchase/distribution arrangement with WCC to maximize bulk purchasing pricing and provide continuity of branding/messaging.

GANNT Chart Appendix

Dallas Water Utilities Water Conservation Road Map

	FY2023 (10/1/22-9/30/23)				FY2024 (10/1/23-9/30/24)				FY2025 (10/1/24-9/30/25)				FY 2026 (10/1/25-9/30/26				FY 2027 (10/1/26-9/30/27)			
did not exist																				
plan																				
implement or continue	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
evaluate																				
consider elimination																				
	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep
OEQS Water Conservation Division																				
Indoor Programs																				
New Throne for your Home - Residential Rebate Program																				
New Throne for your Home - Residential Voucher Program																				
New Throne for your Home - Multifamily Program																				
Minor Plumbing Leak Repair Program																				
Outdoor Programs																				
Landscape Ordinance																				
Residential/Commercial Irrigation Evaluation Program																				
Residential Irrigation System Rebate Program (Proposed)																				
Enhanced Enforcement Initiative																				
Water Wise Landscape Tour																				
Native Vegetation Program (Proposed)																				
ICI Programs																				
ICI Water Efficiency Opportunity Surveys																				
ICI Rebate Program																				
ICI Water Efficiency Partnership (WEP)																				
ICI Water Efficiency Partnership Training Program																				
ICI Nonprofit Retrofit Program																				
City Facilities Retrofit Grant Program																				
Outreach Programs																				
Regional Public Awareness Campaign																				
Local Public Awareness Campaign																				
Digital Media																				
Water Conservation Mascot																				
Employee Conservation on the Plaza																				
Water Conservation Art Contest																				
Education Programs																				
North Texas Regional Water Conservation Symposium																				
Environmental Education Initiative (K-12)																				
Conservation-focused Workshops & Classes																				
DWU																				
Meter Programs																				
Meter Testing, Repair or Replacement																				
Unauthorized Consumption Prevention Feasibility Study																				
Customer Meter Accuracy and Exchange Initiative																				
Large Meter Automated Maintenance Plan																				
Service Meter Repair Initiative																				
AMI/AMR Meter Technology																				
Leak Detection Programs																				
Acoustic Logger Leak Detection Program																				
Proactive Leak Detection & Repair using Advanced Technology																				
Real Loss Proactive Leak Detection																				
Small-diameter Pipeline Proactive Leak Detection																				
Valve and Pressure Reducing Valve Check Crew																				
Traditional Main Break and Leak Repair Programs																				
Pipeline Replacement Program																				
Other Programs																				
Data Handling Error Process																				
Biologically Active Filtration																				
Water Production Facilities Strategic Plan																				
Direct NonPotable Water Reuse Alternatives																				
Indirect Potable Water Reuse Alternatives																				
Monitoring and Record Management of Water Deliveries, Sales, Losses																				
Wholesale Customers																				
WCC Monitoring, Measurement and Reporting																				
Monitor and Track Water Conservation and Drought Plans																				
Monitor and Track Water Conservation BMPs																				
Monitor and Track Total and Residential GPCD																				
Monitor and Track Total Water Loss																				
Monitor and Track Total Water Consumption																				
WCC Outreach Program																				
Recognize and promote WCC water conservation achievements																				
Assist WCC in enhancing and expanding existing programs																				

WCC TWDB Best Management Practices Appendix

List of Best Management Practices for Water Conservation	Addison	Balch Springs	Carrollton	Cedar Hill^	Combine WSC	Cockrell Hill	Coppell	DeSoto^	DFW Airport	Duncanville	Farmers Branch	Flower Mound	Glenn Heights^	Grand Prairie	Hutchins	Irving	Lancaster	Lewisville	Ovilla	Red Oak	Seagoville	The Colony
[Compiled from Report to DWU 2020 (Blue) and TWDB 2022 Annual Reports (Black)]																						
TWDB Annual Report Required (2022)	Submitted	Submitted	Submitted	Submitted	Not Required	Not Required	Submitted	Submitted	Not Required	Submitted	Submitted	Submitted	Submitted	Submitted	Not Required	Submitted	Submitted	Submitted	Not Required	Not Required	Submitted	Submitted
^Did not complete BMP Table in Annual Report				X				X					X									
Conservation Analysis and Planning																						
Conservation Coordinator	X		X								X			X		X	X	X				
Cost Effective Analysis											X											
Water Survey for Single Family and Multi-family Customers																						
Customer Characterization																						
Financial																						
Wholesale Agency Assistance Programs																						
Water Conservation Pricing	X	X	X		X		X	X		X	X	X		X		X						X
Leak Alert Program							X															
Customer Portal							X															
System Operations																						
Metering New Connections and Retrofitting Existing Connections	X		X							X	X	X		X		X		X				
Utility Water Audit and Water Loss	X		X							X	X	X		X		X	X	X				X
Landscaping																						
Landscape Irrigation Conservation and Incentives											X			X				X				
Athletic Fields Conservation			X													X		X				X
Golf Course Conservation			X													X		X				
Park Conservation																X						X
Residential Landscape Irrigation Evaluation			X													X		X				
WaterWise Landscape Events								X			X			X				X				X
Time of Day Watering Restriction	X		X			X	X	X		X	X	X		X		X	X	X	X	X	X	X
Outdoor Watering Schedule										X		X		X		X	X	X				X
Education and Public Awareness																						
School Education			X				X			X				X		X		X				
Public Information	X	X	X							X	X	X		X		X	X	X	X			X
Public Outreach and Education	X	X	X			X	X	X		X		X		X		X	X	X		X	X	X
Water Conservation Mascot																		X				
Partnerships with Nonprofit Organizations																		X				
Rebate, Retrofit, and Incentive Programs																						
Conservation Programs for ICI Accounts			X				X															
Home Water Audit																	X					
Water Conservation Kits											X											
Residential Water Conservation Credit Program																		X				
Residential Clothes Washer Incentive Program																		X				
Water Wise Landscape Design and Conversion Programs			X																			
Showerhead, Aerator, and Toilet Flapper Retrofit											X			X				X				
Residential Toilet Replacement Programs																		X				
Custom Conservation Rebates																		X				
Plumbing Assistance for Economically Disadvantaged Customers																						
Conservation Technology & Reuse																						
New Construction Graywater																						
Rainwater Harvesting and Condensate Reuse														X				X				
Water Reuse BMP Categories																						
Reuse for On-site Irrigation																X						
Reuse for Plant Washdown																		X				
Reuse for Chlorination/Dechlorination																		X				
Reuse for Industry																X						
Reuse for Agriculture																						
Regulatory and Enforcement																						
Prohibition on Wasting Water		X	X				X				X	X		X		X	X	X				
Conservation Ordinance Planning and Development							X							X		X		X				X
Enforcement of Irrigation Standards		X														X		X				X
Retail																						
Other											X*											
Estimated Water Savings from Conservation Activities/Programs																						
Gallons Saved/Conserved	8,500,000	2,000,000	0				0			2,700,000	151,261,751	9,200,000		0		354,278,243		206,472,074				244,549,962
Gallons Recycled/Reused			0				0			0				0		677,898,287		271,561,412				0
Total Volume of Water Saved[1]	8,500,000	2,000,000	0				0			2,700,000	151,261,751	9,200,000		0		1,032,176,530	0	478,033,486			0	244,549,962
Dollar Value of Water Saved[2]	$ 40,800.00	$ 7,800.00	$ -				$ -			$ 1,000.00	$ 400,844.00	$ 150,000.00		$ -		$ 877,570.00						

[1] ***Estimated Gallons Saved + Estimated Gallons Recycled/Reused = Total Volume Saved***

[2] ***Estimated this value by taking into account water savings, the cost of treatment or purchase of water and deferred capital cost due to conservation***

^Did not complete sections needed for this Appendix

DCP Stage I est. 5% reduction

WCC Wholesale Customer Cities GPCD, Water Loss, and Water Graphs Appendix

WCC - Wholesale Customer Cities GPCD, Water Loss, and Water Consumption Graphs Appendix

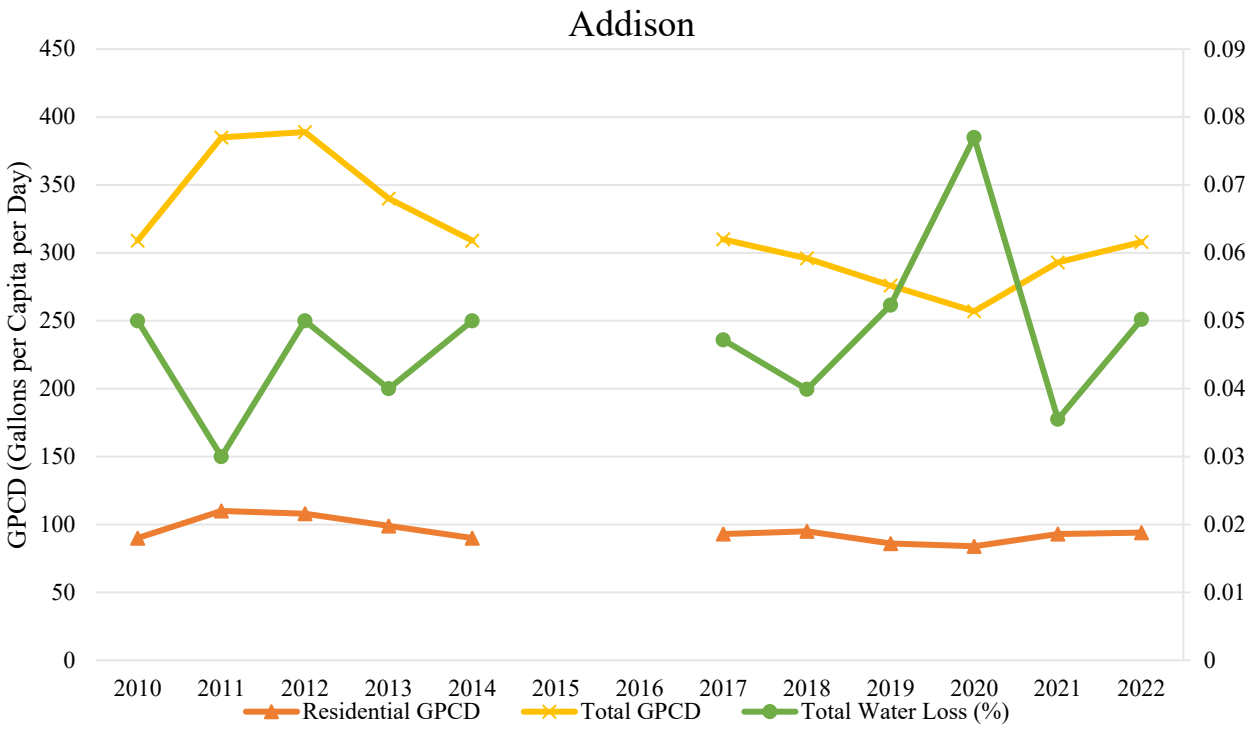

Figure WCC-3: Addison Total GPCD, Residential GPCD, and Water Loss Percentage

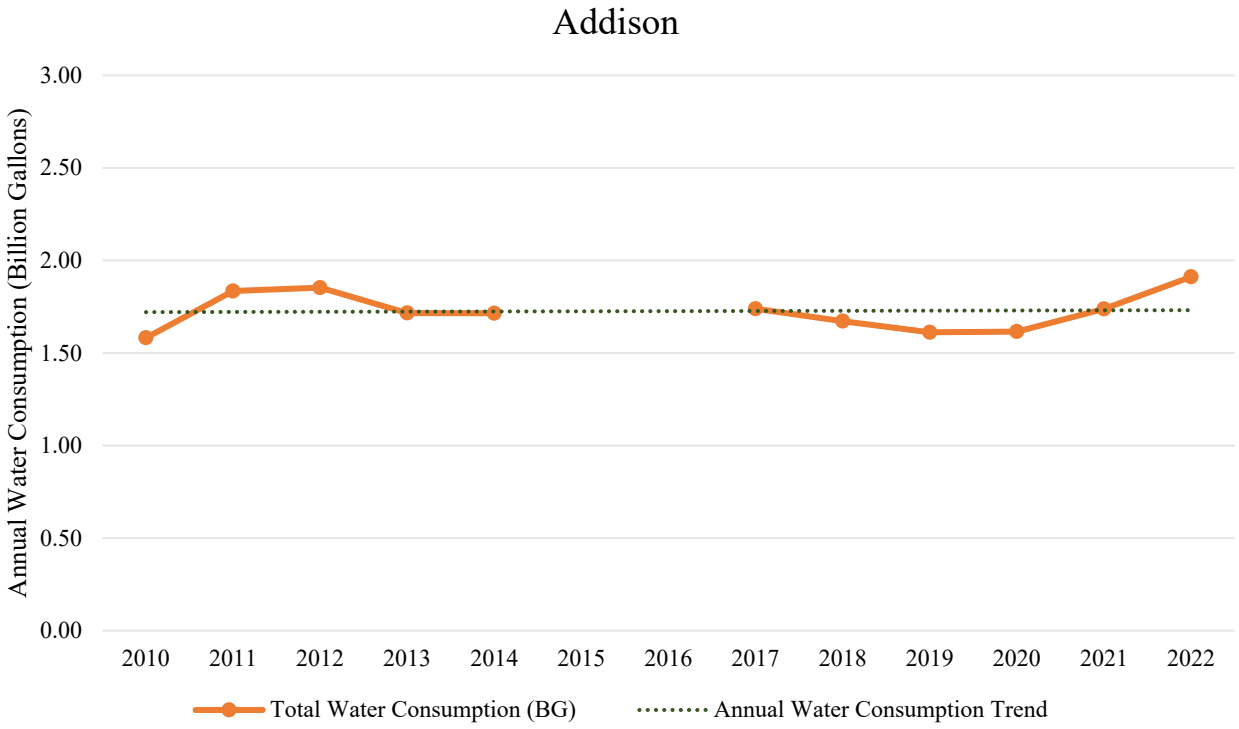

Figure WCC-4: Addison Total Water Consumption

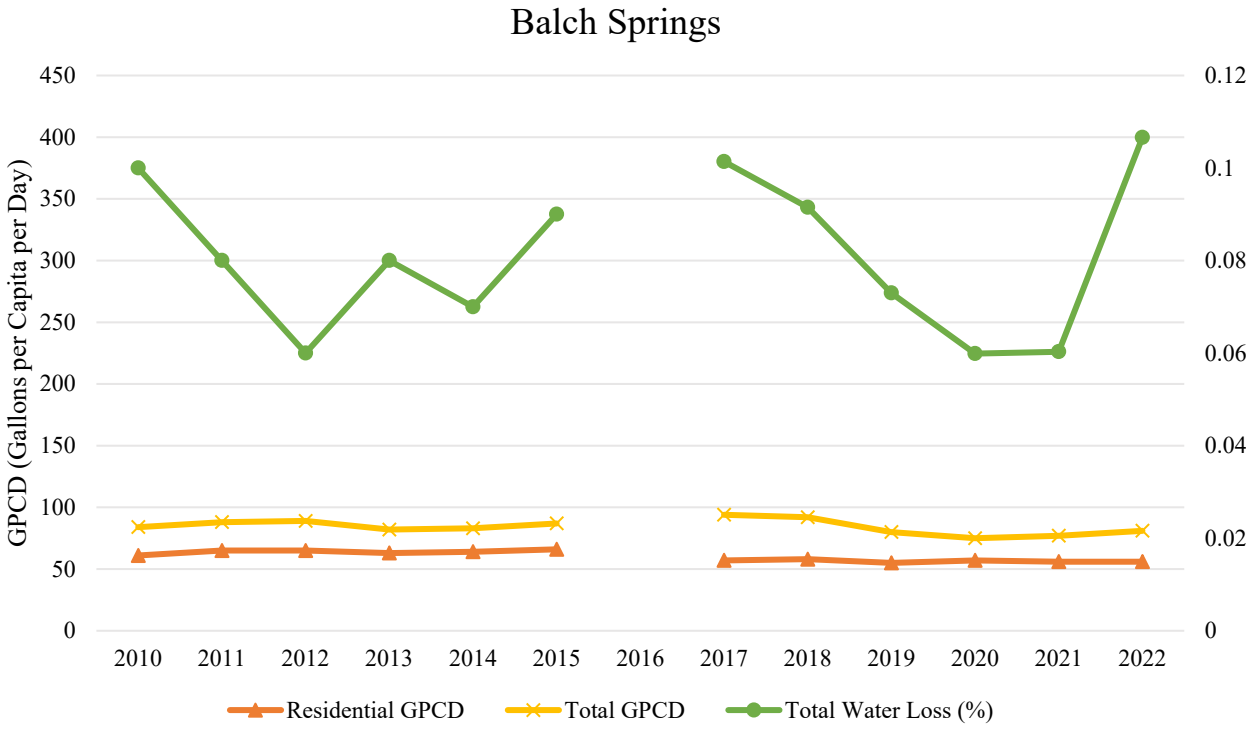

Figure WCC-5: Balch Springs Total GPCD, Residential GPCD, and Water Loss Percentage

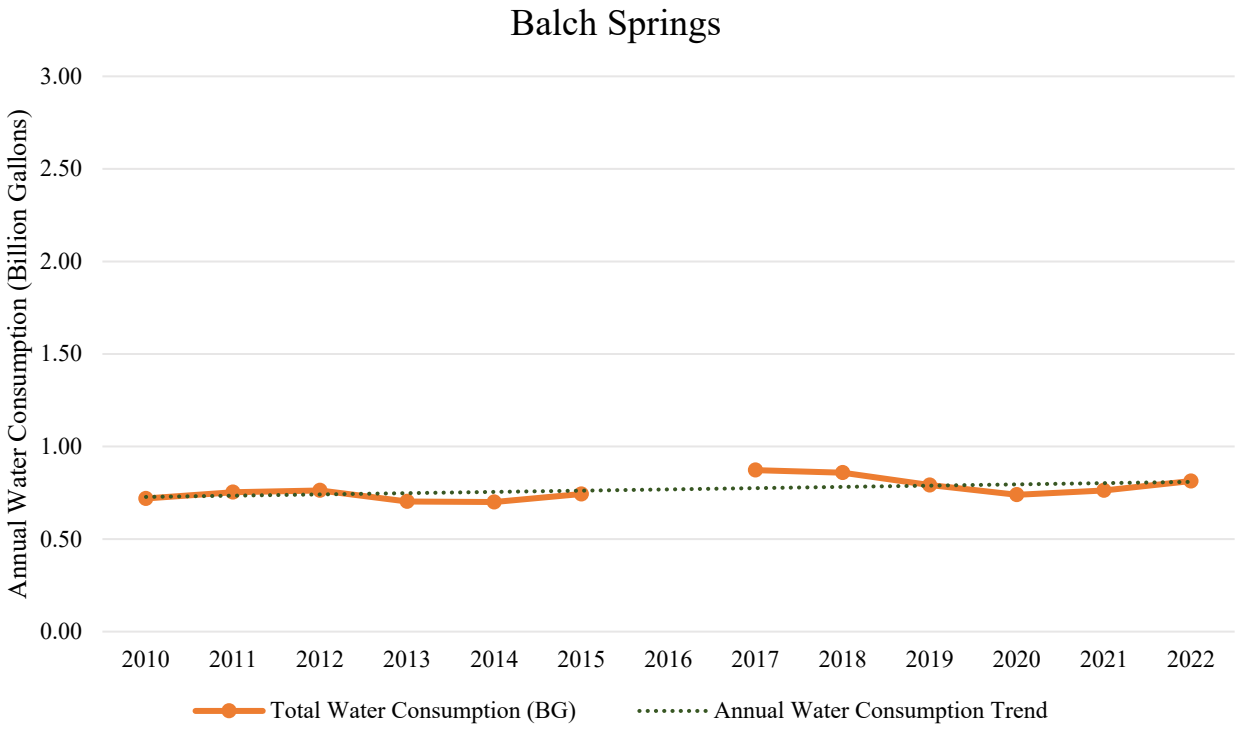

Figure WCC-6: Balch Springs Total Water Consumption

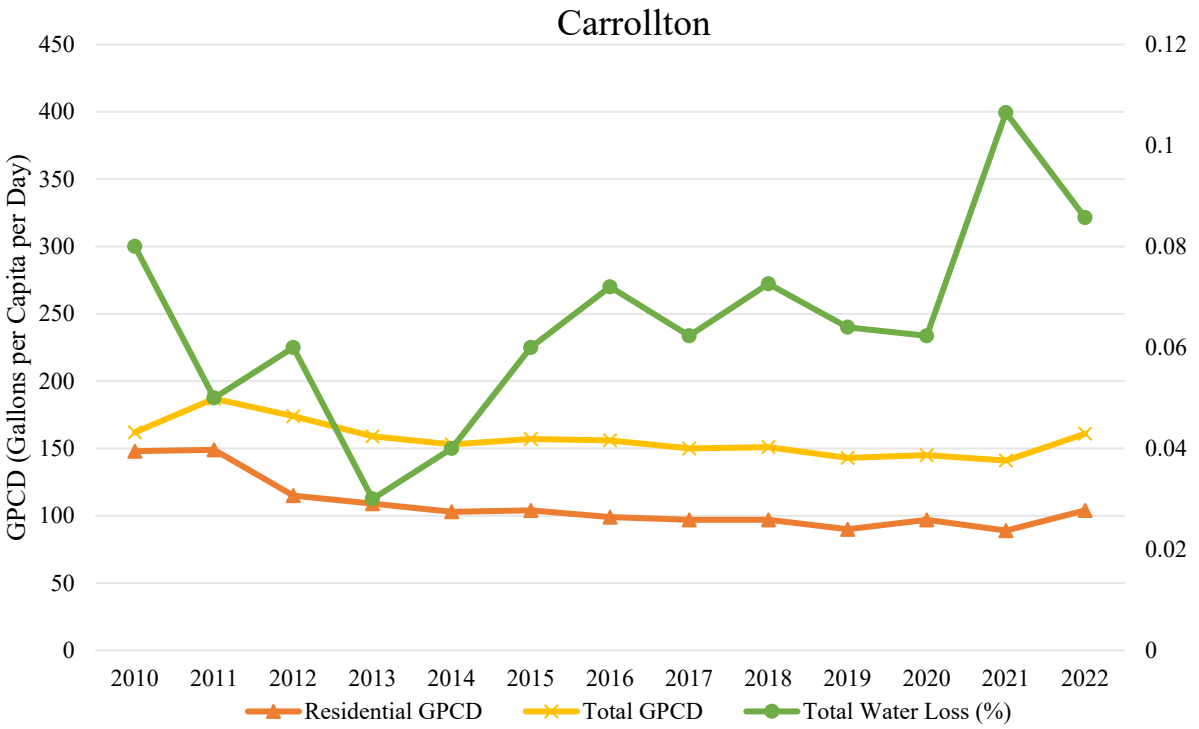

Figure WCC-7: Carrollton Total GPCD, Residential GPCD, and Water Loss Percentage

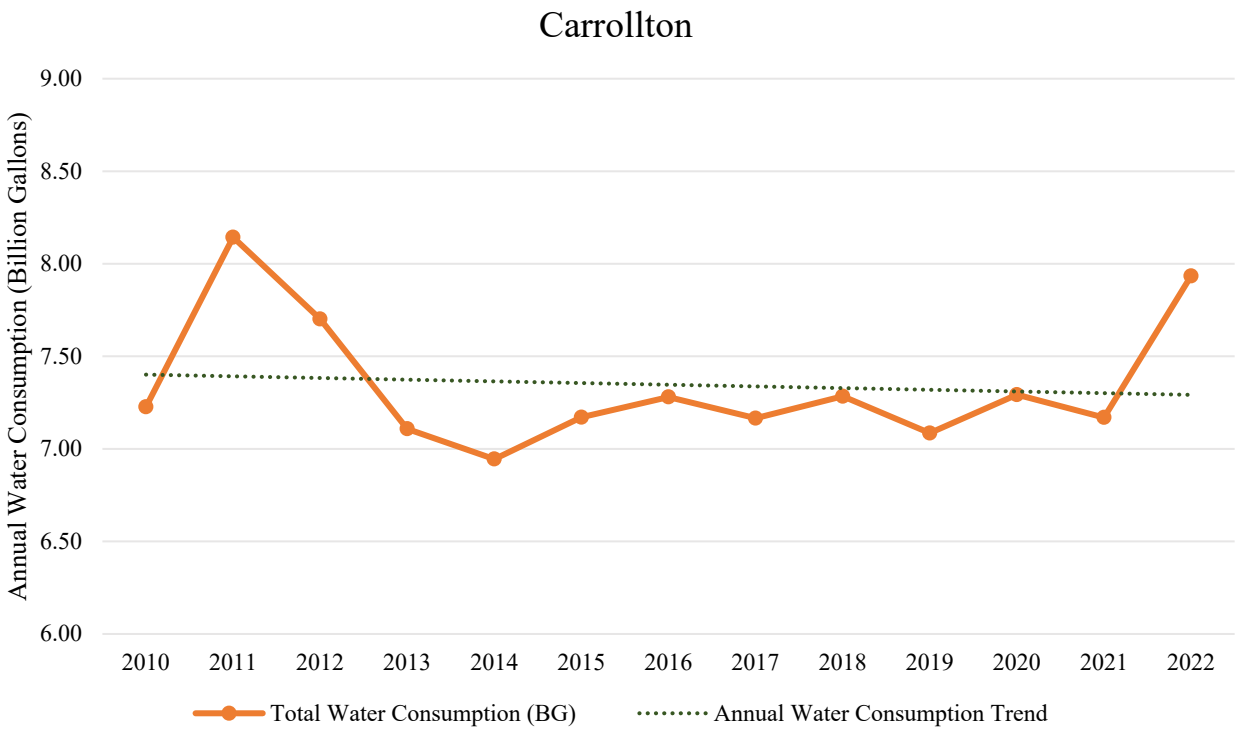

Figure WCC-8: Carrollton Springs Total Water Consumption

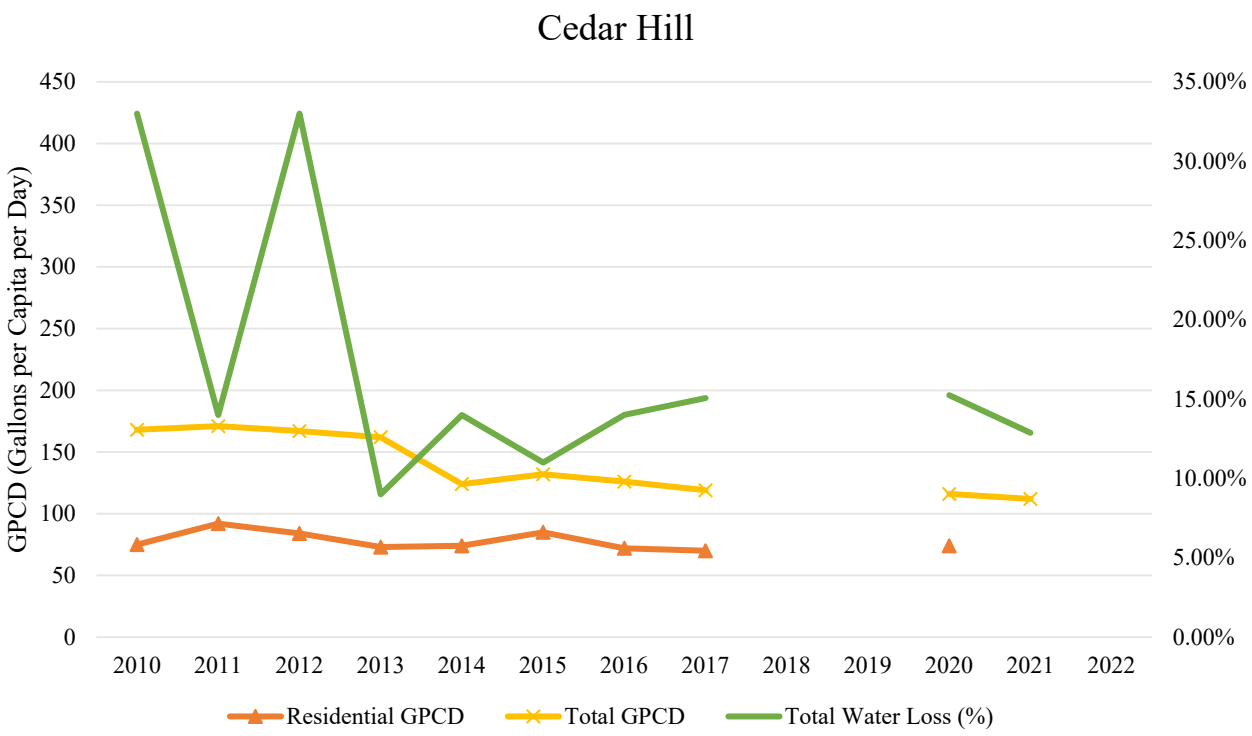

Figure WCC-9: Cedar Hill Total GPCD, Residential GPCD, and Water Loss Percentage

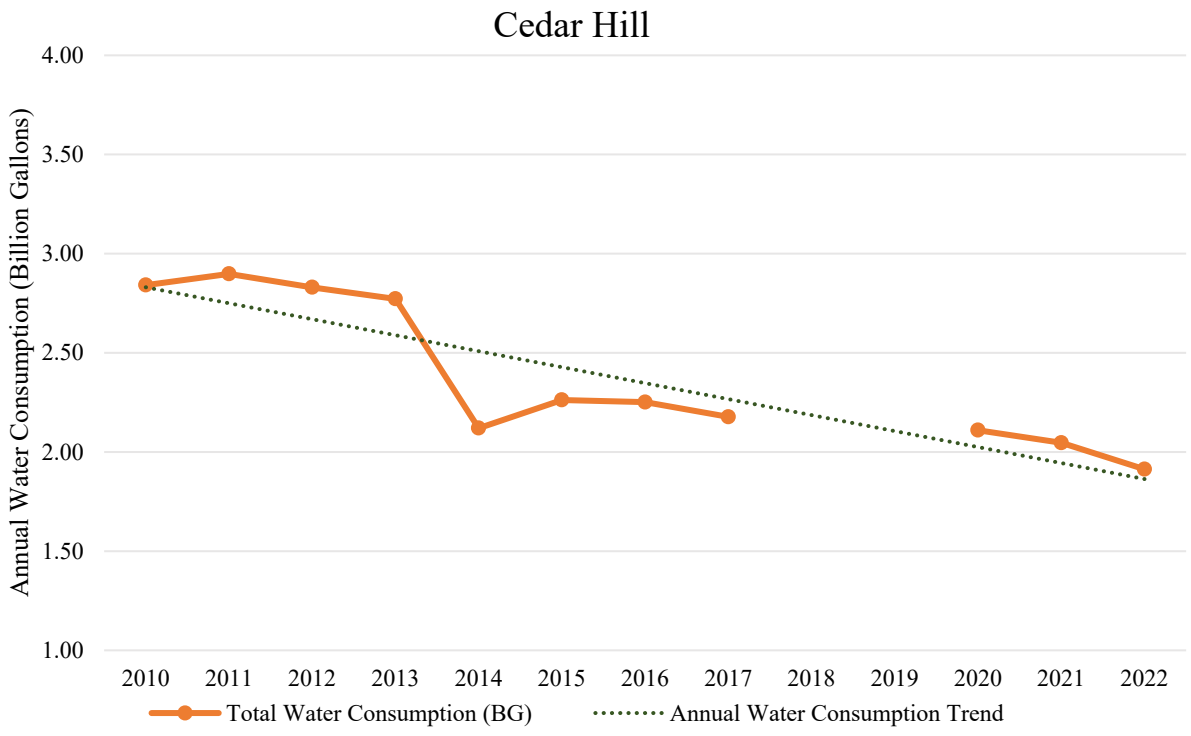

Figure WCC-10: Cedar Hill Total Water Consumption

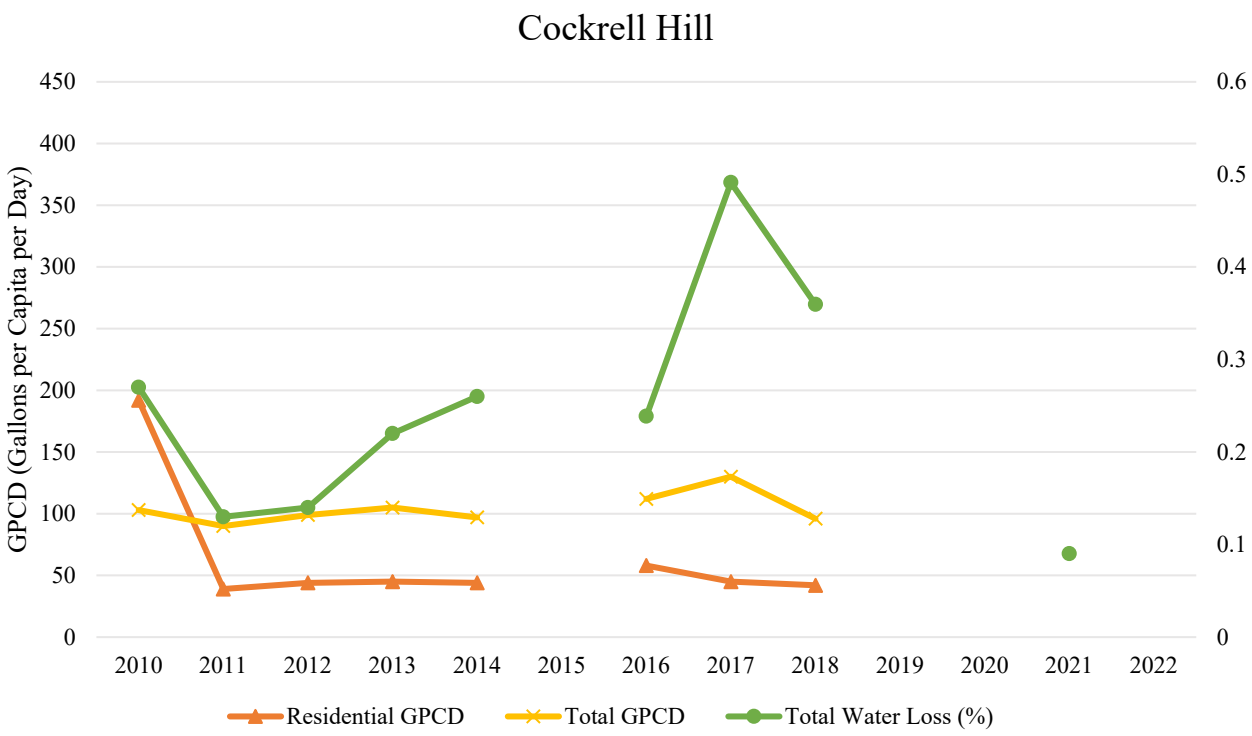

Figure WCC-11: Cockrell Hill Total GPCD, Residential GPCD, and Water Loss Percentage

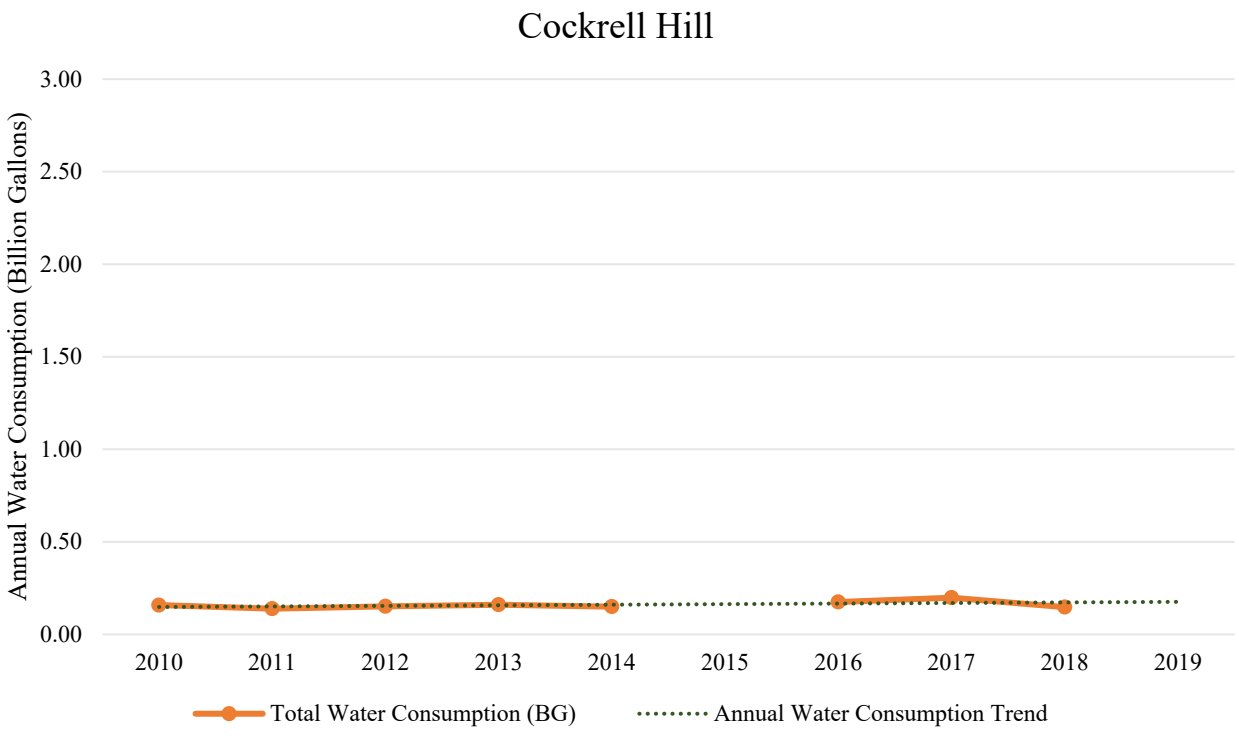

Figure WCC-12: Cockrell Hill Total Water Consumption

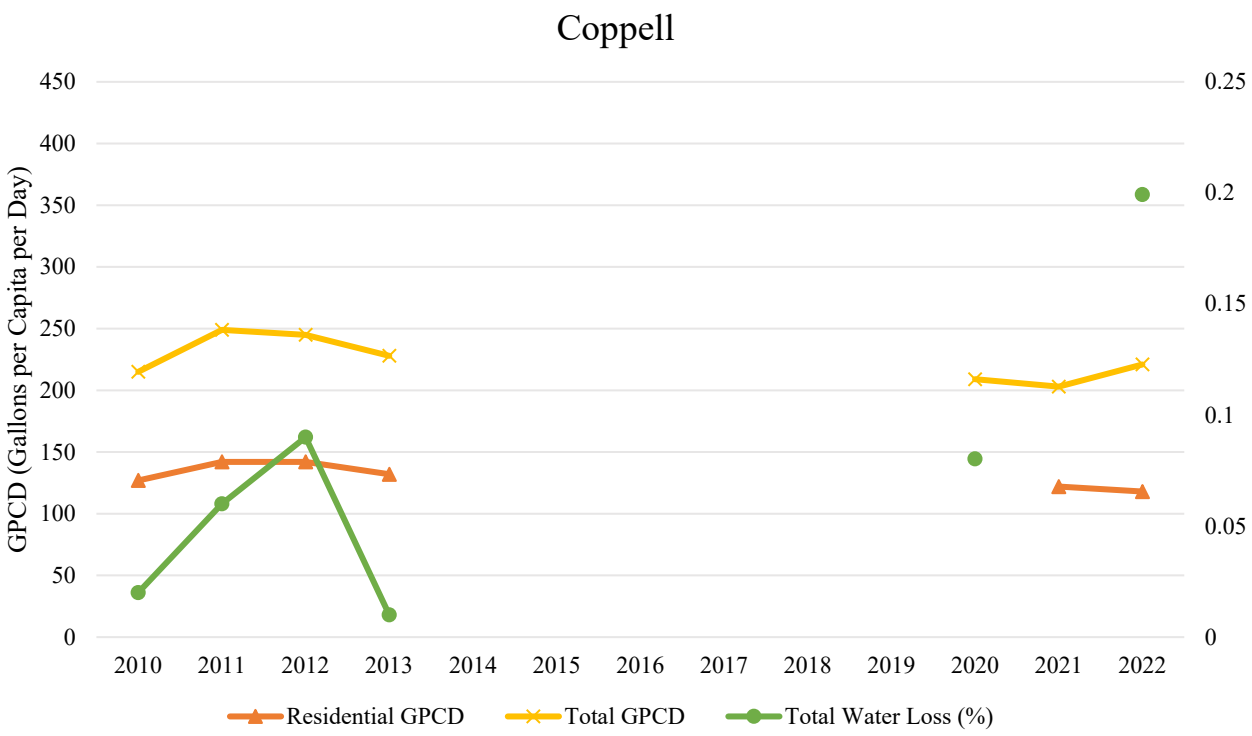

Figure WCC-11: Coppell Total GPCD, Residential GPCD, and Water Loss Percentage

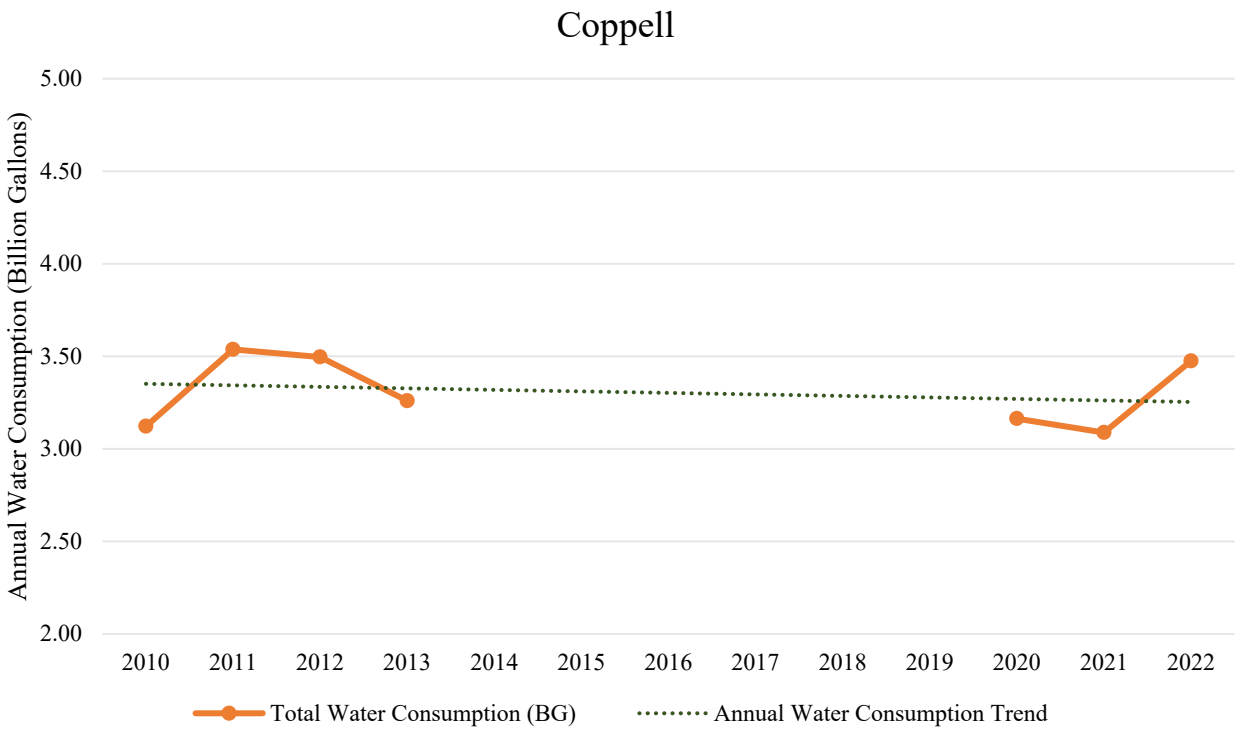

Figure WCC-12: Coppell Total Water Consumption

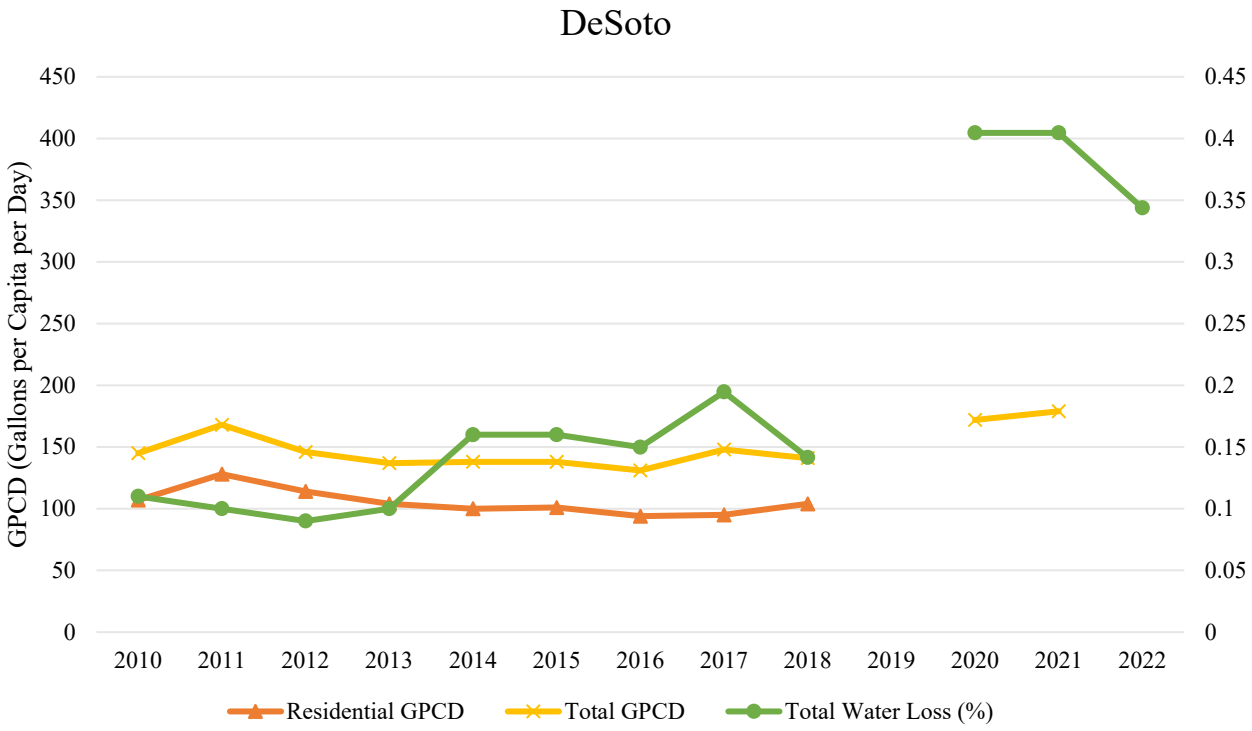

Figure WCC-13: DeSoto Total GPCD, Residential GPCD, and Water Loss Percentage

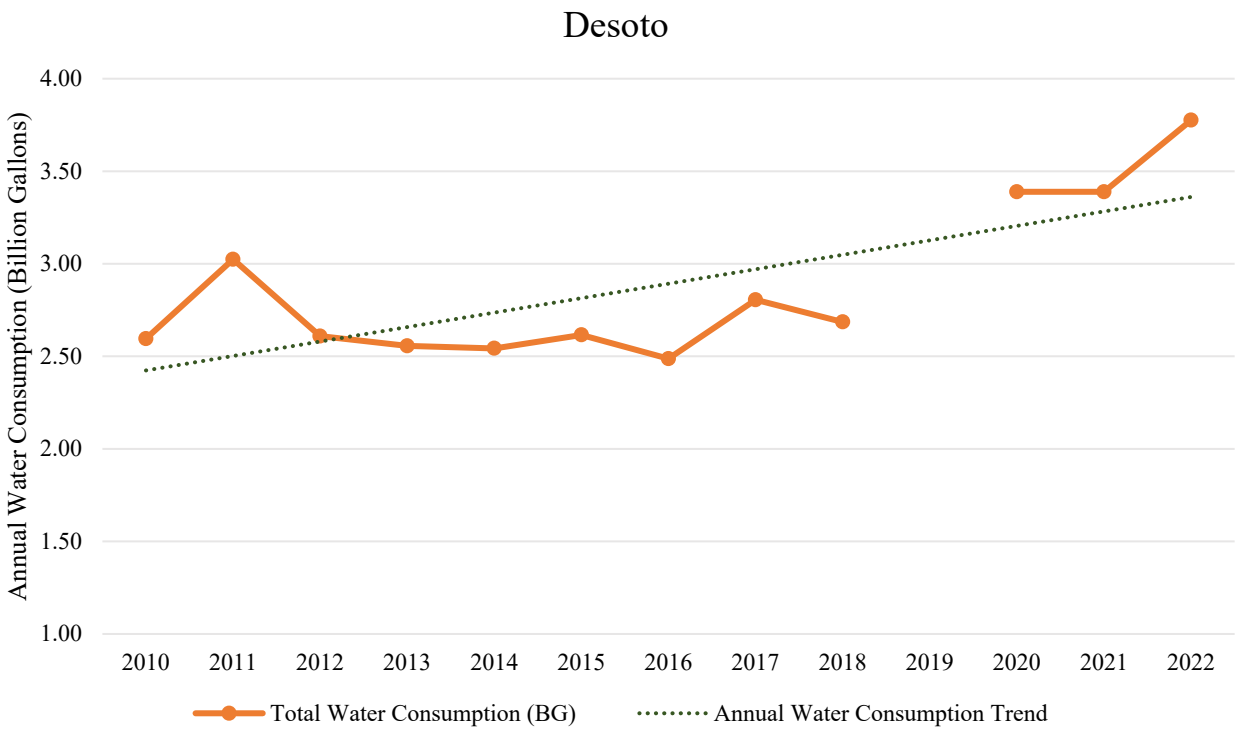

Figure WCC-14: DeSoto Total Water Consumption

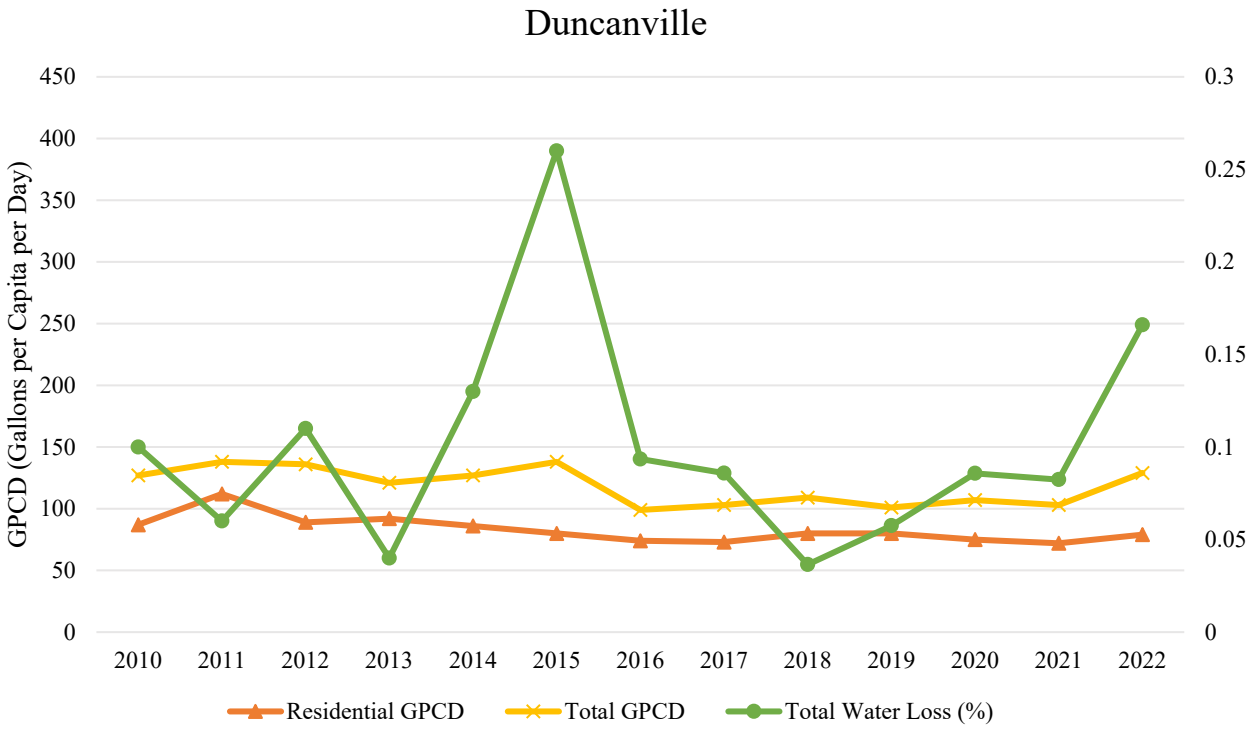

Figure WCC-15: Duncanville Total GPCD, Residential GPCD, and Water Loss Percentage

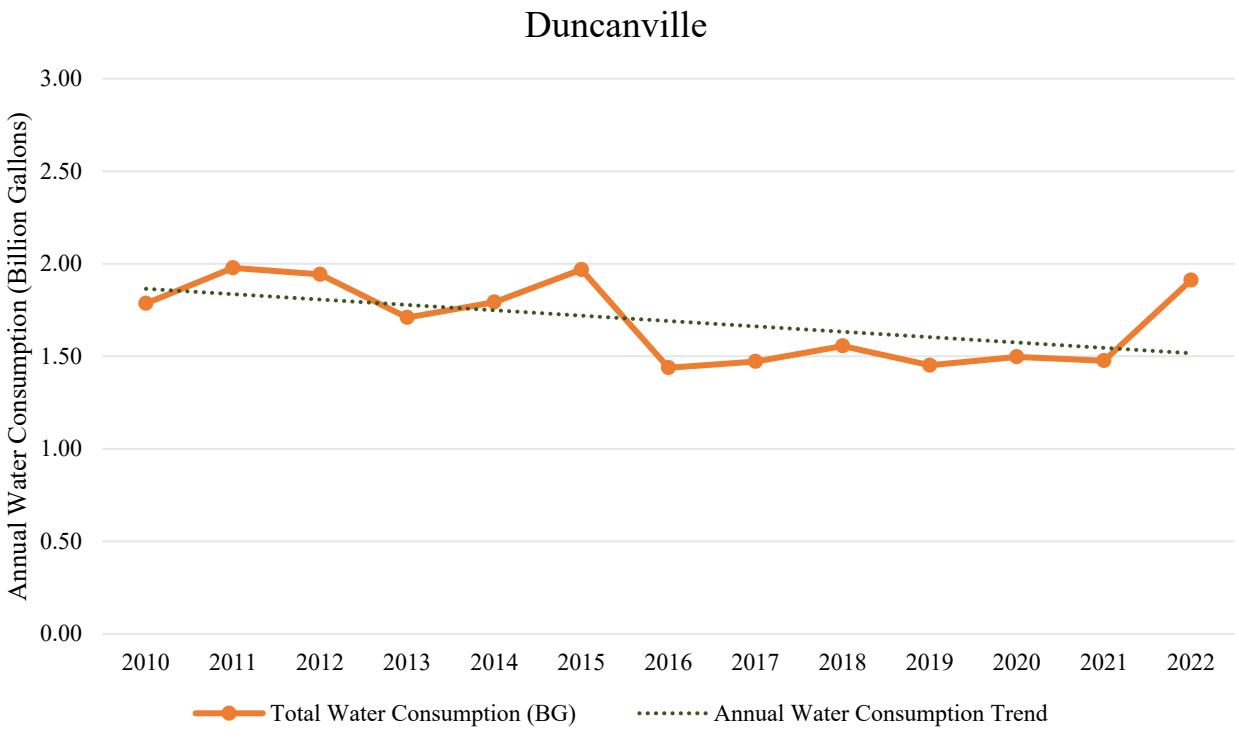

Figure WCC-16: Duncanville Total Water Consumption

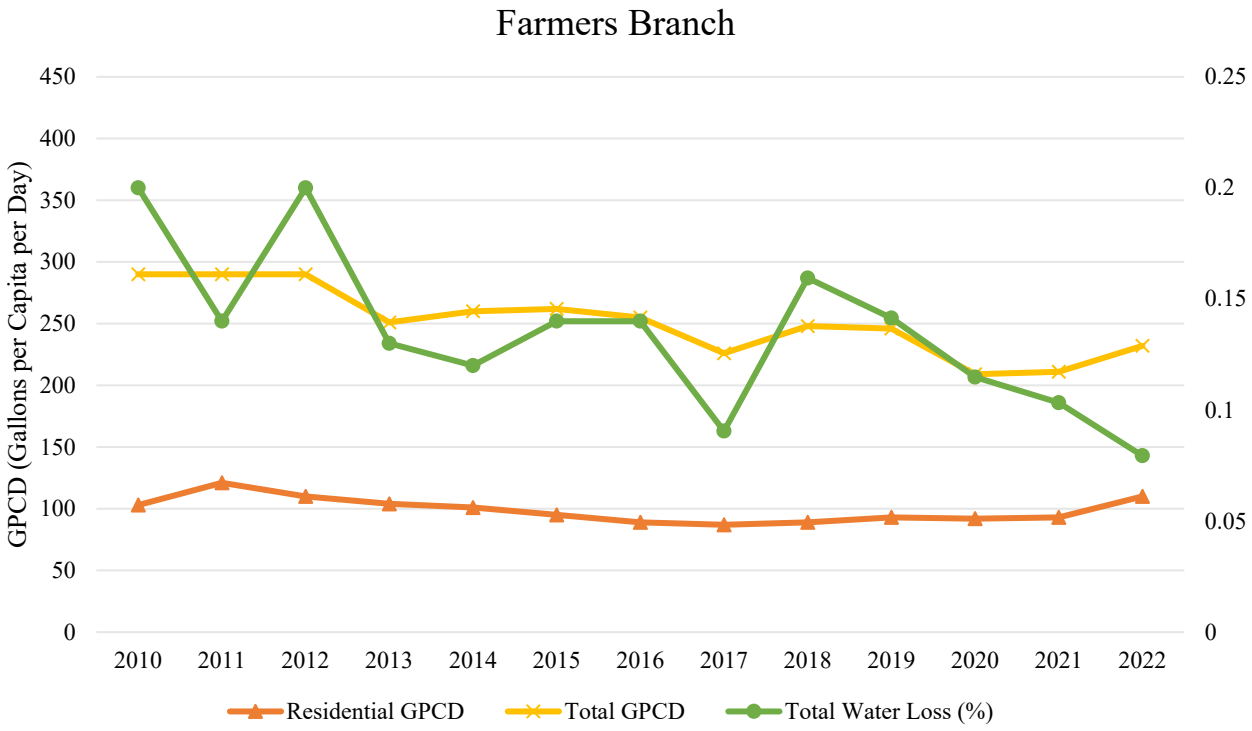

Figure WCC-17: Farmers Branch Total GPCD, Residential GPCD, and Water Loss Percentage

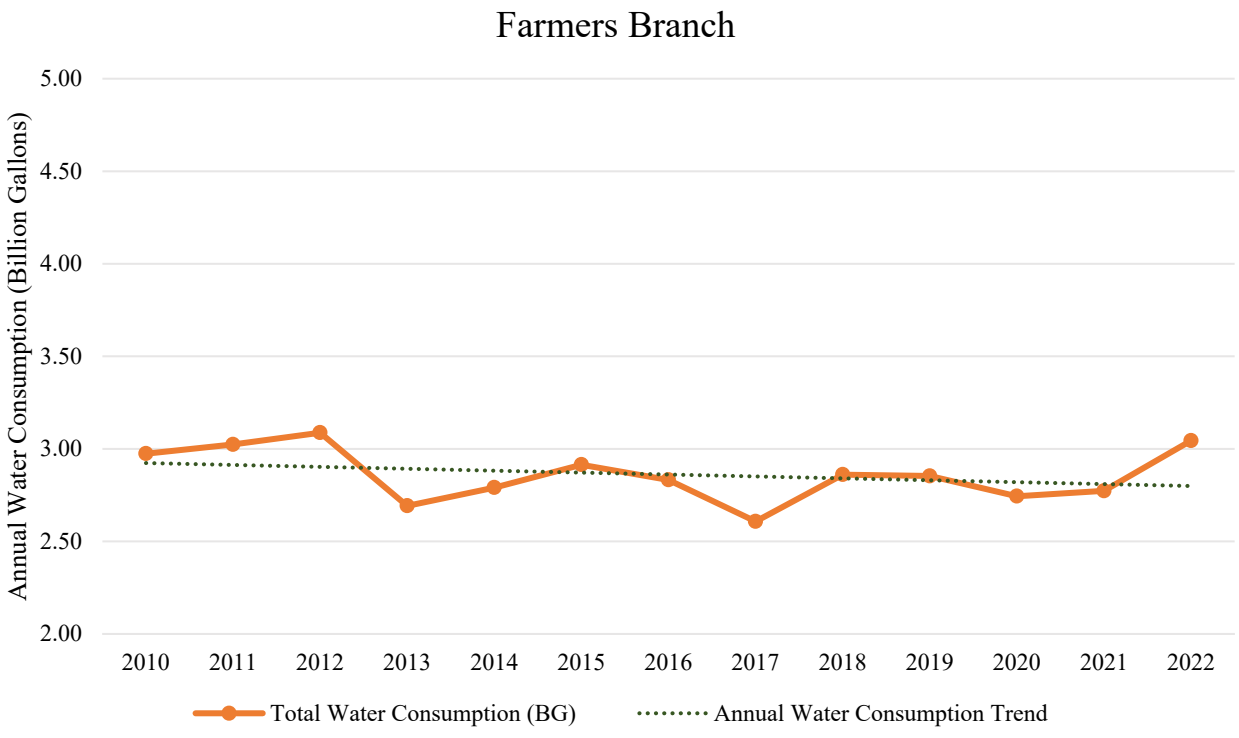

Figure WCC-18: Farmers Branch Total Water Consumption

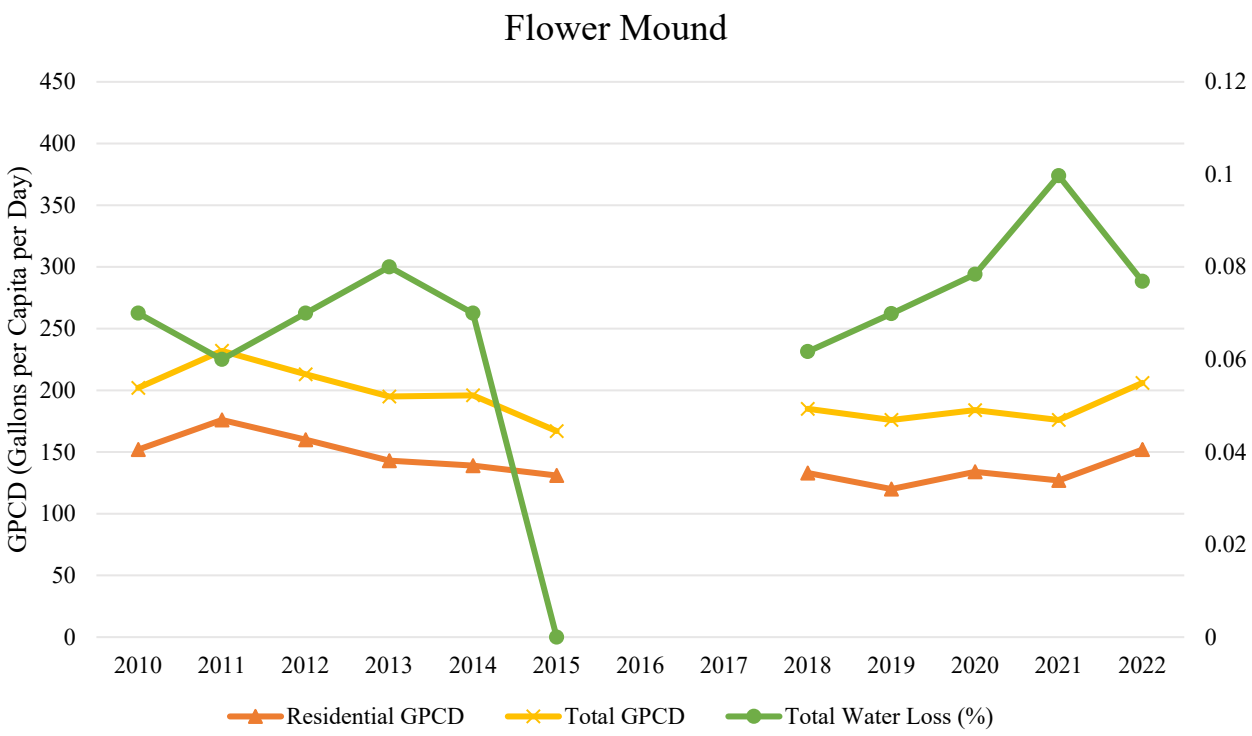

Figure WCC-19: Flower Mound Total GPCD, Residential GPCD, and Water Loss Percentage

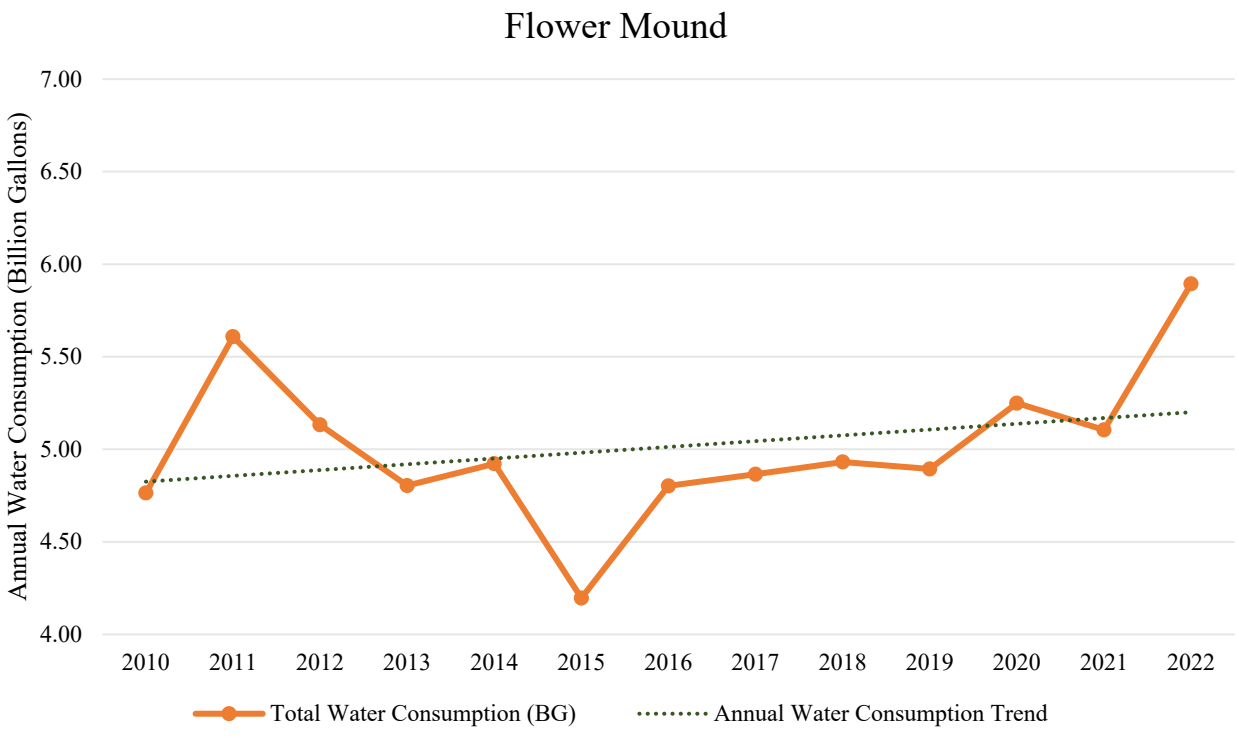

Figure WCC-20: Flower Mound Total Water Consumption

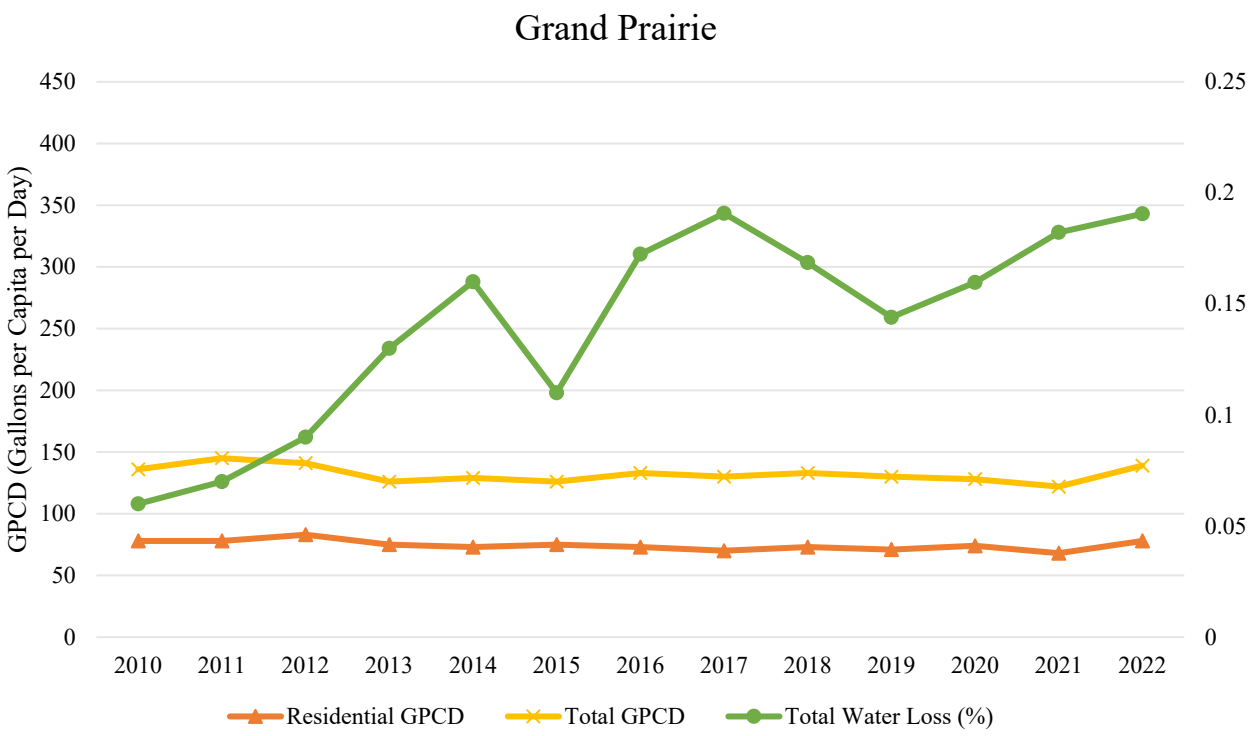

Figure WCC-21: Grand Prairie Total GPCD, Residential GPCD, and Water Loss Percentage

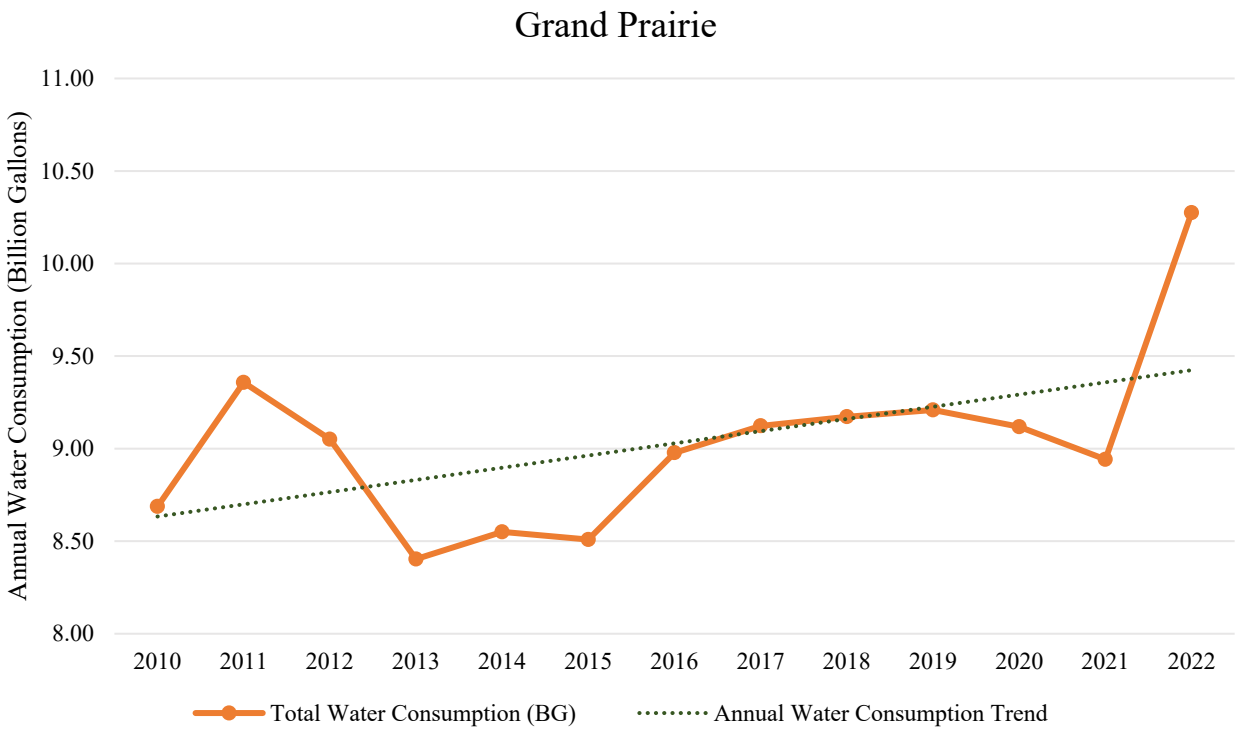

Figure WCC-22: Grand Prairie Total Water Consumption

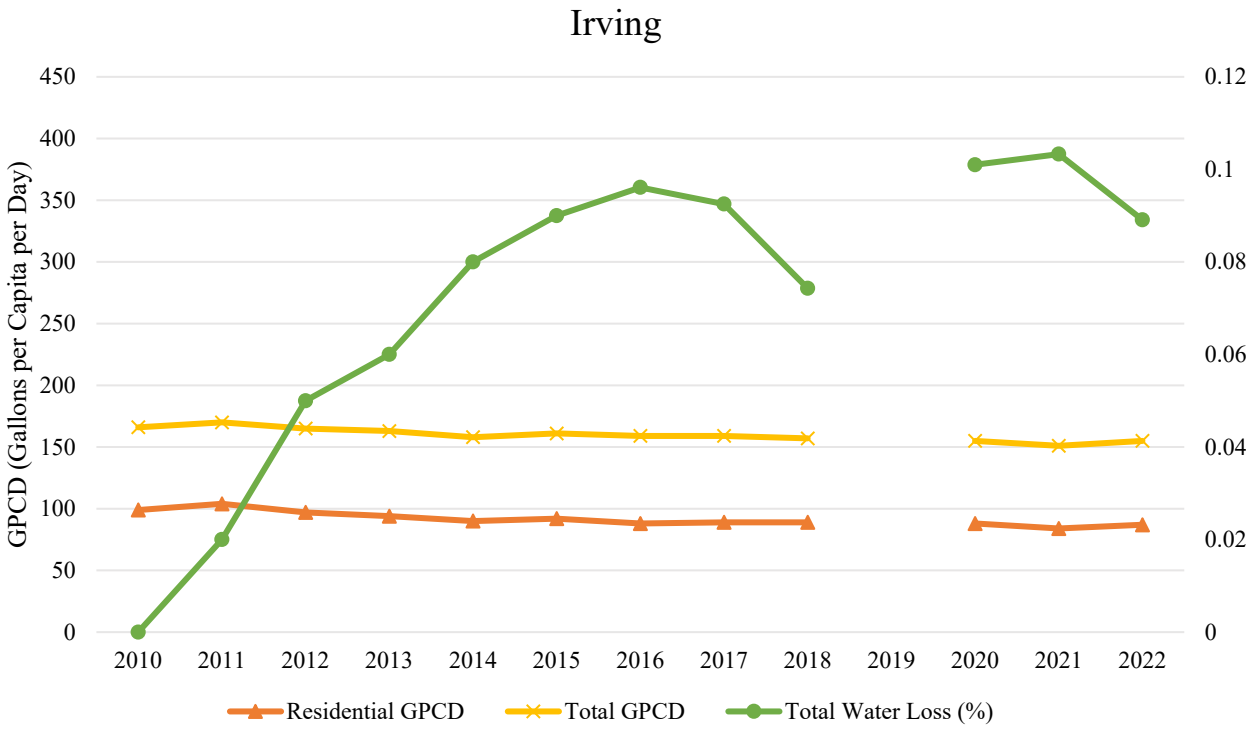

Figure WCC-23: Irving Total GPCD, Residential GPCD, and Water Loss Percentage

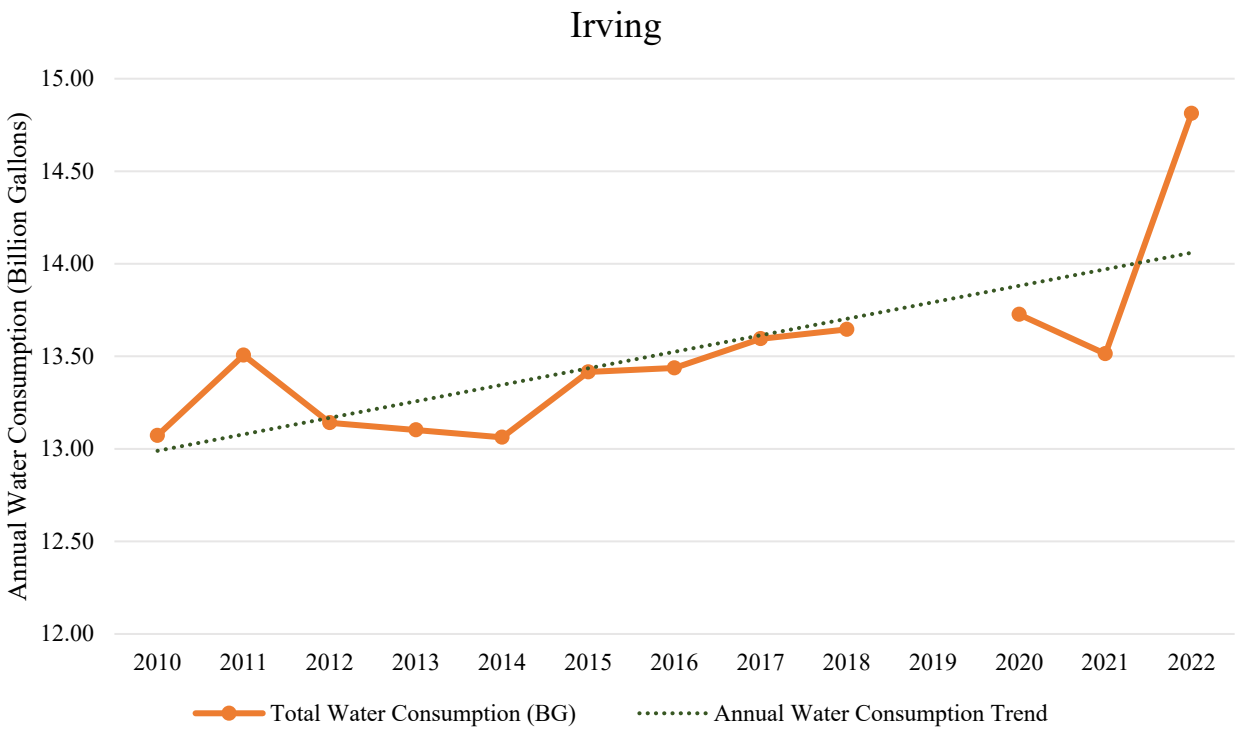

Figure WCC-24: Irving Total Water Consumption

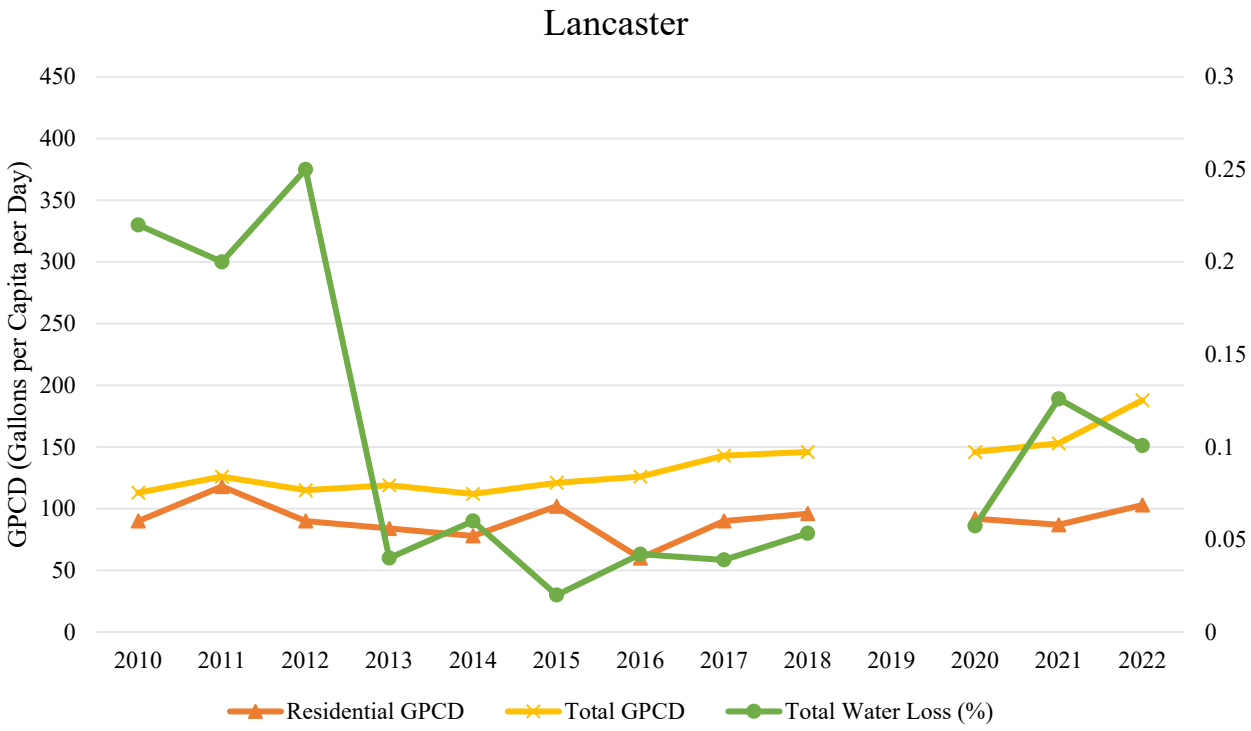

Figure WCC-25: Lancaster Total GPCD, Residential GPCD, and Water Loss Percentage

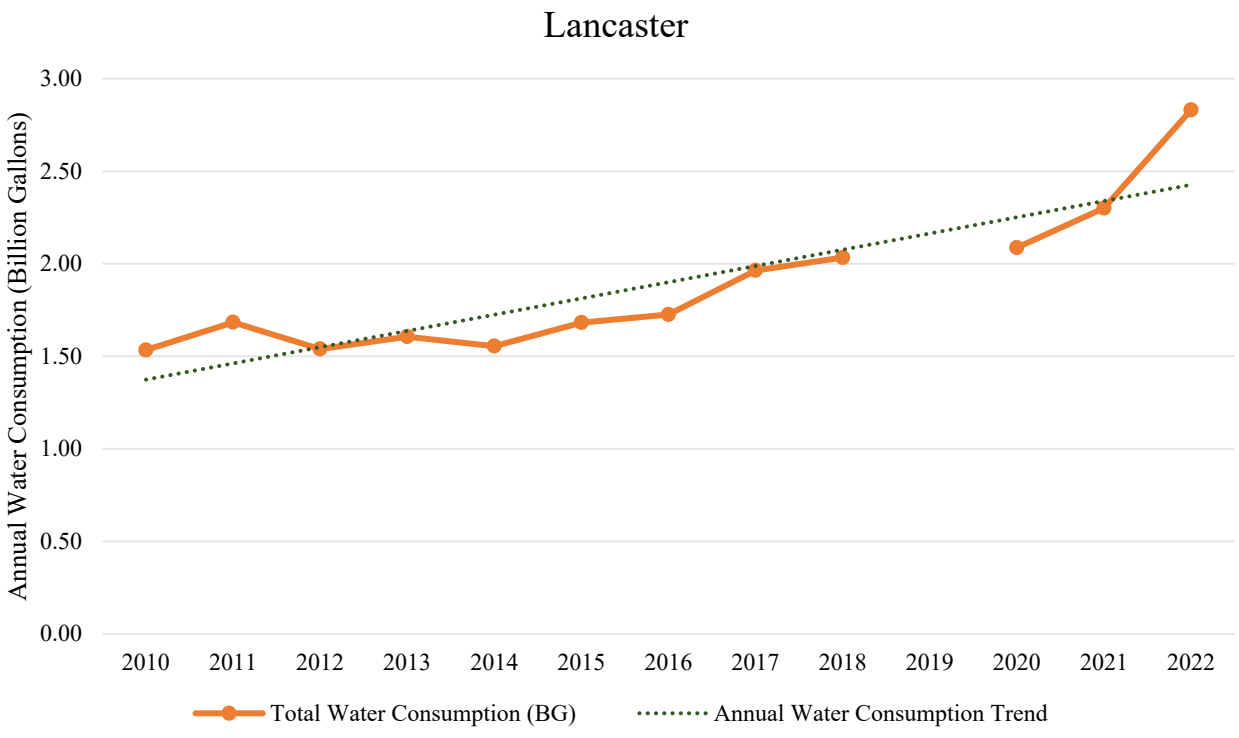

Figure WCC-26: Landcaster Total Water Consumption

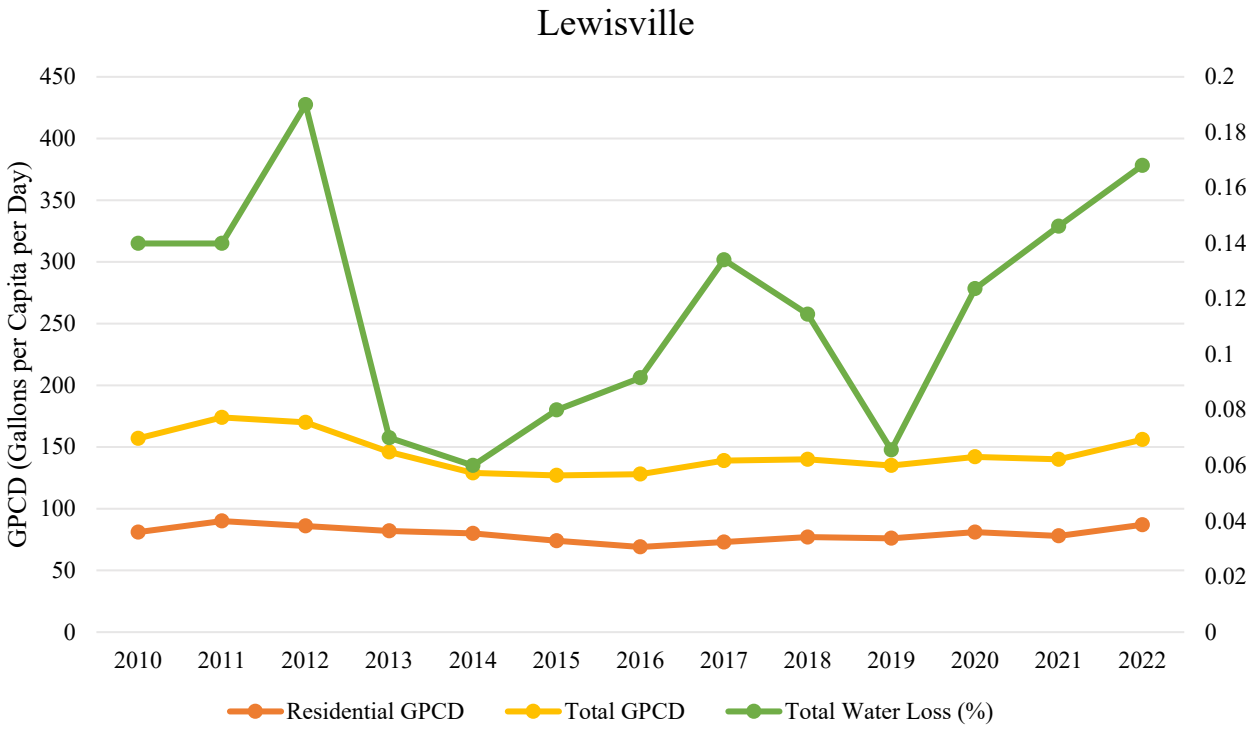

Figure WCC-27: Lewisville Total GPCD, Residential GPCD, and Water Loss Percentage

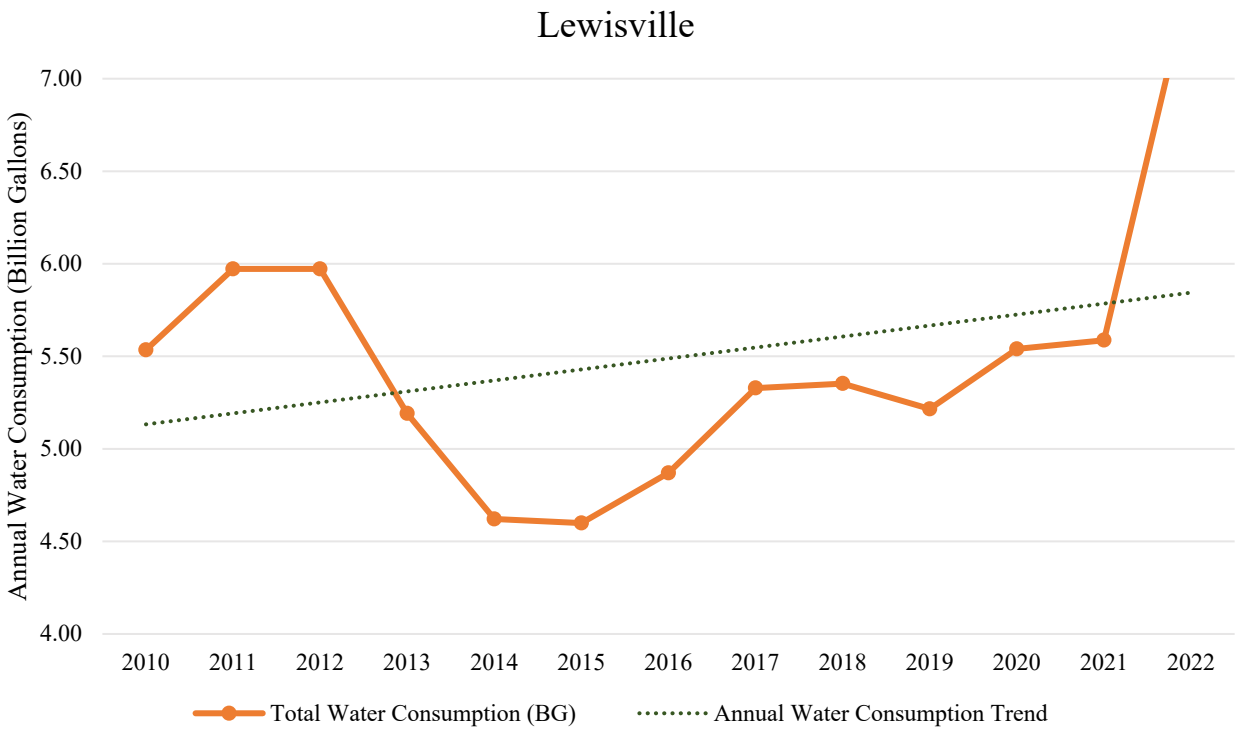

Figure WCC-28: Lewisville Total Water Consumption

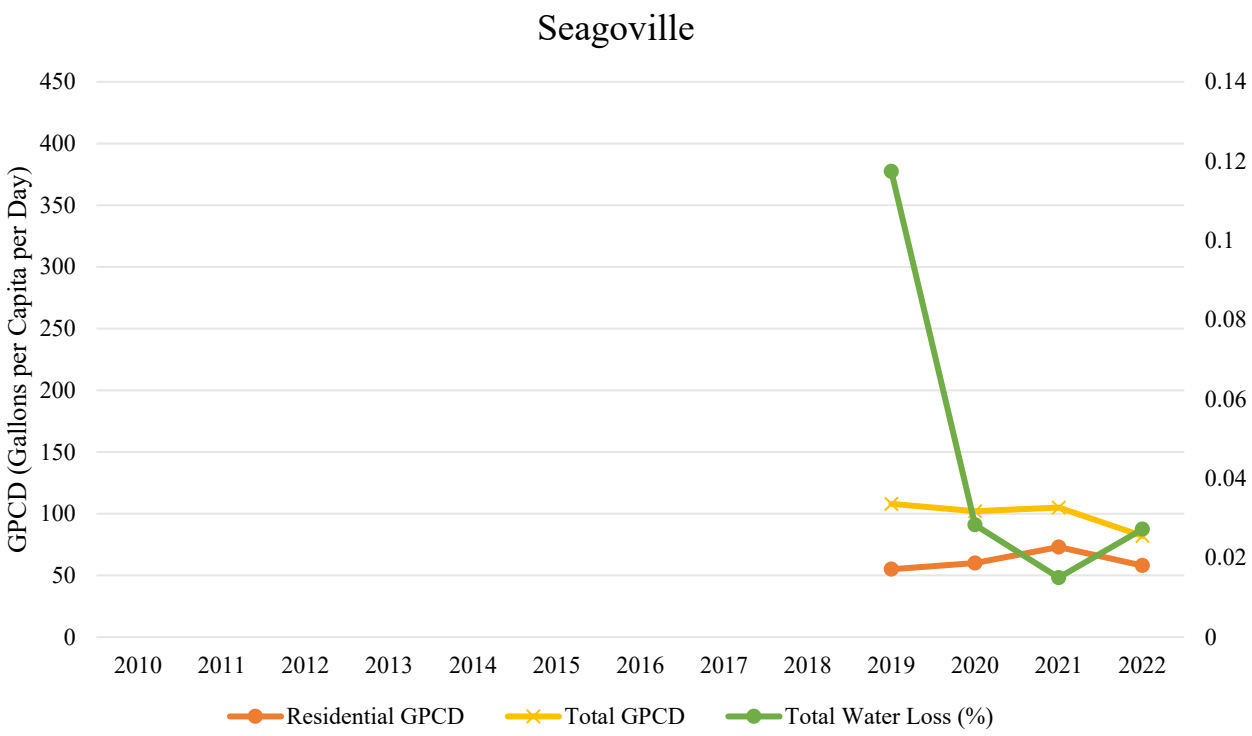

Figure WCC-29: Seagoville Total GPCD, Residential GPCD, and Water Loss Percentage

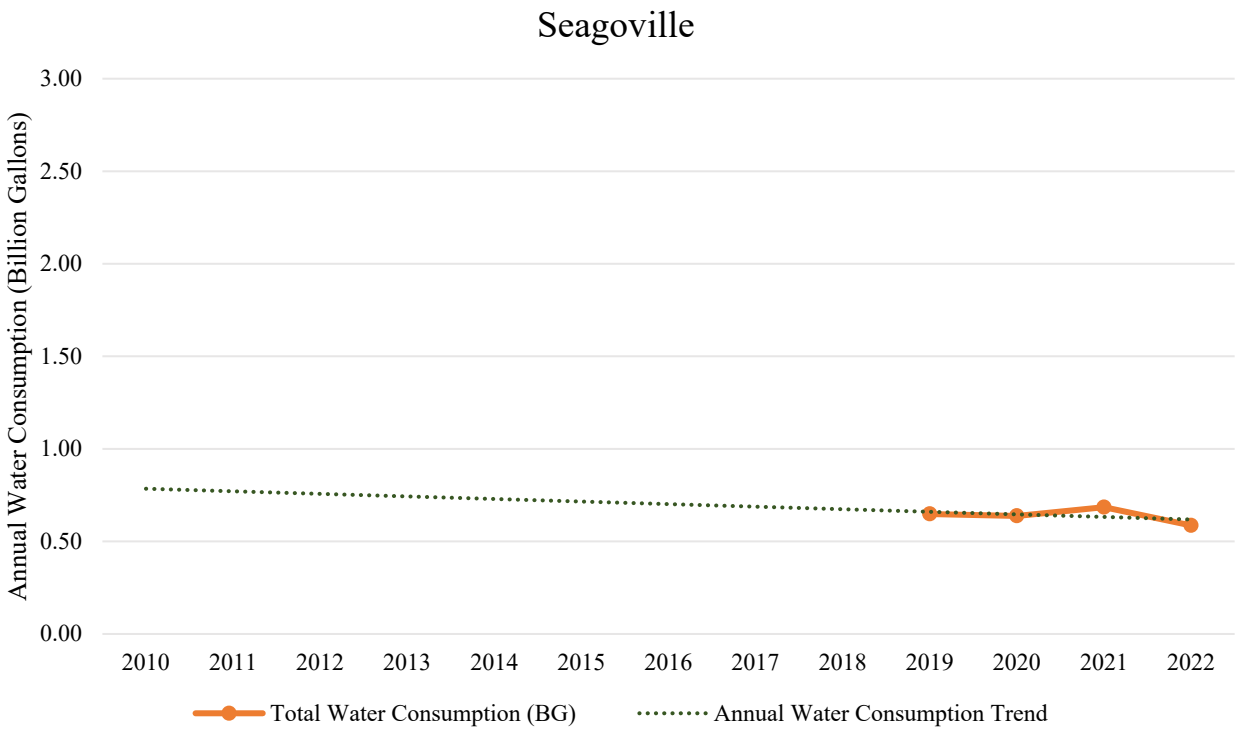

Figure WCC-30: Seagoville Total Water Consumption

Landscape Ordinance Review Appendix

Landscape Ordinance Review Summary of Landscape/Irrigation Ordinances of Select Cities

According to Environmental Protection Agency WaterSense calculations, about 30% of the average family's water use is outdoors, nearly nine billion gallons per day nationwide. In drier climates that estimate can reach as high as 60%. As much as 50% of that water can be lost to evaporation, wind or runoff caused by inefficient irrigation methods and systems.

Water-efficient landscape and irrigation ordinances are becoming more common, especially across the Southwest. The extent of the ordinances ranges from time-of-day and days-per-week restrictions for irrigation, to specific plant lists, programs for turf reduction and replacement, and use of recycled water.

Dallas's current Water Conservation Ordinance **(SEC. 49-21.1. Conservation Measures Relating to Lawn and Landscape Irrigation)** outlines time-of-day and day-of-week restrictions. It contains the standard water waste offenses, requires rain/freeze sensors, and lists types of variances.

To provide Dallas Water Utilities (DWU) with potential paths of action to increase water efficient landscaping and irrigation regulation as a water conservation tool, existing and proposed landscaping ordinances of multiple municipalities, primarily in the Southwest, are described below and summarized in **Table 1-2** at the end of this report. This compilation does not include water waste, time-of-day and day-of-week watering restrictions, and other commonly held restrictions in cities and states across the country that are common and already part of the City of Dallas implemented water conservation measures. As per the scope of this task, this section focuses only on ordinances and regulations that apply to landscaping. Many of these cities employ other water conservation measures as part of their ordinances that could merit further investigation.

TEXAS

Austin TX

The City of Austin Code of Ordinances, **Chapter 6-4 Water Conservation**, establishes a Water Use Management Plan that applies to anyone who uses, directs, manages, or allows the use of potable water supplied by Austin Water.[1] As in most other cities in this report, it establishes time-of-day and day-of-week restrictions on outdoor watering and variance exemptions.

Since 2014, all commercial or multifamily residential facilities of one acre or more must have permanently installed automatic irrigation systems evaluated by an authorized irrigation inspector at a frequency set by the city (currently every two years). It establishes several irrigation-related prohibitions on water waste.

Another change in 2014 helped facilitate the use of rainwater, gray water, reclaimed water, and condensate. In 2015, Austin required new commercial development and redevelopment within 250 feet of a reclaimed water main are required to obtain and utilize permitted connections for irrigation,

[1] Austin, Texas, Code or Ordinances Chap. 6-4. n.d. https://library.municode.com/tx/austin/codes/code_of_ordinances?nodeId=TIT6ENCOCO_CH6-4WACO.

cooling, or other significant non-potable water uses. Estimates by Austin water are a savings of 1.2 billion gallons per year.

In 2021, Austin adopted the Innovative Commercial Landscape Ordinance which requires new commercial development to direct stormwater to an area at least 50% of the size of the required landscape. Commercial customers can choose whether to install permanent irrigation at the periphery of the property, and undisturbed vegetation will count towards the 50% requirement.

Water Forward is Austin's 100-year integrated water resource plan established in 2018 and will be updated in 2024. [2]Water Forward is an adaptive plan to be updated on a 5-year cycle and evaluates and plans for water supply and demand management strategies for the City of Austin in a regional water supply context. Through public outreach and coordination of efforts between City departments and the Water Forward Task Force, Water Forward is a holistic and inclusive approach to water resource planning.

The Water Forward plan includes a robust set of strategies to conserve water and make our buildings and landscapes more water efficient[3]. Water Forward includes strategies to expand several existing Austin Water rebate programs, including programs to assist customers with the costs of smart controllers that help to make irrigation systems more efficient and current incentives to existing development to install water-efficient landscapes. The plan also includes a strategy to develop an ordinance to require water efficient landscapes for new single-family homes. To achieve efficient water use for many diverse types of development, the plan includes a strategy to develop benchmarks and water budgets that would initially encourage and eventually require customers to meet water usage targets.

Austin Water has a robust rebate incentive program. It offers several residential rebates for outdoor water conservation; including conversion of turf grass to native bed; improvements to irrigation efficiency; compost, mulch, and core aeration service; graywater use for landscape watering; pressure regulating valves; hose timers; rainwater harvesting; and rainscaping.[4] Commercial/Multifamily/School rebates include conversion of turf grass, rainwater harvesting, pressure regulating valves, reclaimed water connections, and rainscaping.

El Paso TX

The City's Code of Ordinances, **Chapter 18.46 Landscape**, applies to residential and commercial property development within the corporate limits of the city.[5] Sections require the submission of separate plans for landscaping and irrigation, with the irrigation plan designed and sealed by a licensed

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[2] 2023. *Water Forward Integrated Water Resource Plan.* September 25. https://www.austintexas.gov/sites/default/files/files/Water/WaterForward/Water_Forward_Plan_Report_-_A_Water_Plan_for_the_Next_100_Years.pdf.

[3] Austin Water. n.d. *Water Forward.* https://www.austintexas.gov/department/water-forward. "

[4] —. 2018. "Water Forward Plan." November. https://www.austintexas.gov/sites/default/files/files/Water/WaterForward/Water_Forward_Plan_Report_-_A_Water_Plan_for_the_Next_100_Years.pdf.

[5] El Paso, Texas, Code of Ordinances Chap. 18.46. n.d. https://library.municode.com/tx/el_paso/codes/code_of_ordinances?nodeId=TIT18BUCO_CH18.46LA.

irrigator, registered architect, licensed engineer, or registered landscape architect. Landscape plans must address the type and location of all plant material, including the plant tags. Irrigation plans must include elements of **Chapter 18.47 Irrigation,** requiring that all irrigation systems be designed, installed, maintained, altered, repaired, serviced, and operated in a manner that will promote water conservation.[6] Beginning January 1, 2010, either a licensed irrigator or a licensed irrigation technician shall be on-site at all times while the landscape irrigation system is being installed. When an irrigator is not onsite, the irrigator shall be responsible for ensuring that a licensed irrigation technician is on-site to supervise the installation of the irrigation system. All irrigation systems shall be designed, installed, maintained, altered, repaired, serviced, and operated in a manner that will promote water conservation as defined in the Definitions section of the Irrigation Systems ordinance. All systems must include an automatic controller with multiple programs, multiple repeat cycle capabilities and a flexible calendar program after 2011.

The city's **Water Conservation Ordinance (Chapter 15.13)** requires mandatory compliance with lawn and landscape watering time-of-day and day-of-week restrictions, defines water waste, and outlines the variance process.[7] Large and very large water users must submit a water conservation plan, including a justification of water consumption to recycling potential. The water conservation plan, submitted every five years, shall include techniques and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water. All conversion to recycling and reuse of water, if required, shall be accomplished within five years from the date of submittal of the water conservation plan. **Section 15.13.140** prohibits turf grass in all parkways, narrow strips of land and sloped areas within new residential or commercial sites unless irrigated with sub-surface irrigation (drip). After 2002, no more than 50 percent of total area of residential yards (front and back) and no more than 33.3 percent of commercial sites can be turf grass. It requires 75% of plants be selected from an approved plant list and at least 50% must be plant material of low water, drought-tolerant variety. A home or property owner who installs an irrigation system must meet the standards contained in Title 30, Texas Administrative Code, Chapter 344 regarding spacing, water pressure, spraying water over impervious materials, rain or moisture shut-off devices or other technology, backflow prevention and isolation valves.

San Antonio TX

Article. IV Water Conservation and Reuse, §§ 34-271--34-425, addresses water conservation measures across multiple water uses. Section 34-272 establishes time-of-day watering restrictions, requires commercial power washers to register and obtain a use certificate, and prohibits vehicle wash fundraisers outside of commercial facilities.[8] In addition to the discussion below, the ordinance also establishes variance requirements and enforcement procedures.

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[6] El Paso, Texas, Code of Ordinances Chap. 18.47. n.d. https://library.municode.com/tx/el_paso/codes/code_of_ordinances?nodeId=TIT18BUCO_CH18.47IRSY.

[7] El Paso, Texas, Code of Ordinances Chap 15.13. n.d. https://library.municode.com/tx/el_paso/codes/code_of_ordinances?nodeId=TIT15PUSE_CH15.13WACO.

[8] San Antonio, Texas, Code of Ordinance Chap 34, Sec. 34-271. n.d. https://library.municode.com/tx/san_antonio/codes/code_of_ordinances?nodeId=PTIICO_CH34WASE_ARTIVWACORE

Section 34-273 sets new standards for minimum irrigation area and flow direction, pop-up sprays and mandates an annual irrigation system analysis for athletic fields, golf courses, large use, and large properties. This section sets new requirements for pool construction, with multiple components to minimize water loss through the system from fill to backwash. This section also requires registration of nonresidential and residential non potable tanks (requirements differ).

Section 34-274 requires new commercial construction to install single, independent air conditioning condensate wastewater lines for future utilization as process water and cooling tower makeup and or landscape irrigation water. No condensate is allowed to drain to a storm sewer, roof drain overflow piping system, public way, or impervious surface.

Per **Section 34-275**, homebuilders/developers must offer a xeriscape option in any series of landscaping options offered to prospective homebuyers. At least one model home per subdivision must be landscaped accordingly. All inground irrigation systems installed after this date must be zonal. Irrigators must provide owners with a seasonal irrigation schedule and instructions on how to use the system and set the controller in writing, as approved by SAWs Conservation Director. A minimum of four inches of soil must be under new turfgrass installations. Turfgrass installed after January 1, 2007, must have summer dormancy capabilities. Finally, this section designates the licensed irrigator to ensure that permits are secured.

CALIFORNIA

The state of California has adopted a **Model Water Efficient Landscape Ordinance (MWELO)** to provide a path to design, install, manage, and maintain landscapes that conserve water. The Model Water Efficient Landscape Ordinance (MWELO) is in effect in every city and county unless a local or regional Water Efficient Landscape Ordinance (WELO) has been adopted. It achieves conservation through specific requirements related to soil, plants, irrigation, stormwater, and nonportable water supplies. It sets an upper limit for the water budgets of landscape projects, thereby driving water-efficiency through the thoughtful selection of climate-appropriate plants, organic soil amendments, water-saving irrigation devices, and use of alternative water supplies. MWELO encourages landscapes that require less water than the water budget's upper limit. It also encourages the innovation of landscaping equipment, products, and materials that use resources as efficiently as possible.

The **Model Water Efficient Landscape Guidebook (MWELO Guidebook)** was produced by the California Department of Water Resources for use by local building and planning departments, water providers, designers, builders, and applicants to comply with the 2015 Model Water Efficient Landscape Ordinance (MWELO), Chapter 2.7, Division 2, Title 23, California Code of Regulations.[9]

A statewide ban on the use of drinking water for irrigation of nonfunctional or decorative grass (mowed grass that is not used for recreational or community activities) on commercial, industrial, or institutional properties, including common areas of homeowners" associations, was readopted by the State Water

[9] O'Cain, Kim. 2015. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/MWELO-Files/MWELO-Guidebook/1--Model-Water-Efficient-Landscape-Ordinance-Guidebook.pdf.

Resources Control Board on May 31, 2023.[10]

SOUTHWEST REGION

Albuquerque NM

Ordinance 18-1995, known as the **Water Conservation Landscaping and Water Waste Ordinance**, establishes time-of-day and days-per-week watering restrictions and defines water waste. It establishes water budgets and planting restrictions, design regulations, sets irrigation system standards, inspection standards, and lists variance requirements.[11]

Section 6-1-1-8 establishes water budgets and planting restrictions. Subsection A requires water budgets for all city-owned athletic fields and golf courses and non-city owned golf courses. New golf courses or expansions allow 37 inches of water per acre of landscape area per year and limits the landscape acreage per course by number of holes. Parks are allowed up to 35 inches of water per acre per year. Excess use surcharges apply to both golf courses and parks if the amounts are exceeded. Part A also requires use of reclaimed wastewater, shallow groundwater, or other alternative water supplies when available and economically feasible. **Design Regulation**s, Section 6-1-1-9, apply to all new developments, expansions or major renovations to all city-owned parks, all golf courses, and city owned athletic fields constructed after 1971. The standards include requirements for irrigation type and location, requires existing features to be considered in design, discourages concrete and asphalt, requires evaluation of rainwater harvesting potential, and requires the approval of the Mayor for any pond, fountain, wetland, holding ponds, reservoirs, etc., in excess of 500 square feet or surface area.

Subsection B requires that all new city-owned developments, other than parks, golf courses, and housing, must use medium and low water use plants on 100% of landscapes. Existing city-owned housing and all non-city owned properties cannot use high water use turf or other restricted plants on more than 20% of landscaped area, except for single family residential property. If 20% of the landscaped area is greater than 3,000 square feet, high water use turf and restricted plants may not be used on more than 3,000 square feet. If 20% of landscaped area is less than 300 square feet, high water turf and restricted plants can be used on up to 300 square feet.

Subsection C prohibits property holder associations from prohibiting or restricting removal or turf grass, installation of xeriscape landscaping under Part B, installation of efficient irrigation systems, including underground drip systems, rain barrels or other water harvesting devices. Associations can, under Part B, require that the maximum percentage of high-water use turf be maintained.

Irrigation System Standards, Section 6-1-1-10, apply to all expansions or major renovations at existing parks, golf courses and athletic fields originally constructed after 1971, and to all new development except single family residential. The standards serve as voluntary guidelines for single-family residential development. In general, irrigation systems shall be designed to be site-specific, reflecting plant type, soil type, infiltration rates, slopes, and prevailing wind direction. All new development with new spray irrigated landscaped areas totaling one-half acre or more shall have a

[10] California Water Boards. 2023. "Press Releases." May 1. https://www.waterboards.ca.gov/press_room/press_releases/2023/pr20230601-decorative-watering.pdf.

[11] Albuguerque, New Mexico, Code of Ordinanaces Part 1, § 6-1-4-1. n.d. https://codelibrary.amlegal.com/codes/albuquerque/latest/albuquerque_nm/0-0-0-88119

Landscape Irrigation Audit performed by a Certified Landscape Irrigation Auditor, certified by the Irrigation Association. The auditor shall be independent of the property owner and of all contractors associated with the property.
Minimum efficiency requirements are 60% distribution for fixed spray systems and 70% distribution for rotary systems. All new development with spray irrigated landscapes greater than 10 acres shall have the sprinkler heads tested for uniformity of performance using the Center for Irrigation Technology's (CIT) Sprinkler Profile and Coverage Evaluation (SPACE) program, or a comparable assessment acceptable to the city. The sprinkler heads shall have a scheduling coefficient of 1.3 or less for full circle heads and 1.5 or less for partial circle heads, with a rating of 1.0 being perfect. The sprinkler heads shall be installed in the spacing and pressure range evaluated. The results of this test shall be provided to the city in a form acceptable to the city. Certificates of Occupancy will not be issued without compliance.

Water Conservation Large Users Ordinance, Section 6-1-4-1, applies to all new and existing large and very large users within the city limits and/or served by the municipal water utility, excepting customers which receive over 80% of their water from sources other than the city and public and private golf courses and parks, which are regulated by the Water Conservation Landscaping and Water Waste Ordinance. Compliance with this article is a condition of service from the utility. Private well usage will be included in the calculation of total usage and surcharges. Section 6-1-4-7 requires large and very large uses to develop and get approval of a water conservation plan.

Denver CO

Chapter 14 of the Operating Rules of the Board of Water Commissioners City and County of Denver discusses water conservation. **14.02.1** states that prohibitions on the use of xeriscape is contrary to public policy. **14.02.2** requires that irrigation of more than one acre may be subject to special review. **14.02.3** restricts spray irrigation of narrow strips of land. **14.02.4** requires proper soil amendment for irrigation of turf for new licensed premises and **14.02.5** requires rain sensors. **14.05** prohibits the use of potable water to fill or maintain water levels in lakes and pools with more than one-half-acre surface area.[12] Denver began a three-year pilot project in 2023 to research the impacts of using reclaimed (recycled) water to irrigate edible crops.[13]

Las Vegas NV

Chapter 14.11 Drought Plan of the City of Las Vegas Code of Ordinances establishes water conservation measures and enhances efficient utilization of water resources.[14] This ordinance works to support the Southern Nevada Water Authority to address the region's water needs.

Section 12.11.140 and **14.11.150** prohibit the installation of new turf in common areas of residential neighborhoods, except for parks if the turf area is less than 10 square feet. New turf is prohibited in front yards. Inside or rear yards, turf cannot exceed 50% of the gross area or 100 square feet, whichever

[12] Denver, Board of Water Commissioners City and County of. 2021. July 2. https://www.denverwater.org/sites/default/files/operating-rules.pdf.
[13] Denver Water. 2023. *Recycled Water.* https://www.denverwater.org/your-water/recycled-water.
[14] Las Vegas, Nevada, Code of Ordinances Chap 14.11. n.d. https://library.municode.com/nv/las_vegas/codes/code_of_ordinances?nodeId=TIT14PUSE_CH14.11DRPL.

is greater. No turf is allowed in areas where any dimension is less than 10 feet. Turf in nonresidential development is prohibited without a permit.

Section 14.08.120 prohibits property association covenants that prevent utilization of water-efficient landscaping, solely on its water-efficient design, provided it receives architectural review approval.[15]

For more than 20 years, the **Southern Nevada Water Authority** (SNWA)has been taking actions to respond to the drought and prepare for potential water cuts. One of the SNWA's largest efforts is implementing aggressive conservation initiatives.

Nevada Law AB356, passed in 2021, prohibits the use of Colorado River water to irrigate nonfunctional grass.[16] This includes streetscape turf, frontage, courtyard, interior and building adjacent turf, and nonrecreational HOA- managed landscape areas.

In 2021, the SNWA Board of Directors approved a resolution prohibiting the installation of irrigated grass in new commercial and residential developments. It applies to front and back yards of new residential developments, including HOAs, neighborhood developments, community associations, master-planned communities built by developers, and individual custom homes built by property owners.

The Las Vegas Valley Water District Service Rules comprise the contract between the Water District and its customers, outlining the rights and responsibilities of both. **Chapter 11** outlines conservation policies.[17] **Section 11.6** gives the District the right to assign water budgets to customers and prescribe rates or surcharges for levels related to the budgets. Budgets may be assigned for any period and may prorate water amounts at its discretion. Budgeted customers are exempt from time and day frequency restrictions.

Oklahoma City OK

Chapter 59, Article XI, Section 59-11350 of the Oklahoma City Code of Ordinances allows for the use of temporary and aboveground irrigation systems and to provide irrigation for the first three years only for landscape areas utilizing xeriscape plants and installation techniques.[18] **Section 59-11300** requires a landscape plan that includes the type and location of irrigation for all properties, except single-family or two-family residential lots, to receive a building permit.

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[15] Las Vegas, Nevada, Code of Ordinances Chap. 14.08. n.d. https://library.municode.com/nv/las_vegas/codes/code_of_ordinances?nodeId=TIT14PUSE_CH14.08WARE#TIT14PUSE_CH14.08WARE_14.08.030WAWAPR.

[16] Southern Nevada Water Authority. 2023. *Understand Laws and Ordinances.* https://www.snwa.com/conservation/understand-laws-ordinances/index.html.

[17] Las Vegas Valley Water District. n.d. https://www.lvvwd.com/assets/pdf/service-rules-chapter11.pdf.

[18] Oklahoma City, Oklahoma, Code of Ordinances § 59-11100. - Purpose. n.d. https://library.municode.com/ok/oklahoma_city/codes/code_of_ordinances?nodeId=OKMUCO2020_CH59ZOPLCO_ARTXILASCRE.

Phoenix AZ

The Phoenix City Code of Ordinances sets limitations on water use for turf-related facilities and filling or refilling bodies of water, requirements to comply with the management plan when applying water delivered by the City to water landscape plants. **Section 37-112** limits water use for watering landscaping plants and turf-related facilities.[19] City delivered water may not be applied to new turf-related activities unless it is non potable or untreated water delivered by the city, unless the director deems it prohibitively expensive. New turf-related facilities must be designed for future conversion to non-potable or untreated water. Fines in this section of the Code can be as high as 2000% of the charges for water used in violation of the article.

The city of Phoenix has created a comprehensive guide for landscape watering for both desert-adapted and high-water use plants.[20] See chart below.

LANDSCAPE WATERING GUIDELINES

TYPE OF PLANT	WATERING NEEDS	WATERING FREQUENCY - DAYS BETWEEN WATERINGS				WATERING DEPTH
		SPRING Mar - May	SUMMER May - Oct	FALL Oct - Dec	WINTER Dec - Mar	
Trees	Desert Adapted	14 - 30 days	7 - 21 days	14 - 30 days	30 - 60 days	24" - 36"
	High Water Use	7 - 12 days	7 - 10 days	7 - 12 days	14 - 30 days	24" - 36"
Shrubs	Desert Adapted	14 - 30 days	7 - 21 days	14 - 30 days	30 - 45 days	18" - 24"
	High Water Use	7 - 10 days	5 - 7 days	7 - 10 days	10 - 14 days	18" - 24"
Groundcovers & Vines	Desert Adapted	14 - 30 days	7 - 21 days	14 - 30 days	21 - 45 days	8" - 12"
	High Water Use	7 - 10 days	2 - 5 days	7 - 10 days	10 - 14 days	8" - 12"
Cacti & Succulents	n/a	21 - 45 days	14 - 30 days	21 - 45 days	If Needed	8" - 12"
Annuals	n/a	3 - 7 days	2 - 5 days	3 - 7 days	5 - 10 days	8" - 12"

Water to the outer edge of the plant's canopy and to the depth shown. Watering frequency will vary depending on season, plant type, weather and soil. These watering guidelines are for established plants (one year for shrubs, three years for trees). Additional water is needed for new plantings or unusually hot or dry weather. Less water is needed during cool or rainy weather. Drip run times are typically two hours or more for each watering.

Salt Lake City UT

Code of Ordinances Chapter 56-9-1: Water Conservation and Efficiency for city departments requires monthly irrigation audits, incorporation of Salt Lake City Landscape Best Management Practices for Water Resource Efficiency and Protection, including those for landscape design, installation, maintenance, irrigation, plant selection, green infrastructure, and stormwater best practices on city properties.[21] It also requires installation of irrigation only meters on new construction or major renovation of city facilities. Finally, city properties must follow landscape design requirements as described in title 21A, chapter 21A.48 of the City Code.

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[19] Phoenix, Arizona, Municipal Codes Sec. 37-112. n.d. https://phoenix.municipal.codes/CC/37-112.

[20] The Ciy of Pheonix. n.d. "Water Services Site." https://www.phoenix.gov/waterservicessite/Documents/PHXWaterSmartLandscapeWatering.pdf.

[21] Salt Lake CIty, Utah. n.d. "Code of Ordinances, Chap. 56-9-1." https://codelibrary.amlegal.com/codes/saltlakecityut/latest/saltlakecity_manual_ut/0-0-0-11674

Chapter 21A.48 Landscaping and Buffers, a comprehensive water and energy efficiency ordinance, is designed to, among other goals, promote the prudent use of water and energy resources.[22] An approved landscape plan shall be required whenever landscaping or alteration of landscaping is required by this ordinance. The plan must list the location, quantity, and name of all proposed plants, total area, and percentage of the site in landscape area, turf grass, and drought tolerant plant species. Plant materials must be capable of handling individual site microclimate extremes and installation may be delayed until optimal planting seasons. No less than 80% of trees and shrubs used on a site must be drought tolerant species; the city has a list of plants that may be available locally. Plants must be grouped by hydrozones following city guidelines and schedules. All developments greater than 0.5 acres must install an irrigation meter at the expense of the applicant and shall be assigned a water budget by the water department.

Turf on single family residential properties may not exceed 35% of area to be covered by vegetation or a maximum of 250 square feet. All other properties may not exceed 20%. Other restrictions on turf included a width requirement of at least eight feet and turf cannot be planted on slopes exceeding 25%. Mulch (3-4") is required in planting beds and landscaped areas not covered with vegetation. Fiber barriers and plastic sheeting not porous to air and water are prohibited. A separate water efficiency irrigation system plan is also required.

Artificial turf is not permitted as a replacement for vegetation when meeting landscaping requirements in the front yard, corner side yard or park strip. The same applies to any buffer requirements or parking lot landscaping requirements. The required landscaping must be at least one-third live vegetation in the required front yard, corner side yard, and park strip. The remainder of the landscaping must be an approved organic material such as turf, mulch, bark, rock, and gravel. Artificial turf is only allowed in yards where there is no required landscaping such as the interior side and rear yard in single-family residential zones.

SOUTHEAST REGION

Jacksonville FL

The St. Johns River Water Management District has the responsibility and authority for regulating consumption of water and the City of Jacksonville cooperates with the District in accordance with **Sec. 366-501** of **Part 5 Water Conservation and Landscape Irrigation** of the City of Jacksonville Code of Ordinances.[23]

Sec. 366-502 notes that time-of-day and day-of-week irrigation restrictions apply to all sources of water, whether it be surface water, from a well, or from the public or private utility. **Sec.366.504** restricts the use of private wells where reclaimed water is available.

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[22] Salt Lake Cit, Utah. n.d. "Code of Ordinances, Chap. 21A.48." https://codelibrary.amlegal.com/codes/saltlakecityut/latest/saltlakecity_ut/0-0-0-70213.

[23] Jacksonville, Florida. n.d. "Code of Ordinances, Chap 366, Sec. 336." https://library.municode.com/fl/jacksonville/codes/code_of_ordinances?nodeId=TITXENAF_CH366GRSUWAREMA_PT5WACOLAIR_S366.501WACOPL.

JEA, serving 352,000 water customers as a nonprofit, community-owned utility, published an **Integrated Water Resources Plan** in 2021.[24] The only major landscape recommendation was to implement a Smart Irrigation Controller Rebate.

Atlanta GA

Chapter 154, Article III, Section 154.74.5 (Ordinance No. 2018-O-1712) of the City of Atlanta Code of Ordinances requires compliance self-certifications for 1" and larger connections to new water or irrigation meters. Applicants must declare one of three options: (1) no irrigation system included in plans; (2) irrigation system will not serve a large landscape and will require only backflow prevention, WaterSense controller, and rain sensor; or (3) includes a large landscape irrigation system and will have to meet all requirements of the

In 2013, the City of Atlanta adopted its nation-leading **Post-Development Stormwater Management Ordinance** (**Chapter 74, Article X**).[25] The Ordinance applies to nearly every type of development, including commercial, and single-family residential property. The Ordinance requires all New Development and Redevelopment to manage the first inch (1.0”) of rainwater that falls on a site using green infrastructure.

SUMMARY

Below is a summary of the Landscape/Irrigation Ordinances of the cities reviewed in this Task. Items have been placed in broad categories and may have significant differences in content within each individual ordinance. As a reminder, this summary did not include water waste and irrigation time/day restrictions that are common to many water utilities.

Perspective regarding annual median rainfall totals is helpful to understand the extent of the landscape/irrigation ordinances supported by the selected cities for this review. **Table 1-1** contains this information. **Table 1-2** then summarizes the content of the ordinances by city.

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[24] JEA. n.d. *Integrated Resource Planning.* Accessed October 2023. https://www.jea.com/irp/.

[25] Atlanta, Georgia - Code of Ordinances. 2020. *Article X, Chapter 74.* November 5. https://library.municode.com/ga/atlanta/codes/code_of_ordinances?nodeId=COORATGEVOII_CH74EN_ARTXPODESTMA.

Table 1-1: Summary of Median Rainfall in Inches by City

MEDIAN RAINFALL FOR SELECTED CITIES (1992-2022)	
City	**Median Rainfall (Inches)**
Las Vegas	3.47
Phoenix	6.82
El Paso	8.63
Albuquerque	8.78
Denver	13.96
Salt Lake City	15.34
San Antonio	32.00
Austin	35.14
Oklahoma City	35.35
Dallas	**35.39**
Atlanta	48.15
Jacksonville	54.72
Source: https://www.weather.gov/wrh/climate	

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Table 1-2: Summary of Water Conservation Landscape/Irrigation Ordinances by City

SUMMARY OF LANDSCAPE/IRRIGATION ORDINANCES BY CITY												
SELECT LANDSCAPE ORDINANCE PROVISIONS *(Items selected are required by landscape ordinance)*	**Dallas TX**	**Austin TX**	**El Paso Tx**	**San Antonio TX**	**Albuquerque NM**	**Denver CO**	**Las Vegas NM**	**Oklahoma City OK**	**Phoenix AZ**	**Salt Lake City UT**	**Atlanta GA**	**Jacksonville FL**
Athletic Field, Park, Golf Course Restrictions				x	x		x		x			
Artificial Turf Restrictions										x		
HOA Turf/Xeriscape Prohibition Restrictions		x		x	x	x	x					
Irrigation System Inspections		x		x	x					x		
Irrigation Installation by Professional			x	x	x							
Irrigation Meter										x		
Irrigation System Standards (plan)			x	x	x	x		x		x	x	
Irrigation System Standards (parts)	x		x	x	x	x					x	x
Irrigation Restrictions by Water Type												x
Landscape Design Plan			x		x			x		x		
Median Turf Grass Restrictions		x	x		x	x	x					
Non potable Irrigation Water Use		x		x		x			x			x
Plant List Recommendations or Restrictions			x		x			x		x		
Registration of Non potable Water Tanks				x								
Soil Depth under Turf				x		x						
Stormwater Management for Irrigation		x									x	
Turf Percentage Limits			x		x		x			x		
Turfgrass Dormancy Requirement				x								
Water Budget or Management Plan		x	x		x		x					
Water Feature Restrictions					x				x			
Water Reuse				x	x							